FINAL DRAFT - Interchange Justification Report

NW La Center Road/I-5 Interchange Improvement Project (MP 16.80)

La Center, Washington

February 2015

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Project No. 12393.0

February 2015

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NW La Center Road/I-5 Interchange Improvement Project (MP 16.80)

This ***Interchange Justification Report***, prepared under my direct supervision, has been prepared in accordance with RCW 18.43 and appropriate Washington State Department of Transportation manuals.

☐ **IJR Engineer of Record**

☐ **Traffic Analysis Engineer**

By:_____ P.E.

_____

Title

Date:_____, 2015

☐ **Concurrence – Region Area Engineer / Project Engineer**

By:_____, P.E. Date:_____, 2015

☐ **Concurrence – Region Traffic Review**

By:_____, P.E. Date:_____, 2015

☐ **Concurrence – Project Development Engineer**

By:_____, P.E. Date:_____, 2015

☐ **WSDOT Approval – Assistant State Design Engineer**

By:_____, P.E. Date:_____, 2015

☐ **FHWA Approval – FHWA Safety and Design Engineer**

By:_____, Date:_____, 2015

☐ **FHWA Approval – Headquarters Development Services & Access Manager**

By:_____, Date:_____, 2015

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EXECUTIVE SUMMARY

The Exit 16 interchange (at NW La Center Road and NW 319th Street, milepost 16.80) along Interstate 5 serves the City of La Center and surrounding rural areas. The interchange is a diamond interchange with a two-lane structure over the freeway and stop-controlled access at the ramp terminals. Closely spaced frontage road intersections exist just outside each of the I-5 ramp terminals, posing access management challenges to the operations of the interchange. From a functional standpoint, the existing interchange form is supporting existing development within the City of La Center and surrounding rural areas. However, the interchange has been the subject of recent planning studies that examined the impacts of enhancing development opportunities along NW La Center Road on the east side and NW 319th street on the west side of I-5.

One near-term approved development involves 152 acres of land that will be held in trust by the U.S. Department of the Interior for the Cowlitz Indian Tribe along the west side of I-5. This property spans the north and south sides of NW 319th Street and has been approved by the Department of the Interior to be developed as a casino, resort and tribal government center by the Cowlitz Tribe (herein referred to as the Cowlitz Reservation Development). The City of La Center has annexed property on the south side of NW La Center Road from the original municipal boundary to and including I-5, making over thirty acres available for urban development.

Given the anticipated increase in traffic due to local/regional growth there is a need to modify/reconstruct the existing NW La Center Road/I-5 interchange along with portions of the adjacent frontage road network in order to provide safe and efficient access to/from I-5. Based on a detailed planning and operations analysis, the interchange project will include the following:

- Construction of a new overpass structure located immediately south of the existing structure which will accommodate four travel lanes and pedestrian and bicycle facilities;
- Modification of the existing northbound and southbound interchange ramp terminals to include multiple lane roundabouts;
- A modified northbound off-ramp that is lengthened and includes a second exit lane;
- A modified southbound on-ramp that includes two receiving lanes off of the ramp terminal that transition to a single lane prior to merging with I-5 mainline traffic;
- A partial relocation of Paradise Park Road and the development of a new intersection with NW La Center Road. This new intersection would be located approximately 450 feet (centerline-to-centerline) east of the northbound roundabout terminal to meet Washington State Department of Transportation (WSDOT) guidelines for intersection spacing of 350 or more feet. The new intersection will operate as a two-way stop-control intersection in the near-term and eventually need to be converted to a roundabout or traffic signal with future development;
- Relocation of NW 319th Street approximately 350 feet south of the current alignment to accommodate the new overpass and provide an enhanced east-west circulation network that is more compatible with the Cowlitz Reservation Development; and
- A partial relocation of NW 31st Avenue and the development of a new intersection with NW 319th Street. This new intersection would be located approximately 600 feet (centerline-to-

centerline) west of the southbound roundabout terminal to meet WSDOT intersection spacing guidelines. The new intersection will operate as a roundabout to accommodate near-term and future development.

To support the NW La Center Road/I-5 interchange reconstruction/modification project, this Interchange Justification Report (IJR) has been prepared as required by WSDOT and the Federal Highway Administration (FHWA). The IJR documents the interchange planning process, the evaluation of improvement alternatives, the design of the preferred alternative, the impacts to the Interstate system and local street network, and the coordination details to support and justify the request for an access revision. As a component of the IJR process, the *WSDOT Design Manual* requires a '*Methods and Assumptions Document*' be developed to record assumptions, criteria, and support team decisions used in the IJR. The *NW La Center Road/I-5 Interchange Improvement Project (MP 16.80) IJR Methods and Assumptions Document* was approved in October 2013 and is provided in *Appendix A* for reference.

INTRODUCTION

The existing NW La Center Road/I-5 Interchange is a simple diamond interchange form that was constructed in the late 1960s to provide access between I-5, the City of La Center, and surrounding rural residential areas. Based on a limited interchange form and the findings of several recent planning studies[1][2], the interchange and supporting local circulation system are not capable of safely and efficiently supporting extensive new development. One such development, the Cowlitz Reservation Development, involves 152 acres of land that will be held in federal trust for the Cowlitz Indian Tribe. This property, which is located on the west side of I-5 and spans the north and south sides of NW 319th Street, has been approved for development of a cultural center, tribal government buildings, housing for tribal elders, a gaming facility, and a hotel.

To support anticipated future traffic volumes in the region, the existing interchange and supporting local street network will need to be reconfigured to better accommodate intensified traffic patterns at the interchange. This IJR documents the planning, evaluation, and selection of a new interchange form, interchange terminal control, and frontage roadway configurations. It was completed with the following focus areas:

- Accommodating multi-modal traffic circulation in a safe and efficient manner,
- Upgrading the interchange bridge to current design standards.
- Addressing and satisfying regulatory agency approval criteria,
- Minimizing negative impacts to adjacent property owners (right-of-way and access),
- Addressing the existing closely spaced frontage road intersections at NW 31st Avenue and NW Paradise Park Road by appropriately realigning these frontage roads,
- Advancing the transportation system in a manner consistent with long-term community aspirations (e.g, La Center Transportation Plan), and
- Ensuring that the selected interchange form supports future expansion to meet the surrounding communities' growth needs through the year 2037.

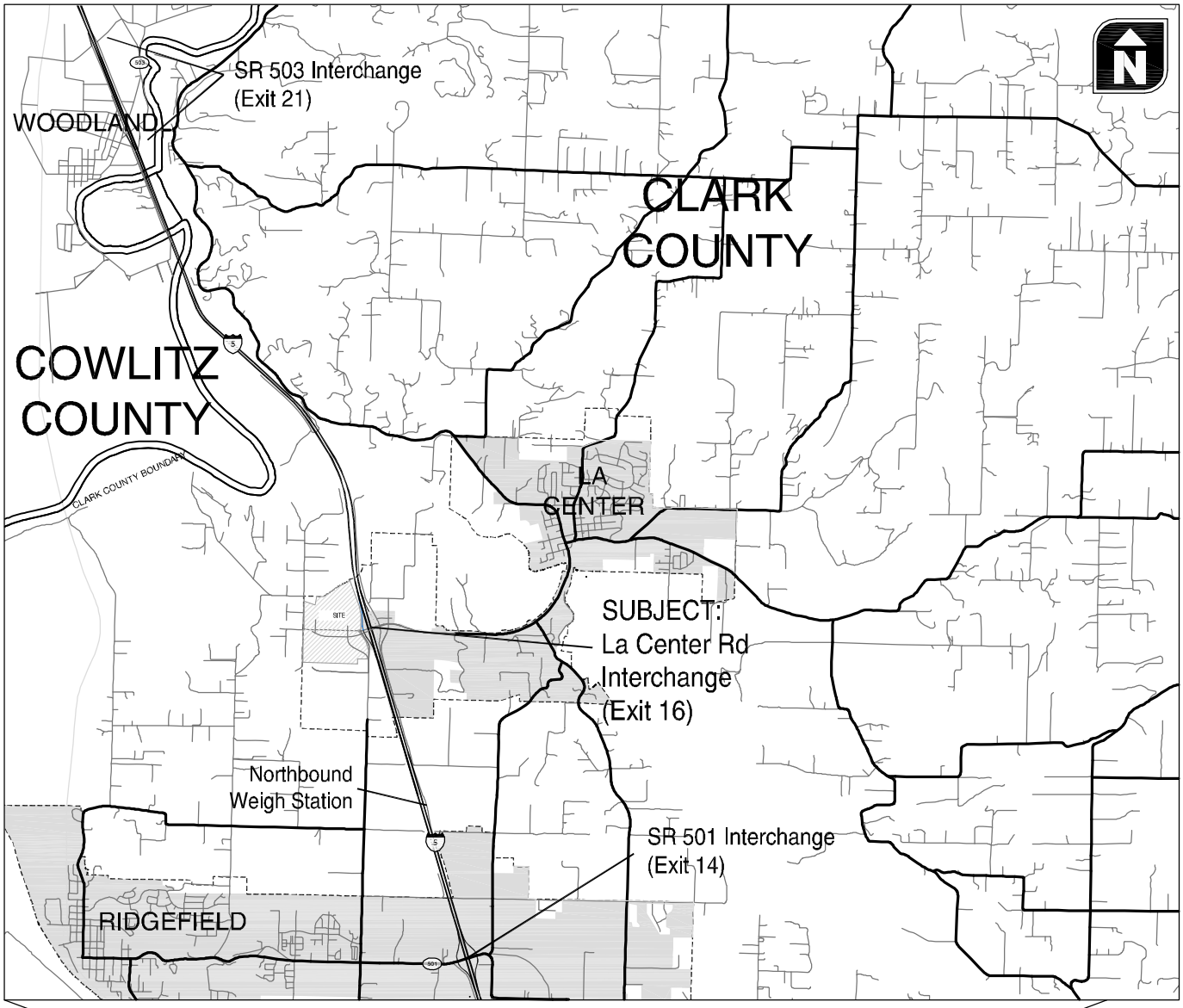
The following sections describe the existing interstate system and the non-interstate highway/local transportation system within the project study area.

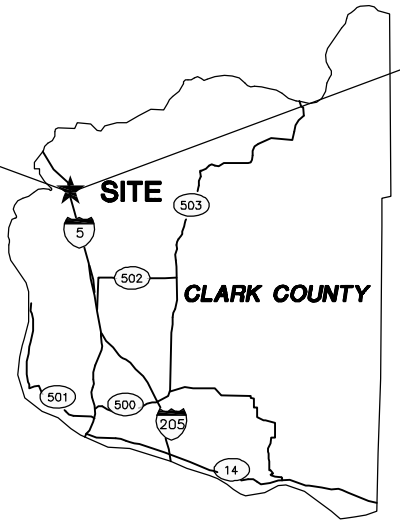
STUDY AREA AND TRANSPORTATION FACILITIES

The IJR focuses on the existing NW La Center Road/I-5 Interchange and its functional area along the NW 319th Street/NW La Center Road corridors, including the two adjacent frontage roads on either side of the interchange. As illustrated in Figure I-1, the project study area also includes the two upstream/downstream

[1] *La Center Junction Subarea Plan* (Reference 1)

[2] *Cowlitz Indian Tribe Casino Project: Traffic Impact Study*, *Supplemental Report* (Reference 2)





LEGEND

COUNTY BOUNDARY

URBAN GROWTH AREA

CITY LIMITS

SITE VICINITY
LA CENTER, WASHINGTON

FIGURE
I-1

H:\profile\12393 - Cowlitz Reservation Development\dwgs\figs\IJR Figures 2014\Cowlitz_IJR_figures.dwg Feb 23, 2015 - 8:55am - bcullimore Layout Tab: I-1_SV

(SR 501 Exit 14 at milepost 14.17 and SR 503 Exit 21 at milepost 21.08) interchanges along the I-5 corridor. However, a complete traffic operations analysis of these two upstream/downstream interchanges was not formally included in the IJR as there are no significant increases in traffic expected in these locations[3]. Furthermore, the SR 501 Exit 14 interchange was recently reconstructed with 20-year capacity as documented in the *Interstate 5/SR 501 Ridgefield Interchange Project* IJR dated May 4, 2009. The remainder of this section describes each facility located within the IJR study area.

I-5 Mainline

Within the interchange improvement study area, I-5 is a 6-lane, median-separated, interstate highway. The WSDOT State Highway Log classifies this section of I-5 as *Rural*. It should be noted that WSDOT envisions this classification changing to Urban over the next 20-year period with build out of the La Center Growth Management Area. Existing average annual daily traffic (AADT) for this section of I-5 is approximately 68,000 vehicles per day based on the most recent 2013 data at nearby R045 permanent traffic recorder station located at milepost 20.14. The posted speed limit along this segment of I-5 is 70 mph.

NW La Center Road/I-5 Interchange

The NW La Center Road interchange is a diamond interchange located at milepost 16.80. The interchange is located within the City of La Center and consists of single-lane on- and off-ramps with unsignalized ramp terminals at NW La Center Road. Traffic volumes on I-5 north of the NW La Center Road interchange are approximately 68,000 vehicles per day.

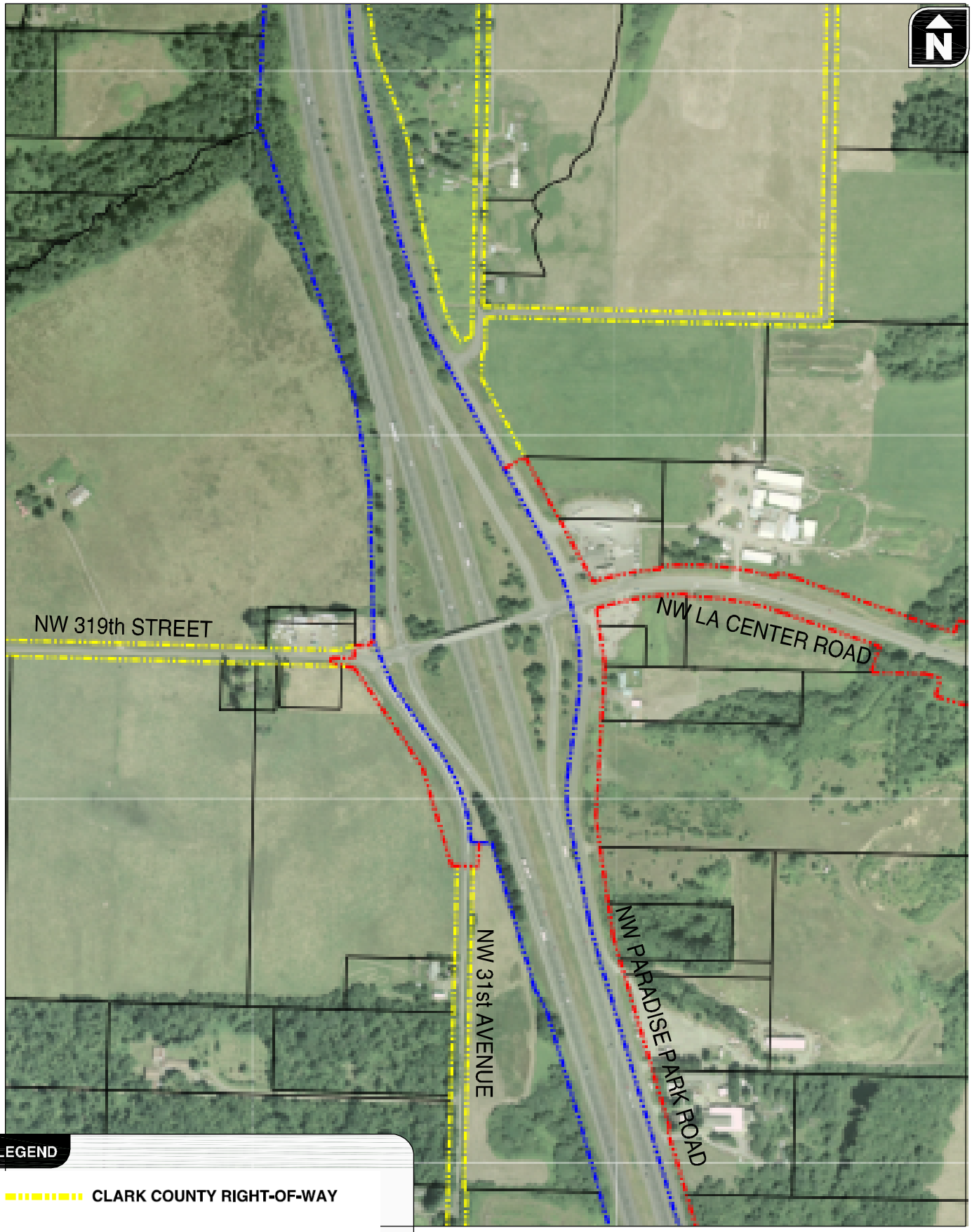
The ramp terminals are located approximately 535 feet (centerline-to-centerline) apart and are separated by a relatively narrow two-lane overpass structure that was constructed in 1969. The bridge provides eleven-foot travel lanes, two-foot shoulders, and three-foot wide sidewalks on each side, which do not meet current width design standards. In addition, the existing bridge does not meet current seismic design standards.

The NW La Center Road/I-5 interchange is served by several local roadways that provide connectivity between I-5, La Center, and the surrounding rural areas. These facilities are documented below and mapped in Figure I-2, which also shows the boundaries of the City of La Center.

NW La Center Road

NW La Center Road is an east-west, two-lane roadway that connects I-5 and the City of La Center. Based on recent traffic count information, the existing ADT east of the I-5 interchange is approximately 11,000 vehicles per day .The City of La Center owns the roadway within their city limits and currently classifies it as a *Major Collector.* Within the vicinity of the interchange, there are no sidewalks or bicycle lanes along either side of the roadway. Based on future projected volumes and uses (detailed in later sections), the roadway will be designed as a *Major Arterial* in accordance with the City's street standards.

[3] Further explanation of the study area is provided in the section "Study Area Defined" under Policy Point 1.



STUDY INTERCHANGE
LA CENTER, WASHINGTON

FIGURE
I-2

NW 319th Street

West of I-5, NW La Center Road becomes NW 319th Street. This east-west roadway is classified as a *Rural Minor Collector* by Clark County, which maintains a roadway easement west of the City's limits. NW 319th Street primarily serves the rural residential development located between I-5 and the Columbia River to the west. Existing ADT along this roadway is approximately 1,500 vehicles per day.

NW 31st Avenue

NW 31st Avenue is a north-south roadway located on the west side of I-5 south of NW 319th Street. The City of La Center owns the northern portion of the roadway within its City limits and classifies it as a two-lane *Rural Major Collector*. Clark County owns the remainder of the roadway south and also classifies NW 31st Avenue as a *Rural Major Collector*. Oriented parallel to I-5, this roadway acts as a rural frontage road to I-5 providing a continuous connection between NW 319th Street and the City of Ridgefield to the south. The intersection of NW 31st Avenue with NW 319th Street is located approximately 100 feet (centerline-to-centerline) from the I-5 southbound ramp terminal.

NW Paradise Park Road

NW Paradise Park Road is a north-south roadway located on the east side of I-5. As with NW 31st Avenue, NW Paradise Park Road acts as a rural frontage road to I-5 and connects to NW La Center Road approximately 125 feet (centerline-to-centerline) east of the northbound ramp terminal. Clark County owns the portion south of the City's limits and also classifies NW Paradise Park Road as a *Local* roadway. The City of La Centers owns the portion of the roadway near the interchange within its City Limits and classifies the roadway as a *Local* roadway. Based on future projected volumes and uses (detailed in later sections), the roadway will be designed as a *Major Collector* in accordance with the City's street standards.SR 503/I-5 Interchange

The SR 503/I-5 interchange is a split diamond interchange located in Woodland, WA. This interchange is located approximately 4.28 miles north of the NW La Center Road/I-5 interchange at milepost 21.08 in Woodland, WA. Traffic volumes on I-5 south of the SR 503 interchange are approximately 68,000 vehicles per day.

SR 501/I-5 Interchange

The SR 501/I-5 Interchange is diamond interchange located approximately 2.63 miles south of the NW La Center Road/I-5 interchange at milepost 14.17. Recently reconstructed to include a six-lane overpass and signalized ramp terminals, this interchange primarily serves the City of Ridgefield and the surrounding rural residential areas. Traffic volumes on I-5 south of the SR 501 interchange are approximately 82,000 vehicles per day.

I-5 Weigh Station

An existing weigh station for northbound I-5 traffic is located south of the La Center/I-5 interchange at milepost 15.5.

Gas Station Access Locations in Northeast Quadrant of the Interchange

An existing Shell Fuel Station is located on NW La Center Road just east of the interchange with a driveway on NW Paradise Park Road and on NW La Center Road. The driveway on NW La Center Road is located approximately 250 feet from the intersection of NW La Center Road/NW Paradise Park Road and 390 feet from the I-5 northbound ramp terminal. According to the WSDOT Design manual "If a frontage road or local road is located at or within 350 feet of a ramp, limited access will be established and then acquired along the crossroad and for an additional minimum distance of 130 feet in all directions from the centerline of the intersection of the crossroad and the frontage or local road" (Section 530.03(3)(c), Reference 5). Therefore the access currently meets WSDOT design standards.

RELEVANT BACKGROUND DOCUMENTS

Several documents offer foundational information relevant to the project and were reviewed as part of the study preparation. Two of these studies are briefly summarized below.

2008 Cowlitz Environmental Impact Statement

The Bureau of Indian Affairs (BIA) prepared an Environmental Impact Statement (EIS) for The Cowlitz Indian Tribe Trust Acquisition and Casino Project in 2008 for acquisition of the Cowlitz property into federal trust and the construction and operation of a casino resort and supporting infrastructure, including improvements to the La Center Road/I-5 Interchange (Reference 3). As part of the EIS, a traffic impact assessment (TIA) was completed to evaluate six site alternatives and their impacts to the surrounding transportation network. Four of the studied alternatives included a casino, hotel, and convention center; one alternative included an office park and warehouse; and one was a no-build alternative. The Cowlitz Reservation Development proposal documented in this IJR (see below) is very similar to -- and consistent with -- Alternative A of the EIS. It is worth noting, however, that the Cowlitz Reservation Development is somewhat reduced in size and intensity as compared to Alternative A, and, for that reason, some impacts may be somewhat smaller than those identified in the EIS. Alternative A, including mitigation to improve the I-5 Interchange, was approved by the BIA in a Record of Decision issued by the BIA on April 22, 2013.

2010 La Center Junction Subarea Plan

The City of La Center prepared a subarea plan for the local community that assessed long-term needs at the NW La Center Road/I-5 interchange (Reference 1). This study was not formally adopted but was used for informational and guidance purposes during preparation of the IJR.

Transportation Impact Analysis

A separate transportation impact analysis (TIA) has been prepared that addresses the increased traffic expected to be generated by the Cowlitz Reservation Development project and surrounding regional growth in the City of La Center and Clark County. This separate TIA is a companion document to the NW La Center Road/I-5 Interchange Improvement Project IJR and is provided in *Appendix B*. This document along with the analysis summarized in the following IJR Policy Points has concluded that future development-driven traffic

growth will necessitate the reconstruction of the existing NW La Center Road/I-5 interchange and require realignment of portions of the NW 31st Avenue and NW Paradise Park Road frontage roads. These findings are consistent with the Final Environmental Impact Statement (EIS) for the Cowlitz Indian Tribe Trust Acquisition and Casino Project dated May 30, 2008 and subsequent Record of Decision issued on April 22, 2013 (refer to discussion under Policy Point 8).

DESCRIPTION OF FUTURE GROWTH

The NW La Center Road/I-5 Interchange Improvement Project will accommodate the increase in future traffic volumes projected as a result of approved and anticipated development. A description of local development projects anticipated to increase traffic volumes at the interchange, including the Cowlitz Reservation Project and anticipated growth in the City of La Center, is provided below:

Cowlitz Reservation Development. While the site layout/program has yet to be finalized, full build-out the site in the northwest quadrant of the interchange is anticipated to include the following uses:

- 2,440 gaming positions (the IJR will study 3,500 gaming positions for a conservative analysis);
- Four interior restaurants;
- 5,000 – 6,000 square feet of interior retail space;
- Casino bars;
- An event center with seating for up to 1,500 guests; and
- Valet parking services
- A 250-room hotel with restaurant and retail space; and
- Up to 3,450 parking spaces

La Center Regional Growth. Based on currently adopted land use plans, growth within the City of La Center and near the La Center interchange is expected to increase at a rate similar to County wide population growth estimates of approximately 1.1%. The La Center urban growth area (UGA) is not currently planned for expansion near the interchange. For near-term 2017 analysis, a conservative growth rate of 3% per year is used for traffic east and west of the interchange at the request of City of La Center staff. For long term 2037 analysis, travel demand modeling from Southwest Washington Regional Transportation Council (RTC) is used to estimate traffic. The RTC's models are developed in part based on the 2014 update to the *Regional Transportation Plan For Clark County* (RTP).

IJR POLICY POINTS

Chapter 550 of the *WSDOT Design Manual* (Reference 5) outlines the eight policy points that need to be addressed as part of an IJR. These eight policy points are:

- Policy Point 1 – Need for Access Point Revision;
- Policy Point 2 – Reasonable Alternatives;
- Policy Point 3 – Operational and Collision Analyses;
- Policy Point 4 – Access Connections and Design;
- Policy Point 5 – Land Use and Transportation Plans;
- Policy Point 6 – Future Interchanges;
- Policy Point 7 – Coordination; and
- Policy Point 8 – Environmental Processes.

METHODS AND ASSUMPTIONS

As part of the IJR process, the *WSDOT Design Manual* requires a *Methods and Assumptions* document be developed to document the project, assumptions, methodologies, criteria, and decisions made in preparation of the project's final IJR. The final approved version of the *NW La Center Road/I-5 Interchange Improvement Project (MP 16.80) IJR Methods and Assumptions Document* is provided in *Appendix A* for reference.

For this project, special emphasis has been placed on Policy Points 2 and 3. Policy Point 2 describes the alternate interchange forms, terminal traffic control, and frontage roadway alignments that were considered and the process used to select the most appropriate design. Policy Point 3 describes the operations assessment of the I-5 mainline, merge/diverge locations, and intersections within the study area. It also describes the measures of effectiveness used to assess operations under several alternatives scenarios. Each policy point is discussed in the following sections.

POLICY POINT 1 – NEED FOR ACCESS POINT REVISION

Policy Point 1 describes the need for the interchange improvement and why the existing interchange is not sufficient to meet the design year needs. To address this policy point, the project study area is further defined and the existing and future needs are identified.

Study Area Defined

The IJR study area includes the I-5 mainline at the existing NW La Center Road/I-5 Interchange and its functional area along the NW 319th Street/NW La Center Road corridors. This includes the two adjacent frontage roads on either side of the interchange (NW 31st Avenue and NW Paradise Park Road). As such, the following intersections have been identified for detailed operational analysis:

- NW 31st Avenue/NW 319th Street;
- I-5 Southbound Ramps/NW La Center Road;
- I-5 Northbound Ramps/NW La Center Road; and
- Paradise Road/NW La Center Road.

Additional local intersections that go beyond the IJR study area are provided in the *Cowlitz Reservation Development TIA (see Appendix B)* prepared separately from the IJR.

The IJR study area extends to the northern interchange (SR 503 Exit 21 at milepost 21.08 in Woodland) and southern interchange (SR 501 Exit 14 at milepost 14.17 in Ridgefield) along the I-5 corridor. However, complete operational analyses of these interchanges are not included in the IJR. The 2017 and 2037 forecasts are anticipated to have a negligible impact at these two regional interchanges. Based on a trip distribution pattern developed for the Cowlitz Reservation Development, it is estimated that a very small percentage of the site-generated trips will use these interchanges. Specifically, it is estimated that between 0.5% and 1% of the total generated trips will utilize each of these interchanges. Based on trip generation estimates, this equates to approximately 8 to 17 total vehicle trips traveling through each of the adjacent interchanges during the highest trip generation period (Friday peak period). In addition, there is sufficient distance between the NW La Center Road/I-5 Interchange and the adjacent interchanges (approximately 4.3 miles to I-5/SR 503 and 2.7 miles to I-5/SR 501) to negate any impacts caused by the merging and diverging movements of the NW La Center Road interchange. Furthermore, the SR 501 Exit 14 interchange was recently reconstructed with available capacity exceeding 20 years as documented in the *Interstate 5/SR 501 Ridgefield Interchange Project* IJR dated May 4, 2009 (Reference 6). For these reasons, the impacts to the I-5/SR 503 and I-5/SR 501 interchanges are expected to be negligible with the NW La Center Road/I-5 Interchange Improvement Project.

Identification of Existing and Future Needs

The City of La Center published the "La Center Junction Subarea Plan" in 2010 which identified the need for improvements to the NW La Center Road/I-5 interchange in order to support development planned for the area (Reference 1). In addition, the City annexed a total of 471 acres of property with an additional 112 acres of roads and right-of-way up to I-5 in September 2011, providing developable industrial and commercial lands (Reference 4). As noted in the Subarea Plan, the current configuration provides two lanes

on the NW La Center Road/I-5 overcrossing, which "*does not allow for left-turn lanes and the closely spaced local street intersections reduce the efficiency and safety of the current design*" (Reference 1). In addition, the *Cowlitz Indian Tribe Casino Project Traffic Impact Study*, updated in 2007, found the existing operations at the NW La Center Road/I-5 southbound on ramp to be deficient, and projected additional failures at the interchange in the future with development of the Cowlitz property (Reference 2). Finally, the Final Environmental Impact Statement (EIS) for the Cowlitz Indian Tribe Trust Acquisition and Casino Project dated May 30, 2008 (Reference 3) and subsequent Record of Decision issued on April 22, 2013 (Reference 7) cite the need for a number of transportation improvements, including:

- "Realignment of NW 31st Avenue approximately 300-350 feet west of its current intersection with NW 319th Street in order to provide appropriate intersection spacing from the I-5 interchange. The intersection with NW 319th would be signalized and improved with left- and right-turn lanes."
- "Signalization of the northbound and southbound ramp intersections with separate controllers, which are in coordination with one another."
- "Addition of an auxiliary lane to the northbound off-ramp of approximately 1,500 feet in length (consistent with WSDOT standards) and widening to accommodate a two-lane off-ramp."
- "Widening of the overpass between the I-5 northbound and southbound ramps to accommodate a second westbound traffic lane and back-to-back left turn lane (a total of four lanes on the overpass); the overpass shall be constructed so as to accommodate a second eastbound travel lane in the long-term (2030) future."

The historical planning study findings cited above were further corroborated by the existing conditions analysis conducted as part of this IJR that found the southbound approach to the NW 319th Street/I-5 Southbound Ramp intersection to be operating at a LOS "F" and with a v/c ratio of 0.71 during the weekday AM peak hour. The need for interchange improvements from a traffic operations perspective is further established in the existing conditions assessment, provided in Policy Point 3. As detailed in the reports, significant amounts of growth are projected for the west side of I-5 that the current interchange form cannot support. The anticipated conditions are further discussed in *Policy Point 3, Operational and Accident Analyses*.

Additionally, the current interchange does not meet WSDOT standards for access spacing at an interchange. Chapter 530 of the WSDOT Design Manual, "Limited Access Control," requires 350 feet of spacing between ramp terminal intersections and frontage or local roads (Reference 5). Currently, the NW 31st Avenue frontage road is located less than 100 feet (centerline to centerline) west of the I-5 Southbound Ramps/NW 319th Street intersection and the NW Paradise Park Road frontage road is located less than 150 feet east of the I-5 Northbound Ramps/NW La Center Road intersection. The close spacing of the frontage road intersections is an access management concern that can lead to operational and safety challenges when considering future operations of the interchange. The deficient access spacing at the interchange will be further discussed and mitigations identified in *Policy Point 4*.

A more detailed engineering assessment was performed on the existing interchange bridge structure. This report is provided in *Appendix C*. The assessment concluded that the bridge has sufficient capacity to carry existing loads. However, the structure is substandard in terms of lane-widths, shoulders, and pedestrian

facilities, and does not meet current seismic standards. The image in Exhibit 1-1 illustrates the narrow bridge deck.

Exhibit 1-1: Existing Bridge Deck

Therefore, from an operations, access management, and roadway standards perspective, the current interchange does not meet current or future needs. These deficiencies were considered and addressed through the IJR development process and are documented herein.

POLICY POINT 2 – REASONABLE ALTERNATIVES

Several interchange, terminal traffic control, and frontage road alternatives for the NW La Center Road/I-5 interchange were assessed prior to determining that a diamond configuration best meets the near- and long-term operations and safety needs. The majority of the concepts discussed below were originally presented at the interchange improvement Alternatives Workshop on March 14th, 2013 (attended by WSDOT, FHWA, and City of La Center staff[4], Meeting Minutes provided in *Appendix D*). Based on feedback at the meeting, two additional concepts were evaluated. These concepts were developed as part of earlier planning efforts by the City of La Center[5]. The updated concepts were presented and reviewed at an updated Alternatives and Frontage Road Workshop on July 14th, 2014 (attended by WSDOT, FHWA, Clark Public Utility (CPU) District, and City of La Center staff[4], Meeting Minutes provided in *Appendix E*). The process used to identify potential design concepts, compare the concepts, and select the most appropriate design is described in the sections below.

The project team applied practical design in the development of reasonable alternatives. The preferred diamond interchange form will fit the future context of the anticipated land uses surrounding the interchange. Diamond interchanges avoid free-flow movements that are undesirable for bicyclists and pedestrians within the future anticipated urban setting. The implementation of roundabouts – selected as the preferred intersection traffic control - at the ramp terminal intersections results in narrower cross sections along the road segments with less impervious area. In addition, roundabouts have shown to reduce the frequency and number of injury crashes at intersections. The project team considered trade-offs between traffic operations, design, and safety in developing a practical design solution of the transportation system at the NW La Center Road/I-5 interchange.

Interchange Design Objectives

The project interchange, terminal traffic control, and frontage road alternatives assessment was guided by the following objectives:

1. **Follow the principles** of **interchange design**: any alternative should consider appropriate design guidance to provide for safe and efficient operations.
2. **Accommodate dominant traffic volumes**: the interchange should accommodate current traffic volumes, as well as those projected for year 2017 (opening of the Cowlitz Reservation Development). In addition, capacity needs in year 2037 should also be considered so that the selected interchange form does not fail under long-term growth projections or preclude the potential for future expansion.
3. **Optimize the performance of the interchange for all users**: freight, vehicle, bicycle, and pedestrian users and their respective needs should be adequately considered.

[4] While Clark County staff were invited to participate in this workshop (and future workshops), they elected not to participate.

[5] *La Center Junction Subarea Plan*, City of La Center, 2010

In order to ensure that the interchange accommodates future traffic volumes, traffic volume projections for 2017 (anticipated opening year of the Cowlitz Reservation Development) and 2037 (20-year long-term forecast year required for an interchange justification report [IJR]) with and without the Cowlitz Reservation Development were developed. An operational analysis was performed at the ramp terminals, freeway mainline, and ramp merge/diverge locations to assess geometric needs. Both signals and roundabouts were assessed as potential control options for the ramp terminals and frontage roads. The findings of this analysis are summarized in the memorandum *Interchange Evaluation – Intersection Traffic Control (*provided in *Appendix F)*. Significant findings include:

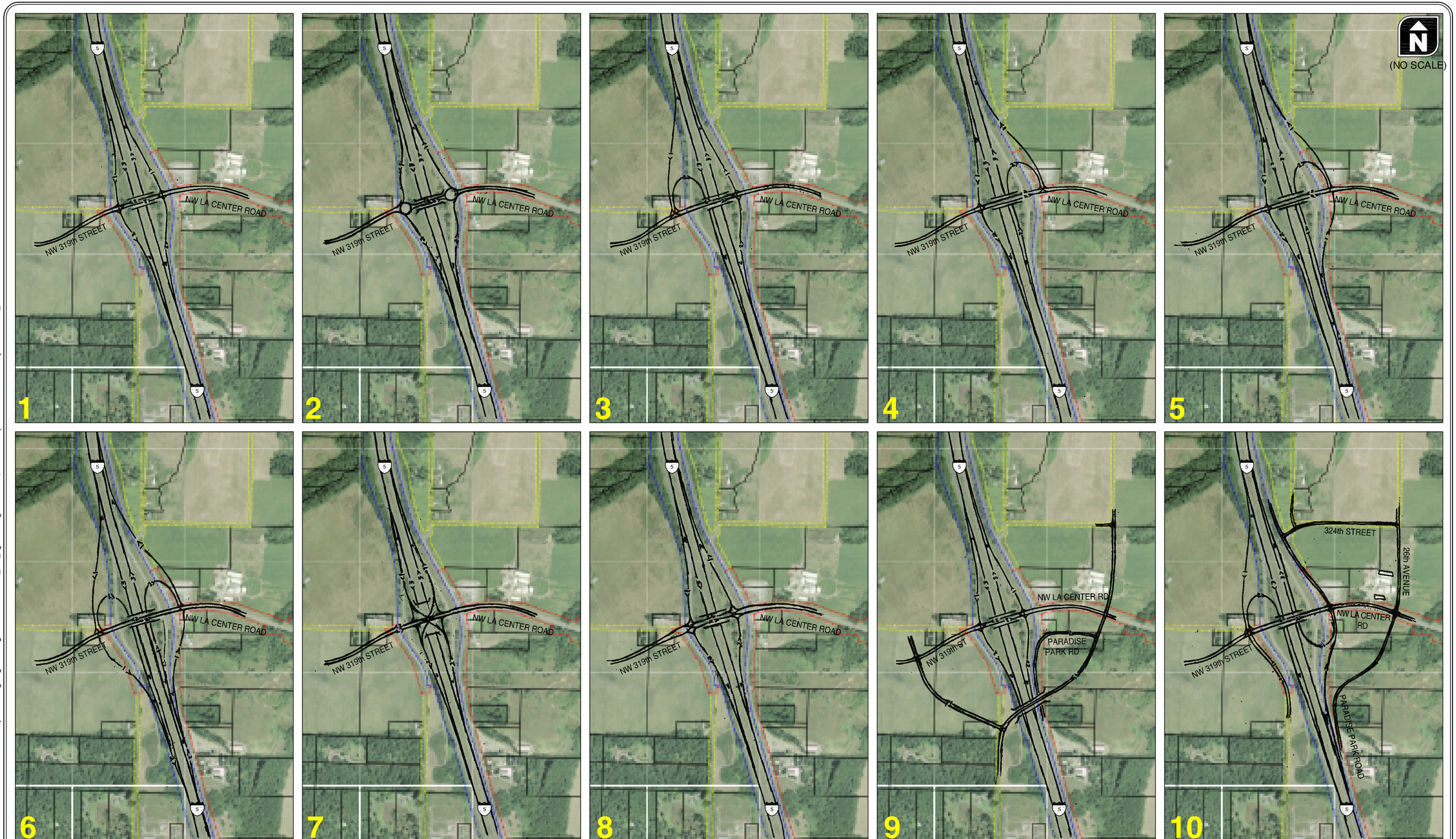
- The northbound off-ramp requires dual exit lanes in 2017 with the Cowlitz Development Reservation.
- With signals at the ramp terminal intersections, a 5-lane bridge structure will be required in 2017 and a 6-lane structure in 2037 to support future traffic volumes and the Cowlitz Reservation development.
- With roundabouts at the ramp terminals, there is more flexibility for staging the interchange reconstruction and a narrower (4-lane) bridge structure could be maintained through the 2037 study period.

The capacity needs identified through this analysis were used to inform the development of interchange forms capable of serving existing and future demand at the interchange.

Interchange Concept Development

Eight interchange improvement concepts were originally developed for the NW La Center Road/I-5 Interchange, which were discussed at the Alternatives Workshop on March 14th, 2013. Based on feedback from the City of La Center, the team also reviewed the *La Center Junction Subarea Plan* (Reference 1). The subarea plan developed three concepts for the interchange and considered the improvements that would be necessary with and without the development of a casino-resort in the northwest quadrant of the interchange. The team added Option 2 and Option 3 from the subarea plan to the concepts under consideration (Option 1 was found to be very similar to the original concepts already under consideration). All of the concepts alternatives are briefly described below. Single-line sketches of each concept are provided in Figure 2-1; larger images are provided in *Appendix G.* The sketches are intended to provide a high-level look at the interchange forms and their anticipated impacts. Although frontage roads are included in some of these sketches, the concepts were evaluated purely on the interchange form. The alignment and influence of frontage roads was addressed in subsequent analysis from this initial step.

- **Concept 1 – Signalized Diamond Interchange:** the existing diamond interchange form is maintained and improved to accommodate additional traffic volumes with traffic signals at the ramp terminal intersections. This concept would require the widening or replacement of the existing bridge structure. This alternative could likely be accommodated within existing right-of-way in 2017 with only minor changes to the existing freeway ramps.
- **Concept 2 – Roundabout Diamond Interchange:** the existing diamond interchange form is maintained and improved to accommodate additional traffic volumes with roundabouts at the ramp terminal intersections. This concept is similar to the signalized diamond interchange, but



INTERCHANGE CONCEPT OPTIONS
LA CENTER, WASHINGTON

FIGURE 2-1

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does not require as wide of a bridge structure. Additionally, it provides more flexibility for expanding the interchange to accommodate projected 2037 traffic volumes. It would require minor realignments of the off-ramp approaches to the ramp terminals to slow traffic speeds entering the roundabouts.

- **Concept 3 – Partial Cloverleaf Interchange (Southbound Parclo A)**: a southbound looping on-ramp is added to the northwest quadrant of the interchange. The loop ramp is intended to accommodate anticipated high traffic volumes to the south. The bridge structure would require widening or replacement and the southbound on- and off-ramps would require alterations. This design has significant property impacts to the northwest quadrant of the interchange.
- **Concept 4 – Partial Cloverleaf Interchange (Northbound Parclo B)**: a northbound looping off-ramp is added to the northeast quadrant of the interchange. The loop ramp is intended to accommodate anticipated high traffic volumes from the south destined to the west side of I-5. The bridge structure would require widening or replacement. The property impacts to the northeast quadrant and existing developments are significant. The northbound on- and off-ramps would require significant alterations and additional right-of-way.
- **Concept 5 – Partial Cloverleaf Interchange (Northbound Parclo B and "A" Ramp)**: this concept includes a northbound loop off-ramp to the northeast of the interchange for motorists destined to the west of the interchange, while the standard northbound off-ramp will be maintained for motorists destined to the east. There will only be one northbound off-ramp that will feed both the loop and standard ramps. The bridge structure would require widening or replacement. Similar to Concept 4, the impacts to the northeast quadrant and existing developments are significant. The northbound on- and off-ramps would require significant alternations and additional right-of-way.
- **Concept 6 – Partial Cloverleaf Interchange (Southbound Parclo A, Northbound Parclo B and "A" Ramp)**: a southbound loop on-ramp and northbound loop off-ramp are added to the north quadrants of the interchange to accommodate high traffic volumes to and from the south. This interchange form would have significant property impacts north of the interchange and require additional right-of-way. The bridge structure would require widening or replacement. All interchange ramps would require significant modifications.
- **Concept 7 – Single-Point Urban Interchange (SPUI) Configuration:** the interchange is converted to a SPUI form, which centralizes all interchange ramp movements at one intersection. This would require a significantly larger bridge structure and reconstruction of the approach alignments. The SPUI configuration is typically unfriendly towards bicyclists and pedestrians due to the exposure within a large intersection.
- **Concept 8 – Diverging Diamond Interchange (DDI):** the existing diamond interchange is altered at the ramp terminals to create a DDI, as well as replaces the existing bridge. The DDI design has shown to improve the operations of turning movements to and from the freeway facility and significantly reduces the number of vehicle-to-vehicle conflict points compared to a conventional diamond interchange. The DDI also reduces the severity of conflicts, as conflicts between left-turning movements and the opposing through movement are eliminated. The remaining conflicts are reduced to merge conflicts for turning movements, and the reduced-

speed crossover conflict of the two through movements. This design may provide challenges to bicyclists and pedestrians unfamiliar with the interchange form.

- **Concept 9 – Diamond Interchange with Additional Overcrossing (La Center Junction Subarea Plan Concept 2):** the diamond interchange is maintained and an additional overcrossing is proposed south of the interchange that provides a connection between NW 31st Avenue on the south and NW 26th Avenue on the north. The intent of the additional I-5 crossing is to reduce east-west local trips from the interchange. Based on the subarea junction plan, additional travel lanes would be required on NW La Center Road across the interchange with the development of a casino northwest of the interchange.
- **Concept 10 – Partial Cloverleaf Interchange (Parclo A) (La Center Junction Subarea Plan Concept 3):** a northbound loop on-ramp and southbound loop on-ramp are added to the northwest and southeast quadrants. This concept has undesirable road hierarchy by mixing frontage roads and ramp terminals. NW La Center Road, the bridge structure, and several ramps would need to be widened to also accommodate the casino traffic. The concept also includes extending NW 26th Avenue south to NW La Center Road.

Interchange Evaluation Criteria and Assessment

An initial evaluation and comparison of the interchange concepts was conducted based on selected screening criteria. The evaluation served to eliminate concepts with "fatal flaws" that did not warrant more detailed evaluation. It also helped to rank the concepts and identify the most feasible concepts.

A scoring system was developed to help quantify the ratings and compare the concepts. Each evaluation criterion was assigned a numerical value (-2, -1, 0, 1, 2) that was then applied to each concept. Concepts that scored better than others received a "+2." Those that do not impact the metric or have a neutral impact received a "0." Those that underperform compared to the other concepts received a "-2." The concepts that fall in between receive a "+1" or "-1" score. The selected evaluation criteria used for this assessment are outlined and briefly described below:

- **Transportation Operations:** includes mobility, freight mobility, and safety. The interchange configuration will accommodate current and anticipated future traffic volumes.
- **Land Use**: considers right-of-way impacts, consistency with adopted land use and economic development plans, impacts to utilities, and impacts to existing businesses/developments. There is currently a service station and other established private properties located on the east side of the interchange.
- **Multimodal Accessibility**: considers pedestrian and bicycle mobility. While pedestrian and bicycle activity at the interchange is currently low, multimodal facilities should be provided in the future to accommodate potential demand.
- **Cost**: expected relative cost between the concepts.
- **Environmental Impact**: considers impacts to the environment. There are environmentally sensitive areas within the vicinity of the interchange.

- **Constructability**: includes the ability to construct the improvements in phases (to expand the interchange in the future), local impacts during construction, and potential to utilize the existing bridge structure and freeway ramps.
- **Accessibility and Connectivity**: considers access spacing requirements, local roadway connectivity, and future access for undeveloped properties. Realignment of the frontage roads to the east and west of the interchange will be considered independent of the concepts assessment. Therefore, this assignment focuses primarily on the interchange form's influence on the area's accessibility.

Safety has not been identified as a separate evaluation criterion, because safety will be addressed inherently throughout the design and construction of the new interchange. These criteria were presented at the Alternatives Workshop on March 14th, 2013. Based on feedback at the meeting, the potential for wrong way movements were also assessed for each concept. Other feedback at the meeting was noted and factored in to the evaluation process as well.

Table 2-1 provides a summary of the preliminary evaluation of the initial interchange concepts. More detailed notes further explaining the scores are provided in *Appendix H*.

After this initial evaluation, Concepts 3, 4, 5, 6 and 10 (all variations of partial cloverleaf designs) were eliminated because they were determined to underperform based on the screening criteria compared to the other concepts. These concepts scored poorly primarily due to environmental and land use impacts north of the interchange (particularly to the existing gas station) and the significant costs associated with reconstructing multiple freeway ramps and the bridge structure.

Concept 7 (SPUI) has a positive rating, but the large expensive structure, the associated constructability challenges, as well as the pedestrian and bicycle exposure through the large intersection makes this alternative undesirable for this location.

The expense associated with the additional bridge structure in Concept 9 (additional I-5 overcrossing) outweighs the benefit it provides to the overall transportation system.

Concept 8 (DDI) rates fairly well; however, due to the La Center interchange's traffic pattern characteristics, a DDI design at this location does not take full advantage of a DDI's improved operational benefits for turning movements to and from the freeway facility, which reduces the number of vehicle-to-vehicle conflict points compared to a conventional diamond interchange. Traffic patterns at the La Center interchange will consist of dominant northbound (afternoon peaks) and westbound left-turns (morning peaks) with limited opposing traffic, which does not necessarily play toward the strengths of a typical DDI design configuration.

Concept 1 (Signalized Diamond Interchange) and Concept 2 (Roundabout Diamond Interchange) perform the highest. Both of these concepts maintain the existing diamond interchange form and use either signals or roundabouts at the ramp terminals. Based on the evaluation shown in Table 2-1 and feedback received at the design workshops held in March 2013 and July 2014, the diamond interchange form was selected as the preferred alternative. The assessment of signals or roundabouts for the ramp terminals is provided in the following section.

Table 2-1 Initial Interchange Form Concept Evaluation

Interchange Form Concept	Primary Advantages	Primary Constraints	Transpor-tation Operations	Land Use	Multimodal Access	Cost	Environ-mental Impact	Construct-ability	Access. & Connectivity	Total	Alternatives Workshop Feedback (3/14/2013)
Concept 1 – Signalized Diamond Interchange	• Utilizes existing interchange form/freeway ramps. • Minimal ROW impacts.		+1	+1	+1	+2	+1	+1	0	+7	• City does not have staff to maintain traffic signals currently.
Concept 2 – Roundabout Diamond Interchange	• Utilizes existing interchange form/freeway ramps. • Minimal ROW impacts. • Flexibility in expanding interchange in the future		+2	+1	+1	+2	+1	+1	0	+8	• Positive feedback and consistent with WSDOT practices.
Concept 3 – Partial Cloverleaf Interchange (Southbound Parclo A)	• Capacity for southbound on-ramp during AM peak (dominant movement)	• Significant impacts to NW quadrant • Requires full reconstruction of southbound ramps	+2	-1	0	-1	-1	0	0	-1	• The parclo concept will push the ramp gore points farther from the interchange and has impacts on the properties at the NW quadrant of the interchange. • Potential for wrong-way movements
Concept 4 – Partial Cloverleaf Interchange (Northbound Parclo B)	• Capacity for northbound off-ramp during PM peak (dominant movement)	• Significant impacts to NE quadrant and existing gas station • Requires full reconstruction of northbound ramps	+2	-2	0	-1	-1	0	-1	-3	• The parclo concept will push the ramp gore points farther from the interchange and has impacts on the properties at the NE quadrant of the interchange. • Potential for wrong-way movements
Concept 5 – Partial Cloverleaf Interchange (Northbound Parclo B and "A" Ramp)	• Capacity for northbound off-ramp during PM peak (dominant movement)	• Significant impacts to NE quadrant and existing gas station • Requires full reconstruction of northbound ramps	+2	-2	0	-1	-1	0	-1	-3	• The parclo concept will push the ramp gore points farther from the interchange and has impacts on the properties at the NE quadrant of the interchange. • Potential for wrong-way movements
Concept 6 – Partial Cloverleaf Interchange (Southbound Parclo A, Northbound Parclo B and "A" Ramp)	• Capacity for southbound on-ramp during AM peak and northbound off-ramp during PM peak	• Significant impacts to NW quadrant and NE quadrant (existing gas station) • Requires full reconstruction of southbound and northbound ramps	+2	-2	-1	-2	-2	-1	-1	-7	• The parclo concept will push the ramp gore points farther from the interchange and has impacts on the properties at the NW and NE quadrants of the interchange. • Potential for wrong-way movements
Concept 7 – Single-Point Urban Interchange (SPUI) Configuration	• Minimal ROW impacts Improved operation efficiency • Requires one signal	• Large and expensive bridge structure, posing constructability challenges • Unfriendly for pedestrians and bicyclists	+2	+2	-2	-1	+1	-1	+1	+2	• Likely would require large and expensive bridge structure, and could create pedestrian and bike unfriendly environment.
Concept 8 – Diverging Diamond Interchange	• Improved operation efficiency • Reduces signal delay • Minimal ROW impacts	• Lack of familiarity for drivers, bicyclists, and pedestrians	+2	+1	-1	+2	+1	+1	0	+6	• To pursue a DDI, there needs to be a reason to select it above other concepts, otherwise not preferred • Design is likely to be unpopular with community, although left-turn movements on to I-5 are a concern and would be addressed with design.
Concept 9 – Diamond Interchange with Additional Overcrossing	• Removes local trips from the interchange	• Significant costs and ROW impact with additional overcrossing	+1	-2	+2	-2	-2	+1	0	-2	• Low volume of local trips that would be removed with overpass, but new connection has significant impacts.
Concept 10 – Partial Cloverleaf Interchange (Parclo A)	• Capacity for southbound on-ramp during AM peak (dominant movement)	• Significant impacts to NW and SE quadrants of interchange • The northbound loop on-ramp does not provide much benefit to the operations of the ramp terminal • Requires full reconstruction of southbound and northbound ramps	+2	-2	-2	-2	-2	-1	0	-7	• The parclo concept will push the ramp gore points farther from the interchange and has impacts on the properties at the NW and SE quadrants of the interchange. • Potential for wrong-way movements

Terminal Traffic Control Options

As noted in the alternative interchange form descriptions, the existing interchange could be improved by adding either traffic signals or roundabouts at the ramp terminals. In order to help inform the assessment of the terminal traffic control, further operations analysis was performed for both the traffic signal and roundabout scenarios (detailed operational analysis is provided in *Interchange Evaluation – Intersection Traffic Control,* provided in *Appendix F)*. For the signalized option, the signals along NW La Center Road were assumed to be coordinated in order to progress dominant movements between the I-5 ramps and NW La Center Road. As part of this assessment, the required lane configurations to accommodate traffic volumes in 2017 and 2037 with the Cowlitz Reservation Development were developed for both traffic signal and roundabout scenarios. Concept sketches were then created for each scenario to better understand the feasibility and impacts of each alternative. Figure 2-2 provides a conceptual sketch of the lane configuration needed in 2017 with traffic signals and operations, while Figure 2-3 shows the roundabout concept. As seen by comparing the figures, fewer lanes are needed on the overpass with the roundabout option (three lanes compared to four) and fewer turn lanes (particularly left-turn lanes) at the ramp terminals and NW 31st Avenue frontage road intersection are needed with the roundabout option. Table 2-2 compares operations in 2017 with traffic signals or roundabouts.

Table 2-2 2017 Ramp Terminal Traffic Control Operations Comparison

Intersection	Operating Standard	Signal Control		Roundabout Control	
		Forecast Weekday AM	Forecast Weekend	Forecast Weekday AM	Forecast Weekend
NW 319th Street/NW 31st Avenue	D	A (0.32)	B (0.84)	A (0.17)	A (0.53)
NW La Center Road/I-5 SB Ramps	C	A (0.87)	A (0.77)	A (0.31)	A (0.61)
NW La Center Road/I-5 NB Ramps	C	B (0.85)	B (0.66)	A (0.56)	A (0.55)
NW La Center Road/NW Paradise Park Road[1]	E	E (0.58)	E (0.15)	E (0.57)	E (0.15)

Notes: LOS (V/C Ratio)
[1]Intersection is modeled as two-way stop controlled intersection in both scenarios as low volumes don't warrant signal or roundabout

As seen in the table, the intersection of NW 319th Street/NW 31st Avenue and ramp terminals all operate at a better LOS with roundabout control compared to signalized control.

Figure 2-4 provides a conceptual sketch of the lane configuration needed in 2037 with traffic signals and operations, while Figure 2-5 shows the roundabout concept. Again, fewer lanes are needed on the overpass with the roundabout option (four lanes compared to six) and fewer turn lanes (particularly left-turn lanes) at the ramp terminals and 31st Avenue frontage road intersection are needed with the roundabout option. Table 2-3 compares operations in 2037 with traffic signals or roundabouts.

CONCEPTUAL

AM
75 → LOS=B Del=17.3 V/C=0.85(NBR) ← 155
160 → ← 605
290 ↓ ↑ 320

WEEKEND
75 → LOS=B Del=14.8 V/C=0.66(NBR) ← 125
245 → ← 430
925 ↓ ↑ 565

BLUE LINES ARE PREDOMINANT AM TRAVEL PATTERNS

AM
25 ↓ ↓ 120
120 → LOS=A Del=9.7 V/C=0.87(WBL) ← 360
225 → ← 535

WEEKEND
140 ↓ ↓ 170
145 → LOS=A Del=8.6 V/C=0.77(SBL) ← 980
635 → ← 375

I-5 SB
I-5 NB
STOP
STOP
NW LA CENTER RD

AM
65 ↓ ↓ 40
90 → CM=SB LOS=E Del=48.2 V/C=0.58 ← 10
385 → ← 630
5 → ← 10
10 ↑ ↑ 165

WEEKEND
35 ↓ ↓ 30
80 → CM=NB LOS=E Del=37.4 V/C=0.15 ← 10
720 → ← 455
5 → ← 5
10 ↑ ↑ 55

50% OUT
50% IN
50% IN
NW 319TH ST
50% OUT
NW PARADISE PARK ROAD

AM
5 ↓ ↓ 110
<5 → LOS=A Del=6.3 V/C=0.32(WB) ← 145
155 → ← 190
15 → ← 50
5 ↑ ↑ 80

WEEKEND
5 ↓ ↓ 330
<5 → LOS=B Del=15.7 V/C=0.84(SBL) ← 495
385 → ← 555
15 → ← 75
5 ↑ ↑ 165

NW 31ST AVE

YELLOW LINES ARE PREDOMINANT WEEKEND TRAVEL PATTERNS

0 100 200 300 400
SCALE: 1"=200'

LEGEND

CM = CRITICAL MOVEMENT (UNSIGNALIZED)
LOS = INTERSECTION LEVEL OF SERVICE (SIGNALIZED & ROUNDABOUT)/CRITICAL MOVEMENT CONTROL DELAY (UNSIGNALIZED)
Del = INTERSECTION AVERAGE CONTROL DELAY (SIGNALIZED & ROUNDABOUT)/CRITICAL MOVEMENT CONTROL DELAY (UNSIGNALIZED)
V/C = CRITICAL VOLUME-TO-CAPACITY RATIO

2017 WEEKDAY AM AND WEEKEND TOTAL VOLUME AND MOVEMENT SUMMARY FOR SIGNALIZED INTERSECTIONS
LA CENTER, WASHINGTON

FIGURE **2-2**

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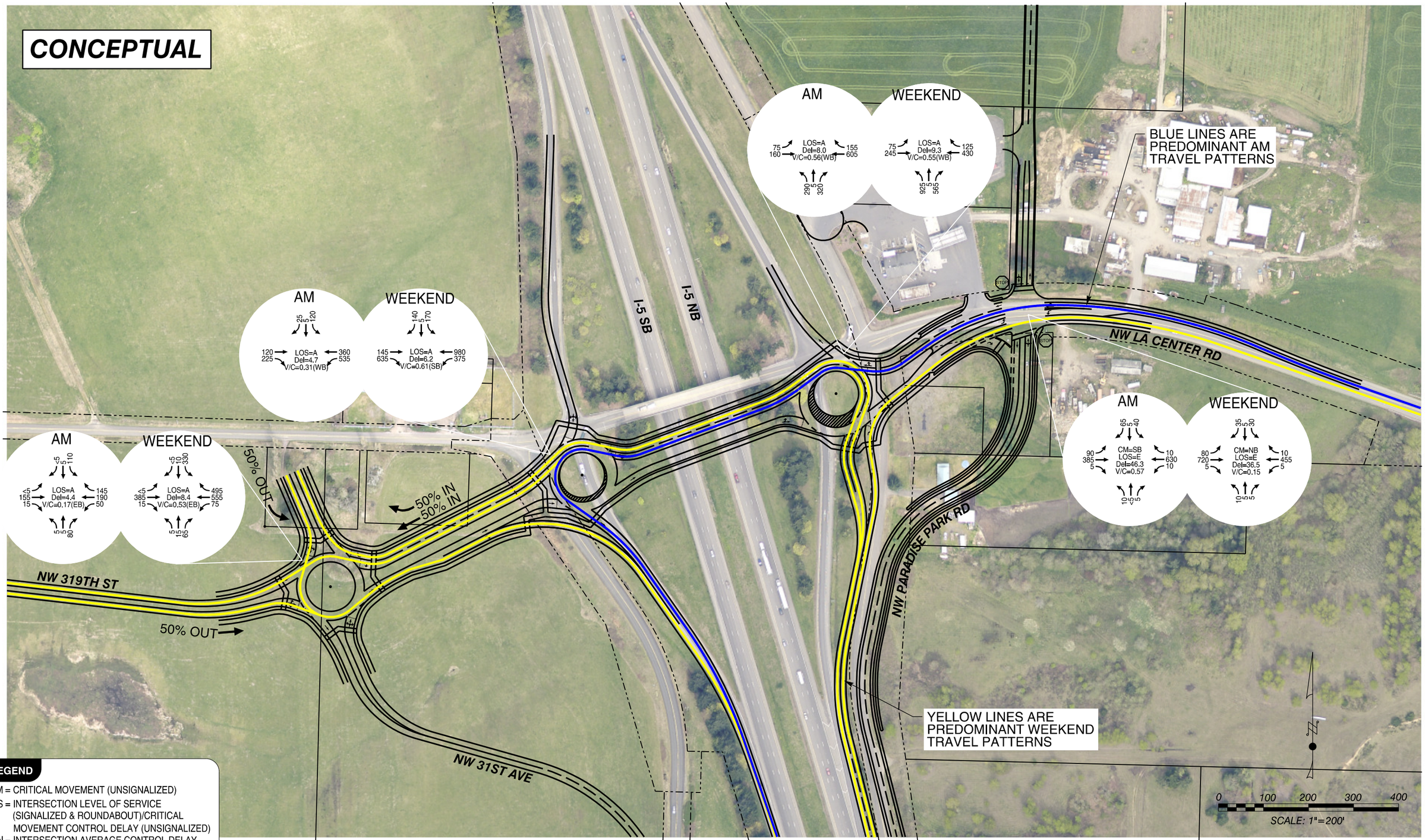
CONCEPTUAL



LEGEND

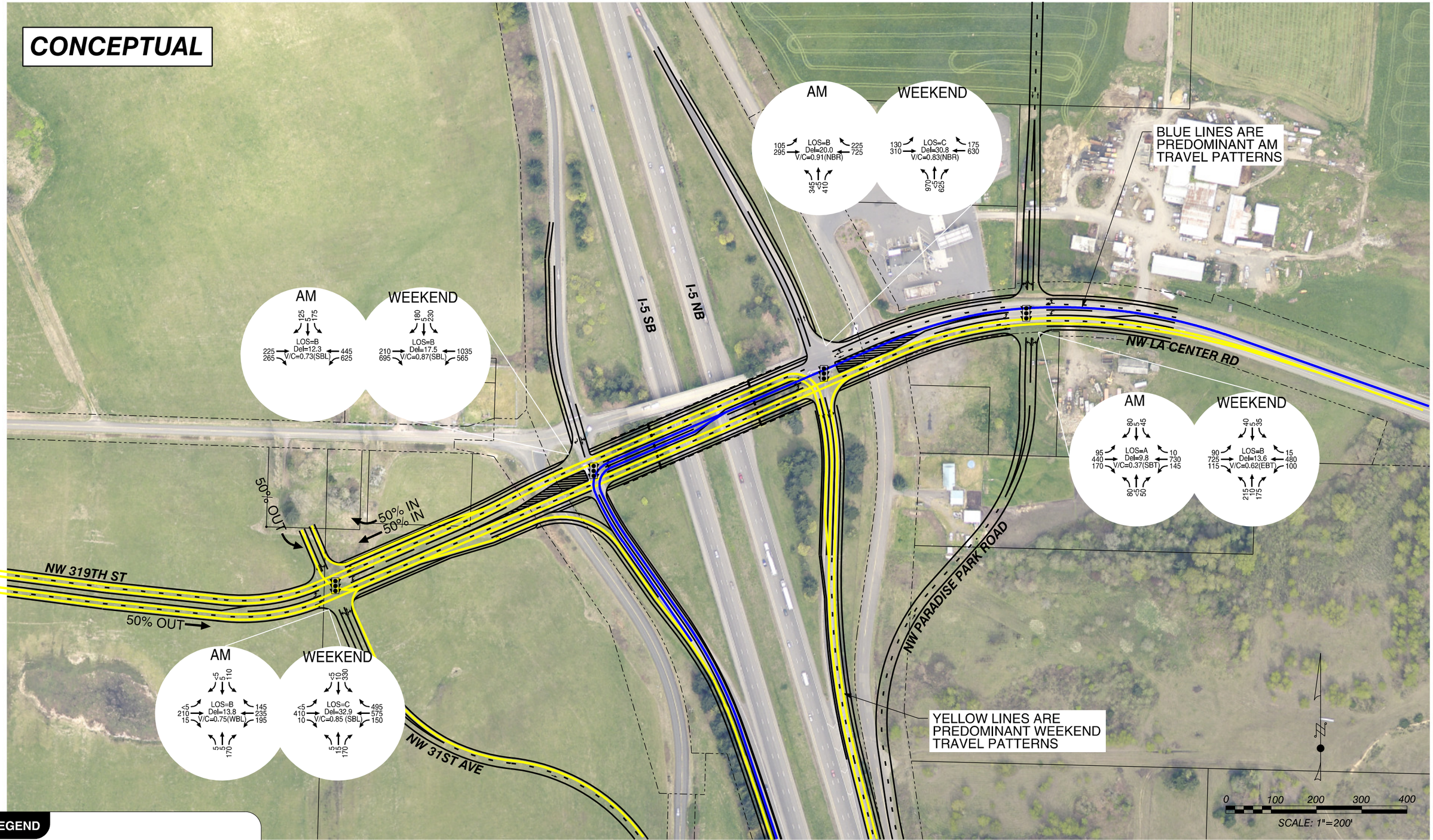
CM = CRITICAL MOVEMENT (UNSIGNALIZED)
LOS = INTERSECTION LEVEL OF SERVICE (SIGNALIZED & ROUNDABOUT)/CRITICAL MOVEMENT CONTROL DELAY (UNSIGNALIZED)
Del = INTERSECTION AVERAGE CONTROL DELAY (SIGNALIZED & ROUNDABOUT)/CRITICAL MOVEMENT CONTROL DELAY (UNSIGNALIZED)
V/C = CRITICAL VOLUME-TO-CAPACITY RATIO

2017 WEEKDAY AM AND WEEKEND TOTAL VOLUME AND MOVEMENT SUMMARY FOR ROUNDABOUT INTERSECTIONS LA CENTER, WASHINGTON

FIGURE **2-3**

Kittelson & Associates, Inc.
Transportation Engineering / Planning

CONCEPTUAL



LEGEND

LOS =INTERSECTION LEVEL OF SERVICE
Del =INTERSECTION AVERAGE CONTROL DELAY
V/C =CRITICAL VOLUME-TO-CAPACITY RATIO

2037 WEEKDAY AM AND WEEKEND TOTAL VOLUME AND MOVEMENT SUMMARY FOR SIGNALIZED INTERSECTIONS LA CENTER, WASHINGTON

FIGURE **2-4**

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CONCEPTUAL

AM
130 → 175
225 → LOS=A Del=5.5 ← 445
265 ↘ V/C=0.41(WB) ↙ 625

WEEKEND
180 → 230
210 → LOS=A Del=6.0 ← 1035
695 ↘ V/C=0.53(WB) ↙ 565

AM
105 → 225
295 → LOS=A Del=8.3 ← 725
345 ↑ 410

WEEKEND
130 → 175
310 → LOS=B Del=12.1 ← 630
970 ↑ 625

AM
80 → 45
95 → LOS=A Del=6.5 ← 10
440 → 730
170 ↘ V/C=0.38(WBT) ↙ 145
80 ↑ 50

WEEKEND
40 → 35
90 → LOS=A Del=9.0 ← 15
725 → 480
115 ↘ V/C=0.45(NBL) ↙ 100
215 ↑ 175

AM
<5 → 5 ← 110
<5 → LOS=A Del=5.1 ← 145
210 → 235
15 ↘ V/C=0.23(EB) ↙ 195
5 ↑ 5
170

WEEKEND
<5 → 10 ← 330
<5 → LOS=A Del=8.1 ← 495
410 → 575
10 ↘ V/C=0.52(EB) ↙ 150
5 ↑ 15
170

I-5 SB
I-5 NB
NW LA CENTER RD
NW PARADISE PARK RD
NW 319TH ST
NW 31ST AVE
50% OUT
50% IN
50% IN
50% OUT

BLUE LINES ARE PREDOMINANT AM TRAVEL PATTERNS

YELLOW LINES ARE PREDOMINANT WEEKEND TRAVEL PATTERNS

0 100 200 300 400
SCALE: 1"=200'

LEGEND

LOS =INTERSECTION LEVEL OF SERVICE
Del =INTERSECTION AVERAGE CONTROL DELAY
V/C =CRITICAL VOLUME-TO-CAPACITY RATIO

2037 WEEKDAY AM AND WEEKEND TOTAL VOLUME AND MOVEMENT SUMMARY FOR ROUNDABOUT INTERSECTIONS LA CENTER, WASHINGTON

FIGURE **2-5**

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Table 2-3 2037 Ramp Terminal Traffic Control Operations Comparison

Intersection	Operating Standard	Signal Control		Roundabout Control	
		Forecast Weekday AM	Forecast Weekend	Forecast Weekday AM	Forecast Weekend
NW 319th Street/NW 31st Avenue	D	B (0.75)	C (0.85)	A (0.23)	A (0.52)
NW La Center Road/I-5 SB Ramps	D	B (0.73)	B (0.87)	A (0.41)	A (0.53)
NW La Center Road/I-5 NB Ramps	D	B (0.91)	C (0.83)	A (0.66)	B (0.76)
NW La Center Road/NW Paradise Park Road	D	A (0.37)	B (0.62)	A (0.38)	A (0.45)

Notes: LOS (V/C Ratio)

As seen in the table, all intersections are projected to operate at a better LOS with roundabout control than with signal control.

Based on this operational analysis and assessment of future lane configuration needs, the roundabout option can be constructed in phases so that the 2017 layout and configuration can easily be expanded to accommodate growth anticipated for 2037. The roundabout option also requires a narrower bridge structure (4-lanes). Access to the properties on NW La Center Road could be more easily provided with roundabouts due to the easier ability to accommodate U-turn movements. In comparison, signals have the advantage of being easier to construct while maintaining traffic during construction. A summary of the key differences between the options is provided in Table 2-4.

Table 2-4 Ramp Terminal Traffic Control Comparison

Consideration	Traffic Signals	Roundabouts
Operations	With appropriate lane configuration, signals could accommodate future traffic volumes.	Roundabouts provide better overall operations and reduce the turn-lanes needed.
Intersection Footprint	Smaller intersection footprint.	Requires more land in immediate vicinity of intersection to accommodate the central island, splitter islands, and approaches.
Turn-Lane Needs	Require additional turn-lanes to serve demand.	Able to accommodate left-turns within the roundabout.
Phasing	Additional capacity added by widening/adding turn-lanes, requiring reconstruction of curbing and pedestrian/bicycle facilities.	Additional capacity added by shrinking splitter islands and diameter of the central island, limiting impacts.
Bridge Structure	4-lane bridge structure needed in 2017; 6-lane bridge structure needed in 2037.	3-lane bridge structure needed in 2017; 4-lane bridge structure needed in 2037.
Access to Adjacent Properties	Accommodating some existing private property accesses along NW La Center Road that would be located within the intersection influence area may be challenging	Accesses between roundabouts can be limited to right-in/right-out, because left-turns can be accommodated at the roundabouts.
Safety	Signals provide protected movements, but some crash types (such as angle and turning crashes) may result in high-severity conflicts.	Roundabouts provide increased safety levels due to fewer conflict points, lower speeds, and reduced potential for high-severity conflicts.
Cost	Traffic signal is slightly less expensive to construct with 2017 improvements (approximately $27M), but more expensive to expand to accommodate 2037 improvements (additional $24.1M).	Roundabout is slightly more expensive to construct with 2017 improvements (approximately $28.7M), but less expensive to expand to accommodate 2037 improvements (additional $10.8M),

Interchange Form & Terminal Traffic Control Findings and Recommendations

Based on the considerations documented herein and input provided at the design workshops in March 2013 and July 2014, the preferred option is to improve the existing diamond interchange with roundabouts at the ramp terminals. The feedback is captured in Table 2-1 and the Alternatives Workshop Meeting Minutes (*Appendix D* and E). Overall, the feedback for the roundabout option was favorable, with the following key considerations:

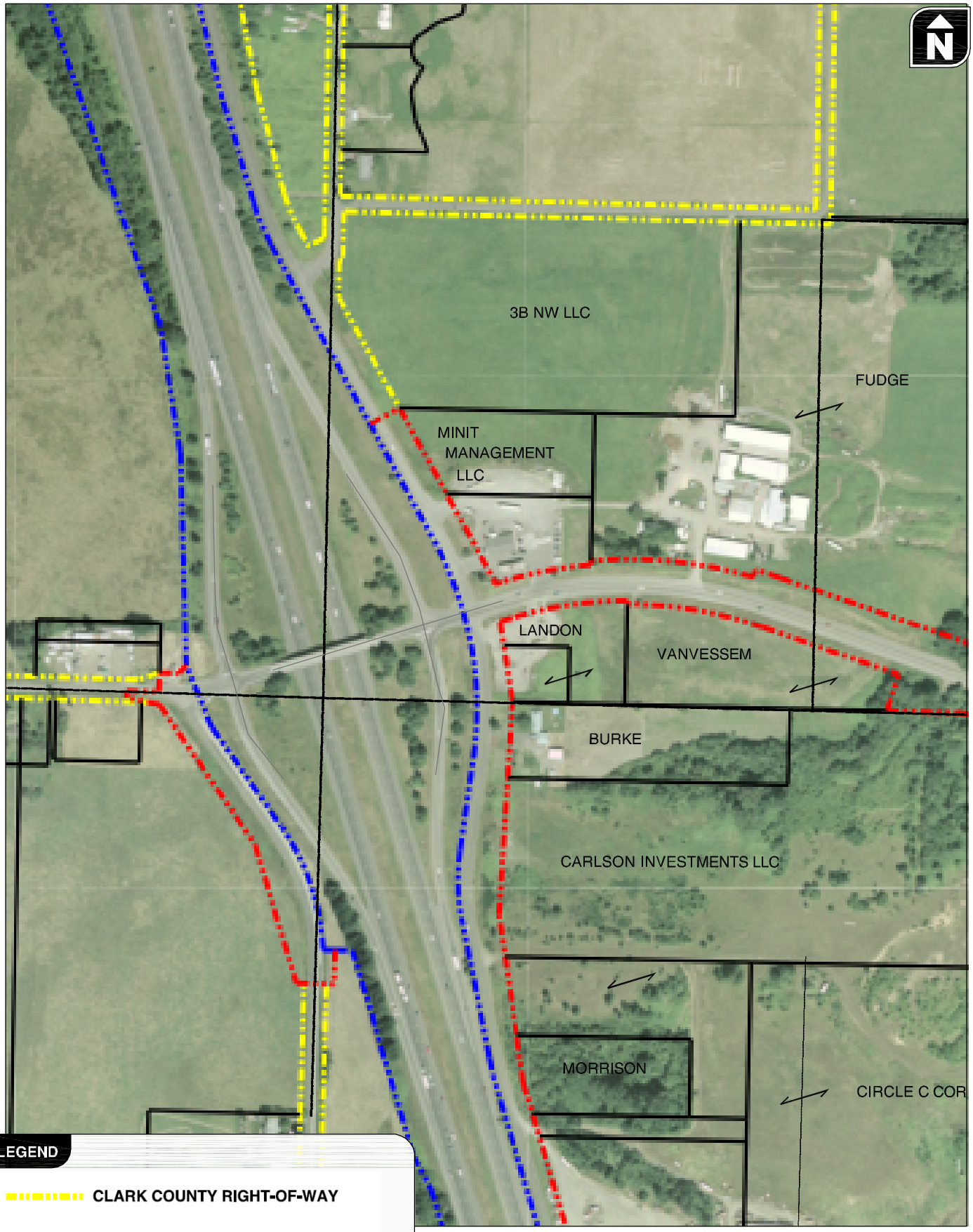
- Minimizes construction phasing between 2017 and 2037 by allowing the roundabouts to be expanded inward to maintain the same footprint and minimize impacts to curbing.
- Requires fewer lanes on most intersection approaches compared to signalized scenario.
- Outperforms signals from both an operational and safety perspective, and reduces the number of necessary travel lanes through and between the ramp terminals. This results in an ultimately narrower bridge structure (4-lanes) in 2037 compared to the signalized scenario (6-lanes).
- Requires minimal changes to on-ramp and off-ramp alignments to achieve necessary speed reduction on roundabout approaches.
- Minimizes right-of-way impacts.
- Provides more overall accessibility to land uses along NW La Center Road via the U-turns movements accommodated at roundabouts.

The remainder of this section will focus on the inclusion of a diamond configuration for the NW La Center Road/I-5 interchange with roundabouts at the ramp terminals.

Frontage Road Alignment

In addition to assessing several interchange forms and terminal traffic control options, options for the realignment of the frontage roads on the east and west sides of the interchange were evaluated. As described in Policy Point 1, the spacing of the frontage roads is currently deficient and does not meet WSDOT standards. In developing and evaluating the potential frontage road options, similar evaluation criteria to that used in the interchange form analysis were employed. However, the primary driver in the development of the frontage roadway options was the availability of existing right-of-way and parcels for purchase. Given that the project is ***not federally funded*** and the Cowlitz Tribe's ability to have the federal government exercise eminent domain on its behalf is limited to trust lands, the frontage road improvement options were limited to existing right-of-ways and parcels available for purchase (i.e., willing sellers).

To determine and define parcel availability, all the properties adjacent to NW La Center Road, NW 319th Street, NW 31st Avenue, and NW Paradise Park Road within 500 feet of the interchange (and not under control of the Cowlitz Tribe) were contacted regarding potential purchase. Based on this process, six additional parcels were brought under contract over the course of the IJR development process and were deemed available at the time of this analysis for the potential development of frontage roads. Figure 2-6 summarizes the existing right-of-ways and/or easements controlled by WSDOT, Clark County, and the City of La Center as well as the properties fully owned or under contract by the Cowlitz Tribe.



MAP OF PARCEL OWNERS ON EAST SIDE OF INTERCHANGE LA CENTER, WASHINGTON

FIGURE 2-6

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Frontage Road Design Objectives

Based on the available right-of-way and property, the following design objectives were used in developing the frontage road options:

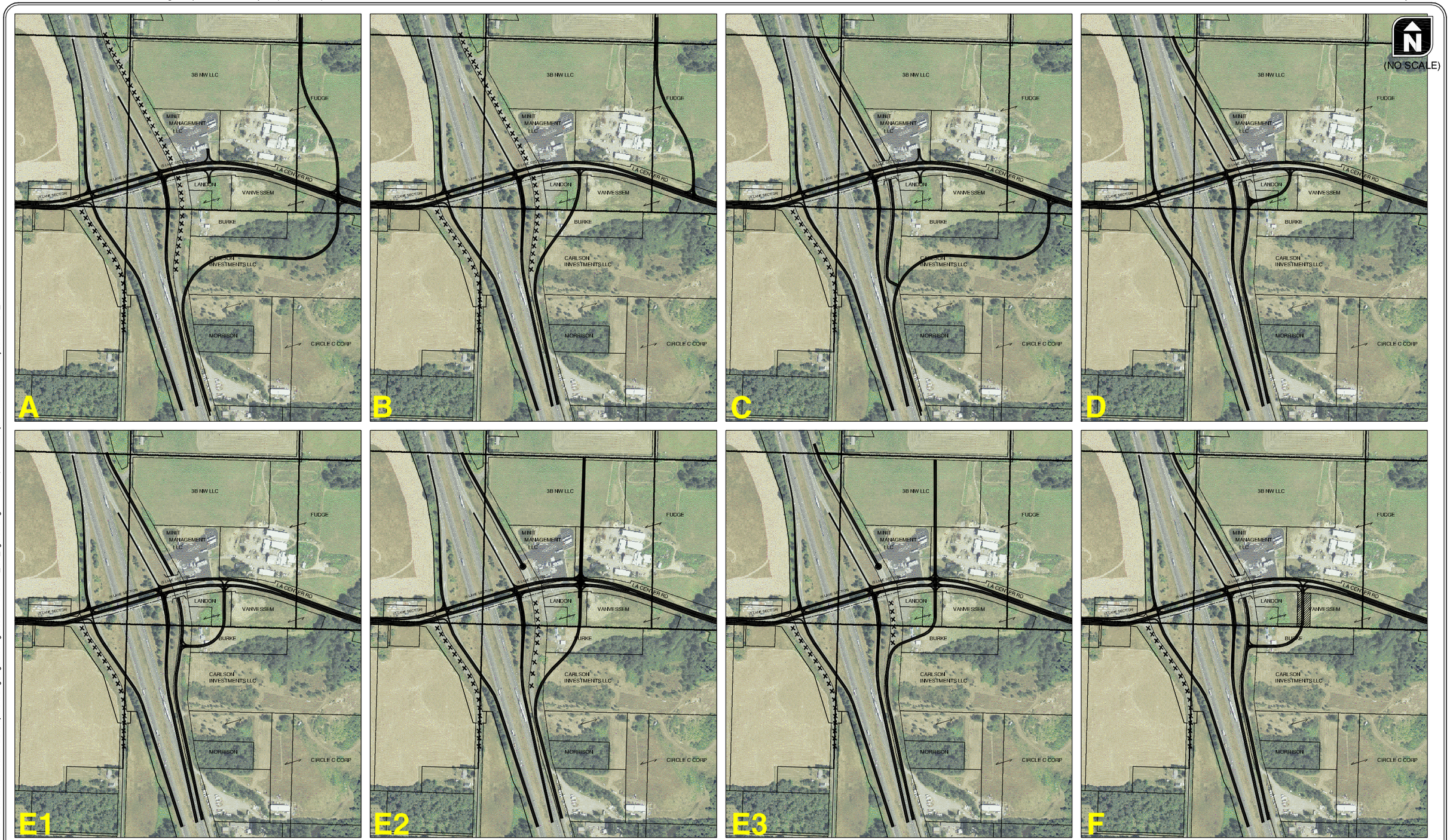
1. **Follow the principles of roadway system design**: any option should consider appropriate roadway design guidance to provide for safe and efficient operations, and meet the design criteria of the applicable road authority (e.g., WSDOT, Clark County, City of La Center, or the Cowlitz Tribe).
2. **Meet or exceed access spacing requirements**: the frontage road intersections should be located to meet or exceed the WSDOT minimum crossroad spacing requirement of 350 feet (centerline to centerline) and 130 feet on the frontage roads themselves.
3. **Accommodate opening year traffic volumes and future expansion needs**: the frontage road system should accommodate current traffic volumes, as well as those projected for 2017. In addition, capacity needs in 2037 should also be considered so that the selected frontage road system design does not fail under long-term growth projections or does not preclude the potential for future expansion.
4. **Optimize the performance of the frontage road system for all users**: freight, motor vehicle, bicycle, and pedestrian users and their respective needs were considered.

Frontage Road Options

Based on the preferred diamond interchange concept and the design objectives discussed above, eight frontage road options were developed on the eastside of I-5 for NW Paradise Park Road. Single-line sketches of each concept are provided in Figure 2-7; larger images are provided in *Appendix I.*

- **Option A –** This frontage option utilizes the *Carlson/Fudge* parcels and locates the new Paradise Park Road/La Center Road intersection approximately 1,400 feet east of the northbound ramp terminal. The existing Paradise Park Road intersection would be eliminated by forming cul-de-sacs (or potentially vacating the roadways) north and south of NW La Center Road. This option relies on NW 324th Street to connect to the northerly portion of Paradise Park Road.
- **Option B –** This option utilizes the *Carlson/Burk/Landon/Fudge* parcels and locates the new Paradise Park Road/La Center Road offset "T" intersections approximately 500 (south leg) and 1,400 feet (north leg) east of the northbound ramp terminal. The existing Paradise Road intersection would be eliminated by forming cul-de-sacs (or potentially vacating the roadways) north and south of NW La Center Road. This option relies on NW 324th Street to connect to the northerly portion of Paradise Park Road.

Option C – This option utilizes the *Carlson* parcel and develops a Paradise Park Road underpass at NW La Center Road. The underpass provides access to properties north of NW La Center Road via the newly realigned southern Paradise Park Road "T" intersection. This option eliminates the existing Paradise Park Road intersection and lowers the roadway approximately 20 feet to pass under NW La Center Road. The new frontage "T" intersection would be located approximately 1,400 feet from the existing I-5 northbound ramp terminal.

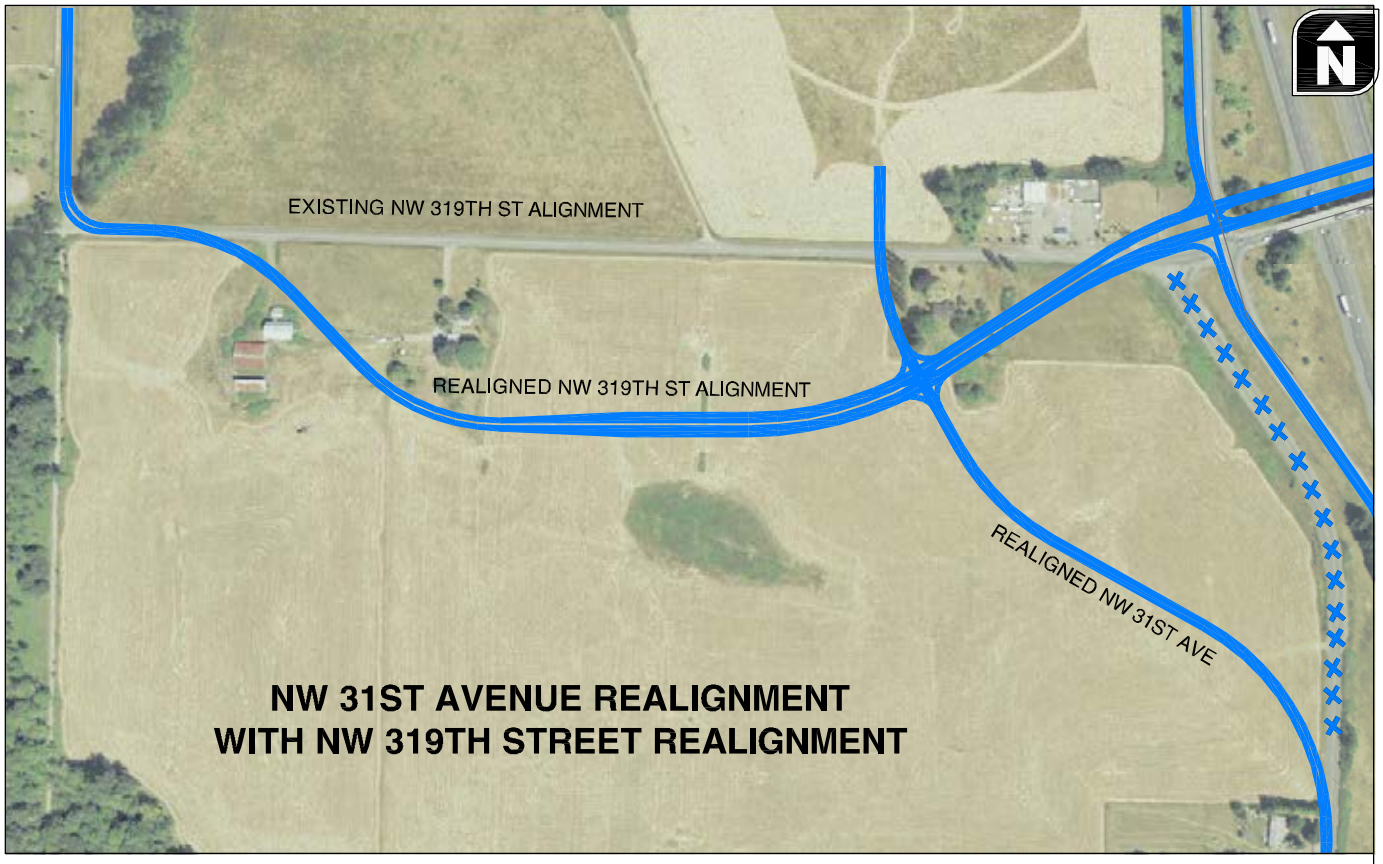


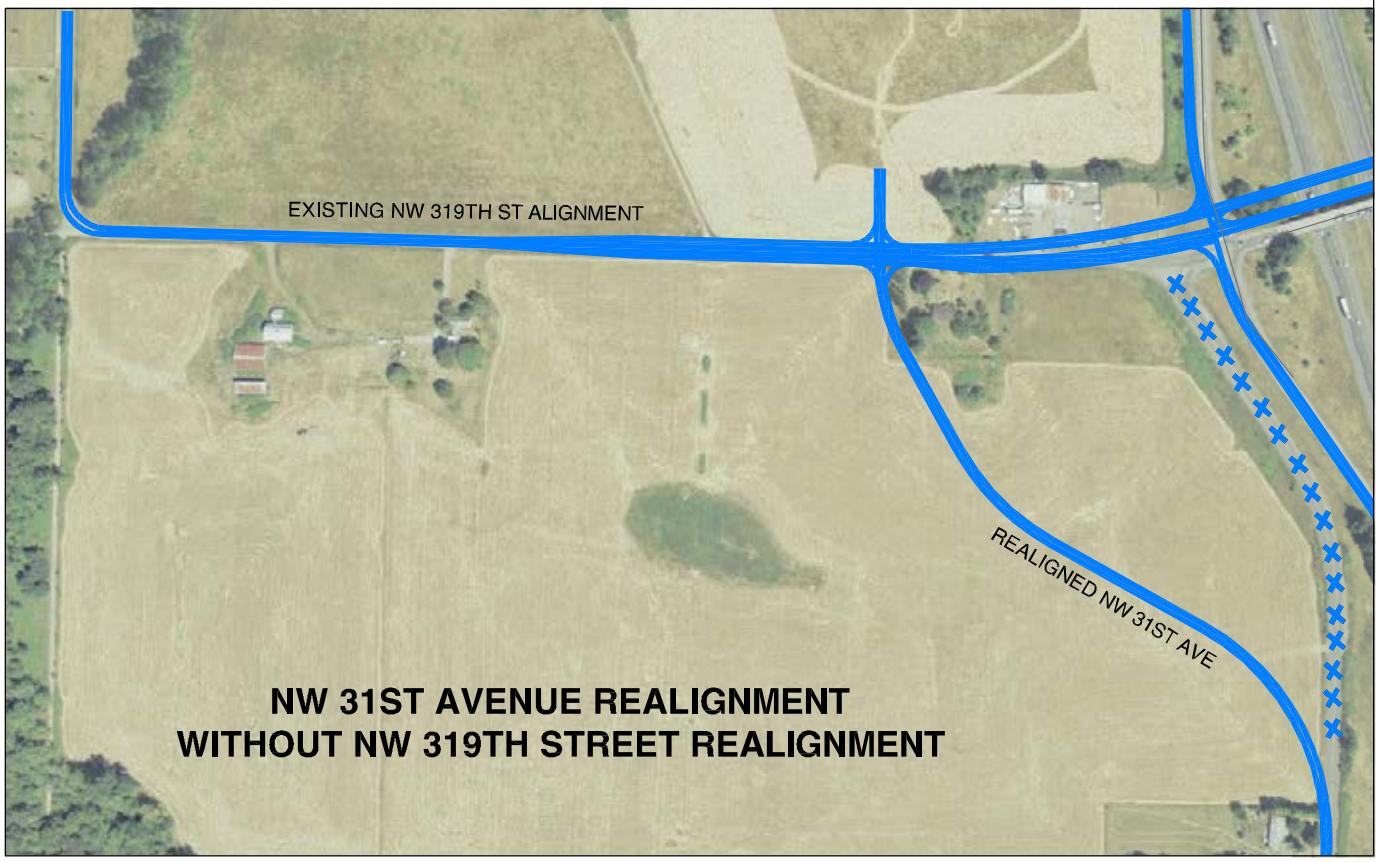
FRONTAGE ROAD CONCEPT OPTIONS
LA CENTER, WASHINGTON

FIGURE 2-7

- **Option D –** This option in similar to Option C and utilizes the *Landon* Parcel to access NW La Center Road. The new frontage road "T" intersection would be approximately 480 feet east of the existing I-5 northbound ramp terminal.
- **Option E1 –** This option utilizes the *Burk/Landon* parcels and develops a La Center Road underpass similar to Option C to access properties to the north on Paradise Park Road. The new frontage intersection would be located approximately 480 feet from the existing I-5 northbound ramp terminal.
- **Option E2 –** This option utilizes the *Carlson/Burk/Landon/Fudge/3BNW* parcels to develop a new frontage road intersection approximately 480 feet east of the existing I-5 northbound ramp terminal. The existing Paradise Park Road intersection would be eliminated by forming cul-de-sacs (or potentially vacating the roadways) north and south of NW La Center Road. This option relies on NW 324th Street to connect to the northerly portion of Paradise Park Road.
- **Option E3 –** This option utilizes the *Burk/Landon/Fudge/3BNW* parcels and is similar to Option E2. The new frontage road intersection would be located approximately 480 feet east of the existing I-5 northbound ramp terminal. The existing Paradise Park Road intersection would be eliminated by forming cul-de-sacs (or potentially vacating the roadways) north and south of NW La Center Road. This option relies on NW 324th Street to connect to the northerly portion of Paradise Park Road.
- **Option F –** This option utilizes the *Burk/Vanvessum* parcels and develops a Paradise Park Road underpass of La Center Road similar to Options C, D, and E1. The new frontage "T" intersection would be located approximately 575 feet from the existing I-5 northbound ramp terminal.

In addition to the Paradise Road options, a single frontage road option for NW 31st Avenue was developed on the west side of I-5. The single option was developed to optimally fulfill the design objectives because all the property in the southwest quadrant of the interchange is under the control of the Cowlitz Tribe. Figure 2-8 shows the NW 31st Street realignment option under both the realigned and non-realigned NW 319th Street scenarios.





FRONTAGE ROAD REALIGNMENT
WEST OF INTERCHANGE
LA CENTER, WASHINGTON

FIGURE **2-8**

Evaluation Criteria and Assessment

An initial evaluation and comparison of the frontage road options was conducted based on a variety of screening criteria. The evaluation served to eliminate options with "fatal flaws" that did not warrant more detailed evaluation. It also helped to rank the options and identify the most feasible option.

A scoring system was developed to help quantify the ratings and compare the options. Each evaluation criterion was assigned a numerical value (-2, -1, 0, 1, 2) that was then applied to each option. Options that scored better than others received a "+2." Those that do not impact the metric or have a neutral impact received a "0." Those that underperform compared to the other options received a "-2." The options that fall in between receive a "+1" or "-1" score. The evaluation criteria used for this assessment are outlined and briefly described below:

- **Transportation Operations:** includes mobility, freight mobility, and safety. The frontage road intersections will accommodate current and anticipated future traffic volumes.
- **Land Use**: considers right-of-way impacts, consistency with adopted land use and economic development plans, impacts to utilities, and impacts to existing businesses/developments. A service station and other established private properties are currently located on the east side of the interchange.
- **Multimodal Accessibility**: considers pedestrian and bicycle mobility. While pedestrian and bicycle activity in the area is currently limited, multimodal facilities should be provided in the future to accommodate potential demand.
- **Cost**: reflects anticipated relative cost compared to other options.
- **Environmental Impact**: considers impacts to the environment. There are environmentally sensitive areas within the vicinity of the frontage road system.
- **Constructability**: includes the ability to construct the improvements in phases (to expand the frontage intersections in the future) and local impacts during construction.
- **Accessibility and Connectivity**: considers access spacing requirements, local roadway connectivity, and future access for undeveloped properties.

Safety has not been identified as a separate evaluation criterion recognizing that safety will be inherently addressed through the design and construction of the new frontage road system.

Table 2-5 provides a summary of the evaluation of the frontage road system options presented in this memorandum.

Table 2-5 Frontage Road Option Evaluation

Frontage Road Alignment Option	Primary Advantages	Primary Constraints	Transportation Operations	Land Use	Multimodal Access	Cost	Environmental Impact	Constructability	Access & Connectivity	Total	Alternatives Workshop Feedback (3/14/2013)	Comments on Next Steps
Option A - Carlson/Fudge	• Meets crossroad spacing standards • Provides access to all properties within the interchange area • Facilitates potential future north-south signalized crossing of La Center Road	• Requires a degree of out-of-direction travel to access properties currently serviced by Paradise Park Road in the vicinity of La Center Road • Creates wetland impacts both north and south of NW La Center Road • The alignment was deemed to be fatally flawed because the Fudge property did not become available for right-of-way or easement acquisition	+1	-2	+1	-1	-2	0	+1	-2	• Does not align with the plan City of La Center street network	Further consideration eliminated due to property lack of available property
Option B - Carlson/Burk/Landon/Fudge	• Meets crossroad spacing standards • Provides access to all properties within the interchange area	• Requires a degree of out-of-direction travel to access properties currently serviced by Paradise Road in the vicinity of La Center Road • Requires a relatively steep grade to connect La Center Road and Paradise Park Road • Eliminates future development potential on the Landon parcel • The alignment was deemed to be fatally flawed because the Fudge property did not become available for right-of-way or easement acquisition	+1	-1	+1	0	-1	-1	+1	0	• Does not align with the plan City of La Center street network	Further consideration eliminated due to property lack of available property
Option C – Carlson/La Center Road Underpass	• Meets crossroad spacing standards • Provides access to all properties within the interchange area • Provides grade-separated Paradise Park Road crossing of La Center Road	• Requires a degree of out-of-direction travel to access properties currently serviced by Paradise Park Road in the vicinity of La Center Road • Requires the development of a underpass and the lowering of Paradise Park Road	+1	-1	+1	-2	-1	-2	+1	-3		Further consideration eliminated due to grade separation cost and inherent out-of-direction travel required
Option D – Landon/La Center Road Underpass	• Meets crossroad spacing standards • Provides access to all properties within the interchange area • Provides grade-separated Paradise Park Road crossing of La Center Road	• Requires a degree of out-of-direction travel to access properties currently serviced by Paradise Park Road in the vicinity of La Center Road • Insufficient horizontal radii on the southern portion of the realigned Paradise Park Road • The Landon parcel becomes undevelopable • Requires the development of a underpass and the lowering of Paradise Park Road	+1	-1	+1	-1	0	-2	+1	-1		Further consideration eliminated due to grade separation cost and inherent out-of-direction travel required
Option E1 – Burk/Landon/La Center Road Underpass	• Meets crossroad spacing standards • Provides access to all properties within the interchange area • Provides grade-separated Paradise Park Road crossing of La Center Road	• Requires a degree of out-of-direction travel to access properties currently serviced by Paradise Park Road in the vicinity of La Center Road • Requires the development of a underpass and the lowering of Paradise Park Road	+1	0	+1	-1	0	-2	+1	0		Further consideration eliminated due to grade separation cost and inherent out-of-direction travel required

Frontage Road Alignment Option	Primary Advantages	Primary Constraints	Transpor-tation Operations	Land Use	Multimodal Access	Cost	Environ-mental Impact	Construct-ability	Access & Connectivity	Total	Alternatives Workshop Feedback (3/14/2013)	Comments on Next Steps
Option E2 – Carlson/Burk/Landon/Fudge/3BNW	• Meets crossroad spacing standards • Provides access to all properties within the interchange area • Provides grade-separated Paradise Park Road crossing of La Center Road	• Impacts multiple properties • High cost associated with acquisition of Carlson property	+1	+1	+1	-1	+2	+1	+1	+6		
Option E3 – Burk/Landon/Fudge/3BNW	• Meets crossroad spacing standards • Provides access to all properties within the interchange area • Facilitates potential future north-south signalized crossing of La Center Road	• Impacts multiple properties •	+1	0	+1	+2	+2	+1	+1	+8		
Option F – Burk/Vanvessem/La Center Road Underpass	• Meets crossroad spacing standards • Provides access to all properties within the interchange area • Provides grade-separated Paradise Park Road crossing of La Center Road	• Requires the development of a underpass and the lowering of Paradise Park Road	+1	0	+1	-1	+1	-2	+1	+1		Further consideration eliminated due to grade separation cost and inherent out-of-direction travel required

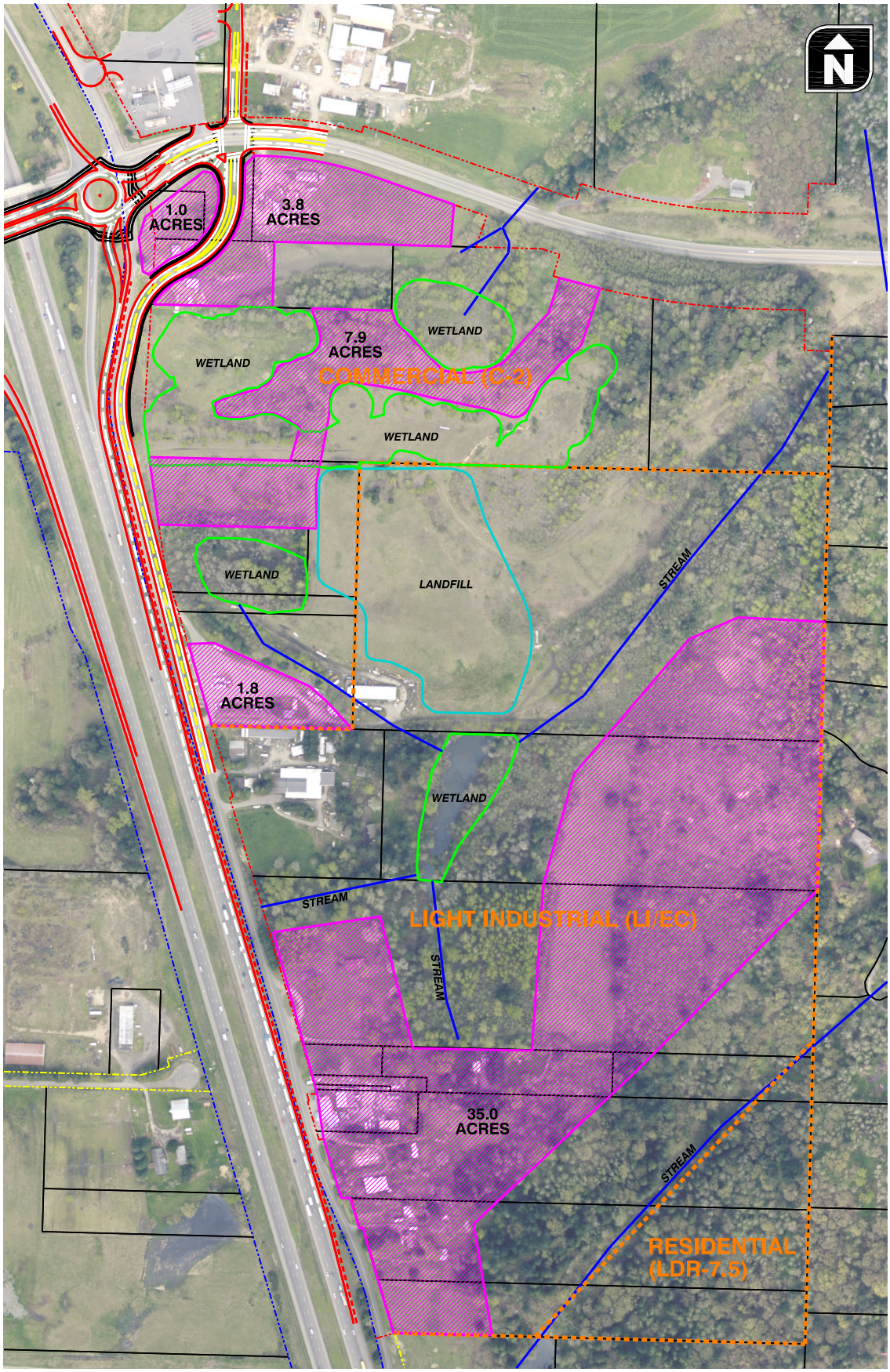
Frontage Road Findings and Recommendations

After this initial evaluation, Options A and B were eliminated because the Fudge property could not ultimately be brought under contract for the easterly alignment. Furthermore, both Options A and B had potential environmental impacts north of NW La Center Road. Options C, D, E1, and F were removed from consideration due to the relatively high costs of developing the Paradise Road underpass and the relative out-of-direction travel created for properties north of the NW La Center Road.

Option E2 (Carlson/Burk/Landon/Fudge/3BNW), requires the largest number of property acquisitions and was ranked second highest through the scoring system. This option meets all the design objectives and minimizes out-of-direction travel for properties located both north and south of La Center Road east of I-5. However, the cost associated with the acquisition of the Carlson property is significant and a deterrent for this option. Option E3 (Burk/Landon/Fudge/3BNW) minimizes impacts to the Carlson property and was ranked highest through the scoring system. Based on the evaluation criteria and available right-of-ways and properties for purchase, Option E3 is recommended as the preferred option moving forward.

Developable Property

In order to help inform the interchange design and frontage road alignments, developable property in the vicinity of the interchange was assessed. Figure 2-9 illustrates the preferred interchange form, terminal traffic controls, and frontage road alignments, as well as developable property. As seen in the figure, developable property southeast of the interchange is constrained by wetlands. The NW Paradise Park Frontage Road was aligned to avoid impacts to the Carlson property and maximize developable land. The interchange improvement project intends to maximize the potential for future development in the vicinity of the interchange by providing improved operations and as much area as possible for development.



DEVELOPABLE PROPERTY
LA CENTER, WASHINGTON

FIGURE **2-9**

POLICY POINT 3 – OPERATIONAL AND COLLISION ANALYSES

The following operational and collision analysis will demonstrate that a preferred redesigned NW La Center Road/I-5 interchange (including the freeway, ramps, and adjacent intersections) will operate acceptably under future near- and long-term traffic forecasts. The operational analysis assesses existing and future traffic operations under a number of scenarios to confirm that the preferred interchange meets standards. The collision analysis contains details concerning the crash history at the interchange and in the immediate vicinity.

Operational Analysis

The operational analysis is divided into a background section that includes operational scenarios, traffic volumes, pedestrian and bicycle volumes, measures of effectiveness, WSDOT operating standards, City of La Center operating standards, summary of applicable agency operating standards, and analysis tools; and an analysis results section providing an assessment of operations under each analysis scenario.

Operational Scenarios

Operations were assessed for the weekday AM peak hour, weekday PM peak hour, and weekend[6] peak hour. The weekend peak hour was selected for study in addition to the typical weekday peak hours to capture the anticipated peak of the roadway system and casino traffic. The analysis years (2014, 2017, and 2037) were selected based on materials submitted to the City of La Center, Clark County, WSDOT and FHWA and comments received. The 2017 study year is assumed to represent the build out year of the Cowlitz Reservation Development and will be used for identifying mitigations that will be needed for and funded exclusively (no federal, state, or local dollars will be used to plan, design, and/or construct the project) by the Cowlitz Reservation Development. The 2037 study year scenario is informational for WSDOT to ensure that near-term interchange improvements do not preclude the ability to provide future long-term improvements. In total, traffic operations were assessed for the eighteen scenarios, listed below:

- 2014 Existing
  - Weekday AM Peak Hour
  - Weekday PM Peak Hour
  - Weekend Peak Hour
- 2017 Background
  - Weekday AM Peak Hour
  - Weekday PM Peak Hour

[6] This time period was referred to as the Friday PM peak hour in the *Methods and Assumptions* document. This time period was selected to represent the highest cumulative impact anticipated on the freeway between background I-5 volumes and the trips generated by the Cowlitz Reservation Development. Although volumes are anticipated to be highest during the Friday afternoon, the analysis scenario assesses the highest volumes anticipated during the weekend, and thus is referred to as the weekend peak hour for clarity.

  - Weekend Peak Hour
- 2017 Total No-Build (with Cowlitz Reservation Development and no infrastructure improvements)
  - Weekday AM Peak Hour
  - Weekday PM Peak Hour
  - Weekend Peak Hour
- 2017 Total Build (with Cowlitz Reservation Development and interchange improvements)
  - Weekday AM Peak Hour
  - Weekday PM Peak Hour
  - Weekend Peak Hour
- 2037 Total No-Build (with Cowlitz Reservation Development and 2017 infrastructure improvements)
  - Weekday AM Peak Hour
  - Weekday PM Peak Hour
  - Weekend Peak Hour
- 2037 Total Build (with Cowlitz Reservation Development and full interchange improvements)
  - Weekday AM Peak Hour
  - Weekday PM Peak Hour
  - Weekend Peak Hour

Traffic Volumes

Turning-movement counts were collected at the I-5/La Center Ramp terminals for a typical weekday and Friday in mid-May 2014. At the same time, I-5 mainline counts were collected south of the interchange. Traffic data from the weigh station on northbound I-5 located south of the NW La Center Road interchange was received from WSDOT for June 2014. Additional details on the development of the traffic volumes used in the existing conditions analysis and future analysis scenarios are provided in the memorandum *Cowlitz Reservation Development IJR Analysis Methodology*, provided in *Appendix J.* Traffic volumes at the I-5 ramps used in the IJR analysis are consistent with those developed for the TIA, which provides a full explanation on the traffic volume development (including peak hours, planned developments, and growth rates). The TIA is provided in *Appendix B.*

A thorough trip generation analysis was prepared for the Cowlitz Reservation Development. The trip generation is based on data from other similar casino developments and calculates the projected number of trips based on the number of gaming positions. The site-generated traffic was assigned to the study intersections and interchange using the estimated trip distribution patterns within the site vicinity for each of the three analysis periods. The trip generation and trip assignments for the Cowlitz Reservation Development are provided in the TIA in *Appendix B*.

Bicycle and Pedestrian Volumes

There are no pedestrian or bicycle facilities in the study area, which in part reflects the relatively rural nature of the study area and the lack of existing development around the immediate interchange. Field

observations and traffic counts in the site vicinity revealed little to no existing pedestrian or bicycle activity along the study area roadways during most hours of the day. Therefore, a thorough operational analysis was not conducted for bicyclists and pedestrians. However, bicycle and pedestrian facilities were considered in the design of the preferred alternative and factored in to the alternatives analysis conducted as part of Policy Point 2. Bicycle and pedestrian accommodations will be provided with the interchange improvements.

Measures of Effectiveness (MOE)

The *WSDOT Design Manual*, Chapter 320 describes the measure of effectiveness (MOE) used for determining a highway facilities' level of service (LOS) as follows:

- The level of service (LOS) for operating state highway facilities is based upon measures of effectiveness (MOEs), in accordance with the latest version of the *Highway Capacity Manual.*
- These MOEs (see Table 3-1 below) describe the measures best suited for analyzing state highway facilities, such as freeway segments and on- or off-ramps. Depending on the facility, WSDOT LOS thresholds are LOS C and LOS D on state highway facilities. Table 3-3 presents the thresholds applicable to the study locations on I-5.

Table 3-1 WSDOT Measures of Effectiveness by Facility Type

Type of Facility	Measure of Effectiveness (MOE)
Basic Freeway Segments	Density (pc/mi/ln)
Ramps	Density (pc/mi/ln)
Ramp Terminals	Delay (sec/veh)
Multilane Highways	Density (pc/mi/ln)

Note: pc/mi/ln = passenger cars per mile per lane

The level of service (LOS) for freeway merge, diverge, and weave operations is determined by traffic density based on criteria outlined in the *Highway Capacity Manual (HCM) 2010,* as shown in Table 3-2.

Table 3-2 LOS Criteria for Freeway Merge/Diverge/Weave (HCM 2010)

LOS	Maximum Density (pc/mi/ln)	
	Merge/Diverge	Weave
A	≤10	0-10
B	>10-20	>10-20
C	>20-28	>20-28
D	>28-35	>28-35
E	>35	>35
F	Demand Exceeds Capacity	Demand Exceeds Capacity

Speed (mph) and travel time (minutes) are also indicators of the performance of an individual segment and the overall freeway facility.

WSDOT Operating Standards

WSDOT provides a table of LOS standards for state highways of statewide significance (HSS) based on RCW 47.06.140(2). Regional transportation planning organizations (RTPOs) and WSDOT jointly develop and RTPOs establish LOS standards for regionally significant state highways based on RCW 47.80.030(1)(c). Table 3-3 presents the WSDOT standards for state facilities in Clark County and Cowlitz County.

Table 3-3 WSDOT Level of Service Standards for Washington State Highways, January 1, 2010

Regional Organization/County	LOS for Non-HHS[1]		LOS for HSS[1]	
	Urban	Rural	Urban	Rural
(RTC) Southwest Washington Regional Transportation Council – MA/MP/RTPO				
Clark County	E	C	D	C
Cowlitz County	D	C	D	C

Note: [1] HSS=Highway of Statewide Significance

Per WSDOT direction, LOS C will be the standard used for the I-5 mainline and merge/diverge operations for the existing conditions analysis. As noted in the IJR *Methods & Assumptions*, LOS C will also be the standard used through the 2017 analysis scenarios, while LOS D will be used for the 2037 scenarios.

City of La Center Operating Standards

The City of La Center's standards apply to the Paradise Park Road/NW La Center Road intersection. The City's LOS standards are defined in the *2008 La Center Urban Area Capital Facilities Plan* (Reference 8), Page 17, as follows:

> As LOS drops, intersection improvements may become necessary. In some situations, LOS will drop but an intersection may not meet warrants for placement of a traffic signal or construction of turning lanes. In this situation, where an unsignalized intersection does not meet signal warrants or where a signal is not desired, this plan recommends a LOS standard of "D". When an intersection attains a LOS standard of "D" and/or meets traffic signal warrants, a traffic signal should be installed. The LOS does not apply to local street intersections. Table 3-4 provides service standards based on the type of facility.

Table 3-4 City of La Center Level of Service Standards

Type of Facility	Roadway LOS	Signalized Intersection LOS	Non-Signalized LOS
Classified Streets (arterials & collectors)	LOS D	LOS D	LOS E
Unclassified Streets	LOS D	LOS D	LOS E
Local Streets	N/A	N/A	N/A

While the City's standards do not address volume-to-capacity ratios (v/c), City staff recommends intersections not exceed a v/c ratio of 0.95, and roadway segments not exceed a v/c ratio of 0.90[7].

Summary of Applicable Agency Operating Standards

Table 3-5 summarizes the LOS operational standards and jurisdiction administering each study location.

Table 3-5 Operational Standards

Study Location	Type	Agency	LOS Standard
I-5: SR 501 to La Center Rd	Mainline	WSDOT	C (for year 2017) / D (for year 2037)
I-5: La Center Rd to SR 503	Mainline	WSDOT	C (for year 2017) / D (for year 2037)
I-5/La Center Rd: NB On Ramp	Merge	WSDOT	C (for year 2017) / D (for year 2037)
I-5/ La Center Rd: NB Off Ramp	Diverge	WSDOT	C (for year 2017) / D (for year 2037)
I-5/ La Center Rd: SB On Ramp	Merge	WSDOT	C (for year 2017) / D (for year 2037)
I-5/ La Center Rd: SB Off Ramp	Diverge	WSDOT	C (for year 2017) / D (for year 2037)
I-5/Weigh Station: NB On Ramp	Merge	WSDOT	C (for year 2017) / D (for year 2037)
I-5/Weigh Station: NB Off Ramp	Diverge	WSDOT	C (for year 2017) / D (for year 2037)
NW 31st Avenue/ NW 319th Street	Intersection	Clark County	D
NW 319th Street/ I-5 SB Ramps	Intersection	WSDOT	C (for year 2017) / D (for year 2037)
NW La Center Rd./ I-5 NB Ramps	Intersection	WSDOT	C (for year 2017) / D (for year 2037)
Paradise Park Road/ NW La Center Rd.	Intersection	City of La Center	E (non-signalized) D (signalized)

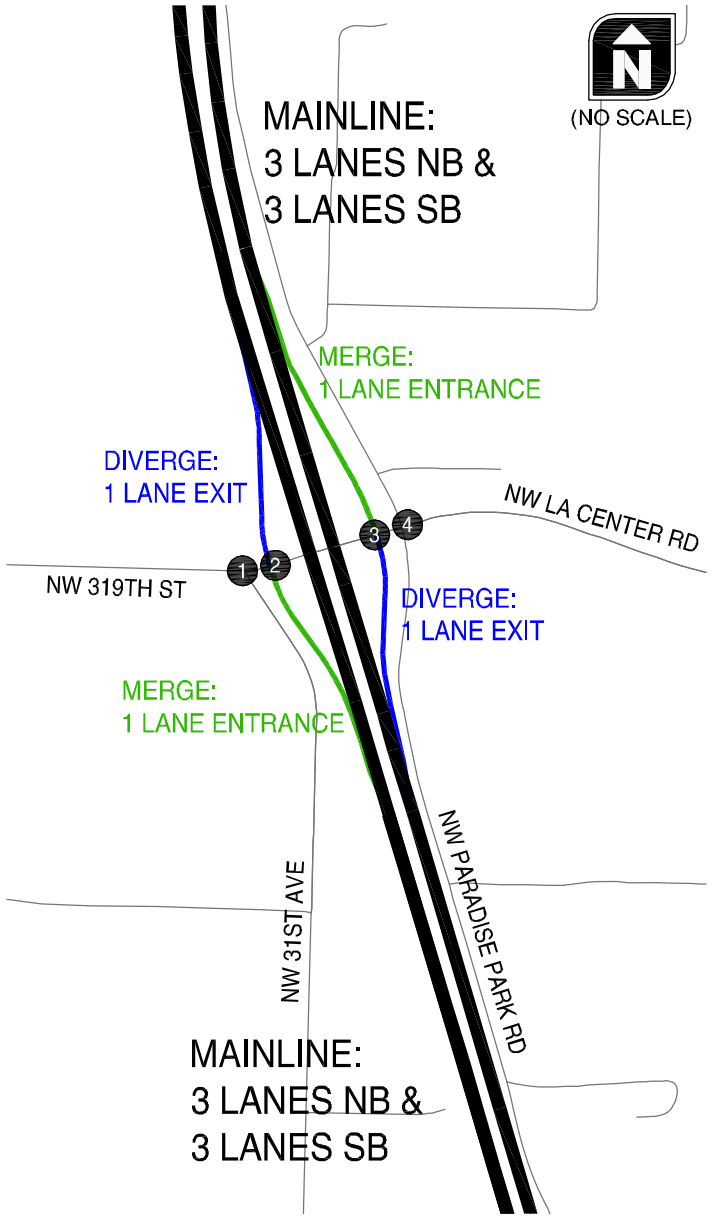
Analysis Tools

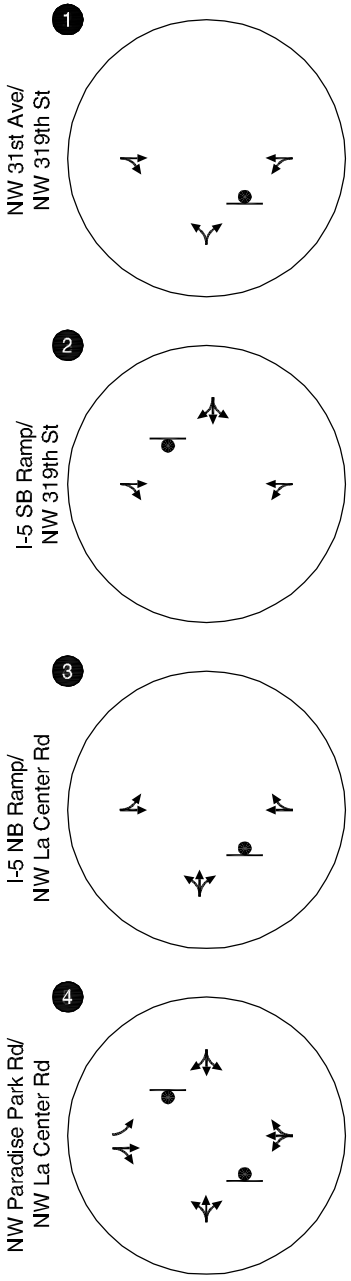
HCS+ was used to analyze the I-5 mainline performance and the interchange merge/diverge areas. Synchro 8 and SimTraffic were used to analyze the signalized and stop-controlled intersections. Synchro 8 analyzes individual signalized and unsignalized intersections as well as coordinated traffic signal timings along a corridor. The traffic analysis software SIDRA was used to conduct the roundabout analysis, in accordance with the WSDOT methodology. Further explanation of the analysis tools and methodology applied is provided in the *Methods and Assumptions* (provided in *Appendix* A) document.

2014 Existing Conditions

The existing transportation conditions analysis documents how the transportation system in the study area is currently operating. The existing lane configurations and traffic control devices are provided in Figure 3-1. As discussed above, the operational analysis includes the freeway mainline, merge/diverge locations at the NW La Center Road/I-5 interchange, and four study intersections adjacent to the interchange. Key findings from the existing conditions analysis include:

[7] As documented in the January 22, 2013 *Cowlitz Casino Transportation Analysis Scoping Review* letter prepared by the City Public Works Director.





LEGEND

- STOP SIGN

2014 EXISTING LANE CONFIGURATIONS AND TRAFFIC CONTROL DEVICES
LA CENTER, WASHINGTON

FIGURE 3-1

- The I-5 mainline north of the La Center Road interchange is operating at a LOS B or better in both the southbound and northbound direction during the weekday and weekend peak periods.
- The I-5 mainline south of the La Center Road interchange is operating at a LOS C or better in both the southbound and northbound direction during the weekday and weekend peak periods.
- The merge/diverge locations at La Center Road/I-5 and the weigh station south of La Center Road operate at a LOS C or better during the weekday and weekend peak periods.
- The southbound approach to the La Center Road/I-5 Southbound Ramp intersection is not meeting standards during the weekday or weekend peak periods.

The existing conditions traffic volumes and operations are summarized in Figure 3-2 and detailed in the sub-sections below.

I-5 Mainline Freeway Operations

Operations on the I-5 freeway were assessed using the previously described methodology and were compared to the respective agency operating standards. Table 3-6 compares the existing operations of the freeway mainline to the minimum operating standards.

Table 3-6 Existing 2014 I-5 Mainline Operations

I-5 Segment	LOS Requirement	Weekday AM Peak	Weekday PM Peak	Weekend Peak	LOS Require-ment Met?
SR 501 to La Center Rd (NB)	C	B	B	C	Yes
SR 501 to La Center Rd (SB)	C	B	B	B	Yes
La Center Rd to SR 503 (NB)	C	B	B	B	Yes
La Center Rd to SR 503 (SB)	C	B	B	B	Yes

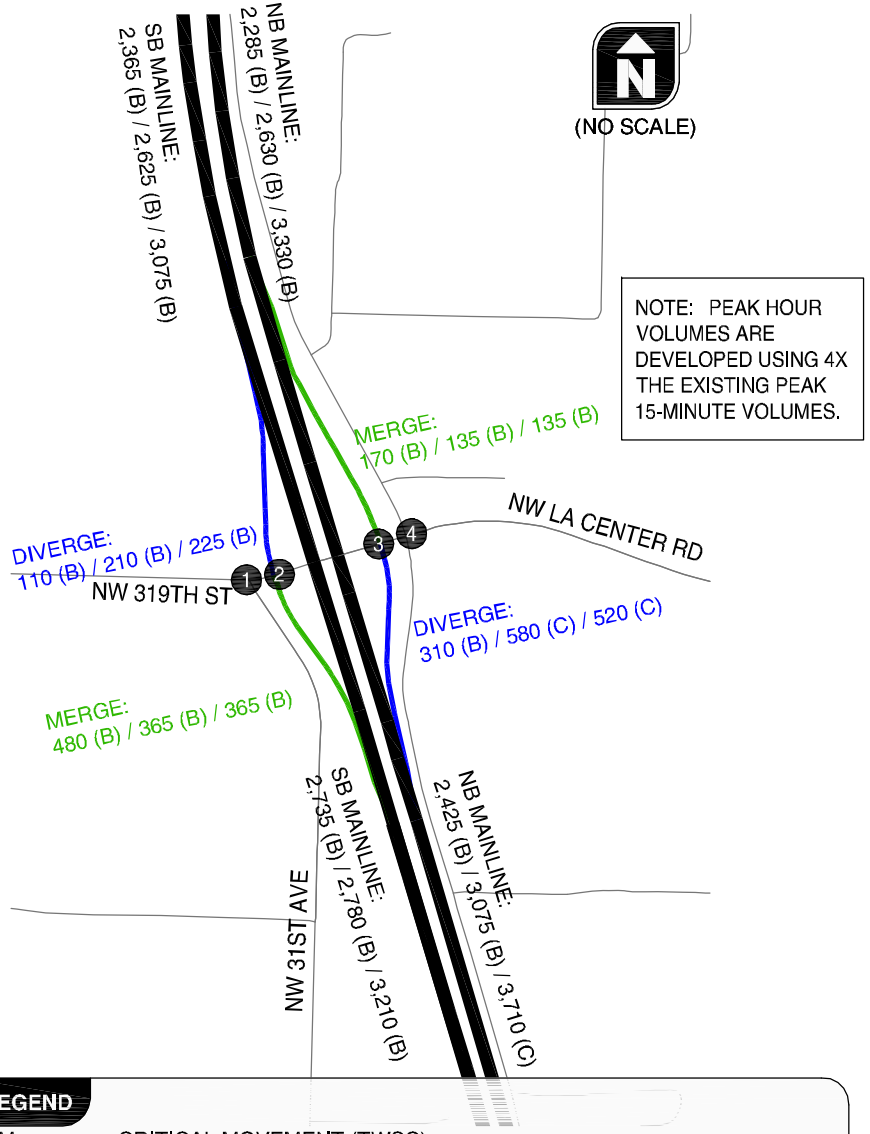
As seen in the table, the freeway is operating acceptably on all study segments. The HCS analysis output sheets for the existing conditions freeway mainline operations are provided in Appendix *K.*

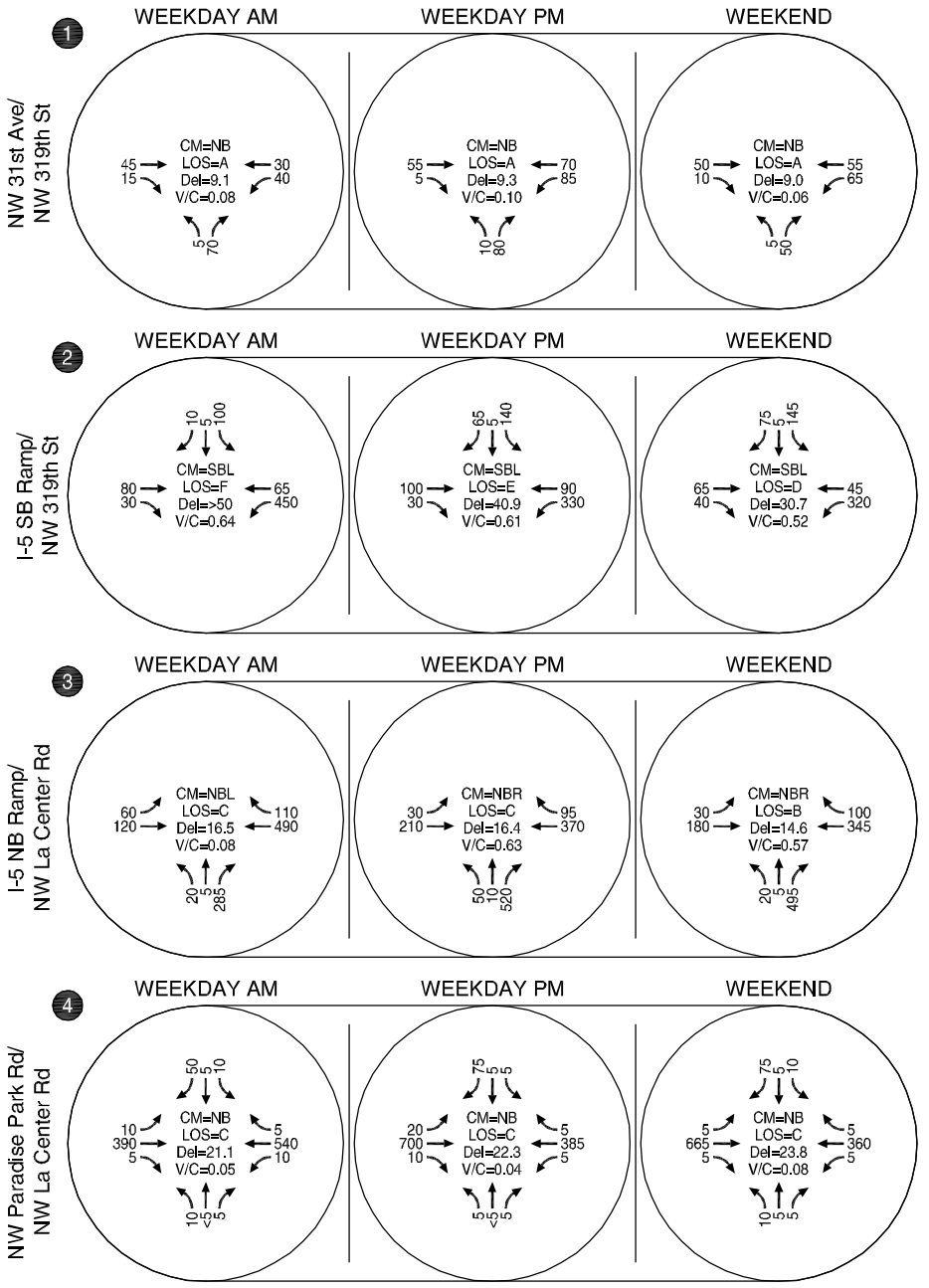
I-5 Freeway Merge/Diverge Operations

Operations of the study merge/diverge locations were assessed and were compared to the respective agency operating standards. Table 3-7 provides a summary of how the existing operations of the study merge/diverge locations compare to the minimum operating standards.

Table 3-7 NW La Center Road/I-5 Interchange Existing 2014 Merge/Diverge Operations

Merge/Diverge Location	LOS Requirement	Weekday AM Peak	Weekday PM Peak	Weekend Peak	LOS Require-ment Met?
La Center Rd/I-5: NB On Ramp	C	B	B	B	Yes
La Center Rd/I-5: NB Off Ramp	C	B	C	C	Yes
La Center Rd/I-5: SB On Ramp	C	B	B	B	Yes
La Center Rd/I-5: SB Off Ramp	C	B	B	B	Yes
I-5/Weigh Station: NB On Ramp	C	B	B	C	Yes
I-5/Weigh Station: NB Off Ramp	C	B	B	B	Yes





LEGEND

CM	= CRITICAL MOVEMENT (TWSC)
LOS	= INTERSECTION LEVEL OF SERVICE (ROUNDABOUT)/CRITICAL MOVEMENT LEVEL OF SERVICE (TWSC)
Del	= INTERSECTION AVERAGE CONTROL DELAY (ROUNDABOUT)/ CRITICAL MOVEMENT CONTROL DELAY (TWSC)
V/C	= CRITICAL VOLUME-TO-CAPACITY RATIO
TWSC	= TWO-WAY STOP CONTROL

MAINLINE, MERGE/DIVERGE ANALYSIS

X,XXX (X) = VOLUME (LOS) WEEKDAY AM/ WEEKDAY PM / WEEKEND

2014 EXISTING CONDITIONS
WEEKDAY AM, WEEKDAY PM, & WEEKEND PEAK HOURS
LA CENTER, WASHINGTON

FIGURE **3-2**

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As seen in the table, all locations are operating acceptably. The HCS analysis output sheets for the existing conditions merge/diverge operations are provided in *Appendix L.*

Study Intersection Operations

Operations of the study intersections were assessed using the previously described methodology and were compared to the respective agency operating standards[8]. Table 3-8 provides a summary of existing intersection operations compared to the applicable minimum operating standards.

Table 3-8 Existing 2014 Study Intersection Operations

Study Intersection	LOS Requirement	Weekday AM Peak	Weekday PM Peak	Weekend Peak	LOS Requirement Met?
NW 31st Ave/ NW 319th St	D	A (0.08)	A (0.10)	A (0.06)	Yes
NW La Center Rd/I-5 SB Ramps	C	**F** (0.64)	E (0.61)	D (0.52)	No
NW La Center Rd/I-5 NB Ramps	C	C (0.08)	C (0.63)	B (0.57)	Yes
Paradise Park Rd/ NW La Center Rd	E	C (0.05)	C (0.04)	C (0.08)	Yes[1]

Notes: LOS (V/C Ratio)
Grey shading indicates failure to satisfy operating standards
[1] While the left-turn movements from the minor street approach experience delays, the intersection does not meet signal warrants and operates below capacity.

As seen in the table, all but one study intersection were found to meet LOS standards during the three analysis periods.

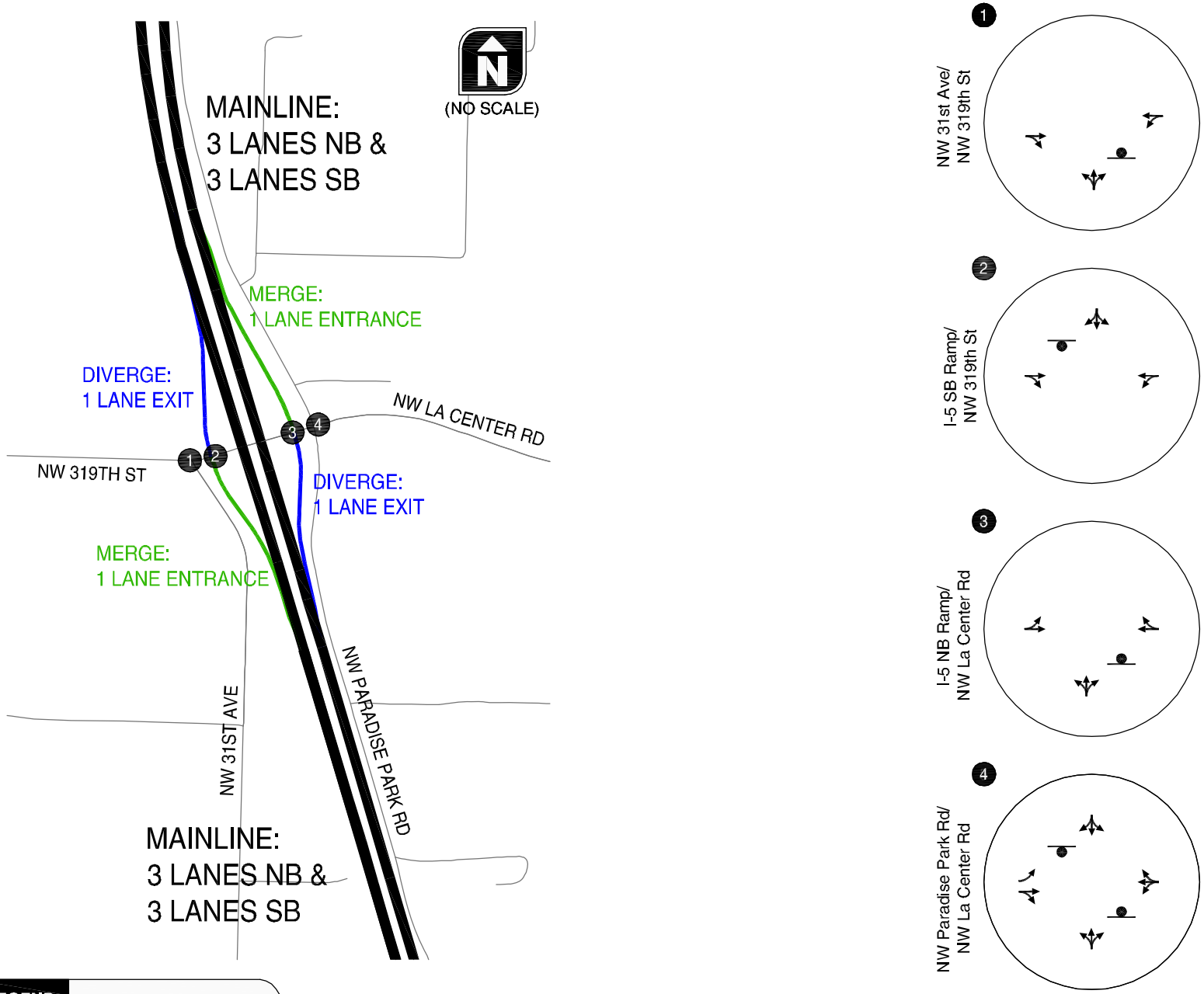
The southbound approach to the NW 319th Street/I-5 Southbound Ramp intersection was found to exceed WSDOT's LOS C requirement during all three analysis periods, though the critical movement v/c ratios during each period indicate there is additional capacity available. The lengthy delays associated with the minor street LOS in part reflect the relatively high volume of westbound NW 319th Avenue traffic turning left onto the I-5 southbound on-ramp during the weekday AM peak hour. While the southbound approach is delayed, the eastbound and westbound approaches operate under capacity and the major street turning and through movements operate at LOS "A". Furthermore, the intersection does not meet signal warrants and therefore should be monitored for potential future operational improvement needs.

Appendix M includes the existing conditions intersection operations analysis worksheets. *Appendix N* includes the signal warrant analysis worksheets.

2017 Background Conditions (Year of Opening)

The year 2017 background traffic analysis identifies how the study area's transportation system will operate in the projected Cowlitz Reservation Development's year of opening. The lane configurations and traffic control devices included in the 2017 background analysis are provided in Figure 3-3 (no change from existing

[8] Note that, per the *2010 Highway Capacity Manual* methodology, peak 15-minute volumes at each intersection were identified and multiplied by four to obtain the peak hour volume (no peak hour factor was applied, per the methodology).



LEGEND

- STOP SIGN

2017 BACKGROUND LANE CONFIGURATIONS AND TRAFFIC CONTROL DEVICES
LA CENTER, WASHINGTON

FIGURE **3-3**

conditions). This analysis includes traffic attributed to planned/approved developments within the study area and to general growth in the region, but does not include traffic from the Cowlitz Reservation Development. Key findings from the analysis include:

- The I-5 mainline north of the La Center Road interchange is operating at a LOS B or better in both the southbound and northbound direction during the weekday and weekend peak under the 2017 background conditions.
- The I-5 mainline south of the La Center Road interchange is operating at a LOS C or better in both the southbound and northbound direction during the weekday and weekend peak periods under the 2017 background conditions.
- The merge/diverge locations at I-5/La Center Road and the weigh station south of La Center Road operate at a LOS C or better during the weekday and weekend peak periods under the 2017 background conditions.
- The I-5 southbound off-ramp at NW La Center Road is projected to operate at a LOS "F" for all study time periods.

The 2017 background conditions traffic volumes and operations are summarized in Figure 3-4 and detailed in the sub-sections below.

I-5 Mainline Freeway Operations

Operations on the I-5 freeway were assessed using the previously described methodology and were compared to the respective agency operating standards. Table 3-9 compares the 2017 background operations of the freeway mainline to the minimum operating standards.

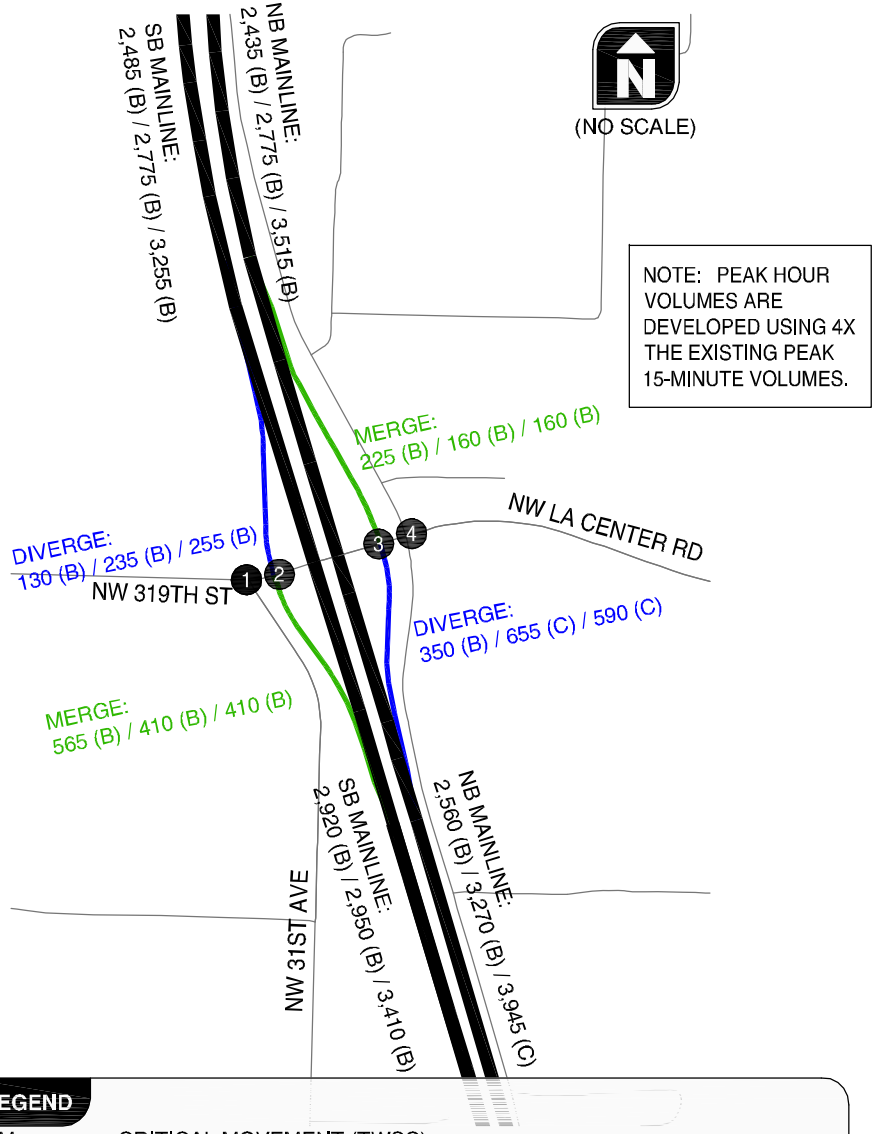
Table 3-9 2017 Background Conditions I-5 Mainline Operations

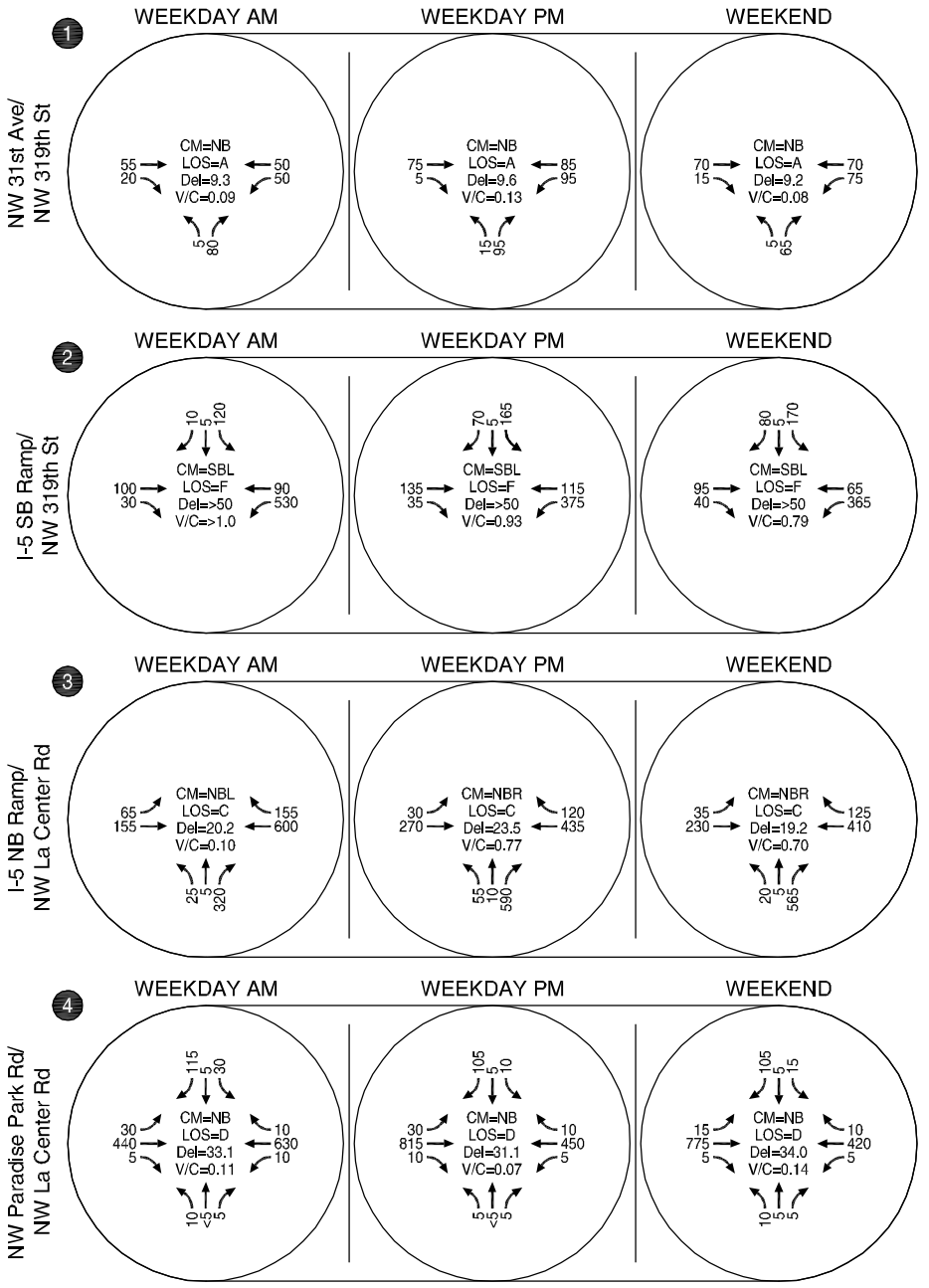
I-5 Segment	LOS Requirement	Forecast Weekday AM Peak LOS	Forecast Weekday PM Peak LOS	Forecast Weekend Peak LOS	LOS Require-ment Met?
SR 501 to La Center Rd (NB)	C	B	B	C	Yes
SR 501 to La Center Rd (SB)	C	B	B	B	Yes
La Center Rd to SR 503 (NB)	C	B	B	B	Yes
La Center Rd to SR 503 (SB)	C	B	B	B	Yes

As seen in the table, the freeway is operating acceptably on all study segments. The HCS analysis output sheets for the 2017 background conditions freeway mainline operations are provided in Appendix *O.*

I-5 Freeway Merge/Diverge Operations

Operations of the study merge/diverge locations were assessed and were compared to the respective agency operating standards. Table 3-10 provides a summary comparison of the 2017 background operations of the study merge/diverge locations with the minimum operating standards.





LEGEND

CM	= CRITICAL MOVEMENT (TWSC)
LOS	= INTERSECTION LEVEL OF SERVICE (ROUNDABOUT)/CRITICAL MOVEMENT LEVEL OF SERVICE (TWSC)
Del	= INTERSECTION AVERAGE CONTROL DELAY (ROUNDABOUT)/ CRITICAL MOVEMENT CONTROL DELAY (TWSC)
V/C	= CRITICAL VOLUME-TO-CAPACITY RATIO
TWSC	= TWO-WAY STOP CONTROL
MAINLINE, MERGE/DIVERGE ANALYSIS	
X,XXX (X)	= VOLUME (LOS) WEEKDAY AM/ WEEKDAY PM / WEEKEND

2017 BACKGROUND CONDITIONS
WEEKDAY AM, WEEKDAY PM, & WEEKEND PEAK HOURS
LA CENTER, WASHINGTON

FIGURE **3-4**

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Table 3-10 NW La Center Road/I-5 Interchange 2017 Background Conditions Merge/Diverge Operations

Merge/Diverge Location	LOS Requirement	Forecast Weekday AM Peak LOS	Forecast Weekday PM Peak LOS	Forecast Weekend Peak LOS	LOS Requirement Met?
La Center Rd/I-5: NB On Ramp	C	B	B	B	Yes
La Center Rd/I-5: NB Off Ramp	C	B	C	C	Yes
La Center Rd/I-5: SB On Ramp	C	B	B	B	Yes
La Center Rd/I-5: SB Off Ramp	C	B	B	B	Yes
I-5/Weigh Station: NB On Ramp	C	B	C	C	Yes
I-5/Weigh Station: NB Off Ramp	C	B	B	B	Yes

As seen in the table, all merge/diverge locations are projected to operate acceptably under 2017 background conditions. The HCS analysis output sheets for the 2017 background conditions merge/diverge operations are provided in *Appendix P.*

Study Intersection Operations

Table 3-11 provides a summary of projected 2017 background operations at the study intersections relative to the minimum acceptable operating standards.

Table 3-11 2017 Background Intersection Operations

Study Intersection	LOS Requirement	Forecast Weekday AM Peak	Forecast Weekday PM Peak	Forecast Weekend Peak	LOS Requirement Met?
NW 31st Ave/ NW 319th St	D	A (0.09)	A (0.13)	A (0.08)	Yes
NW La Center Rd/I-5 SB Ramps	C	F (>1.0)	F (0.93)	F (0.79)	No
NW La Center Rd/I-5 NB Ramps	C	C (0.10)	C (0.77)	C (0.70)	Yes
Paradise Park Rd/ NW La Center Rd	E	D (0.11)	D (0.07)	D (0.14)	Yes

Notes: LOS (V/C Ratio)
Grey shading indicates failure to satisfy operating standards

As shown in the table, the background traffic analysis determined that all study intersections are projected to operate within standards, with the exception of the I-5 southbound off-ramp at NW La Center Road. Similar to existing conditions, the southbound approach to the NW La Center Road/I-5 Southbound Ramp intersection does not meet the WSDOT LOS "C" standard, and operates near or at capacity during all three analysis periods. Turning and through movements along La Center Road operate at LOS "A". The projected intersection traffic volumes are sufficient to warrant signalization during 2017 background conditions. *Appendix Q* includes the 2017 background intersection operations analysis worksheets.

2017 Total Traffic Conditions (No-Build and Build)

The 2017 total traffic conditions analysis forecasts how the study area's transportation system will operate with the traffic generated by the Cowlitz Reservation Development. Site-generated traffic was added to 2017 background traffic volumes for the weekday AM, PM and weekend peak hours to arrive at the total traffic volumes. For this scenario, it was assumed no improvements would be made to the existing roadways or interchange ("No Build"). When comparing this scenario to the 2017 background traffic conditions,

impacts the development will have on the transportation system can be identified as well as needed mitigations ("Build"). The lane configurations and traffic control devices assumed for the 2017 no-build and build total traffic analysis are provided in Figures 3-5 and 3-6, respectively. Key findings from the analysis include:

- The I-5 mainline north of the La Center Road interchange continues to operate at a LOS B or better in both the southbound and northbound direction during the weekday and weekend peak under 2017 total traffic conditions.
- The I-5 mainline south of the La Center Road interchange continues to operate at a LOS C or better in both the southbound and northbound direction during the weekday and weekend peak periods under 2017 total traffic conditions.
- The merge/diverge locations at the NW La Center Road/I-5 interchange ramps and the weigh station south of La Center Road continue to operate at a LOS C or better during the weekday and weekend peak periods under the 2017 total traffic conditions, with the exception of the northbound off-ramp at the NW La Center Road interchange. With the development, the diverge location associated with the northbound off-ramp is project to operate at a LOS D during the weekday PM and weekend peak hours. The LOS deficiency can be mitigated by providing a dual lane exit configuration (adding one lane to the ramp relative to existing condition).
- All study intersections require improvement to meet standards in 2017 with the Cowlitz Reservation Development. Proposed mitigations include a new overpass structure development of both ramp terminals as roundabouts and the realignment of both the NW 31st Street and Paradise Park Road frontage road intersections. These improvements are illustrated in Figure 3-6.

The 2017 no-build and build total traffic conditions traffic volumes and operations are summarized in Figures 3-7 and 3-8, respectively, and detailed in the sub-sections below.

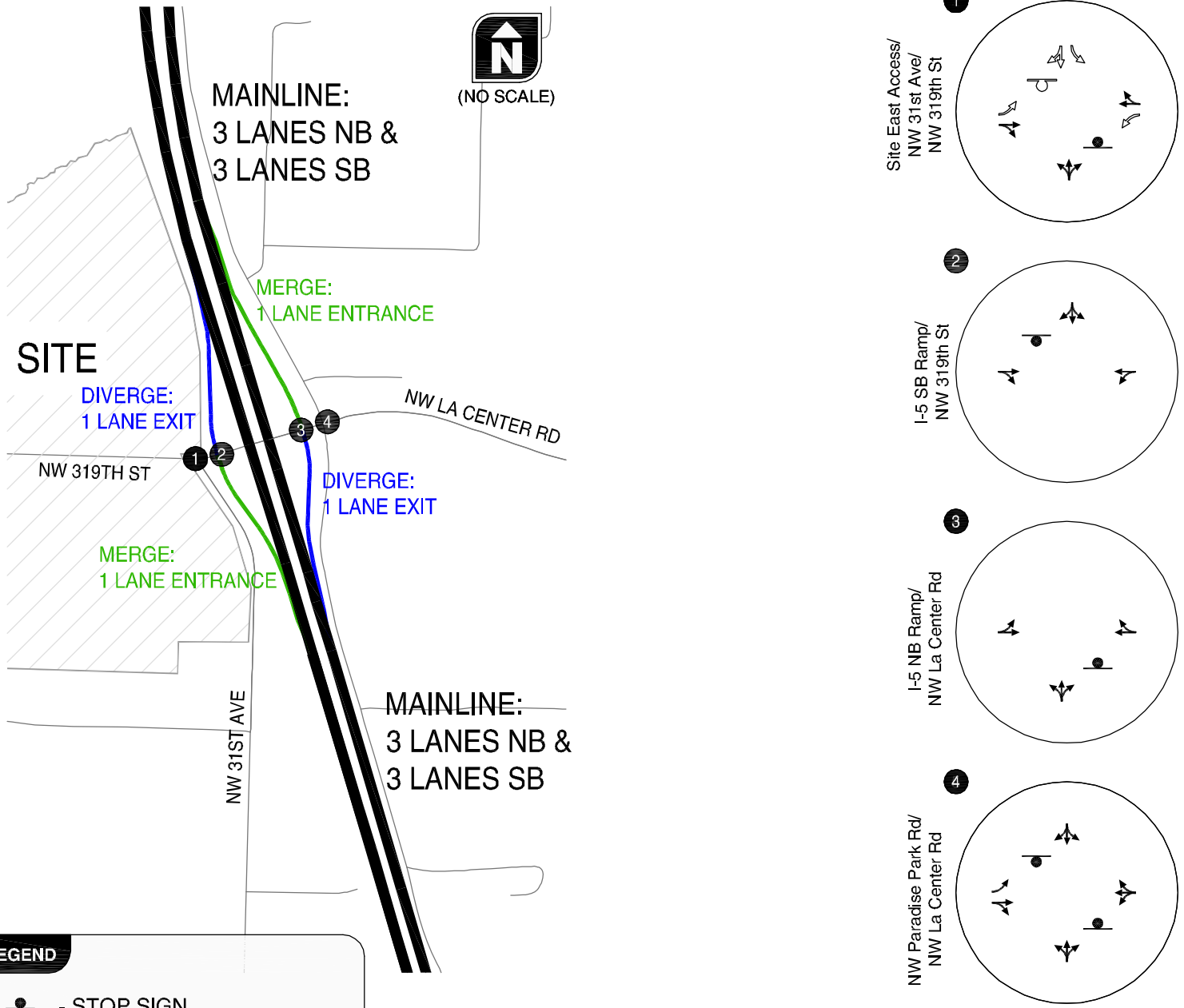
I-5 Mainline Freeway Operations

Operations on the I-5 freeway were assessed using the previously described methodology and were compared to the respective agency operating standards. Table 3-12 compares the 2017 operations of the freeway mainline to the minimum operating standards.

Table 3-12 2017 Total Traffic Conditions (No-Build & Build[1]) I-5 Mainline Operations

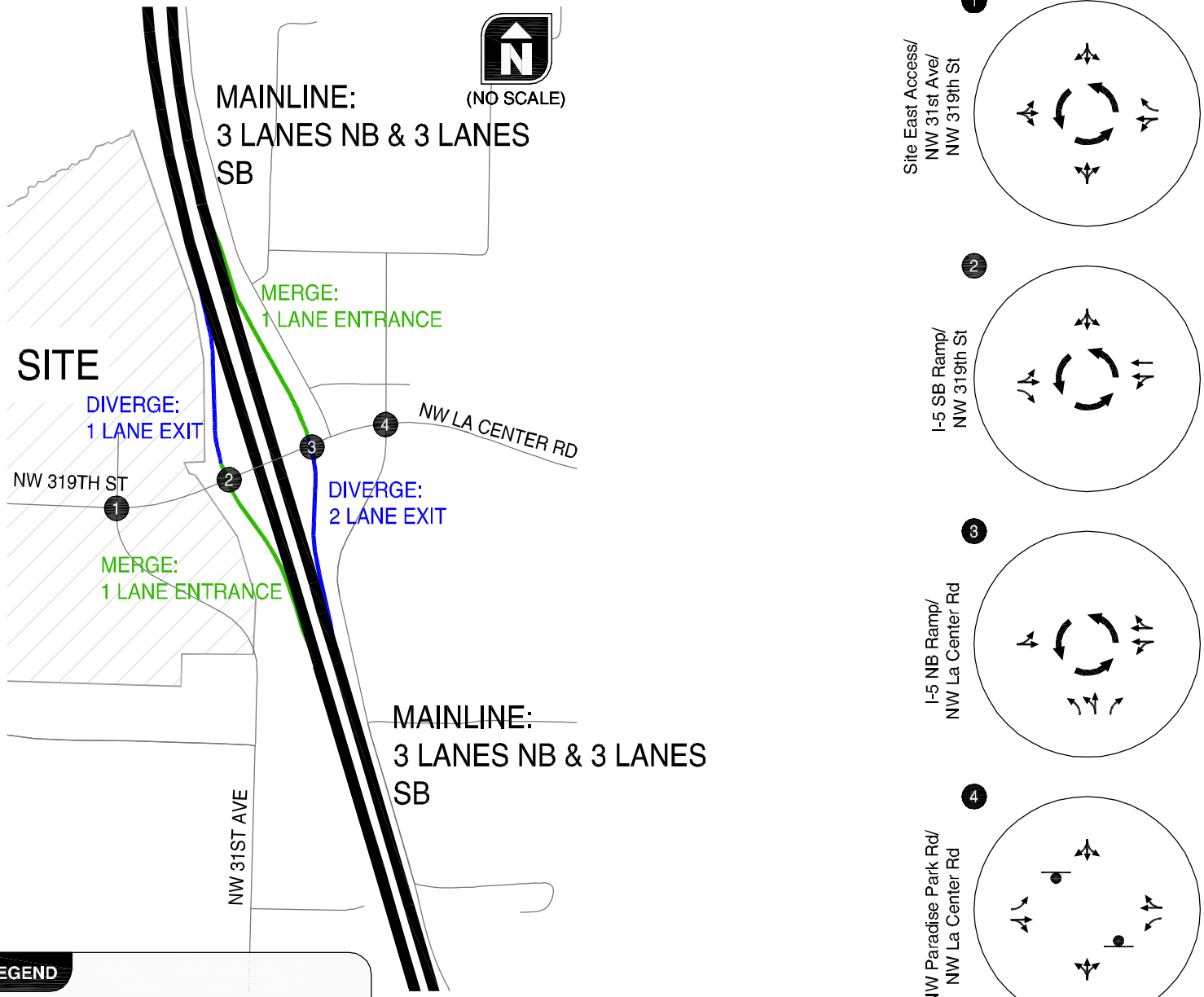
I-5 Segment	LOS Requirement	Forecast Weekday AM Peak LOS	Forecast Weekday PM Peak LOS	Forecast Weekend Peak LOS	LOS Require-ment Met?
SR 501 to La Center Rd (NB)	C	B	C	C	Yes
SR 501 to La Center Rd (SB)	C	B	B	C	Yes
La Center Rd to SR 503 (NB)	C	B	B	B	Yes
La Center Rd to SR 503 (SB)	C	B	B	B	Yes

Note: [1]No changes are recommended that would impact the freeway mainline operations. Thus there is no change between no-build and build operations.



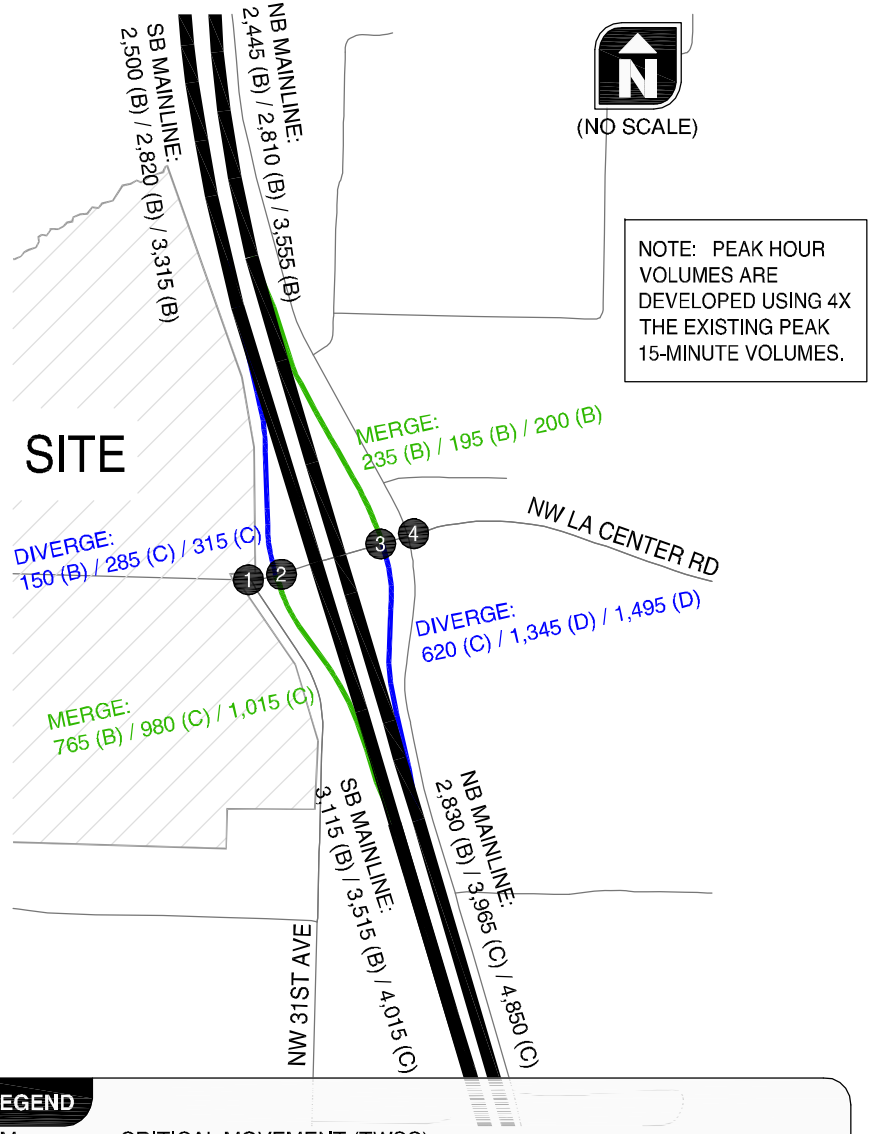
2017 TOTAL TRAFFIC LANE CONFIGURATIONS AND TRAFFIC CONTROL DEVICES (NO BUILD)
LA CENTER, WASHINGTON

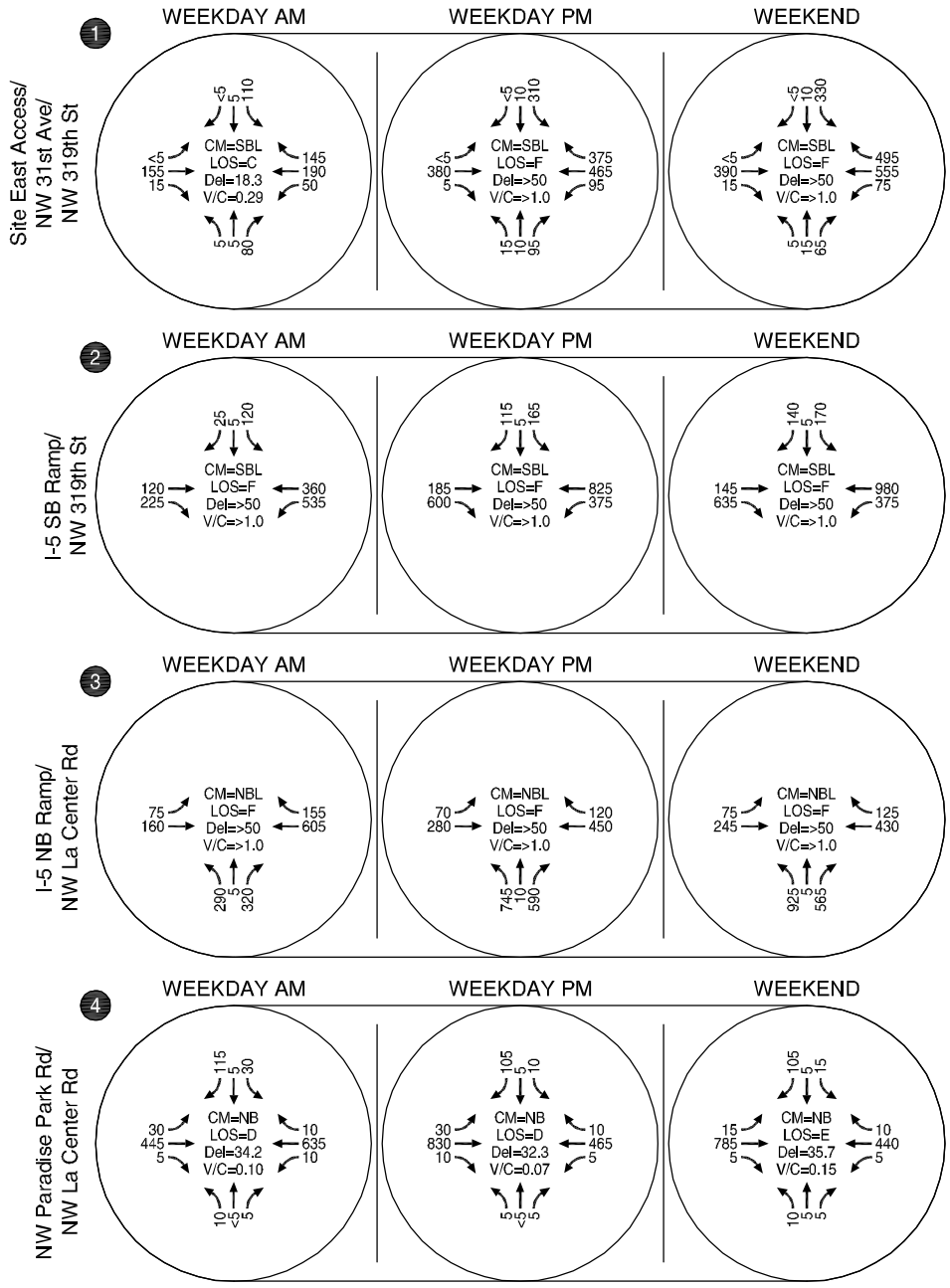
FIGURE **3-5**



2017 TOTAL TRAFFIC LANE CONFIGURATIONS AND TRAFFIC CONTROL DEVICES (BUILD)
LA CENTER, WASHINGTON

FIGURE **3-6**





LEGEND

CM	= CRITICAL MOVEMENT (TWSC)
LOS	= INTERSECTION LEVEL OF SERVICE (ROUNDABOUT)/CRITICAL MOVEMENT LEVEL OF SERVICE (TWSC)
Del	= INTERSECTION AVERAGE CONTROL DELAY (ROUNDABOUT)/ CRITICAL MOVEMENT CONTROL DELAY (TWSC)
V/C	= CRITICAL VOLUME-TO-CAPACITY RATIO
TWSC	= TWO-WAY STOP CONTROL
MAINLINE, MERGE/DIVERGE ANALYSIS	
X,XXX (X)	= VOLUME (LOS) WEEKDAY AM/ WEEKDAY PM / WEEKEND

2017 TOTAL TRAFFIC CONDITIONS (NO BUILD)
WEEKDAY AM, WEEKDAY PM, & WEEKEND PEAK HOURS
LA CENTER, WASHINGTON

FIGURE **3-7**

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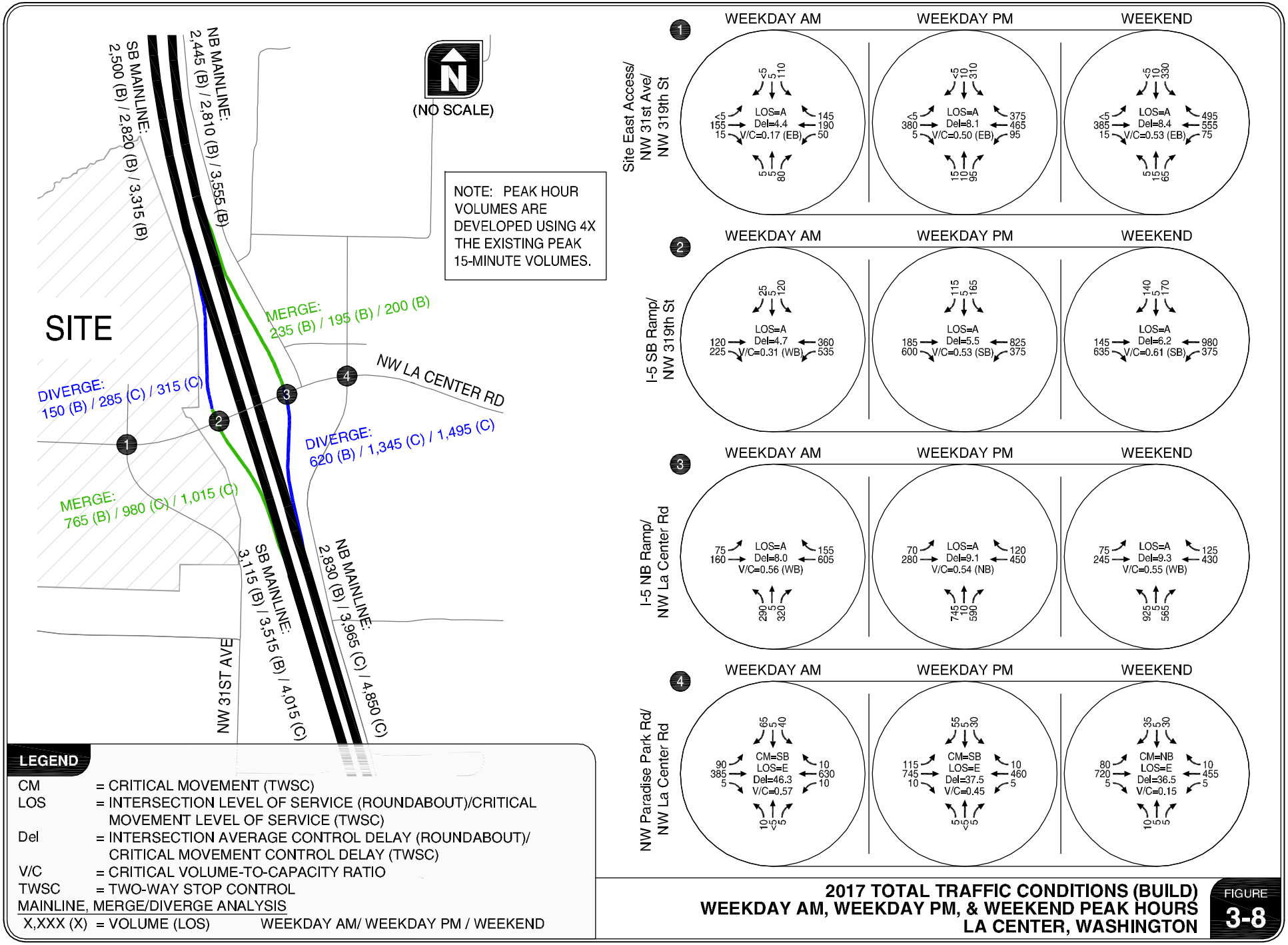


2017 TOTAL TRAFFIC CONDITIONS (BUILD)
WEEKDAY AM, WEEKDAY PM, & WEEKEND PEAK HOURS
LA CENTER, WASHINGTON

FIGURE **3-8**

As seen in the table, the freeway is operating acceptably on all study segments. The HCS analysis output sheets for the 2017 total traffic under No-Build and Build conditions for freeway mainline operations are provided in *Appendix R.*

I-5 Freeway Merge/Diverge Operations

Operations of the study merge/diverge locations were assessed using the previously described methodology and were compared to the respective agency operating standards. Table 3-13 provides a summary comparison of the 2017 total traffic operations under No-Build and Build conditions for the study merge/diverge locations with the minimum operating standards.

Table 3-13 NW La Center Road/I-5 Interchange 2017 Total Traffic Conditions Merge/Diverge Operations

Merge/Diverge Location	LOS Requirement	2017 Total Traffic Conditions (No Build)			2017 Total Traffic Conditions (Build[1])		
		Weekday AM Peak LOS	Weekday PM Peak LOS	Weekend Peak LOS	Weekday AM Peak LOS	Weekday PM Peak LOS	Weekend Peak LOS
I-5/La Center Rd: NB On Ramp	C	B	B	B	*No Change*		
I-5/ La Center Rd: NB Off Ramp	C	C	D	D	B	C	C
I-5/ La Center Rd: SB On Ramp	C	B	C	C	*No Change*		
I-5/ La Center Rd: SB Off Ramp	C	B	C	C	*No Change*		
I-5/Weigh Station: NB On Ramp	C	B	B	C	*No Change*		
I-5/Weigh Station: NB Off Ramp	C	B	B	C	*No Change*		

Notes: Grey shading indicates failure to satisfy operating standards
[1]Build includes a dual lane exit configuration on the northbound off-ramp

As seen in the table, all locations are projected to operate acceptably with the exception of the northbound off-ramp. With the development, the diverge location associated with the northbound off-ramp is projected to operate at a LOS D during the weekday PM and weekend peak hours. Operations can be mitigated by providing a dual-lane exit configuration (adding one lane to the ramp relative to existing condition). With this improvement, 2017 total traffic operations improve to a LOS B during the weekday AM peak hour and LOS C during the weekday PM and weekend peak hours. The HCS analysis output sheets for the 2017 total traffic conditions merge/diverge operations are provided in *Appendix S.* HCS analysis output sheets for the 2017 total traffic conditions (build) northbound off-ramp diverge location are provided in *Appendix T.*

Development Trip Distribution Assumptions at East and West Site Driveways

Traffic operations at the I-5 interchange will be affected by the Cowlitz Reservation Development's trip distribution (routing of trips to and from the site) between the two site driveways on NW 319th Street. The trip distribution will be directly related to the development's parking supply and configuration near the two site driveways. A detailed site plan was not available at the time this report was prepared; therefore, the analysis presented in this report assumes that the two site driveways on NW 319th Street experience a roughly even distribution of site traffic with 50% entering and exiting the site at the NW 319th Street/NW 31st Avenue (east driveway) intersection, and 50% entering and exiting the site at the west driveway on NW 319th Street. The 50/50 trip distribution split translates to an evenly split lane utilization for the northbound left-turn lanes at the La Center Road/I-5 Northbound Ramp intersection. In order to provide for effective on

and off-site operations, development of the site plan will be guided by the operational needs for the site, such as:

- A minimum throat length of 200 feet will be maintained at the easterly driveway approach to the roundabout at NW 31st Avenue/NW 319th Street.
- The site plan will comply with the WSDOT spacing standard that requires a minimum distance of 130 feet of limited access from the centerline of the intersection of the crossroad and the frontage road (e.g. NW 31st Avenue/NW 319th Street).
- The site accesses will accommodate 95th percentile queues on site.

Study Intersection Operations

Operations at the study intersections in 2017 with the Cowlitz Reservation Development and existing infrastructure are shown in Table 3-14 as well as Figure 3-7.

Table 3-14 2017 Total Traffic Conditions Study Intersection Operations (No Build)

Study Intersection	LOS Requirement	Forecast Weekday AM Peak	Forecast Weekday PM Peak	Forecast Weekend Peak	LOS Requirement Met?
NW 31st Ave/ NW 319th St/ Cowlitz East Access	D	C (0.29)	F (>1.0)	F (>1.0)	No
NW La Center Rd/I-5 SB Ramps	C	F (>1.0)	F (>1.0)	F (>1.0)	No
NW La Center Rd/I-5 NB Ramps	C	F (>1.0)	F (>1.0)	F (>1.0)	No
Paradise Park Rd/ NW La Center Rd	E	D (0.10)	D (0.07)	E (0.15)	Yes[1]

Notes: LOS (V/C Ratio)
Grey shading indicates failure to satisfy operating standards
[1] While the left-turn movements from the minor street approach experience delays, the intersection does not meet signal warrants and operates below capacity.

As shown in the table, the following study intersections require mitigation to operate acceptably with the addition to the Cowlitz Reservation Development trips:

- NW 31st Avenue/NW 319th Street/East Site Access
  - Intersection traffic volumes are sufficient to warrant signalization or installation of a roundabout.
- NW La Center Road/I-5 Southbound Ramp
  - Southbound approach LOS also does not satisfy standards under total traffic conditions.
  - Intersection traffic volumes are sufficient to warrant signalization or installation of a roundabout.
- NW La Center Road/I-5 Northbound Ramp
  - Intersection traffic volumes are sufficient to warrant signalization or installation of a roundabout.

Neither frontage road intersection (NW 31st Avenue/NW 319th Street/Cowlitz East Access or Paradise Park Road/NW La Center Road) meets WSDOT standard for frontage road access spacing. The close proximity of the frontage roads to the ramp terminals also provides insufficient queue storage.

Appendix U includes the 2017 no-build total intersection operations analysis worksheets.

Intersection Mitigations (Build)

The need to mitigate the four study intersections identified has been anticipated for some time based on the Final Environmental Impact Statement (EIS) for the Cowlitz Indian Tribe Trust Acquisition and Casino Project dated May 30, 2008 and subsequent Record of Decision issued on April 22, 2013, and the findings of past planning studies prepared by others (References 1 and 8). In particular, the existing I-5/La Center interchange and closely spaced frontage road intersections at NW Paradise Park Road and NW 31st Avenue require mitigation to support the development and/or build-out of the City of La Center. The preferred alternative developed as part of the NW La Center Road/I-5 interchange improvement project includes the following elements:

- *NW 319th Street/NW 31st Avenue/East Cowlitz Access:* reconstructed/realigned NW 31st Avenue and NW 319th Street intersecting at a new roundabout approximately 600 feet west of the southbound interchange terminal;
- *NW 319th Street/I-5 Southbound Ramp:* newly aligned and widened NW 319th Street intersecting with newly aligned I-5 Southbound ramps at a new roundabout;
- *NW La Center Road/I-5 Northbound Ramp:* newly aligned and widened NW La Center Road intersecting with newly aligned I-5 Northbound ramps at a new roundabout, including new dual left-turn lanes and an exclusive right-turn lane on the northbound ramp terminal;
- *NW La Center Road/NW Paradise Park Road:* reconstructed/realigned NW Paradise Park Road intersecting NW La Center Road east of the existing gas station at a two-way stop-controlled intersection approximately 450 feet west of the northbound interchange terminal. Improvements include construction of a new intersection with La Center Road that maintains the current northbound and southbound stop controlled, single-lane approaches along Paradise Park Road. The northbound and southbound approaches will be constructed so they can be restriped in the future to include separate left-turn lanes along with a shared through/right lane; and
- *Bridge structure:* the construction of a new 4-lane, two-span bridge structure with bicycle and pedestrian facilities immediately south of the current structure which will be removed following completion of the new interchange. The new bridge will maintain a single eastbound lane and two westbound lanes under 2017 Build conditions, while maintaining adequate median width to accommodate a future second eastbound lane.

The recommended configurations for each intersection were developed based on projected volumes and operational needs. The associated lane configurations are shown in Figure 3-6.

Table 3-15 provides level of service (LOS) results for the mitigated intersections based on these configurations during the weekday AM, weekday PM and weekend peak hours, which are also shown in Figure 3-8. As with the 2017 total traffic conditions no build assessment, a 50/50 trip distribution was

assumed between the two site driveways on NW 319th Street for site traffic associated with the Cowlitz Reservation Development.

Table 3-15 2017 Total Traffic Conditions Study Intersection Operations (Build)

Intersection	LOS Requirement	Forecast Weekday AM Peak LOS	Forecast Weekday PM Peak LOS	Forecast Weekend Peak LOS	LOS Require-ment Met?
NW 31st Ave/ NW 319th St/ Cowlitz East Access	D	A (0.17)	A (0.50)	A (0.53)	Yes
NW La Center Rd/I-5 SB Ramps	C	A (0.31)	**A** (0.53)	**A** (0.61)	Yes
NW La Center Rd/I-5 NB Ramps[1]	C	A (0.56)	**A** (0.54)	**A** (0.55)	Yes
Paradise Park Rd/ NW La Center Rd	E	E (0.57)	E (0.45)	E (0.15)	Yes

Notes: LOS (V/C Ratio)
Grey shading indicates failure to satisfy operating standards
[1]Lane utilization at this intersection assumed all westbound through traffic destined to turn left onto the I-5 southbound on-ramp at the NW La Center Road/I-5 SB Ramp intersection (traveling towards Vancouver) would line up in the westbound left/through lane (left lane) at the NW La Center Road/I-5 NB Ramp intersection.

As shown in the table, all four of the reconstructed intersections are projected to operate acceptably during the three analysis periods[9]. *Appendix V includes* the 2017 build total intersection operations analysis worksheets.

Intersection Queuing Analysis

Table 3-16 provides projected 95th percentile queue lengths with the proposed intersection mitigations under 2017 total traffic conditions (Build). Both Sidra and Synchro 8 software packages report queues based on number of vehicles. In the table below a single car has been reported as 25 feet. Queue lengths are rounded up to the nearest 25 feet in cases when the software packages report non-whole numbered vehicles.

Table 3-16 2017 Total Traffic Conditions (Build) Intersection 95th Percentile Queue Lengths

Intersection	Approach Lane	Forecast Weekday AM Hour	Forecast Weekday PM Hour	Forecast Weekend Hour	Available Storage	Adequate Storage?
NW 319th Street/ NW 31st Avenue Roundabout	SB	25	75	100	300	Yes
	EB	25	100	125	500+	Yes
	NB	25	50	25	500+	Yes
	WB Through/Left	25	75	100	450[1]	Yes
	WB Right	25	50	75	450[1]	Yes
NW 319th Street/ I-5 SB Ramp Roundabout	SB	25	75	100	500+	Yes
	EB Through/Left	25	50	25	450[1]	Yes
	EB Right	0	0	0	500+	Yes
	WB Through	0	0	0	450[1]	Yes
	WB Through/Left	0	0	0	450[1]	Yes

[9] Note that the NW Paradise Park Road/NW La Center Road intersection satisfies City operating standards and the projected traffic volumes do not meet traffic signal warrants. The City should continue to monitor future growth and development that adds traffic to the intersection to determine if and when signalization may be appropriate.

Intersection	Approach Lane	Forecast Weekday AM Hour	Forecast Weekday PM Hour	Forecast Weekend Hour	Available Storage	Adequate Storage?
NW La Center Road/ I-5 NB Ramp Roundabout	EB	0	0	0	450[1]	Yes
	NB Left	25	75	75	500+	Yes
	NB Left/Through	25	75	75	500+	Yes
	NB Right	50	100	100	250	Yes
	WB Through	100	75	100	325[1]	Yes
	WB Through/Right	50	50	50	325[1]	Yes
NW La Center Road/ Paradise Park Road Stop Controlled	SB	75	75	50	500+	Yes
	EB Left	25	25	25	125	Yes
	NB Left	25	25	25	125	Yes
	NB	25	25	25	500+	Yes

Notes: EB=Eastbound, NB=Northbound, SB=Southbound, WB=Westbound
[1]Distance to adjacent intersection

The table shows that all queue lengths are expected to be relatively small. Queues are not expected to back up to adjacent intersections, or to mainline I-5 along the northbound and southbound off-ramps.

Trip Distribution Sensitivity Analysis

A trip distribution sensitivity analysis was conducted to assess whether the 319th Street/31st Avenue (east driveway) and NW La Center Road/I-5 Northbound Ramp intersections northbound off-ramp terminal could satisfy agency operating standards if the site plan does not facilitate a 50/50 driveway trip split. The sensitivity analysis assumed that 85% of the site-generated trips enter and exit the site at the NW/319th Street/NW 31st Avenue intersection (east driveway), and 15% enter and exit the site from the west driveway. The 85/15 split sensitivity analysis is reflected in the lane utilization of the northbound ramp terminal and the west bound lanes of the southbound ramp terminal.

Table 3-17 shows the NW 319th Street/NW 31st Avenue (east driveway), NW La Center Road/I-5 Southbound Ramp, and NW La Center Road/I-5 Northbound Ramp intersections are projected to operate acceptably during the weekday AM, weekday PM and weekend peak hours assuming an 85/15 trip distribution split at the intersection. Table 3-18 shows the critical lanes (those with or that conflict with the 85% of trip generated traffic) are projected to operate below capacity with queues accommodated within the available storage areas. As such, no additional mitigation measures should be necessary.

Table 3-17 2017 Intersection Operations with an 85/15 Trip Distribution Split

Intersection	Operating Standard	Forecast Weekday AM Peak Hour	Forecast Weekday PM Peak Hour	Forecast Weekend Peak Hour	LOS Require-ment Met?
NW 319th Street/NW 31st Avenue	D	A (0.18)	A (0.58)	A (0.59)	Yes
NW La Center Road/I-5 SB Ramp	C	A (0.36)	A (0.53)	A (0.63)	Yes
NW La Center Road/I-5 NB Ramp	C	A (0.57)	B (0.59)	B (0.67)	Yes

Note: LOS (V/C Ratio)

Table 3-18 2017 Critical Lane Operations with an 85/15 Trip Distribution Split

Intersection	Lane	Forecast Weekday AM Peak Hour			Forecast Weekday PM Hour			Forecast Weekend Hour		
		LOS	v/c	Queue (feet)	LOS	v/c	Queue (feet)	LOS	v/c	Queue (feet)
NW 319th Street/NW 31st Avenue	SB	A	0.18	25	B	0.58	125	B	0.59	125
	WB Right	A	0.15	25	A	0.40	100	A	0.51	125
NW La Center Road/I-5 SB Ramp	SB	B	0.27	25	B	0.53	75	C	0.63	100
	WB Thru/Left	A	0.36	0	A	0.37	0	A	0.37	0
NW La Center Road/I-5 NB Ramp	NB Left	A	0.08	25	A	0.21	25	A	0.22	50
	NB Left/Thru	A	0.23	50	B	0.56	125	B	0.67	125
	WB Thru	B	0.57	100	B	0.54	100	B	0.62	125

As seen when comparing Table 3-18 to 3-17, the majority of queue lengths do not change significantly with the modified distribution split. *Appendix W* includes the 2017 trip distribution sensitivity analysis worksheets assuming an 85/15 trip distribution split.

2037 Total Traffic Conditions (No-Build and Build)

As described in the IJR *Methods & Assumptions* document, the 2037 conditions analysis with the Cowlitz Reservation Development is informational for WSDOT to ensure that near-term interchange improvements do not preclude the ability to provide future long-term improvements. Site-generated traffic was added to 2037 background traffic volumes for the weekday AM, PM and weekend peak hours to arrive at the total traffic volumes. For this assessment, both the "No Build" and "Build" scenarios were evaluated. Under the "No Build" scenario, no additional improvements beyond those identified in the 2017 assessment were assumed. The lane configurations and traffic control devices assumed for the 2037 no-build and build total traffic analysis are provided in Figures 3-9 and 3-10, respectively. Key findings from the analysis include:

- The I-5 mainline north of the La Center Road interchange operate at a LOS C or better in both the southbound and northbound direction during the weekday and weekend peak under 2037 total traffic conditions.
- The I-5 mainline south of the La Center Road interchange operates at a LOS D or better in both the southbound and northbound direction during the weekday and weekend peak periods under 2037 total traffic conditions.
- The mitigation at the northbound off-ramp identified under the 2017 conditions (adding one lane to the ramp relative to the existing condition to provide a dual lane exit configuration) is sufficient to maintain acceptable operations at the ramp in the long-term.
- With the identified mitigation, the merge/diverge locations at the NW La Center Road/I-5 interchange ramps and the weigh station south of La Center Road operate at a LOS D or better during the weekday and weekend peak periods under the 2037 total traffic conditions.
- The roundabout configurations to be built in 2017 at the 319th Street/3st Avenue and ramp terminals can accommodate 2037 traffic volumes and satisfy the LOS criteria; however, the long-term 2037 design should consider the following improvements (measures beyond those

needed in 2017) to mitigate for long-term local and regional growth not accounted for in the regional travel demand models and not associated with the Cowlitz Reservation Development.

  - a second eastbound through lane on the overpass between the ramp terminal roundabouts and between the 319th Street/31st Avenue and southbound ramp roundabout; and
  - a separate right turn-lane on the southbound I-5 off-ramp;

- In addition, a traffic signal with two thru lanes on the eastbound and westbound approaches will be needed at the NW La Center Road/NW Paradise Park Road intersection.

The 2037 no-build and build total traffic conditions traffic volumes and operations are summarized in Figures 3-11 and 3-12, respectively, and detailed in the sub-sections below.

I-5 Mainline Freeway Operations

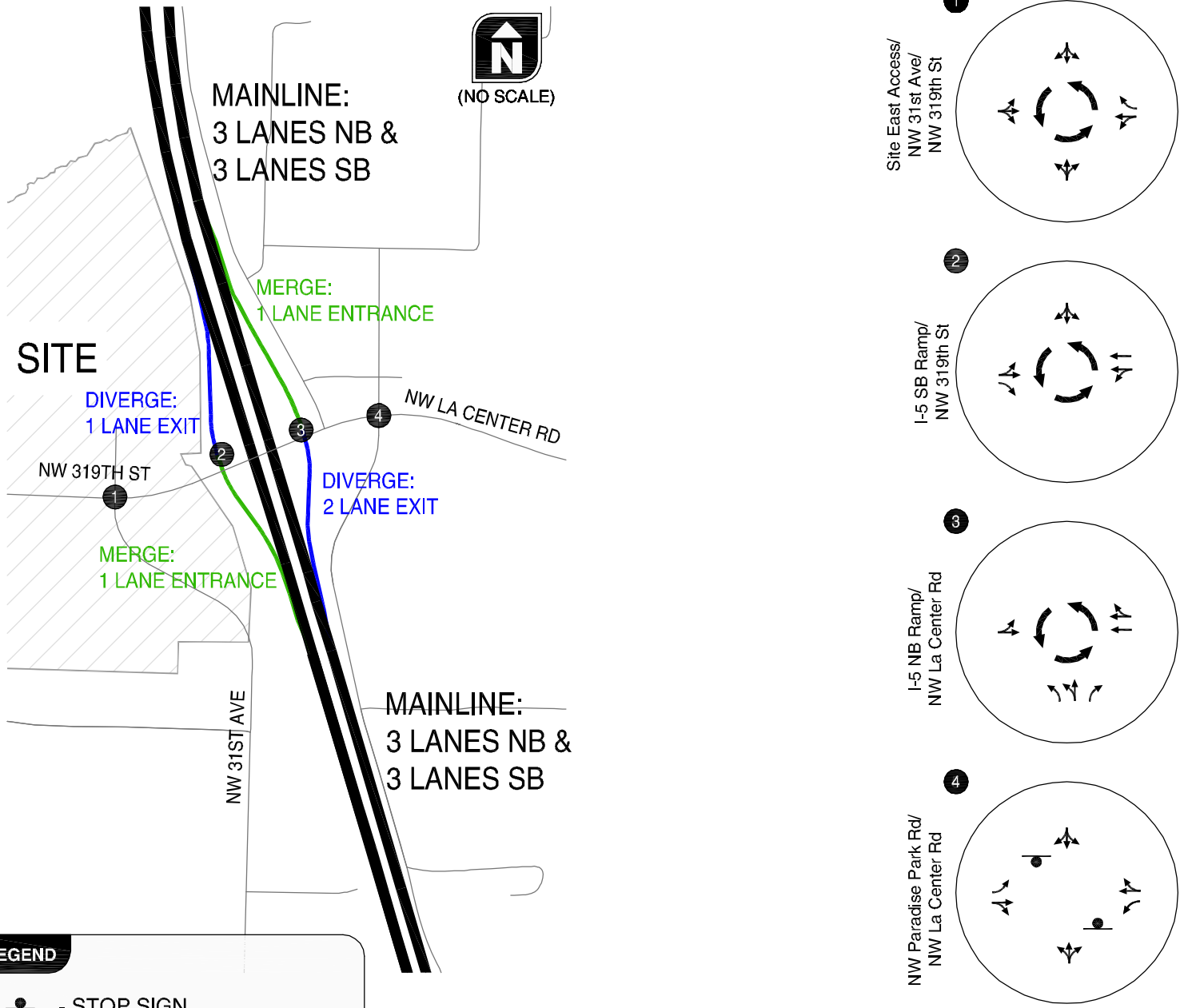
Operations on the I-5 freeway were assessed and compared to the respective agency operating standards. Table 3-19 compares the 2037 operations of the freeway mainline to the minimum operating standards. Note that the applicable standard for the 2037 operations is LOS D.

Table 3-19 2037 Total Traffic Conditions I-5 Mainline Operations (No Build and Build[1])

I-5 Segment	LOS Requirement	Forecast Weekday AM Peak LOS	Forecast Weekday PM Peak LOS	Forecast Weekend Peak LOS	LOS Require-ment Met?
SR 501 to La Center Rd (NB)	D	B	C	D	Yes
SR 501 to La Center Rd (SB)	D	B	C	D	Yes
La Center Rd to SR 503 (NB)	D	B	C	C	Yes
La Center Rd to SR 503 (SB)	D	B	B	C	Yes

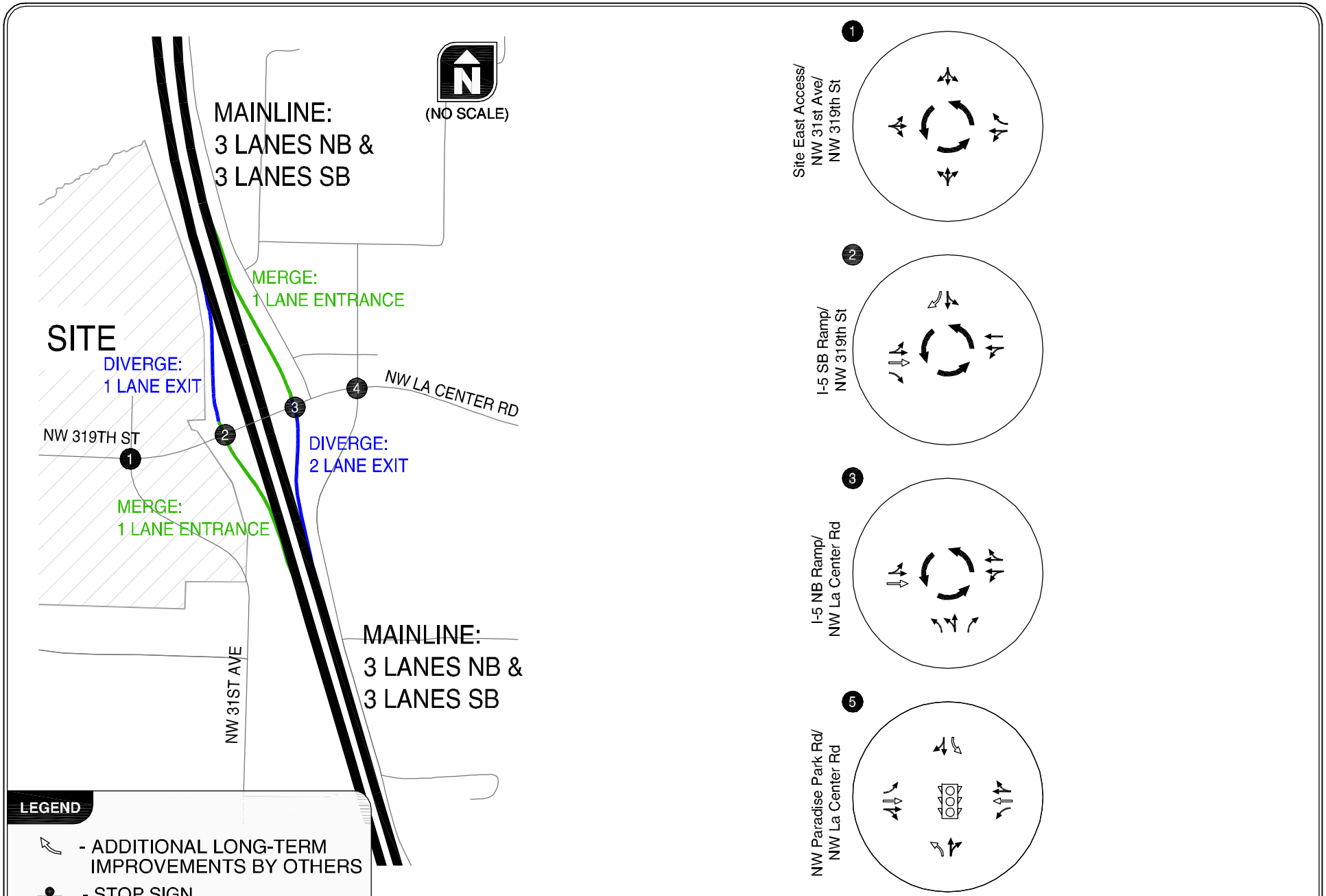
Note: [1]No changes are recommended that would impact the freeway mainline operations. Thus, there is no change between no-build and build operations.

As seen in the table, the freeway is forecasted to operate acceptably on all study segments with no additional mitigations under year 2037 conditions. The HCS analysis output sheets for the 2037 total traffic conditions freeway mainline operations are provided in *Appendix X.*



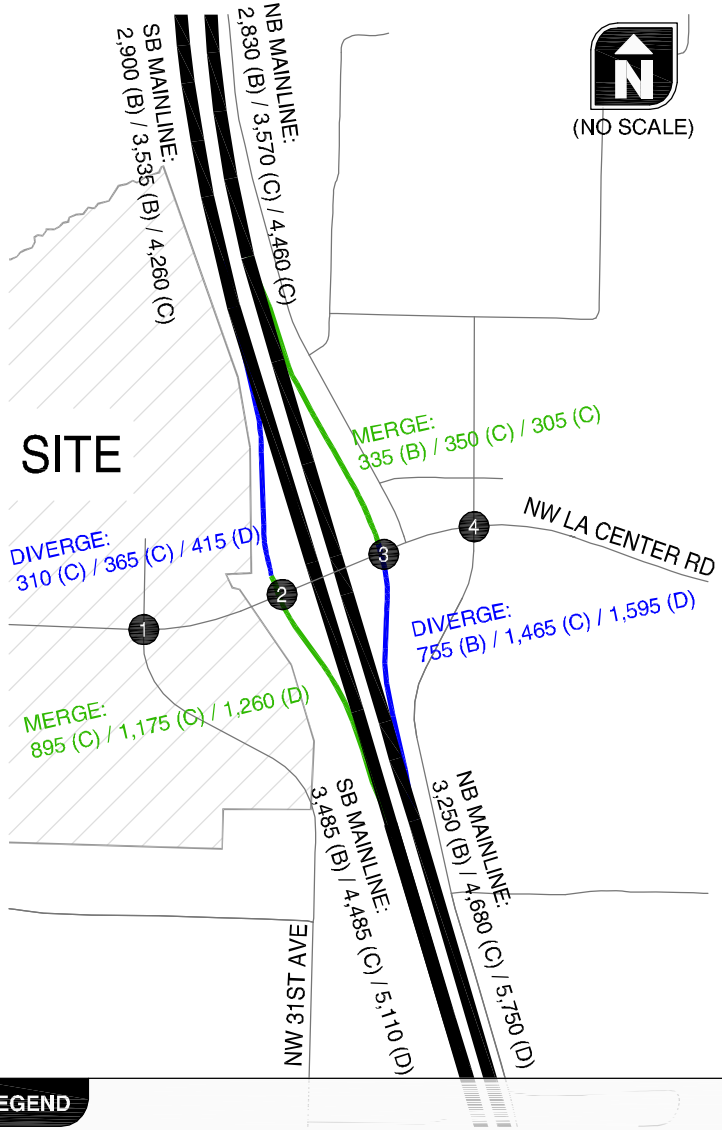
2037 TOTAL TRAFFIC LANE CONFIGURATIONS AND TRAFFIC CONTROL DEVICES (NO BUILD)
LA CENTER, WASHINGTON

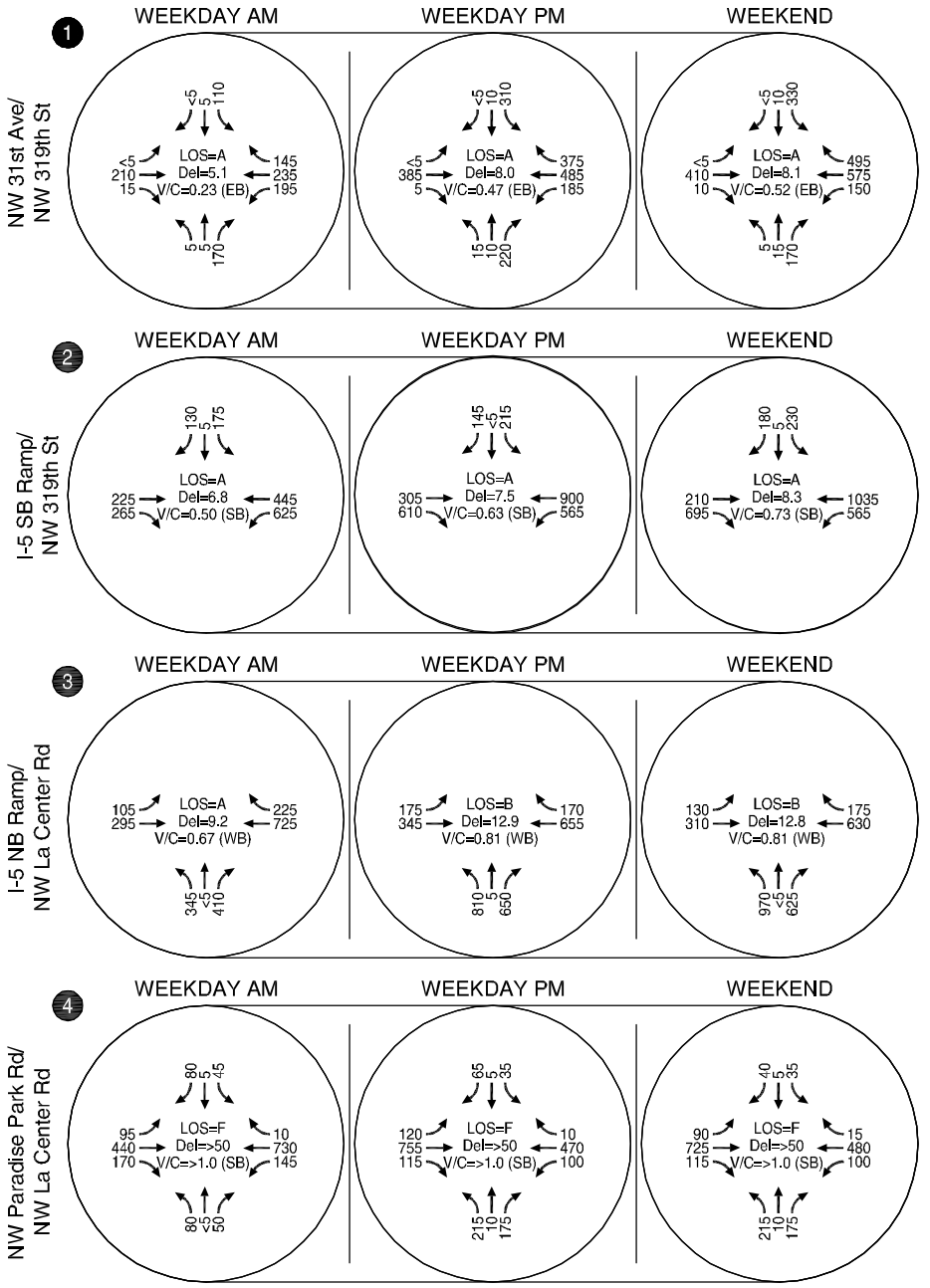
FIGURE **3-9**



2037 TOTAL TRAFFIC LANE CONFIGURATIONS AND TRAFFIC CONTROL DEVICES (BUILD)
LA CENTER, WASHINGTON

FIGURE **3-10**





LEGEND

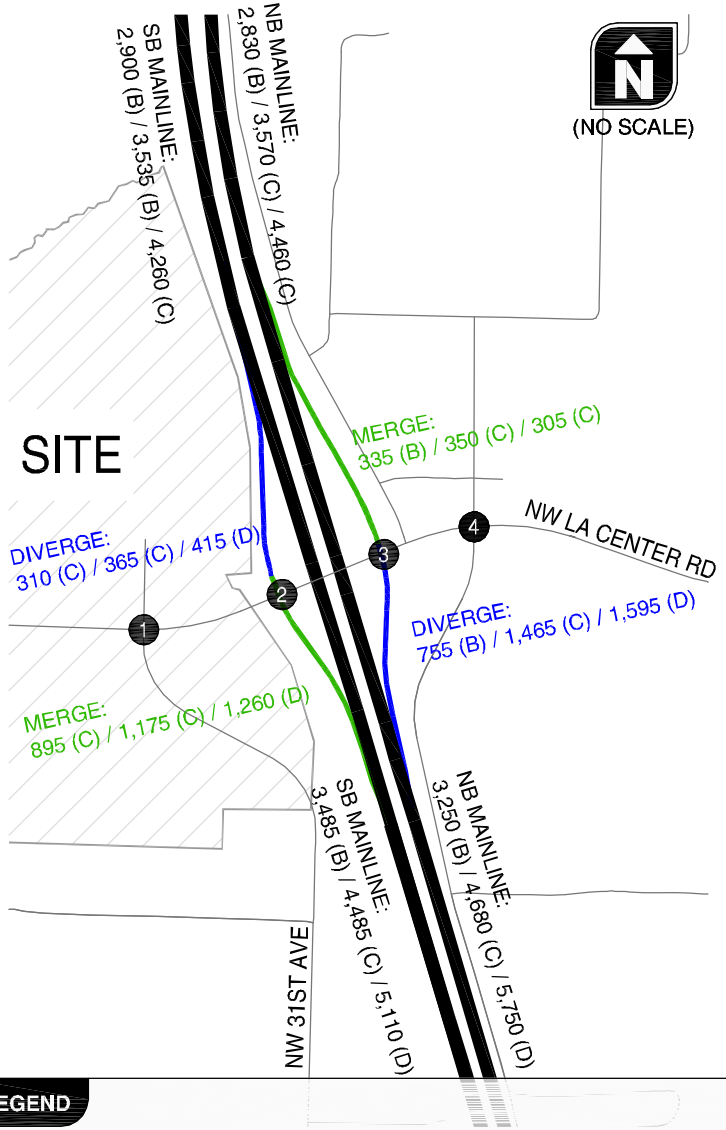
CM	= CRITICAL MOVEMENT (TWSC)
LOS	= INTERSECTION LEVEL OF SERVICE (ROUNDABOUT)/CRITICAL MOVEMENT LEVEL OF SERVICE (TWSC)
Del	= INTERSECTION AVERAGE CONTROL DELAY (ROUNDABOUT)/ CRITICAL MOVEMENT CONTROL DELAY (TWSC)
V/C	= CRITICAL VOLUME-TO-CAPACITY RATIO
TWSC	= TWO-WAY STOP CONTROL

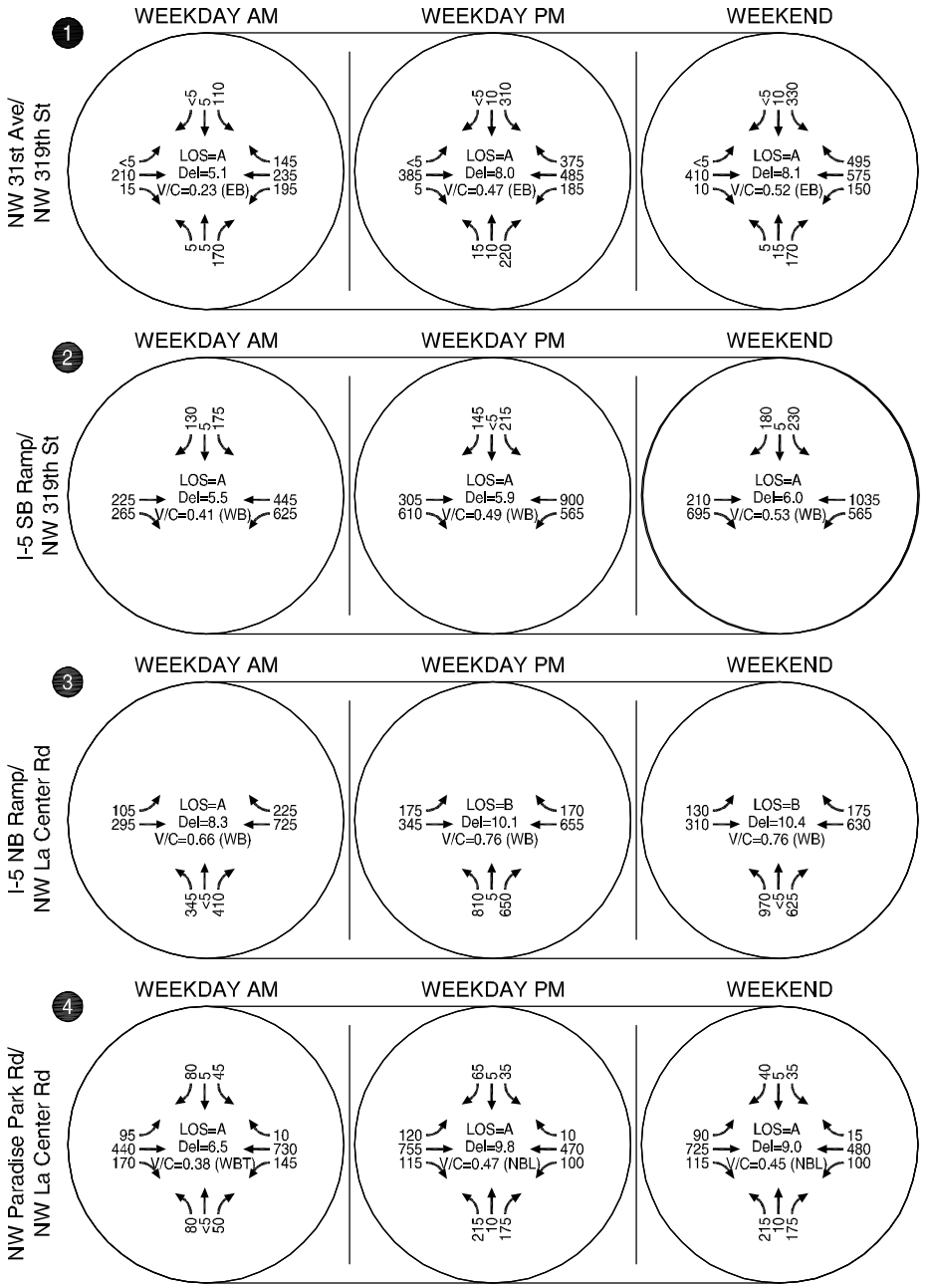
MAINLINE, MERGE/DIVERGE ANALYSIS

X,XXX (X) = VOLUME (LOS) WEEKDAY AM/ WEEKDAY PM / WEEKEND

2037 TOTAL TRAFFIC CONDITIONS (NO BUILD)
WEEKDAY AM, WEEKDAY PM, & WEEKEND PEAK HOURS
LA CENTER, WASHINGTON

FIGURE **3-11**





LEGEND

CM	= CRITICAL MOVEMENT (TWSC)
LOS	= INTERSECTION LEVEL OF SERVICE (ROUNDABOUT)/CRITICAL MOVEMENT LEVEL OF SERVICE (TWSC)
Del	= INTERSECTION AVERAGE CONTROL DELAY (ROUNDABOUT)/ CRITICAL MOVEMENT CONTROL DELAY (TWSC)
V/C	= CRITICAL VOLUME-TO-CAPACITY RATIO
TWSC	= TWO-WAY STOP CONTROL
MAINLINE, MERGE/DIVERGE ANALYSIS	
X,XXX (X)	= VOLUME (LOS) WEEKDAY AM/ WEEKDAY PM / WEEKEND

2037 TOTAL TRAFFIC CONDITIONS (BUILD)
WEEKDAY AM, WEEKDAY PM, & WEEKEND PEAK HOURS
LA CENTER, WASHINGTON

FIGURE **3-12**

I-5 Freeway Merge/Diverge Operations

Operations of the study merge/diverge locations were assessed using the previously described methodology and were compared to the respective agency operating standards. Table 3-20 provides a summary comparison of the 2037 total traffic operations of the study merge/diverge locations with the minimum operating standards.

Table 3-20 NW La Center Road/I-5 Interchange 2037 Total Traffic Conditions Merge/Diverge Operations (No Build and Build[1])

Merge/Diverge Location	LOS Requirement	Forecast Weekday AM Peak LOS	Forecast Weekday PM Peak LOS	Forecast Weekend Peak LOS	LOS Requirement Met?
I-5/La Center Rd: NB On Ramp	D	B	C	C	Yes
I-5/ La Center Rd: NB Off Ramp	D	B	C	D	Yes
I-5/ La Center Rd: SB On Ramp	D	C	C	D	Yes
I-5/ La Center Rd: SB Off Ramp	D	C	C	D	Yes
I-5/Weigh Station: NB On Ramp	D	C	C	D	Yes
I-5/Weigh Station: NB Off Ramp	D	B	C	C	Yes

Notes: [1]No additional improvements beyond the two lane exit configuration on the northbound off-ramp recommended. Thus, there is no change between no-build and build operations.

As seen in the table, all locations are projected to operate acceptably and no further mitigations are recommended beyond the dual exit lanes on the northbound off-ramp, recommended under 2017 total traffic conditions and assumed in the 2037 "No Build" scenario. The HCS analysis output sheets for the 2037 total traffic conditions merge/diverge operations are provided in *Appendix Y.*

Study Intersection Operations

The 20-year horizon analysis is used to ensure the development and associated improvements to the interchange are consistent with, and do not preclude, future improvements. Projected growth within the City of La Center and unincorporated Clark County during the 2037 horizon period may require additional lanes be added to the lane configurations and traffic control required under year 2017 total traffic (Build) conditions.

The operations at the study intersections in 2037 with the Cowlitz Reservation Development and the existing infrastructure are provided in Table 3-21 and Figure 3-11.

Table 3-21 2037 Total Traffic Conditions Study Intersection Operations (No Build)

Study Intersection	Operating Standard	Forecast Weekday AM Peak	Forecast Weekday PM Peak	Forecast Weekend Peak	LOS Requirement Met?
NW 31st Ave/ NW 319th St/ Cowlitz East Access	D	A (0.23)	A (0.47)	A (0.52)	Yes
NW La Center Rd/I-5 SB Ramps	D	A (0.50)	A (0.63)	A (0.73)	Yes
NW La Center Rd/I-5 NB Ramps[1]	D	A (0.67)	B (0.81)	B (0.81)	Yes
Paradise Park Rd/ NW La Center Rd	E	F (>1.0)	F (>1.0)	F (>1.0)	No

Notes: LOS (V/C Ratio)
Grey shading indicates failure to satisfy operating standards

[1]Lane utilization at this intersection assumed all westbound traffic turning left onto the I-5 southbound on-ramp at the NW 319th Street/ I-5 SB ramp intersection, would line up in the westbound left/through lane (left lane) at the NW La Center Road/I-5 NB Ramp intersection.

As shown in Table 3-21, the NW 319th Street/NW 31st Avenue, NW La Center Road/Southbound Ramp, and NW La Center Road/Northbound Ramp intersections satisfy the LOS criteria. Although the ramp terminal roundabouts meet LOS criteria, considerations should be made for additional lanes at the ramp terminal roundabouts as described in the next section. *Appendix Z* includes the 2037 no-build intersection operations analysis worksheets.

Intersection Mitigations (Build)

While the ramp terminal roundabouts are projected to satisfy the LOS criteria, the long-term 2037 design should consider the following improvement measures (beyond those needed in 2017) to mitigate for long-term local and regional growth not accounted for in the RTC travel demand models and not associated with the Cowlitz Reservation Development.

- a second eastbound through lane on the overpass between the I-5 ramp terminal roundabouts, and between the 319th Street/31st Avenue and southbound ramp roundabout; and
- a separate right turn-lane on the southbound I-5 off-ramp.

In addition, a traffic signal with two thru lanes on the eastbound and westbound approaches will be needed at the NW La Center Road/NW Paradise Park Road to mitigate the intersection. (see further discussion below). These improvements are shown in Figure 3-10.

NW Paradise Park Road/NW La Center Road

NW Paradise Park Road is not included in the RTC model projections; however, growth was assumed along the northbound and southbound approaches at the intersection with NW La Center Road. The volumes on Paradise Park Road were developed assuming full build-out of the remaining developable areas located within the City of La Center's current comprehensive plan and city limits that would access La Center Road via Paradise Park Road.

Capacity improvement needs were identified at the intersection as a result of the increase in traffic along La Center Road and modest growth assumed along Paradise Park Road. A traffic signal was assumed as potential mitigation at the intersection in 2037. A roundabout could also be considered as potential mitigation recognizing the NW 319th Street/NW La Center Road corridor would have three roundabouts west of this intersection.

Intersection Operations Analysis

Table 3-22 provides level of service (LOS) results for the intersections during the weekday AM, weekday PM and weekend peak hours, which are also provided in Figure 3-12.

Table 3-22 2037 Total Traffic Conditions Study Intersection Operations (Build)

Study Intersection	Operating Standard	Forecast Weekday AM Peak	Forecast Weekday PM Peak	Forecast Weekend Peak	LOS Require-ment Met?
NW 31st Ave/ NW 319th St/ Cowlitz East Access	D	A (0.23)	A (0.47)	A (0.52)	Yes
NW La Center Rd/I-5 SB Ramps	D	A (0.41)	A (0.49)	A (0.53)	Yes
NW La Center Rd/I-5 NB Ramps[1]	D	A (0.66)	B (0.76)	B (0.76)	Yes
Paradise Park Rd/ NW La Center Rd	D	A (0.38)	A (0.47)	A (0.45)	Yes

Notes: LOS (V/C Ratio)
[1]Lane utilization at this intersection assumed all westbound traffic turning left onto the I-5 southbound on-ramp at the NW 319th Street/ I-5 SB Ramp intersection, would line up in the westbound left/through lane (left lane) at the NW La Center Road/I-5 NB Ramp intersection.

As shown in the table, all intersections satisfy the LOS requirements of the respective agencies in 2037 assuming the identified potential improvements are constructed. Accordingly, it is recommended that the intersection improvements proposed in conjunction with the Cowlitz Reservation Development be designed and constructed in a manner that does not preclude these potential long-term improvements.*Appendix AA* includes the 2037 build intersection operations analysis worksheets.

Intersection Queuing Analysis

Table 3-23 provides projected 95th percentile queue lengths associated with the proposed intersection mitigations. Both Sidra and Synchro 8 software packages report queues based on number of vehicles. In the table below a single car has been reported as 25 feet. Queue lengths are rounded up to the nearest 25 feet in cases when the software packages report non-whole numbered vehicles.

Table 3-23 2037 Intersection 95th Percentile Queue Lengths (feet)

Intersection	Approach Lane	Weekday AM Hour	Weekday PM Hour	Weekend Hour	Available Storage	Adequate Storage?
NW 319th Street/NW 31st Avenue Roundabout	SB	25	75	100	300	Yes
	EB	50	100	125	500+	Yes
	NB	50	75	50	500+	Yes
	WB Through/Left	50	100	100	450[1]	Yes
	WB Right	25	50	75	450[1]	Yes
NW La Center Road/I-5 SB Ramp Roundabout	SB Through/Left	25	50	50	500+	Yes
	SB Right	25	25	50	300	Yes
	EB Through/Left	50	50	25	275	Yes
	EB Through	50	50	25	450[1]	Yes
	EB Right	0	0	0	500+	Yes
	WB Through	0	0	0	450[1]	Yes
	WB Through/Left	0	0	0	450[1]	Yes
NW La Center Road/I-5 NB Ramp Roundabout	EB Through/Left	0	0	0	450[1]	Yes
	EB Through	0	0	0	450[1]	Yes
	NB Left	25	50	50	500+	Yes
	NB Left/Through	25	50	50	500+	Yes
	NB Right	50	75	75	250	Yes
	WB Through	75	50	75	325[1]	Yes[2]
	WB Through/Right	150[2]	175[2]	175[2]	325[1]	Yes

Intersection	Approach Lane	Weekday AM Hour	Weekday PM Hour	Weekend Hour	Available Storage	Adequate Storage?
NW La Center Road/Paradise Park Road Traffic Signal	SB Through/Right	25	25	25	500+	Yes
	SB Left	50	25	25	125	Yes
	EB Left	75	75	50	150	Yes
	EB Through	100	175	175	325[1]	Yes
	EB Through/Right	100	175	175	325[1]	Yes
	NB Through/Right	25	50	50	500+	Yes
	NB Left	50	125	125	200	Yes
	WB Left	100	75	75	150	Yes
	WB Through	150	100	100	500+	Yes
	WB Through/Right	150	100	100	300	Yes

Notes: EB=Eastbound, NB=Northbound, SB=Southbound, WB=Westbound
[1]Distance to adjacent intersection
[2]Lane utilization at this intersection assumed all westbound through traffic destined to turn left onto the I-5 southbound on-ramp at the NW La Center Road/I-5 SB Ramp intersection (traveling towards Vancouver) would line up in the westbound left/through lane (left lane) at the NW La Center Road/I-5 NB Ramp intersection.

Table 3-23 shows that the projected 95th percentile queues can be accommodated within the available storage areas.

Trip Distribution Sensitivity Analysis

A trip distribution sensitivity analysis was conducted to assess whether the 319th Street/31st Avenue (east access) and NW La Center Road/I-5 Northbound Ramp intersections could satisfy agency operating standards if the site plan does not facilitate a 50/50 access split. The sensitivity analysis assumed that 85% of the site-generated trips enter and exit the site at the NW/319th Street/NW 31st Avenue intersection (east access), and 15% enter and exit the site from the west access. The 85/15 split sensitivity analysis is reflected in the lane utilization of the northbound ramp terminal. The sensitivity analysis will have no effect on the southbound ramp terminal because the two westbound lanes at the intersection do not conflict with any traffic.

Table 3-24 shows the NW 319th Street/NW 31st Avenue (east driveway), NW La Center Road/I-5 Southbound Ramp, and NW La Center Road/I-5 Northbound Ramp intersections are projected to operate acceptably during the weekday AM, weekday PM and weekend peak hours assuming an 85/15 trip distribution split at the intersection. Table 3-25 shows the critical lanes (those with or that conflict with the 85% of trip generated traffic) are projected to operate below capacity with queues accommodated within the available storage areas (with the exception of the westbound through lane at the NW La Center Road/I-5 Northbound Ramp, which exceeds available storage with the original distribution as well).

Table 3-24 2037 Intersection Operations with an 85/15 Trip Distribution Split

Intersection	Operating Standard	Weekday AM Peak Hour	Weekday PM Peak Hour	Weekend Peak Hour	LOS Requirement Met?
NW 319th Street/NW 31st Avenue	D	A (0.26)	A (0.58)	A (0.58)	Yes
NW La Center Road/I-5 SB Ramp	D	A (0.44)	A (0.51)	A (0.57)	Yes
NW La Center Road/I-5 NB Ramp	D	A (0.66)	B (0.83)	B (0.85)	Yes

Note: LOS (V/C Ratio)

Table 3-25 2037 Critical Lane Operations with an 85/15 Trip Distribution Split

Intersection	Lane	Weekday AM Peak Hour			Weekday PM Hour			Weekend Hour		
		LOS	v/c	Queue (feet)	LOS	v/c	Queue (feet)	LOS	v/c	Queue (feet)
NW 319th Street/NW 31st Avenue	SB	A	0.19	25	B	0.58	125	B	0.58	125
	WB Right	A	0.17	25	A	0.38	100	A	0.49	125
NW La Center Road/I-5 SB Ramp	SB Thru/Left	A	0.24	25	A	0.30	50	A	0.30	50
	SB Right	A	0.19	25	A	0.23	25	B	0.33	50
	WB Thru	A	0.44	0	A	0.51	0	A	0.57	0
NW La Center Road/I-5 NB Ramp	NB Left/Thru	A	0.24	25	B	0.58	100	A	0.57	100
	WB Thru	B	0.66	150	C	0.83	250	C	0.85	275
	WB Thru/Right	B	0.42	75	B	0.44	75	B	0.49	75

As seen when comparing Table 3-25 to 3-23, for the most part queue lengths do not change significantly with the modified distribution split. *Appendix BB* includes the 2037 trip distribution sensitivity analysis worksheets assuming an 85/15 trip distribution split.

Collision Analysis

The purpose of the collision analysis is to both document the observed crash history and assess the safety effect of the proposed interchange modifications. The methods and assumptions for the collision analysis are detailed in the memorandum *NW La Center Road/I-5 Interchange IJR Methods & Assumptions Supplement – Collision Analysis*, provided in *Appendix CC* for reference. To aid in the collision analysis, WSDOT Statewide Travel & Collision Data Office provided crash data for the study area for the most recent five years (January 1, 2009 through December 31, 2013). The crash data is summarized in the following sections and provided in *Appendix DD* for reference.

Observed Crash History

The WSDOT *Design Manual* specifies that the IJR should "Identify and document collision histories, rates, and types for the freeway section and the adjacent affected local surface system" (Reference 5). The following subsections provide the crash assessment for the I-5 mainline within a half-mile vicinity of the interchange and truck weigh station south of NW La Center Road, interchange ramps, and study intersections. As noted above, crash data was provided by WSDOT for the study area for 2009 through 2013. Crash data was mapped and summarized to assess trends related to crash type, severity, roadway surface condition, weather, lighting conditions, time, and/or date. It should be noted that there were no fatality crashes in any of these subsections for these dates.

I-5 Mainline: Interchange Vicinity

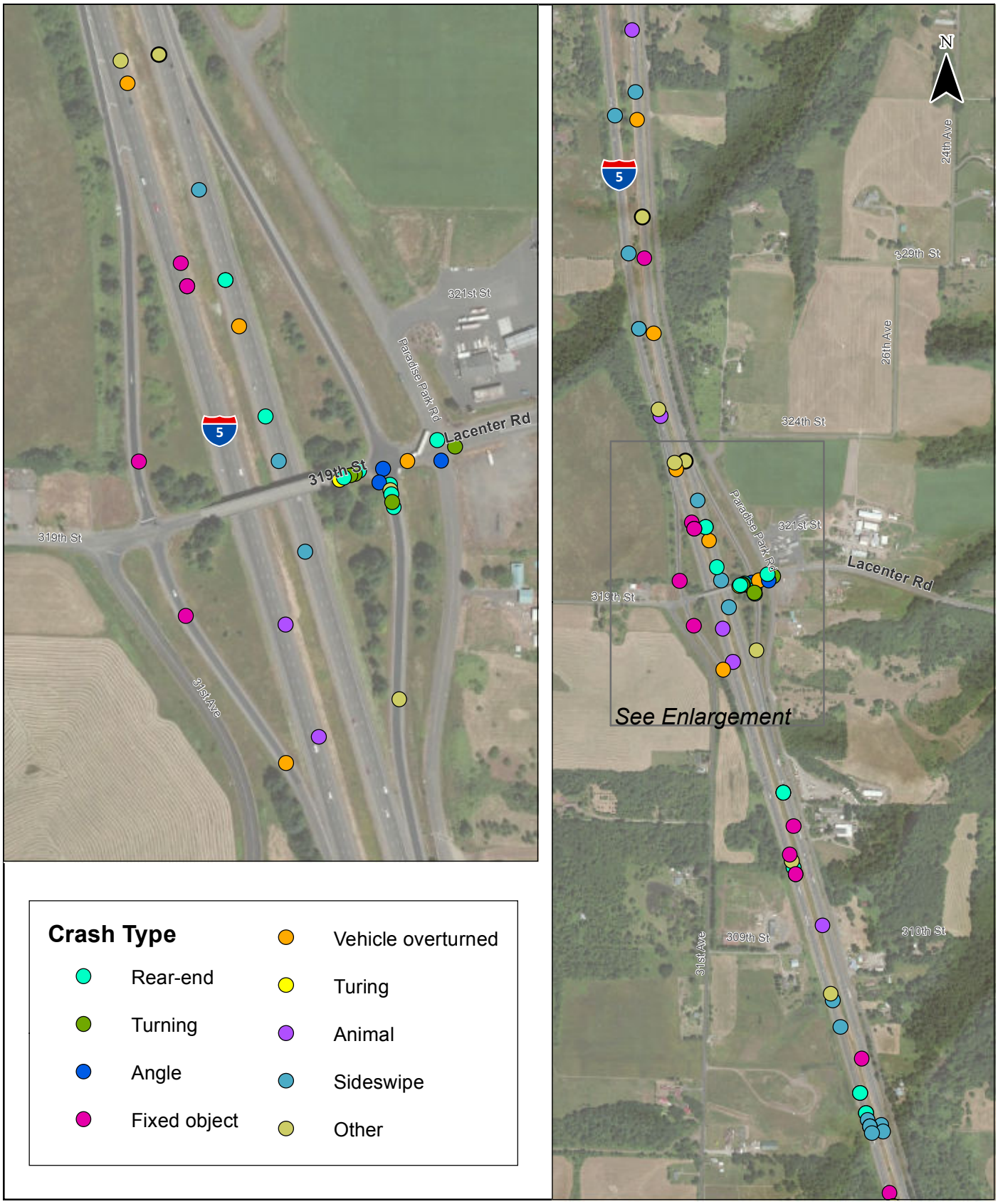
Crash data was collected for the I-5 mainline segment in the vicinity of the NW La Center Road/I-5 interchange. Crash data within a half-mile north and south of the NW La Center Road interchange ramps was isolated to assess conditions in the immediate vicinity of the interchange. The data is provided in Table 3-26 and mapped by severity and type in Figures 3-13 and 3-14, respectively.

NW La Center Road/I-5 Interchange
Crashes by Severity
January 1, 2009 - December 31, 2013

Figure
3-13

H:\profile\12393 - Cowlitz Reservation Development\gis\Crashes by Severity_LaC.mxd - klaustsen - 4:56 PM 2/24/2015

Coordinate System: NAD 1983 HARN StatePlane Washington South FIPS 4602 Feet



NW La Center Road/I-5 Interchange
Crashes by Type
January 1, 2009 - December 31, 2013

Figure
3-14

H:\profile\12393 - Cowlitz Reservation Development\gis\Crashes by Type_LaC.mxd - klaustsen - 5:00 PM 2/24/2015

Coordinate System: NAD 1983 HARN StatePlane Washington South FIPS 4602 Feet

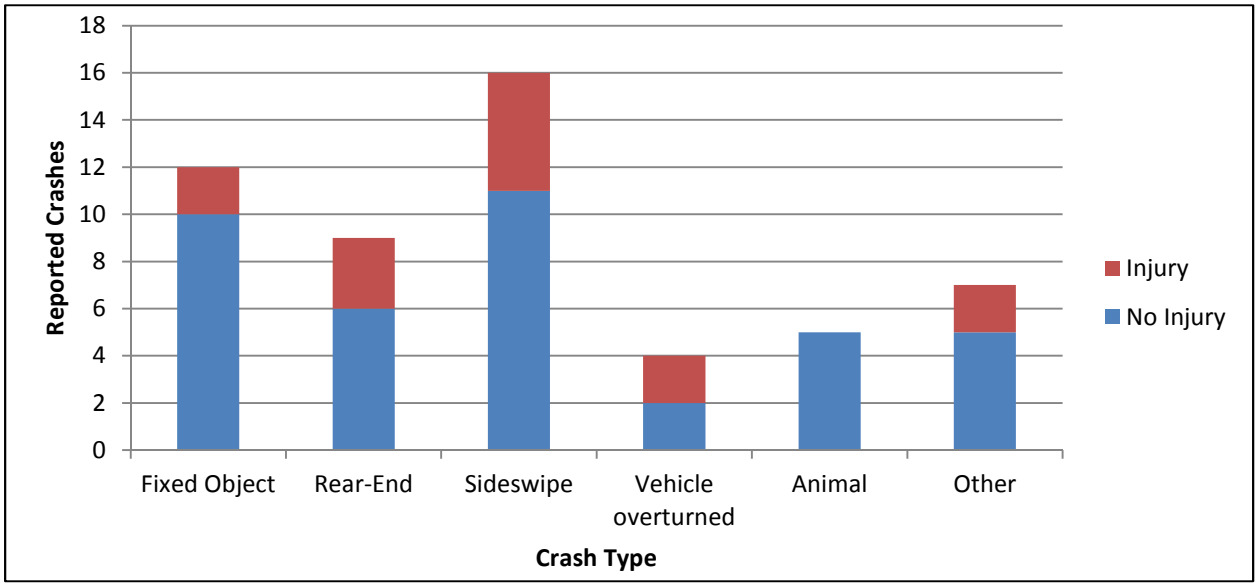
Table 3-26 Crash History I-5 Mainline, MP 15.90 – 17.72 (Jan 1, 2009 – Dec 31, 2013)

Year	Severity			Crash Type						Total
	PDO[1]	Injury	Fatality	Fixed Object	Rear-End	Side-swipe	Vehicle Overturned	Animal	Other	
2009	10	0	0	2	0	4	1	1	2	10
2010	9	3	0	4	4	1	1	1	1	12
2011	2	2	0	0	1	2	1	0	0	4
2012	11	1	0	3	2	4	1	1	1	12
2013	7	8	0	3	2	5	0	2	3	15
Total	**39**	**14**	**0**	**12**	**9**	**16**	**4**	**5**	**7**	**53**

Note: [1] PDO = Property Damage Only

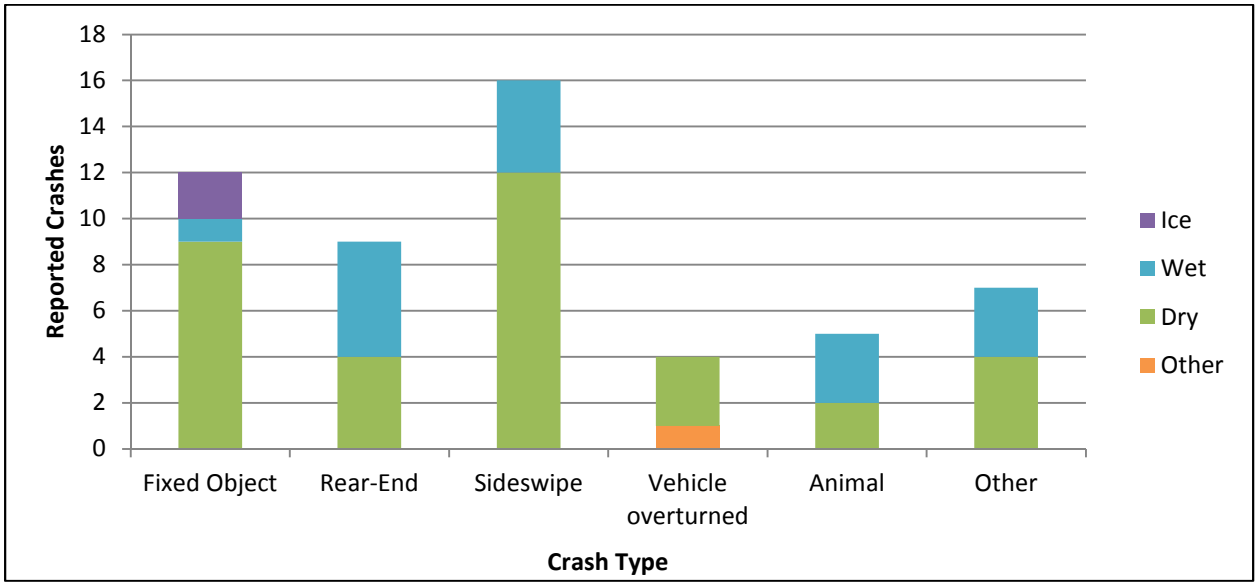
As seen in the table, the majority of the reported crashes were classified as sideswipe (16 crashes), followed by fixed object (12 crashes) and rear-end (9 crashes). Based on data provided by WSDOT, 11 of the 16 sideswipe crashes occurred when one vehicle was changing lanes. Based on available data, one crash on the freeway mainline was associated with the interchange ramps. This crash involved a southbound vehicle merging on to I-5 from the southbound on-ramp from NW La Center Road that struck another vehicle on the left side. The crashes are graphed by type and severity in Exhibit 3-1.

Exhibit 3-1 Crashes by Type and Severity (2009-2013)



As seen in the exhibit, the injury crashes were primarily classified as sideswipe and rear-end crashes. None of the animal crashes resulted in injuries. The crashes are graphed by type and roadway surface condition in Exhibit 3-2.

Exhibit 3-2 Crashes by Type and Roadway Surface Condition (2009-2013)



As seen in the exhibit, the majority of crashes occurred during dry roadway surface conditions. Over half of rear-end crashes and animal crashes occurred when the roadway was wet. The two crashes that occurred during ice conditions were fixed object crashes.

I-5 Mainline: Weigh Station

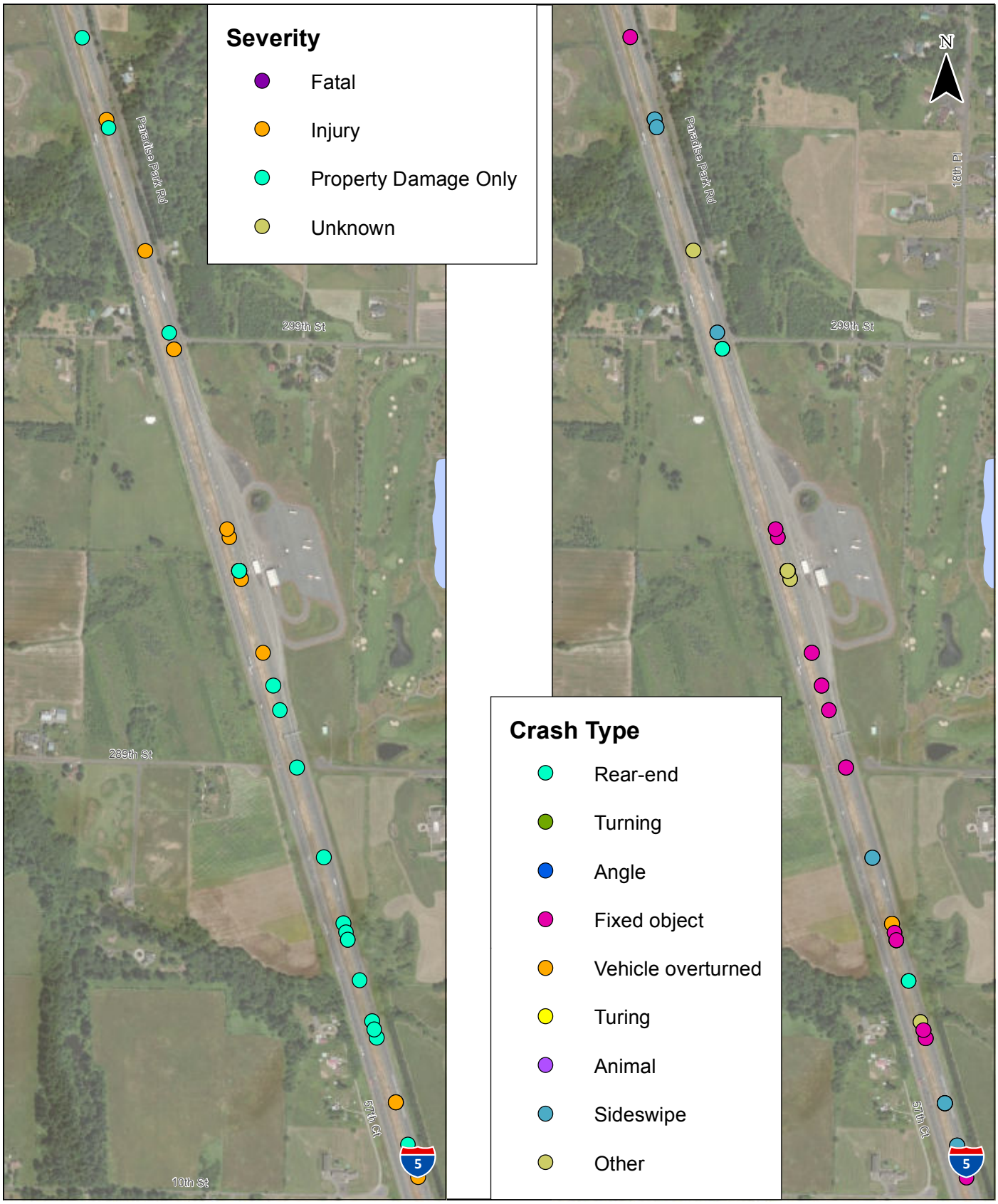
There is a truck weigh station on I-5 northbound at milepost 15.5, south of the NW La Center Road/I-5 interchange. Collisions from 2009 through 2013 were mapped and summarized from a half mile before the painted gore point of the off ramp for the weigh station (MP 14.71) to a half mile after the end of the painted gore (MP 15.24) of the on ramp taper to assess any apparent crash trends. The data is provided in Table 3-27 and mapped by severity and type in figure 3-15.

Table 3-27 Crash History I-5 Mainline NB Weigh Station, MP 14.71 – 16.18 (Jan 1, 2009 – Dec 31, 2013)

Year	Severity			Crash Type						Total
	PDO[1]	Injury	Fatality	Fixed Object	Rear-End	Side-swipe	Vehicle Overturned	Animal	Other	
2009	7	2	0	5	0	1	1	0	2	9
2010	4	0	0	1	0	2	0	1	0	4
2011	4	2	0	3	1	1	0	0	1	6
2012	1	2	0	0	2	0	0	0	1	3
2013	5	4	0	5	0	3	0	0	1	9
Total	**21**	**10**	**0**	**14**	**3**	**7**	**1**	**1**	**5**	**31**

Note: [1] PDO = Property Damage Only

As seen in the table, 31 crashes were reported on I-5 northbound with the majority of these crashes were fixed object (fourteen crashes), followed by sideswipe crashes (seven crashes). Of the fourteen fixed object crashes, four occurred during roadway conditions classified as ice, five in wet, and one in standing water. The majority of the fixed object crashes involved a vehicle hitting a cable barrier, concrete barrier/jersey barrier, or guardrail. Guardrail is provided at select locations in the vicinity of the weigh station due to



I-5 Northbound Weigh Station at Milepost 15.5
Crashes by Severity and Type
January 1, 2009 - December 31, 2013

Figure **3-15**

H:\profile\12393 - Cowlitz Reservation Development\gis\Crashes at Weigh Station.mxd - klaustsen - 4:55 PM 2/24/2015

Coordinate System: NAD 1983 HARN StatePlane Washington South FIPS 4602 Feet

roadway ditches. A concrete barrier/jersey barrier is provided in the immediate vicinity of the weigh station to separate it from the mainline. Six of the sideswipe crashes involved vehicles changing lanes and one involved a vehicle merging to enter traffic (presumably from the weigh station). Eight of the crashes involved one or more semi-trucks or truck tractors.

La Center Road/I-5 Interchange Ramps

For this assessment, crashes that occurred along the ramps themselves were included (crashes related to the ramp terminals are discussed below). The crash history is summarized in Table 3-28 and included in Figures 3-13 and 3-14, which map crashes by severity and type, respectively.

Table 3-28 Crash History La Center Road/I-5 Interchange Ramps (Jan 1, 2009 – Dec 31, 2013)

Ramp	Severity		Crash Type			Total
	PDO[1]	Injury	Fixed Object	Vehicle Overturned	Other	
Northbound Off-Ramp	1	0	0	0	1	**1**
Northbound On-Ramp	0	0	0	0	0	**0**
Southbound Off-Ramp	1	0	1	0	0	**1**
Southbound On-Ramp	2	0	1	1	0	**2**
Total	**4**	**0**	**2**	**1**	**2**	**4**

Note: [1] PDO = Property Damage Only

A total of four crashes were recorded for the five year period, all of which were property-damage only crashes. Two crashes were classified as fixed object crashes, one of which involved a fence the other guardrail face.

La Center Road/I-5 Study Intersections

Crash data was collected for the IJR study intersections, listed below:

- NW 31st Avenue/NW 319th Street;
- I-5 Southbound Ramp/NW La Center Road;
- I-5 Northbound Ramp/NW La Center Road; and
- Paradise Road/NW La Center Road

The crash history for the intersections is summarized in Table 3-29 and included in Figures 3-13 and 3-14, which map crashes by severity and type, respectively.

Table 3-29 Crash History La Center Road/I-5 Study Intersections (Jan 1, 2009 – Dec 31, 2013)

Intersection	Severity		Crash Type				Total
	PDO[1]	Injury	Rear-End	Angle	Turning	Other	
NW 31st Ave/ NW 319th St	0	0	0	0	0	0	**0**
NW La Center Rd/ I-5 SB Ramps	0	0	0	0	0	0	**0**
NW La Center Rd/ I-5 NB Ramps	9	4	5	2	4	2	**13**
Paradise Park Rd/ NW La Center Rd	1	2	1	1	0	1	**3**
Total	**10**	**6**	**8**	**2**	**4**	**2**	**16**

Note: [1] PDO = Property Damage Only

As seen in the table, the NW La Center Road/I-5 Northbound ramp intersection experienced the highest number of crashes, with a total of 13 reported. Seven of those were rear-end crashes, five of which occurred on the northbound off-ramp. In addition, three crashes were observed at the Paradise Road/NW La Center Road intersection, two of which resulted in injuries. No crashes were observed at the I-5 southbound ramp intersection with NW La Center Road or at the NW 31st Avenue/NW 319th Street intersection. All four study intersection will be reconstructed in conjunction with the interchange improvements. The anticipated impacts for the changes are discussed below.

Proposed Improvements

The interchange project will include reconstruction of the four study intersections. Roundabouts are proposed for the intersections of NW 31st Avenue/ NW 319th Street and the NW La Center Road/I-5 ramp terminals. According to NCHRP Report 672 (Reference 9, page 5-4), roundabouts improve overall safety performance, with research showing reductions in crash frequencies, especially evident with less frequent injury crashes. This is as a result of:

- "Fewer vehicular conflict points in comparison to conventional intersections" and greatly reduced potential for high-severity conflicts, such as right angle and left-turn head-on crashes.
- "Low vehicle speeds help reduce crash severity, making fatalities and serious injuries uncommon at roundabouts."
- Lower speed differential (meaning most road users travel at similar speeds), resulting in reduced crash severities compared to some traditionally controlled intersections.
- The roundabout splitter islands act as pedestrian refuges, so that "pedestrians need only cross one direction of traffic at a time at each approach as they traverse roundabouts (i.e., crossing in two stages), as compared with many traditional intersections."

Based on research presented in NCHRP Report 672 (Reference 9, Exhibit 5-9), constructing a roundabout at a two-way stop-controlled intersection has the potential to reduce total crashes by 40.4% to 48%, and reduce injury and fatal crashes specifically by 78.6% to 85%, based on a 95% confidence level.

In addition, the intersection of NW La Center Road/NW Paradise Park Road is proposed to be reconstructed and realigned east of the gas station at a two-way stop-controlled intersection. Improvements include constructing a new two-way stop-controlled intersection with La Center Road that provides a separate left-turn lane and shared through/right-turn lane on each approach to the intersection. The northbound and

southbound approaches would be stop-controlled. Based on research in the FHWA report "Safety Effectiveness of Intersection Left- and Right-Turn Lanes" (Reference 10), providing left-turn lanes on both major approaches of rural, unsignalized intersections has the potential to reduce total crash types by 22.8% to 33.2%, based on a 95% confidence level. Crash data at the intersection from 2009 through 2013 included a rear-end and angle crash.

WSDOT standards require full control limited access along the crossroad at an interchange for a minimum distance of 350 feet beyond the centerline of the ramp (Reference 5), neither NW Paradise Park Road or NW 31st Avenue currently meet this standard. The interchange project will relocate both frontage roads farther from the interchange meeting the 350-foot spacing specified in WSDOT standards, as described in Policy Point 4. By realigning the frontage roads and improving the spacing, the conflict areas of the ramp terminals and frontage roads will be separated, improving operations and safety at the interchange.

Build Versus No Build Alternative Analysis

The *WSDOT Design Manual* (Reference 5) specifies that a collision analysis should be performed for the year of opening and design year under the no build and build condition. It states that the collision analysis should "demonstrate that (1) the proposal does not have a significant adverse impact on the safety of the freeway or the adjacent affected local surface system, or (2) the impacts will be mitigated." The safety data for interchanges is currently limited and therefore all the proposed improvements at the interchange cannot be quantitatively assessed (like the provision of pedestrian and bicycle facilities). Therefore, existing data was used to the extent possible to assess the impact of the project on the safety of the interchange and adjacent transportation system.

The current edition (1st) of the *Highway Safety Manual* does not include a prediction methodology for interchanges. The research presented in the final report *Safety Prediction Methodology and Analysis Tool for Freeways and Interchanges* (Project 17-45, Reference 11) was used to assess improvements at the interchange ramp terminals. This research has been approved by the American Association of State Highway and Transportation Officials (AASHTO) and will be incorporated in to the next edition of the HSM. This research was used to develop the Enhanced Interchange Safety Analysis Tool (ISATe), which can be used to evaluate freeway and interchange safety. The application of ISATe is currently limited, as additional data is needed to expand the tool to test more design features, such as roundabouts. Therefore, the tool was used in conjunction with crash modification factors (CMFs) presented in the HSM to estimate the difference in expected crash frequency between the existing configuration of the ramp terminals (no build) and proposed configuration (build), which includes the installation of roundabouts. The ISATe tool includes an input for "distance to the next public street intersection on the outside crossroad leg," which may account for the effect of the frontage road realignment. Other interchange improvements (like the provision of pedestrian and bicycle facilities) cannot be quantitatively assessed with existing safety prediction tools.

Table 3-30 presents the expected crash frequency at the interchange ramps for the no build and build scenarios for the year 2017 and 2037. As described above, this assessment accounts for the conversion of the intersections to roundabouts[12], future growth in traffic volumes, and realignment of the frontage roads.

Table 3-30 Crash Frequency Assessment at Ramp Terminals with Improvements

Intersection	Observed Crashes (2009-2013)	Observed Crash Rate (/year)	Expected Crash Frequency (/year)			
			2017 No Build	2017 Build	2037 No Build	2037 Build
NW La Center Rd/ I-5 SB Ramps	0	0	0.7	0.4	1.0	0.6
NW La Center Rd/ I-5 NB Ramps	13	2.6	3.1	1.6	5.5	2.9
Total	**16**	**3.2**	**3.8**	**2.0**	**6.5**	**3.5**

As seen in the table, the proposed improvements are anticipated to reduce the expected crash frequency in 2017 and 2037, compared to the no build scenarios. This reduction is attributed both to the increase in distance to the next public intersection on the outside crossroads of the ramp terminals (modeled through ISATe) and installation of roundabout control (estimated using data from NCHRP 672, Reference 9). Crashes are anticipated to increase over time due to the anticipated increase in traffic volumes. In addition to the improvements at the ramp terminals in the build alternative assessed above, the interchange improvement project is also anticipated to provide safety benefits to the surrounding roadway system and on the I-5 ramps at NW La Center Road. The realignment of the frontage roads further separates the intersections of NW 31st Avenue/NW 319th Street and Paradise Park Road/NW La Center Road from the interchange, increasing the separation between the conflict points. The roundabout proposed at NE 31st Avenue/NW 319th Street is anticipated to provide safety benefits, as described above in the section "Proposed Improvements."

As detailed in Policy Point 4, the interchange ramps will be modified with the project. With the proposed changes, the connection location of all four ramps will be changed, which will increase the deceleration length for the northbound off-ramp and southbound off-ramp and acceleration lengths for the northbound on-ramp and southbound on-ramp. With these changes, the proposed ramps meet WSDOT standards for taper rate and deceleration length. Based on research described in the final report *Safety Prediction Methodology and Analysis Tool for Freeways and Interchanges* (Project 17-45), an increase in acceleration or deceleration length is typically related to a reduction in crashes. As part of the improvement project, it is recommended to modify the northbound off-ramp to have dual exit-lanes from I-5. In addition, both the southbound on-ramp and southbound-off ramp are proposed to have two receiving/approach lanes at the ramp terminal, with a single lane entrance/exit to/from I-5. As described in Project 17-45, "Data reported by

[12] The ISATe tool cannot currently account for the conversion of an interchange terminal to a roundabout. Therefore, the tool was used to assess the impact of the increased traffic volumes and change in distance to the frontage road intersections. The effect of the conversion to roundabouts was estimated using the CMF in NCHRP Report 672 (Reference 9, Exhibit 5-9) for conversion from a two-way stop controlled intersection to a roundabout. Given the limited data available for rural locations, the data for all sites was applied. It should be noted that this data is not specific to ramp terminals.

Bauer and Harwood (1998) indicate that 84 percent of interchange ramps in Washington have one lane and 16 percent have two lanes. They developed a regression model that indicates single-lane ramps have more than twice as many crashes as two-lane ramps, for a given traffic volume and configuration" (Reference 11). Therefore, the proposed changes at the interchange ramps are anticipated to yield safety benefits when compared to the no build alternative.

Appendix EE provides the predictive crash assessment worksheets.

Weigh Station Considerations

Consideration was given to the weigh station on I-5 northbound and potential interactions with the northbound exit ramp at NW La Center. The northbound off-ramp is currently located at milepost 16.66 and proposed to move to milepost 16.60 with the interchange improvement project. The weigh station functions as the primary point of entry in to Washington. A weigh-in motion (WIM) system is provided approximately half a mile in advance of the weigh station, which verifies a truck's weight, size, registration and safety record and provides a signal for trucks to either bypass the weigh station or report to the weigh station. In order to better understand the current interaction between the weigh station and exit ramp, a speed study was conducted to assess truck acceleration and speeds north of the weigh station.

Truck speeds were collected at four points along northbound I-5, shown in Exhibit 3-3. The northernmost location site (3350 feet north of the merge point from the weigh station) is about 1300 feet from the gore point of the northbound off-ramp at NW La Center Road.

Exhibit 3-3 Truck Speed Study Data Collection Locations

Source: ©2014 Google

The average truck speeds by vehicle classification at each data collection site are illustrated in Exhibit 3-4. General definitions from WSDOT of each vehicle class and the full set of data collected is provided in *Appendix FF.* The legend indicates the number of trucks of each vehicle class recorded in the study. For example, data was collected for fourteen Class 5 vehicles.

Exhibit 3-4 Average Speeds from Truck Speed Study, by Class

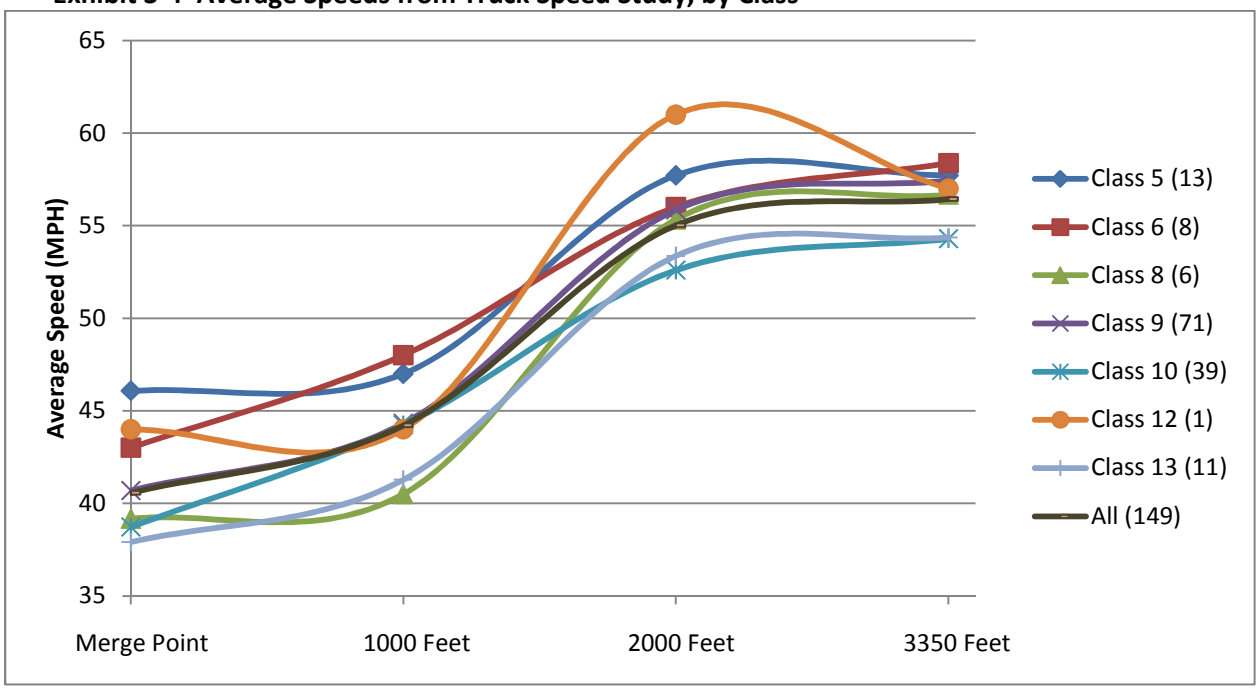
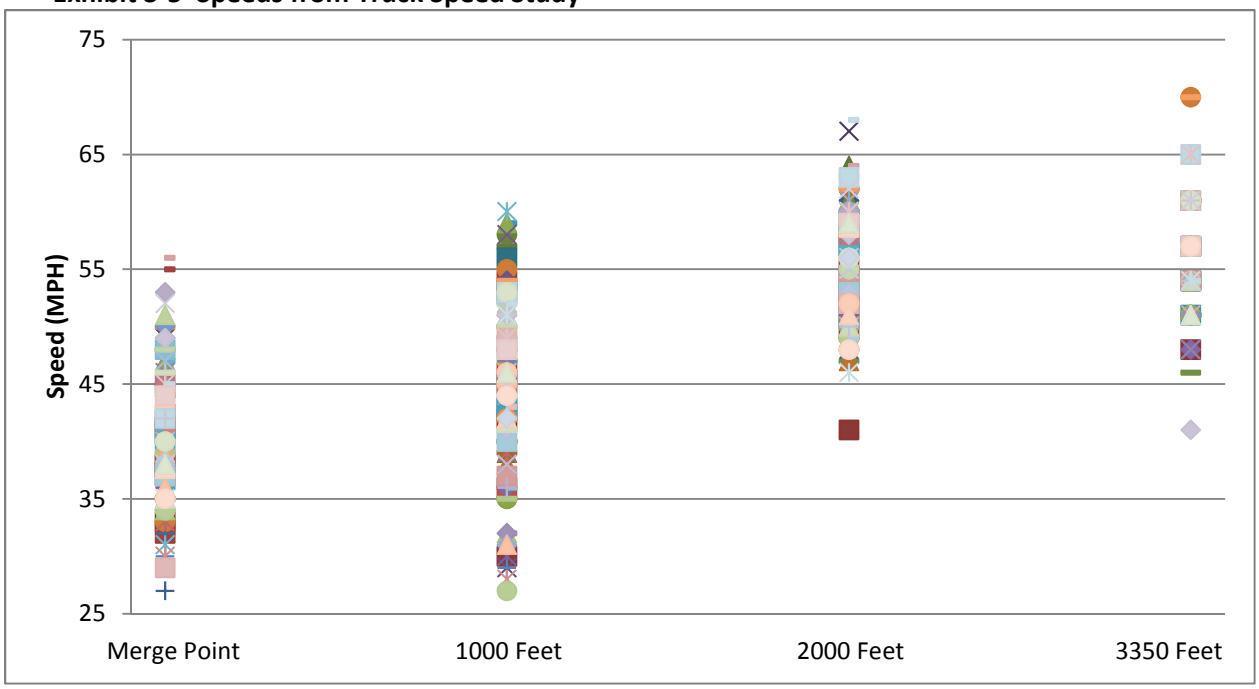


Exhibit 3- graphs the data recorded at each location for each vehicle. It illustrates the ranges of speeds recorded and variance at each location.

Exhibit 3-5 Speeds from Truck Speed Study



As seen in the exhibits, truck speeds generally increase most substantially between 1000 and 2000 feet north of the merge from the weigh station. Speeds are more constant between 2000 and 3350 feet north of the weigh station, with truck speeds increasing by a couple miles per hour on average. Table 3-31 provides the average, minimum, maximum and median speed at each data collection location. It also illustrates the typical increase in speeds as trucks travel north on I-5 from the weigh station.

Table 3-31 Overall Metrics from Truck Speed Study

Metric	Merge Point	1000 Feet	2000 feet	3350 Feet
Average Speed (MPH)	41	44	55	56
Minimum Speed (MPH)	27	27	41	41
Maximum Speed (MPH)	56	60	68	70
Median Speed (MPH)	40	44	55	57

As seen in the table, based on the data collected in the speed study, trucks are traveling an average of 56 miles per hour when they are 3350 feet north of the merge from the weigh station and approximately 1300 feet south of the gore point for the northbound off-ram at NW La Center Road.

To further assess the influence of trucks merging from the weigh station to I-5, WSDOT provided volume data from the mainline and weigh station from several days during June 2014 (provided in *Appendix J*). The average volume of trucks accessing the weigh station during the peak periods is shown in Table 3-32.

Table 3-32 Volumes at I-5 Northbound Weigh Station (June 2014 Data)

Peak Period	Average # of Trucks through Weigh Station
Friday 3:00-6:00 PM	181
Weekday 7:00-9:00 AM	192
Weekday 4:00-6:00 PM	164

As seen in the table, based on the data from WSDOT, an average of less than 200 trucks access the weigh station during the Friday, weekday AM, and weekday PM peak periods.

The proposed interchange improvement project will reconstruct the northbound exit ramp to NW La Center Road, providing dual exit lanes and a great deceleration length. The ramp will be relocated from milepost 16.66 to 16.60, shortening the space between the weigh station and exit ramp by approximately 300 feet. Given the existing truck speeds observed between the weigh station and northbound exit ramp to NW La Center Road, volume of trucks accessing the weigh station during peak periods,and proposed layout for the exit ramp with both exit lanes added (and the eastern lane on I-5 continuing through the NW La Center Road interchange), the interchange improvement project is not anticipated to adversely impact truck operations between the weigh station and NW La Center Road.

Policy Point 3 Findings

The proposed reconstruction of the existing diamond interchange, realignment of the frontage roads, and reconstruction of the ramp terminals and frontage road intersections is planned to be completed in two phases: an initial reconstruction to accommodate projected 2017 volumes and a future expansion to accommodate growth anticipated to occur by 2037.

NW 319th Street will be realigned to the south of its current location. The entire new bridge (to accommodate 2017 traffic conditions) will be built to the south of the existing bridge. To accommodate future 2037 traffic conditions, the bridge will be widened to the north.

The roundabouts can be constructed in phases so that the 2017 layout can be easily expanded to accommodate growth anticipated for 2037. The roundabouts planned for 2017 were designed to occupy the same outer circle diameter (footprint) as the ultimate configurations planned for 2037. This strategy limits the future construction impacts to surrounding properties during widening because sidewalks and outer curb lines will require minimal adjustment.

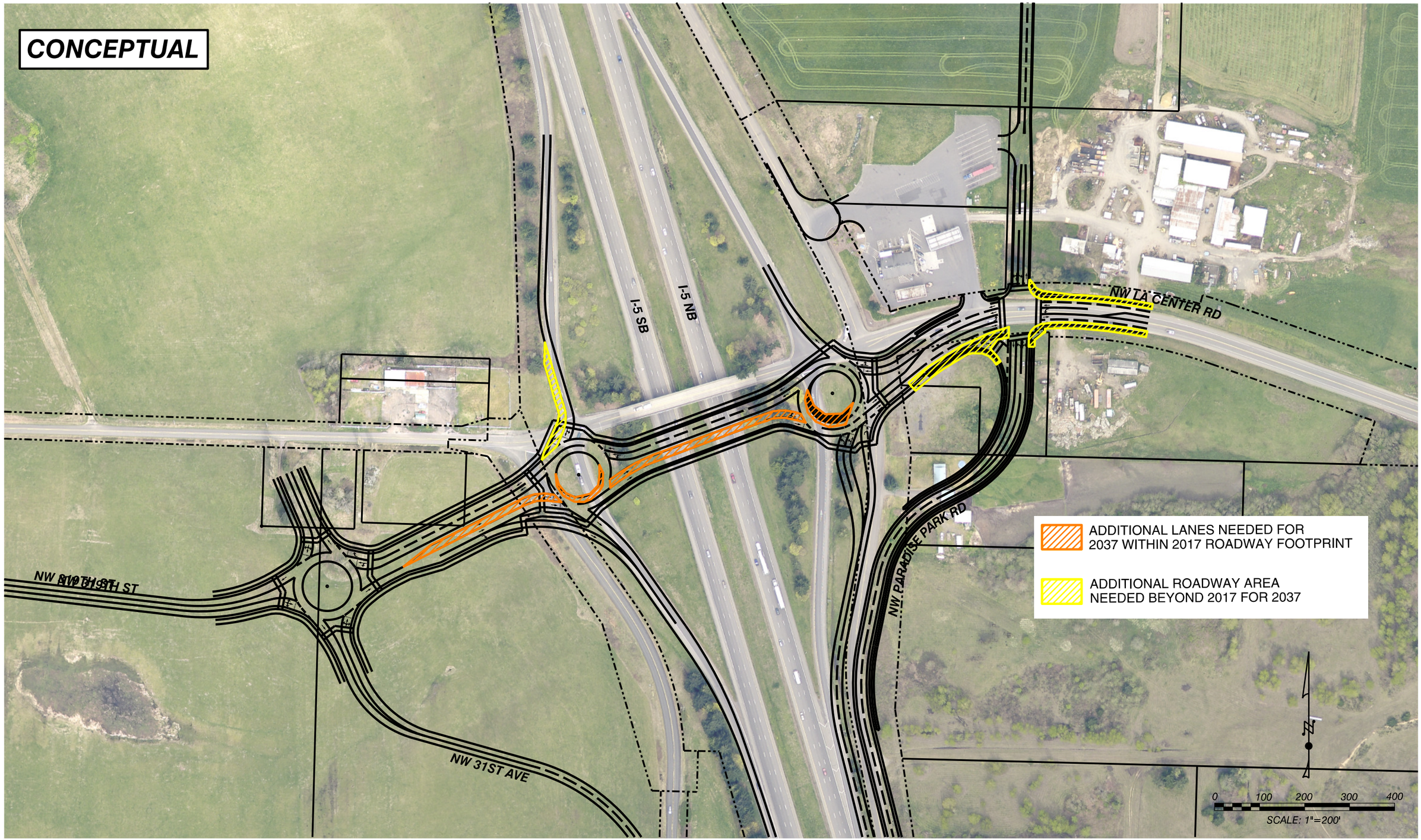
The footprints of the roundabouts and approaches do not change between the near-term 2017 design and the ultimate 2037 design. Instead, the splitter islands and the diameter of the central island are reduced, where necessary, to accommodate additional travel lanes. The ultimate design was established first, and then the near-term design was produced by modifying the ultimate design. Configuring the outer curb line to the ultimate need ensures that the ultimate design can be accommodated at the time the roundabout is constructed. The specific changes required to expand the roundabouts for the 2037 scenario are shown in Figure 3-16.

Both on-ramp alignments would be maintained to the maximum extent possible; however, the southbound on-ramp would be widened to provide two lanes for some distance. Both off-ramps would require new alignments to control entry speeds into the roundabouts in conformance with national design guidelines.

Operational and Safety Implications

With the proposed interchange improvement project, the interchange, surrounding study intersections, and I-5 mainline roadway facilities are expected to operate at an acceptable level of service in the opening year of the Cowlitz Reservation Development (2017) and long-term design year (2037). The interchange improvements have been designed in such a way that they can easily be expanded to accommodate long-term growth projected at the interchange.

An examination of recent crashes in the vicinity of the modification suggests that the project will address some, if not most of the types of accidents previously occurring. By realigning the frontage roads and improving the spacing, the conflict areas of the ramp terminals and frontage roads will be separated. Also, an increase in volume is predicted on the northbound off-ramp in the future. A second lane was added to the off-ramp to increase the operations and safety of the diverging movement. In addition, the ramp terminals were improved such that the potential for queuing down the ramps or across the bridge is reduced through the introduction of roundabouts.



2017 TO 2037 ROADWAY COMPARISON FOR INTERSECTIONS
LA CENTER, WASHINGTON

FIGURE 3-16

H:\profile\12393 - Cowlitz Reservation Development\dwgs\figs\IJR Figures 2014\updated for IJR\Figure3-16.dgn Default (Model) 2/24/2015 - 5:05:29 PM

The reconstruction of the NW La Center Road/I-5 interchange will not have significant adverse impacts to the interstate or the adjacent affected local surface system, and will improve operations at the interchange and in the vicinity.

POLICY POINT 4 – ACCESS CONNECTIONS AND DESIGN

The NW La Center Road/I-5 Interchange Improvement Project involves a reconstruction of the overpass structure and substantial modification of the supporting interchange infrastructure. These improvements do not result in a change to the number of access points to I-5; however, some of the interchange ramps will be modified/lengthened to meet forecast traffic demand and current geometric criteria. In addition, portions of the supporting local roadway network will be modified to accommodate the interchange modifications and better address intersection spacing criteria at interchanges. For these reasons, the response to Policy Point 4 is divided into two sections. The first section addresses the anticipated interchange design and how the overall interchange modifications impact access and spacing criteria to the I-5 corridor. The second section addresses how the interchange modifications will impact access and spacing criteria to the supporting local roadway network both east and west of the interchange. The Project Design Criteria utilized for the interchange improvement are provided in *Appendix GG.*

Interchange Design and Access Impacts to the I-5 Corridor

An assessment of the existing interchange design and proposed modifications are detailed in the following sub-sections.

Existing Interchange Design and Access

All four interchange ramps are currently single-lane and tapered. The ramp curves, deceleration lengths, connection locations, and tapers are detailed in Table 4-1 and compared to WSDOT standards.

Table 4-1 Existing Ramp Design

Location	Connection Location	Taper	Standard	Meets standards?	Curve Radius (ft)	Accel/Decel Length (ft)	Standard (ft)	Meets standards?
Northbound off-ramp	16.66	15:1	20:1 Desirable 15:1 Minimum[1]	Yes	700	440[2]	555[2]	No
Northbound on-ramp	16.96	50:1	50:1[3]	Yes	700	762[4]	1,380[4]	No
Southbound off-ramp	16.96	15:1	20:1 Desirable 15:1 Minimum[1]	Yes	700	477[2]	555[2]	No
Southbound on-ramp	16.67	50:1	50:1[3]	Yes	700	770[4]	1,380[4]	No

Notes: Grey shading indicates failure to satisfy operating standards
[1]Standard for single-lane, tapered off-connection
[2]Decelerating from 80 mph to 40 mph
[3]Standard for single-lane, tapered on-connection
[4]Accelerating from 40 mph to 80 mph

As seen in the table, none of the ramps currently meet standards for acceleration or deceleration length. While the northbound off-ramp and southbound off-ramp meet the minimum standard for taper rate, they do not meet the desirable taper rate.

Interchange Spacing

WSDOT recommends considering the spacing between interchanges, intersections, and other points of access to avoid excessive interruption of mainline traffic (WSDOT Design Manual, Chapter 1360). The minimum spacing between adjacent interchanges is one mile (5,280 feet) in urban areas, measured along the freeway centerline between the gore noses of adjacent ramps.

The nearest connection, not an interchange, to the south of the NW La Center Road/I-5 Interchange is the northbound on-ramp from the weigh station. The approximate spacing between this ramp and the northbound off ramp of the NW La Center Road/I-5 Interchange is approximately 4,800 feet (0.9 miles), which is approximately 500 feet short of the standard. The approximate spacing between the NW La Center Road/I-5 Interchange and Ridgefield interchange to the south is 11,500 feet (2.2 miles).

The nearest connections to the north of the NW La Center Road/I-5 Interchange are the ramps to/from the Woodland interchange. The approximate spacing between these ramps and the northbound on/southbound off-ramps of the NW La Center Road/I-5 Interchange is about 20,000 feet (3.8 miles), which more than meets the one mile standard.

Proposed Interchange Design and Access

In order to meet forecast traffic demand and current geometric criteria, the NW La Center Road/I-5 interchange project will include the following major changes:

- Construction of a new overpass structure located immediately south of the existing structure that will accommodate four travel lanes (only two westbound lanes and one eastbound lane are needed for 2017) and pedestrian and bicycle facilities;
- Modification of the existing northbound and southbound interchange ramp terminals to include multiple lane roundabouts;
- Modification to the northbound on-ramp and southbound off-ramp to meet the acceleration and deceleration length requirements;
- A modified northbound off-ramp that is lengthened and widened to include a dual exit lane;
- A modified southbound on-ramp that includes two receiving lanes south of the ramp terminal that transition to a single lane prior to merging with I-5 mainline traffic; and
- A modified southbound off-ramp that has a single lane exit from I-5 that widens to provide two approach lanes at the ramp terminal.

The proposed modifications are compared to applicable standards in Table 4-2.

Table 4-2 Proposed Ramp Design

Location	Connection Location	Taper	Standard	Meets standards?	Curve Radius (ft)	Accel/Decel Length (ft))	Standard (ft)	Meets standards?
Northbound off-ramp	16.60	25:1	25:1[1]	Yes	1,100	795[2]	360[2]	Yes
Northbound on-ramp	16.98	50:1	50:1[3]	Yes	1,100	719[4]	590[4]	Yes
Southbound off-ramp	16.97	15:1	20:1 Desirable 15:1 Minimum[5]	Yes	700	470[6]	465[6]	Yes
Southbound on-ramp	16.60	50:1	50:1[3]	Yes	9,000	1,110[4]	590[4]	Yes

Notes: [1]Standard for two-lane, tapered off-connection
[2]Decelerating from 80 mph to 60 mph
[3]Standard for single-lane, tapered on-connection
[4]Accelerating from 60 mph to 80 mph
[5]Standard for single-lane, tapered off-connection
[6]Decelerating from 80 mph to 50 mph

As seen in the table, the proposed modifications slightly modify the connection location of all four ramps and increase the deceleration length for the northbound off-ramp and southbound off-ramp and acceleration lengths for the northbound on-ramp and southbound on-ramp. With these changes, the proposed ramps meet WSDOT standards for taper rate and deceleration length.

Interchange Spacing

The proposed interchange design negligibly moves the connection locations of all four ramps, and therefore slightly modifies the spacing between the interchange and adjacent access points. As in existing conditions, with the proposed modifications, the interchange does not meet the one mile spacing standard to the south. The northbound off-ramp at the NW La Center Road/I-5 Interchange and northbound on-ramp at the weigh station are approximately 4,400 feet (0.8 miles) apart, which is less than the recommended one mile. As described in the section "Weigh Station Considerations" in Policy Point 3, a speed study was conducted to assess truck acceleration and speeds north of the weigh station. The results showed that trucks, on average, accelerate from 41 miles per hour at the merge point from the weigh station to 56 miles per hour when they are 3350 feet north of the merge from the weigh station and approximately 1300 feet south of the gore point for the northbound off-ram at NW La Center Road. Based on existing data provided by WSDOT (included in *Appendix J)*, on average approximately seventy to one-hundred trucks access the weigh station during the peak hour. Given these conditions, the fact that the interchange does not meeting the one mile spacing standard to the south is deemed acceptable.

Ramp Terminals

As identified in the analysis conducted as part of Policy Points 2 and 3, roundabouts will be installed at the northbound and southbound ramp terminals and at the NW 319th Street/NW 31st Avenue intersection. The ramp terminals will be located in the approximate location of the existing ramp terminals, but shifted slightly south to accommodate the new overpass design. No design deviations are anticipated for the design of the ramp terminals.

Interchange Design and Access Impacts to the Local Road Network

The NW La Center Road/I-5 Interchange project will include the following changes associated with the supporting local roadway network:

- Relocation of Paradise Park Road and the development of a new intersection with NW La Center Road. This new intersection would be located approximately 450 feet (centerline to centerline) east of the northbound roundabout terminal to comply with Washington State Department of Transportation (WSDOT) guidelines for intersection spacing of 350 or more feet. The new intersection will operate as a two-way stop-control intersection in the near-term and eventually need to be improved to accommodate future development (e.g. with the conversion to a traffic signal or roundabout);
- Relocation of NW 319th Street approximately 350 feet south of the existing alignment to accommodate the new overpass and provide an enhanced east-west circulation network that is more compatible with the Cowlitz Reservation Development; and
- Relocation of NW 31st Avenue and the development of a new intersection with NW 319th Street. This new intersection would be located approximately 600 feet west of the southbound roundabout terminal to address WSDOT intersection spacing guidelines. The new intersection will operate as a roundabout to accommodate near-term and future development.

Figure 4-1 provides a conceptual sketch of the interchange form and frontage road alignment. Red arrows are used to indicate long-term parcel access. The roundabout control at the ramp terminals and frontage road intersections helps to facilitate access by accommodating U-turn movements.

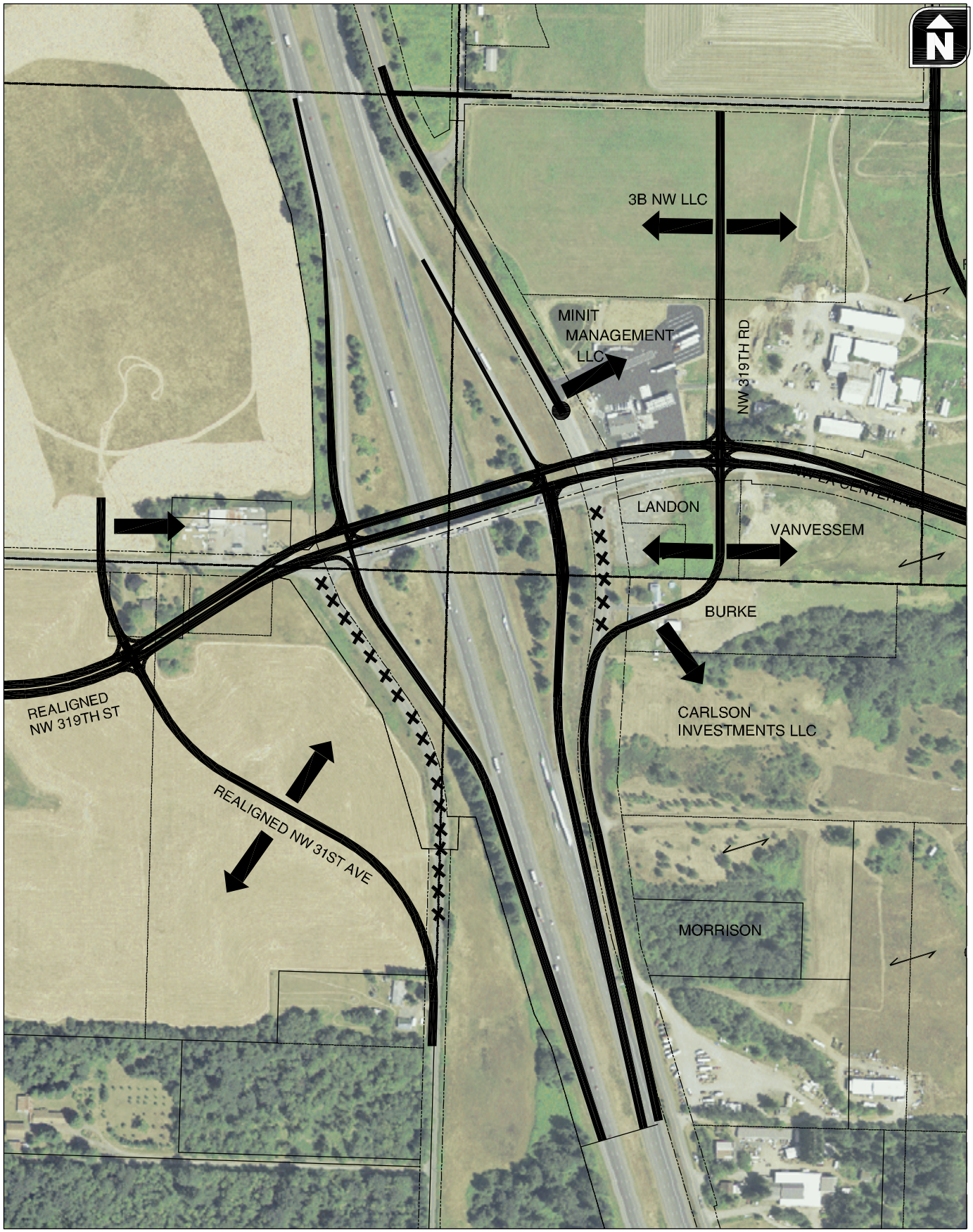
Frontage Roads

The existing frontage road alignment does not meet WSDOT standards [i.e., NW 31st Avenue is located less than 100 feet (centerline to centerline) west of the southbound ramp terminal, and NW Paradise Park Road is less than 150 feet (centerline to centerline) east of the northbound ramp terminal]. The proposed design includes realigning the frontage roads to exceed WSDOT standards. Figure 4-1 illustrates the functional layout of the improved frontage road network, as described above and summarized below:

- NW 31st Avenue (frontage road west of I-5) will be located approximately 600 feet (centerline to centerline) west of the southbound ramp terminal; and
- NW Paradise Park Road (frontage road east of I-5) will be approximately 450 feet (centerline to centerline) east of the northbound ramp terminal.

Deviations

All of the above mentioned design elements will follow the applicable WSDOT Design Manual and City of La Center and Clark County design criteria. No design deviations are currently anticipated.



LONG-TERM PARCEL ACCESS
LA CENTER, WASHINGTON

FIGURE
4-1

POLICY POINT 5 – LAND USE AND TRANSPORTATION PLANS

The 2011 Update of the Metropolitan Transportation Plan (MTP) for Clark County (Reference 12) includes an improvement project at the NW La Center Road/I-5 interchange to rebuild the interchange, with an estimated year of completion 2011-2015. The project is included on the list of "fiscally constrained" projects, meaning it does not yet have a funding source but funds are likely to be available during the term of the MTP to year 2035. The MTP focuses on "consistency between state, regional, and local plans" and included involvement from the Regional Transportation Council, Clark County, Cities of Ridgefield and La Center, WSDOT, and other involved agencies.

In addition, past planning studies, such as the previously referenced 2010 *La Center Junction Subarea Plan* (Reference 1), and the *Cowlitz Indian Tribe Casino Project Traffic Impact Study* (Reference 2) recognized the need for near- and long-term interchange improvements. The City of La Center annexation to I-5 in September 2011 provides developable industrial and commercial lands, furthering the need for improvements at the interchange to accommodate future growth (Reference 4). In addition the Final Environmental Impact Statement (EIS) for the Cowlitz Indian Tribe Trust Acquisition and Casino Project dated May 30, 2008 (Reference 3) and subsequent Record of Decision issued on April 22, 2013 (Reference 7) identify the need for these improvements. The more recent operations analysis presented in this IJR and in the companion *Transportation Impact Analysis for the Cowlitz Reservation Development* (see Appendix B) has formally confirmed the need for and extent of the improvements. To reach these conclusions, the operations analyses were completed in close coordination with local and regional land use plans as summarized below. More detailed information is provided in the *Cowlitz Reservation Development Transportation Impact Analysis* provided in *Appendix B*.

Year 2017 Traffic Volume Development

The year 2017 traffic conditions represent how the study area's transportation system will operate with build out of the Cowlitz Reservation Development. This analysis includes traffic attributed to planned developments within the study area and to general growth in the region. To develop these volumes, in-process development plans from the City of La Center, City of Ridgefield, and Clark County were reviewed and incorporated into the 2017 background traffic volumes.

In addition to the in-process volumes, an annual growth rate was applied to existing traffic count data by intersection approach per agency scoping direction. Growth rates were selected by reviewing historical traffic counts around the interchange area, which indicated a rate of 2% at the I-5 on- and off-ramps and approximately 3% along La Center Road. At City of La Center staff's request, a growth rate of 8% was used for lower-volume roadways within the City of La Center to account for any out-of-ordinary growth. The 2017 traffic volumes on the I-5 mainline were developed by applying a 2% linear annual growth rate to the seasonally adjusted volumes used in the existing conditions analysis. The 2% annual growth rate used in the analysis was developed based on comparison of the Southwest Washington Regional Transportation Council (RTC) travel demand models for the horizon years 2005 and 2035, further discussed in the following section. At the interchange, volumes were balanced following the application of annual growth rates.

Year 2037 Traffic Volume Development

Year 2037 traffic volume projections were developed using existing traffic count data and forecast future volume data provided by Regional Transportation Council (RTC)'s regional travel demand model. RTC uses the travel demand forecasting program EMME/2 to estimate future traffic volumes on the primary roadways. RTC's travel demand forecast model was developed in part based on the 2014 update to the *Regional Transportation Plan for Clark County* (RTP). The 2035 demographic projections and land use allocations were developed by local jurisdictions working in partnership with RTC.

The model's data input includes population and employment for both "base year" conditions (Year 2010) and future "design year" conditions (Year 2035). The 2035 RTC model used in this analysis reflects the repeal of the urban growth area (UGA) boundary near the La Center interchange in 2012.

Paradise Park Road is not included in the RTC model. Therefore, traffic volumes were developed assuming full build-out of the remaining developable areas located within the City of La Center's current comprehensive plan and city limits that would access La Center Road via Paradise Park Road. The process used to develop these volumes was vetted with the City of La Center and is described in the TIA provided in *Appendix B.*

2037 Background Traffic Model Post Processing for Weekday PM and Friday PM (Weekend) Peak Hour

The RTC travel demand model provides weekday PM peak hour volumes including directional flows on key roadway links (i.e., road segment between intersections) and turning movement volumes at key intersections. Because the RTC model does not include all local streets and driveway connections, the raw forecast turning movements at individual intersections from the model are not typically used for design purposes. Rather, the model is used to identify the order-of-magnitude future growth along the primary travel corridors, based on planned changes to the land use and transportation systems within the region. Output from the model, therefore, is "post-processed," or manually adjusted using field traffic data and engineering judgment to better reflect the anticipated turning movements at each study intersection. This method of refining the raw traffic volumes is standard practice for planning and forecasting analyses and is discussed further and in more detail below.

The RTC model volumes were refined using techniques outlined in NCHRP Report 255 to "post-process" the data. In this process, the future traffic projections from the model were evaluated with respect to current year 2014 traffic counts and the relative differences between the model scenarios. The results of using both the "ratio" method and the "difference" method, as outlined in the NCHRP report, were compared. In this case, the average of the "ratio" and "difference" methods was used to establish the initial projected volume of through traffic. Manual adjustments were made to the projected turning movements at individual intersections to better reflect the existing traffic counts and the anticipated build-out conditions to achieve 2035 developed volumes. Finally, a one percent growth rate was applied to the 2035 turning movement volumes to derive year 2037 volumes.

POLICY POINT 6 – FUTURE INTERCHANGES

The NW La Center Road/I-5 Interchange Improvement Project involves a reconstruction of the existing interchange to address projected near- and long-term capacity deficiencies. This project does not propose to modify nor is forecast to operationally impact any of the upstream/downstream I-5 interchanges or access points. Furthermore, a review of WSDOT's Highway System Plan for the I-5 study corridor reveals no planned access point revisions along this segment of the I-5 corridor. Therefore, the proposed NW La Center Road/I-5 Interchange Improvement Project is compatible with the comprehensive transportation network.

POLICY POINT 7 – COORDINATION

Policy Point 7 states that when an access point revision is generated by new development, it must be demonstrated that the development and the changes to the transportation system are fundable, coordinated, and can be realistically achieved.

As identified in the transportation analysis presented herein, the NW La Center Road/I-5 interchange is proposed to be rebuilt and enhanced to support future traffic growth. In addition, targeted modification of portions of the supporting local roadway network is envisioned to support the reconstructed interchange and ensure improved circulation and access management. The impetus of these improvements is the Cowlitz Reservation Development. As such, all funding associated with the identified 2017 interchange reconstruction, right-of-way acquisition, and local circulation improvements will come from this project. No federal, state, or local funds will be used.

Given that the identified transportation improvements are needed to support the Cowlitz Reservation Development project, improvements would ideally be completed prior to completion and occupancy of the development. Furthermore, with the existing NW La Center Road/I-5 interchange providing access to/from I-5 and the surrounding local/regional communities, maintaining its function during construction will be critical. As such, the envisioned NW La Center Road/I-5 interchange reconstruction plan is predicated on the ability to maintain traffic flow on the existing transportation network while the reconstruction project is taking place. This will be achieved through the following key design characteristics:

- The new interchange overpass will be constructed immediately south of the existing overpass on a separate alignment. This separate alignment will allow the new structure to be built with minimal disruption to the existing overpass.
- Land has already been acquired for the identified realignment of Paradise Park Road both north and south of NW La Center Road. The construction of this realigned roadway will occur in parallel with the interchange reconstruction. Until complete, the existing Paradise Park Road alignment will continue to serve local traffic demand.
- Land has already been acquired for the identified realignment of NW 319th Street and NW 31st Avenue. The construction of these realigned roadways will occur in parallel with the interchange reconstruction. Until complete, the existing alignments will continue to serve local traffic demand.

The development of the preliminary interchange alignment and local circulation plans have been shared with staff from WSDOT, FHWA, Clark County, Clark County Public Utility District, Washington State Parks Department, and the City of La Center staff[13] to ensure consistency with known planned development and other infrastructure projects.

[13] All interchange and local circulation analyses developed over the course of the project have been shared with staff from WSDOT, FHWA, Clark County, and the City of La Center. Staff have been invited to attend all project meetings including the two previously identified workshops.

POLICY POINT 8 – ENVIRONMENTAL PROCESSES

The approval of the NW La Center Road/I-5 Interchange IJR requires appropriate environmental documentation. Pursuant to the National Environmental Policy Act (NEPA), the "Cowlitz Indian Tribe Trust Acquisition and Casino Project" and associated off-site transportation improvements were analyzed in detail within an Environmental Impact Statement (EIS) prepared by the Bureau of Indian Affairs (BIA). FHWA and WSDOT served as Cooperating Agencies throughout the EIS process. Through consultation with FHWA and WSDOT, improvements to the NW La Center Road/I-5 interchange and frontage roads were identified as traffic mitigation measures and the environmental consequences of constructing the improvements were thoroughly analyzed within the Final EIS, which was issued on May 30, 2008. Following preparation of an Evaluation of Adequacy Report which concluded that the current conditions of the project area remain largely unchanged from the time of preparation of the 2008 Final EIS, the BIA issued a Record of Decision (ROD) on April 22, 2013. The ROD approved the construction of a casino-resort complex and associated facilities on the 152-acre Cowlitz Reservation property and adopted mitigation measures recommended within the Final EIS, including improvements to the NW La Center Road/I-5 interchange and frontage roads.

Although the passage of time has not eroded the overall validity of the original EIS, a NEPA Reevaluation report has been prepared to update and formally validate the original EIS. The Reevaluation Report will be used along with the original EIS for NEPA compliance purposes. It provides updates and address any deviations between the previous EIS interchange configuration and current configuration. Compliance with SEPA will also be accomplished using the previous EIS and the Reevaluation Report, following the adoption process set forth in Washington law and regulation.

While the majority of the EIS analysis requires minimal updates to address the updated interchange configuration, the most comprehensive updates are provided in the following elements:

- Historic/Cultural Resources
- Hazardous Materials
- Biological Resources
- Transportation

A summary of the primary updates to each section is provided below.

Historical/Cultural Resources

Field surveys of proposed alignments were conducted, as well as an updated records search, consultations, and identification of resources. As a result of these efforts, no known significant cultural resources were identified within the refined area of potential effects for the La Center Interchange Improvements. The Reevaluation Report and supporting Cultural Resources Study determined and that the project would have no effect on historic properties, and no further archaeological work was recommended.

Hazardous Materials

Field surveys of proposed alignments were conducted and consultation with agencies conducted. The results of these efforts were summarized within the Reevaluation Report and supporting Hazardous Materials Technical Memorandum. Three sites were identified in the vicinity of the interchange, in addition to those sites identified in the 2008 FEIS. The study concluded that the sites in the vicinity of the interchange represent a low risk to the project, and there is no known reported hazardous materials contamination that would affect surface and/or subsurface conditions on the site. No additional studies or investigations with respect to hazardous materials were recommended.

Biological Resources

Field surveys of proposed alignments were conducted, as well as an updated assessment of habitat types and special status species in the area. The results of these efforts were summarized within the Reevalation Report and supporting stand-alone reports, including a Biological Resources Technical Memorandum, Biological Assessment (BA) for compliance with Section 7 of the federal Endangered Species Act, and Wetland Delineation. The studies concluded that the La Center Interchange Improvements would not result in any additional impacts to or loss of habitats, waters of the U.S., wildlife, or federally listed species that were not previously identified in the 2008 FEIS. Developed and pasture habitats would be impacted from the improvements, but do not represent significant habitat types. Wetlands and wetland buffers have been avoided to the greatest extent possible, and sediment and erosion control measures would ensure that wetlands and buffer areas are protected from construction activities and associated sedimentation impacts. Impacts to regulated roadside ditches (if any) and wetland buffers would be mitigated in compliance with a permit from the USACE and local critical areas permits. Wildlife observed is typical of disturbed/developed areas and the La Center Interchange Improvements will not constitute a significant loss of habitat to the observed wildlife. Impacts to listed fish species could occur from discharge of treated stormwater, but these impacts would not be expected to adversely affect any federally listed species or critical habitats based on the results of the stormwater analysis conducted as part of the BA. Additional listed species are not expected to be present in the vicinity of the La Center Interchange.

Transportation

The information in this IJR and the Traffic Impact Assessment prepared in conjunction with the Cowlitz Reservation Develop are summarized, as appropriate, in the Reevaluation Report.

REFERENCES

1. City of La Center. *Draft La Center Junction Subarea Plan.* 2010.
2. Parsons Brinckerhoff. *Cowlitz Indian Trip Casino Project: Traffic Impact Study, Supplemental Report*. Revised April 2007.
3. Bureau of Indian Affairs (BIA). Environmental Impact Statement (EIS). 2008.
4. City of La Center. *La Center Approves Annexation, Extends City Limits to I-5*. September 14, 2011.
5. Washington Department of Transportation, *Design Manual*, 2012.
6. Washington State Department of Transportation and HDR Engineering, Inc. *Interchange Justification Report: Interstate 5/SR 501 Ridgefield Interchange Project*, May 4, 2009.
7. Bureau of Indian Affairs (BIA). Record of Decision: Trust Acquisition of, and Reservation Proclamation for the 151.87-acre Cowlitz Parcel in Clark County, Washington, for the Cowlitz Indian Tribe. April 2013.
8. City of La Center. *2008 La Center Urban Area Capital Facilities Plan*. Ordinance No. 2008-007. Adopted May 14, 2008.
9. Rodegerdts, L., et al. *NCHRP Report 672: Roundabouts: An Informational Guide, Second Edition.* Washington, D.C., Transportation Research Board, National Research Council. 2010.
10. Harwood, D. W., Bauer, K. M., Potts, I. B., Torbic, D. J., Richard, K. R., Rabbani, E. R., Hauer, E., Elefteriadou, L., and Griffith, M. S., "Safety Effectiveness of Intersection Left- and Right-Turn Lanes." Washington, D.C., 82nd Transportation Research Board Annual Meeting, (2003).
11. Bonneson, J., et al. *Project 17-45: Safety Prediction Methodology and Analysis Tool for Freeways and Interchanges.* Washington, D.C., Transportation Research Board. 2012.
12. Southwest Washington Regional Transportation Council (RTC). *Metropolitan Transportation Plan (MTP) for Clark County*. 2011 update.

LIST OF APPENDICES

Appendix FF Truck Speed Study

Appendix GG Design Criteria