

**OR 22/51 Build Alternatives
Future Interchange Operations Analysis**

Appendix J

OR 22/OR 51 Interchange Operations

Build Alternatives

Operations analyses were performed at three grade separated interchange forms for the OR 22/OR 51 intersection. These interchange forms included the following:

- Diamond Interchange – interchange ramps spaced anywhere from 500 feet (tight diamond) to 1000 feet (standard diamond).
- Single-Quadrant PARCLO B – conventional interchange with a westbound exiting loop ramp in the northwest quadrant.
- Dual-Quadrant PARCLO B – conventional interchange with westbound and eastbound exiting loop ramps in the northwest and southeast quadrants.

Performance Measures

The Highway Design Manual (HDM) outlines specific design performance measures for all new state highway facilities. These standards are in place to ensure the availability of long-term mobility along important road corridors and vary according to functional classification, location, and role within the overall highway system. According to the HDM, the 20-year design mobility standard for the OR 22/OR 51 ramp terminal intersections is a volume to capacity ratio of 0.60.

Diamond Interchange Operations

Interchange Forecast Volumes

Figure J-1 illustrates a preliminary layout of the Diamond Interchange Alternative. To assess the performance of this interchange alternative, forecast 2030 30th highest hour volumes were projected at the interchange ramp terminals assuming the potential limited access characteristics of OR 22. Two sets of interchange ramp terminal volumes were utilized in this performance assessment. The first set of volumes assumes that there would be no connection between OR 22 and Doaks Ferry Road (herein referred to as the “No Doaks Ferry Connection” scenario. Under this scenario, it is assumed that the end of Doaks Ferry Road would be rerouted onto one of the north side frontage road alternatives where access to OR 22 would then occur via the OR 22/OR 51 interchange. The second set of volumes assumes that there would continue to be access between OR 22 and Doaks Ferry Road; however the intersection would be modified to right-in/right-out/left-in movements only (herein referred to as the “Limited Doaks Ferry Connection” scenario. Both sets of interchange ramp terminal volumes are summarized in Figure J-1. As shown in the figure, the elimination of the OR 22/Doaks Ferry Road intersection has the potential to add a significant amount of traffic to the OR 22/OR 51 interchange, particularly that portion of OR 22 traffic with an origin/destination located west of the OR 22/OR 51 intersection.

Based on the 0.60 design mobility standard, various diamond interchange lane configuration and traffic control alternatives were evaluated to determine how the interchange ramps would perform under the projected 2030 future volume forecasts. Base lane configuration scenarios at the ramp terminal intersections included separate left- and right-turn lanes for each of the interchange off-ramps, a single through travel lane for OR 51, and separate left- or right-turn lanes along OR 51 at the ramp terminal intersections. The results of the operations analysis are summarized in the following paragraphs.

Unsignalized Ramp Terminal Operations

As unsignalized ramp terminal intersections, Figure J-1 illustrates that the critical left-turn movements from both the eastbound and westbound off-ramps are forecast to operate over capacity under the “No Doaks Ferry Connection” scenario. However, under the “Limited Doaks Ferry Connection” scenario, the westbound left-turn movement from the westbound off-ramp is forecast to operate at a volume to capacity ratio of 0.93. While operating under capacity, this intersection is still forecast to exceed the 0.60 design mobility standard by a considerable margin. As such, a planning level analysis of the diamond interchange configuration indicates that the interchange ramp terminals cannot operate as unsignalized intersections and still meet the design mobility criteria.

Based on the results of the unsignalized operations, a planning level signal warrant analysis was conducted under the “No Doaks Ferry Connection” and “Limited Doaks Ferry Connection” forecast traffic volume scenarios. From this analysis, it was found that only the eastbound ramp terminal would meet the preliminary signal warrant under the “No Doaks Ferry Connection” scenario. As a result of these findings, ODOT’s TPAU unit encouraged the investigation of alternative ramp terminal treatments. One such treatment involves the use of roundabouts as the ramp terminal intersections.

Diamond Interchange Preliminary Signal Warrant Summary

Intersection	Meets ODOT’s Preliminary Traffic Signal Warrant?
“No Doaks Ferry Connection” Scenario	
Westbound Ramp Terminal	No
Eastbound Ramp Terminal	Yes
“Limited Doaks Ferry Connection” Scenario	
Westbound Ramp Terminal	No
Eastbound Ramp Terminal	No

Roundabout Operations

Based on the results of the unsignalized operations, the interchange ramp terminals were investigated under the assumption that they could be developed as roundabout intersections. Assuming a single lane roundabout as shown in Figure J-1, the westbound roundabout approach to the westbound off-ramp terminal is forecast to operate over capacity under the “No Doaks

Ferry Connection” scenario. Under the “Limited Doaks Ferry Connection” scenario, the operations would improve significantly for this same approach and operate under capacity.

Diamond Interchange Operations Summary

As shown in the operations analysis, the eastbound and westbound ramp terminals (as unsignalized intersections) do not have sufficient capacity to systematically accommodate future 2030 demand under the “No Doaks Ferry Connection” and “Limited Doaks Ferry Connection” scenarios. Operations improve assuming roundabouts at the ramp terminals, however the westbound ramp terminal is still forecast to operate over capacity. In general, the diamond interchange configuration is unable to efficiently accommodate the heavy westbound to southbound and eastbound to northbound demand. As such, alternative interchange configurations were investigated as outlined in the following sections.

Single Quadrant PARCLO B Operations

Figure J-2 illustrates a preliminary layout of the Single Quadrant PARCLO B Interchange Alternative. This alternative would provide for a westbound exiting loop ramp in the northwest quadrant of the interchange with conventional exit/entrance ramps serving the other interchange movements. To assess the performance of this interchange alternative, forecast 2030 30th highest hour volumes were estimated at the interchange ramp terminals. As with the diamond interchange, two sets of interchange ramp terminal volumes were developed for this interchange alternative that reflect the “No Doaks Ferry Connection” and “Limited Doaks Ferry Connection” scenarios. Both sets of interchange ramp terminal volumes are summarized in Figure J-2.

Unsignalized Operations

With the addition of the westbound exiting loop ramp, Figure J-2 illustrates that the critical right-turn movement from the westbound off-ramp would operate at a volume to capacity ratio of 0.74 under both the “No Doaks Ferry Connection” and “Limited Doaks Ferry Connection”. Although this movement would not meet the 0.60 design mobility standard, this is a substantial improvement compared to the unsignalized diamond interchange terminal. This improvement can be attributed to the loop ramp’s ability to more efficiently accommodate the projected west to south demand. As with the diamond interchange scenario, a signal warrant analysis was performed at the single quadrant PARCLO B westbound loop ramp terminal. As shown in the following table, the ramp terminal is not forecast to meet ODOT’s preliminary signal warrants. Accordingly, a roundabout operations analysis was performed.

PARCLO B Interchange Preliminary Signal Warrant Summary

Intersection	Meets ODOT’s Preliminary Traffic Signal Warrant?
“No Doaks Ferry Connection” Scenario	
Westbound Ramp Terminal	No
“Limited Doaks Ferry Connection” Scenario	
Westbound Ramp Terminal	No

Roundabout Operations

As with the diamond interchange scenario, roundabout treatments were investigated for the single quadrant PARCLO B ramp terminals. As shown in Figure J-2, a single-lane roundabout is forecast to operate under capacity for both of the volume scenarios.

Single Quadrant PARCLO B Operations Summary

As shown in the operations analysis, the westbound exiting loop ramp is better able to accommodate the heavy westbound to southbound demand; however the ramp terminal is still not forecast to meet the 0.60 design mobility standard. Unlike the diamond interchange ramp, a roundabout intersection treatment would operate under capacity.

Dual Quadrant PARCLO B Operations

Figure J-3 illustrates a preliminary layout of the Dual Quadrant PARCLO B Interchange Alternative. This alternative includes westbound and eastbound exiting loop ramps in the northwest and southeast quadrants. To assess the performance of this interchange alternative, forecast 2030 30th highest hour volumes were estimated at the interchange ramp terminals. As with the previous two alternatives, two sets of interchange ramp terminal volumes were developed for this interchange alternative that reflect the “No Doaks Ferry Connection” and “Limited Doaks Ferry Connection” scenarios. Both sets of interchange ramp terminal volumes are summarized in Figure J-3.

Unsignalized Operations

With the addition of the eastbound exiting loop ramp, Figure J-3 illustrates that the critical right-turn movement from the eastbound off-ramp would operate at a volume to capacity ratio of 0.39 under the “No Doaks Ferry Connection” and at 0.05 under the “Limited Doaks Ferry Connection”. Compared to the diamond ramp terminal, this is a substantial improvement that can be attributed to the exiting loop ramp’s ability to more efficiently accommodate the projected east to north demand. Although this terminal would operate at sufficient levels, a roundabout operation was prepared for comparison purposes.

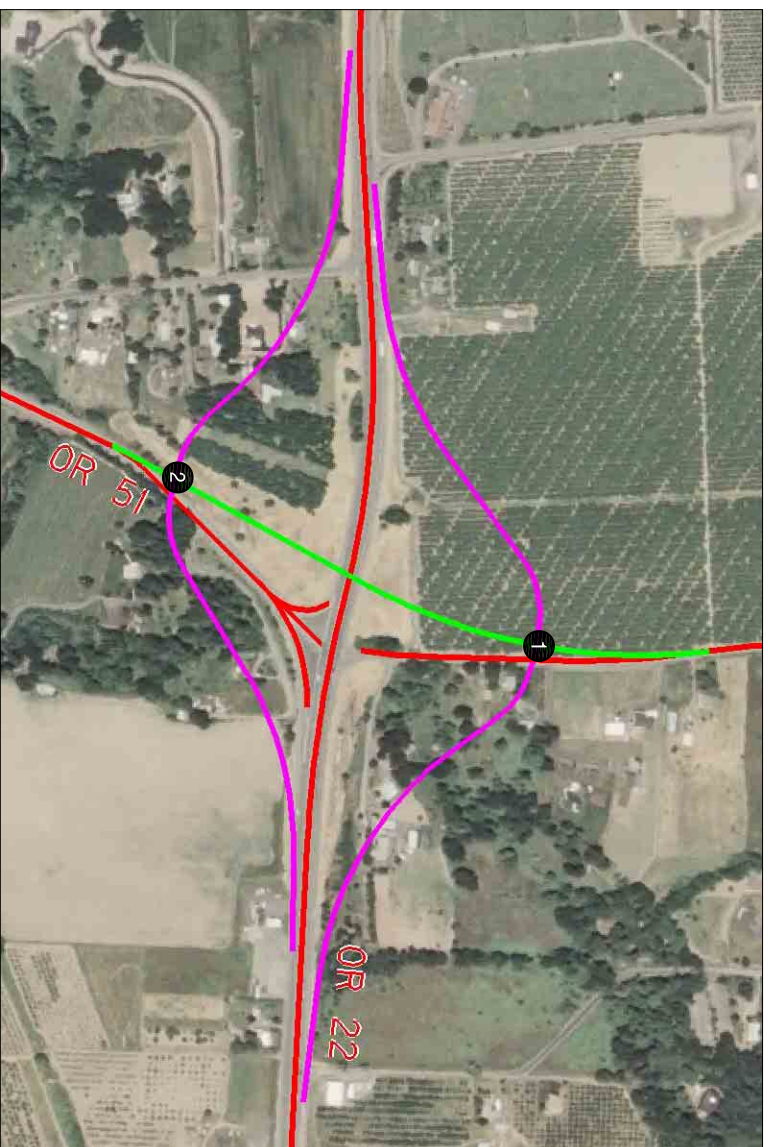
Roundabout Operations

As with the previous two interchange scenarios, the dual quadrant PARCLO B design was investigated as a potential roundabout intersection. As shown in Figure J-3, a roundabout interchange terminal at the eastbound ramp terminal is forecast to operate with sufficient long-term capacity under both of the volume scenarios.

(Figures J-1 through J-3 attached)



(NO SCALE)



LEGEND

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

2030 30TH HIGHEST HOUR RAMP TERMINAL VOLUMES

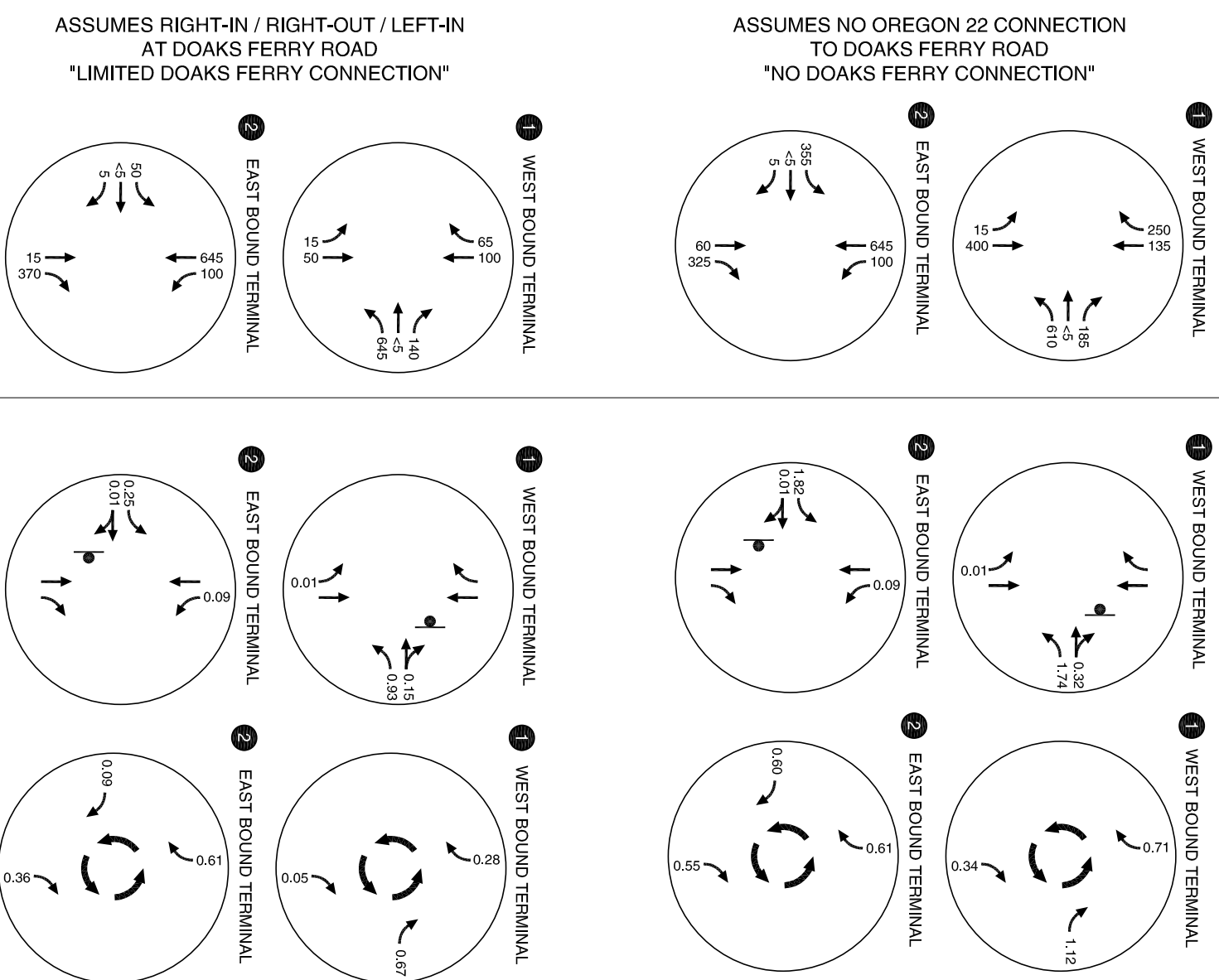
ASSUMED INTERCHANGE GEOMETRY & CORRESPONDING RAMP OPERATIONS SUMMARY

UN SIGNALIZED INTERSECTION

ROUNDABOUT INTERSECTION



(NO SCALE)

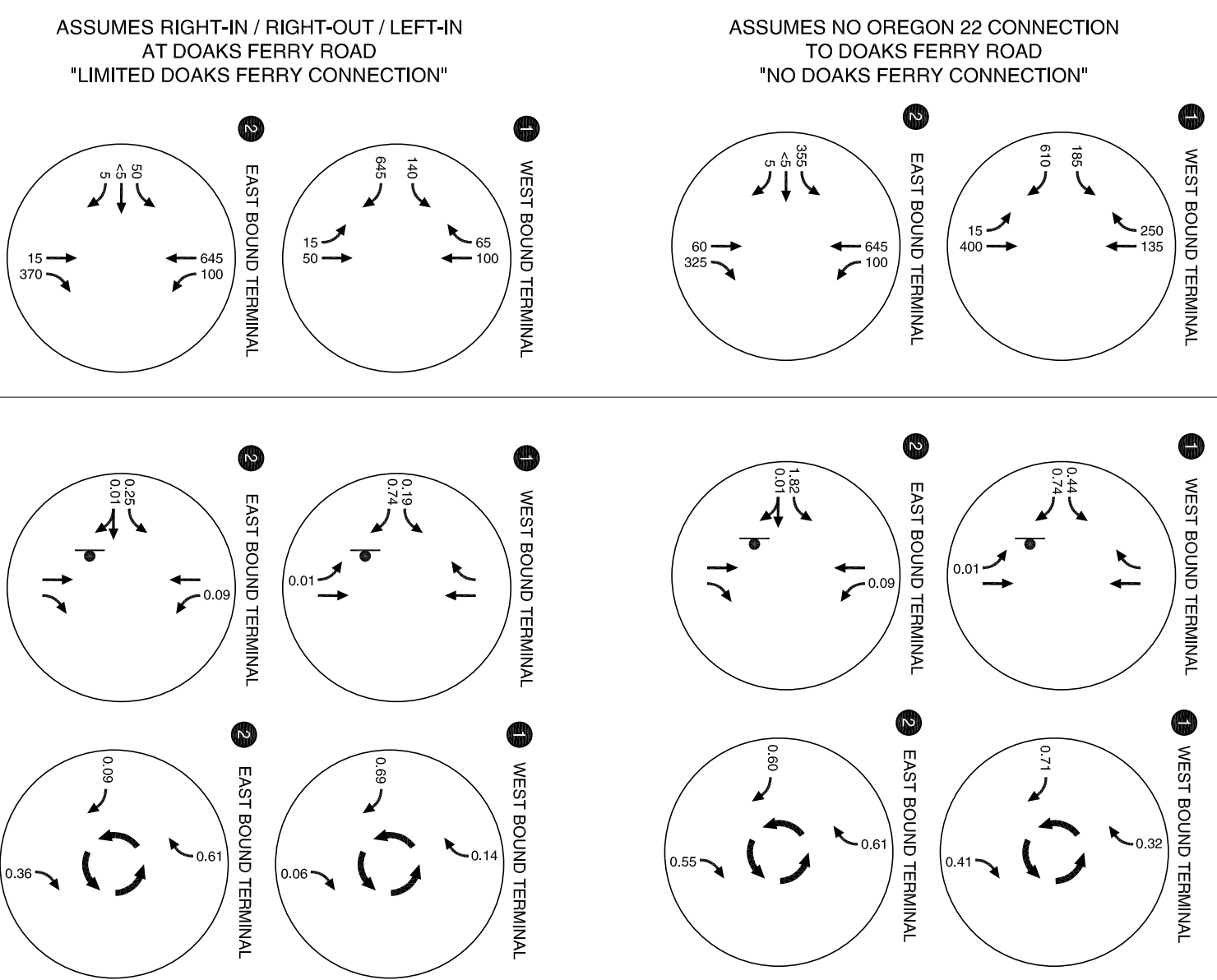
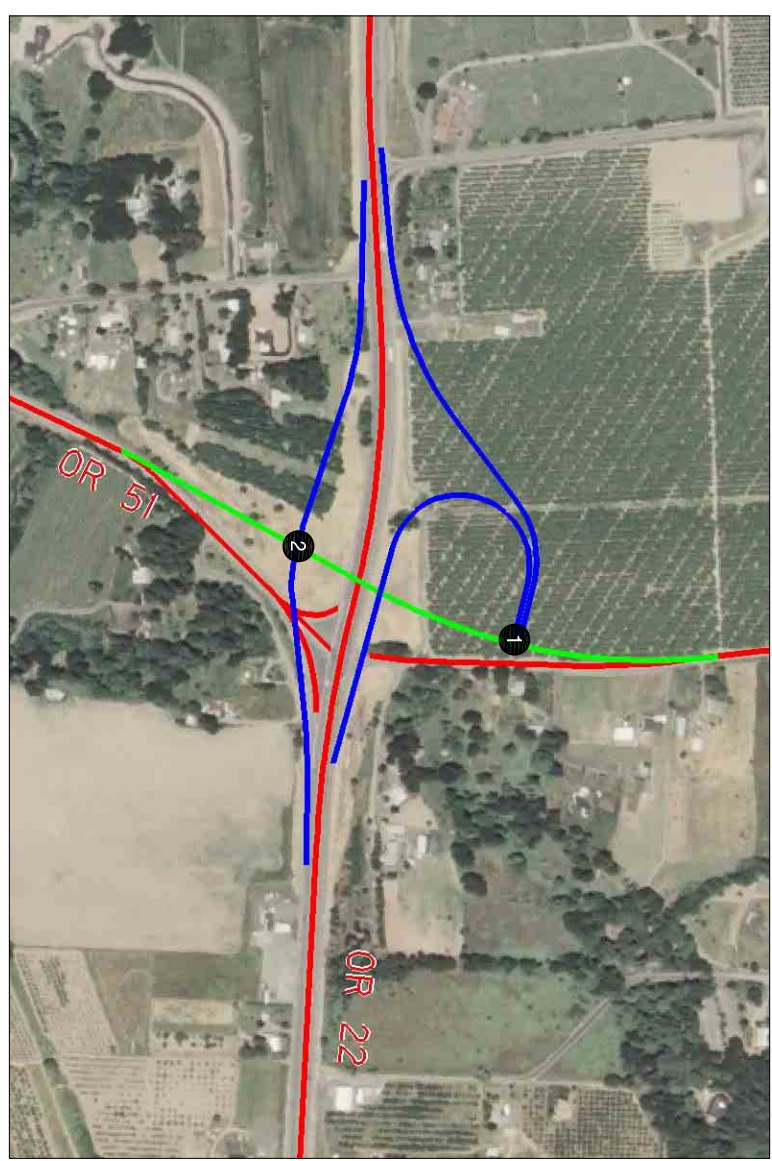


FUTURE 2030 INTERCHANGE OPERATIONS DIAMOND INTERCHANGE ALTERNATIVE

FIGURE J-1

YEAR 2030 30TH HIGHEST HOUR RAMP TERMINAL VOLUMES

ASSUMED INTERCHANGE GEOMETRY & CORRESPONDING RAMP OPERATIONS SUMMARY



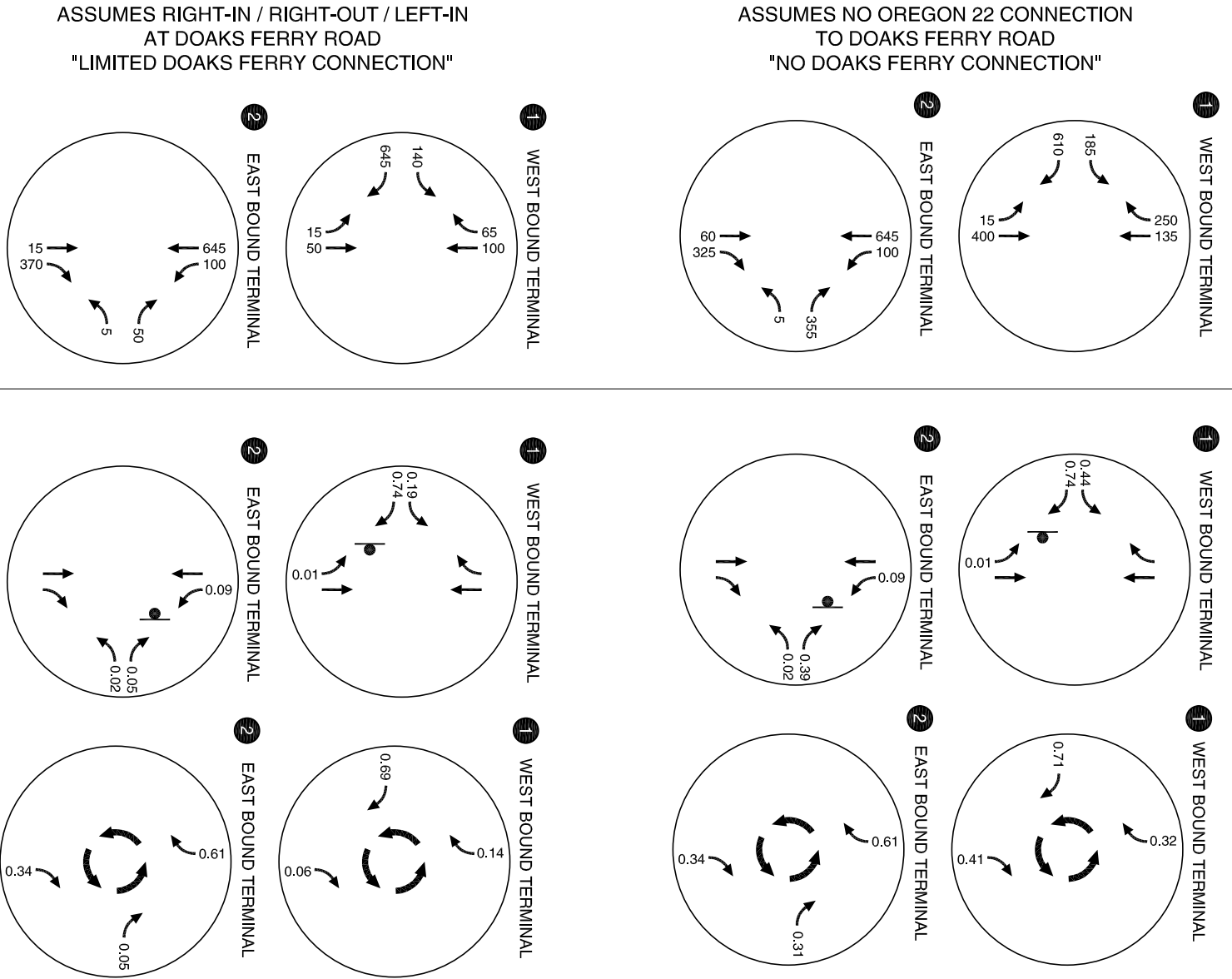
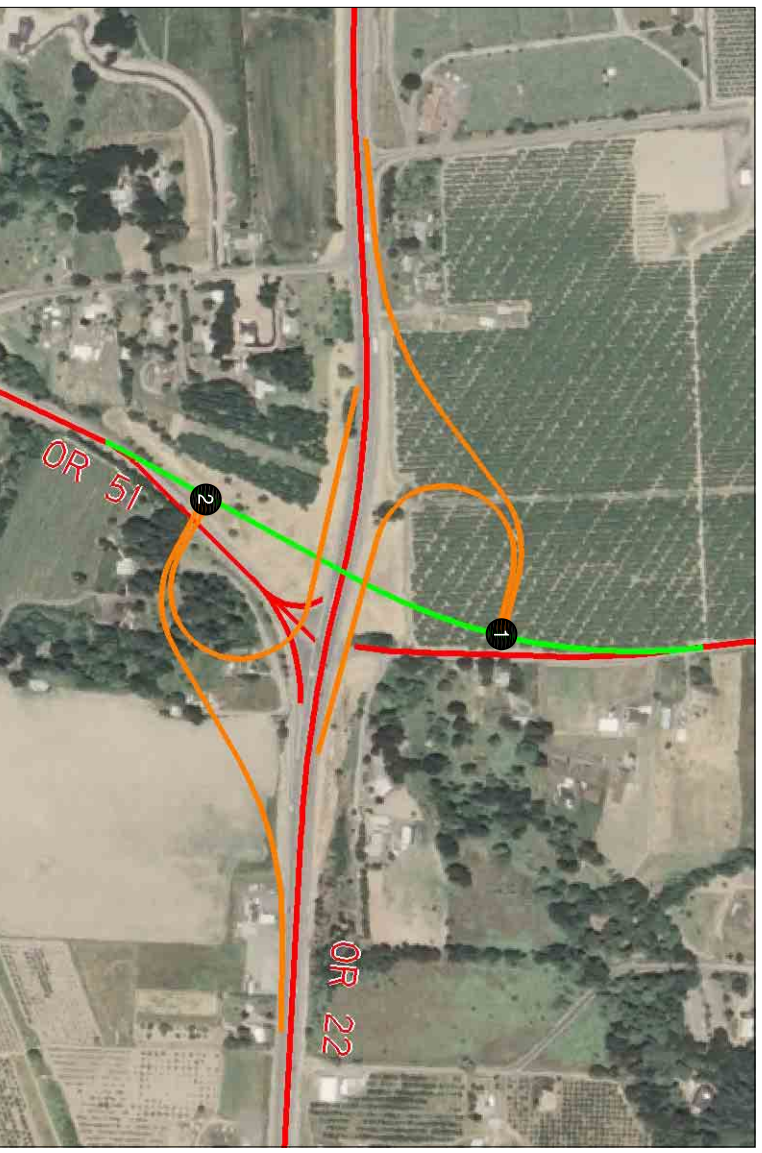
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FUTURE 2030 INTERCHANGE OPERATIONS SINGLE QUADRANT PARCLO-B INTERCHANGE ALTERNATIVE

YEAR 2030 30TH HIGHEST
 HOUR RAMP TERMINAL
 VOLUMES

ASSUMED INTERCHANGE GEOMETRY &
 CORRESPONDING RAMP OPERATIONS SUMMARY



LEGEND

- CM = CRITICAL MOVEMENT (UN SIGNALIZED)
- LOS = INTERSECTION LEVEL OF SERVICE (SIGNALIZED)/CRITICAL MOVEMENT LEVEL OF SERVICE (UN SIGNALIZED)
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- V/C = CRITICAL VOLUME-TO-CAPACITY RATIO

FUTURE 2030 INTERCHANGE OPERATIONS
 DUAL-QUADRANT PARCLO-B INTERCHANGE ALTERNATIVE