INTERSECTION CONTROL EVALUATION REPORT

Interstate 5 at Cook Road - Milepost 232.83

May 2024

1. This Intersection Control Evaluation (ICE) Report was prepared by Design Consultant staff working under my direct supervision, consistent with the requirements of WSDOT Design Manual Chapters 300 and 1300.

Date: 05/28/2024

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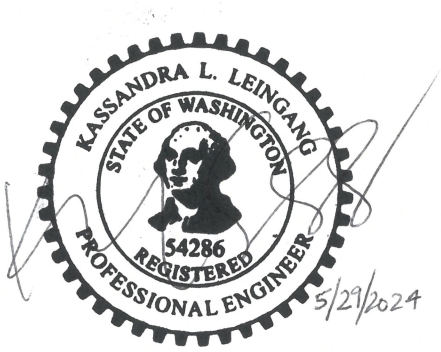

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Introduction

This report summarizes the Intersection Control Evaluation (ICE) completed for the Interstate 5 (I-5) Interchange at Cook Road in Skagit County, Washington. The interchange location and vicinity map is shown in Figure 1. The evaluation was conducted based on the guidelines set in Chapter 1300.05(3) Intersection Control Evaluation Section of the Washington State Department of Transportation (WSDOT) Design Manual M 22-01.22 (October 2023).

Figure 1. Intersection Vicinity Map

As shown in Figure 1, the ICE reviews the Cook Road intersections of the I-5 southbound ramps, I-5 northbound ramps, and Old Highway 99 with consideration for the existing railroad crossing located approximately 75 feet east of the Cook Road/Old Highway 99 N intersection operated by Burlington Northern Santa Fe Corporation (BNSF). This analysis reviews 4 alternatives for the intersections in addition to the No Action Alternative which are summarized below.

Table 1. Description of Alternatives Evaluated

Intersection	**No Action**	**Alternative 1:** *Traffic Signal*	**Alternative 2:** *Traffic Signal with added NBR at Old Highway 99 N*	**Alternative 3:** *Traffic Signal & single controller*	**Alternative 4:** *Roundabout*
1. I-5 southbound ramps/Cook Rd	Two-Way Stop Controlled	Traffic Signal (existing channelization)	Traffic Signal (existing channelization)	Traffic Signal (existing channelization)	Single Lane Roundabout
2. I-5 northbound ramps/Cook Rd	Two-Way Stop Controlled	Traffic Signal with added NBR	Traffic Signal with added NBR	Traffic Signal with added NBR, single controller with Old Highway 99 N	Single Lane Roundabout
3. Old Highway 99 N /Cook Rd	Traffic Signal	Added EBT lane	Added EBT and NBR lanes	Added EBT and NBR lanes, single controller with Old Highway 99 N	Multilane Roundabout

Note: NBR = northbound right-turn, EB = eastbound, EBT = Eastbound Through

Recommendation:

The recommendation for the intersection improvements is the **Alternative 2 traffic signal alternative.** This alternative would include the following:

- Install traffic signals at the 2 ramp intersections,
- Add a northbound right turn lane at the I-5 northbound ramp intersection,
- Widen Cook Road to include an additional eastbound through lane east of the I-5 northbound ramp intersection to east of Green Road, and
- Add a northbound right-turn lane at the Old Highway 99 N intersection.
- Rebuild traffic signal at Old Highway 99 N/Cook Road intersection.

The following documents the 5-step ICE screening process that was coordinated with WSDOT to evaluate the alternatives and determine the best possible intersection type and design. The steps include:

1. Background and Project Needs
2. Feasibility
3. Operational and Safety Performance Analysis
4. Alternatives Evaluation
5. Selection

Step 1: Background and Project Needs

The following section summarizes the existing conditions of the Cook Road corridor in the vicinity of the I-5 ramps and Old Highway 99 N intersections and the adjacent at-grade railroad crossing as well as the project needs, methodology used for analysis, and comparison of the alternatives.

Existing Conditions

The project area includes the intersections of Cook Road with the I-5 southbound ramps, I-5 northbound ramps, and Old Highway 99 with consideration for the existing BNSF railroad crossing located approximately 75 feet east of the Cook Road/Old Highway 99 N intersection. The primary roadways in the study area are described below.

- **Cook Road** is predominantly a two-lane roadway classified as a Major Collector by Skagit County with an estimated annual average daily traffic (AADT) of approximately 14,500 vehicles in the study area[1].
- **Old Highway 99 N** is a two-lane roadway with a general speed limit of 50 miles per hour (mph), providing an alternative route to I-5. In the vicinity of the project area, the speed limit is reduced to 35 mph.
- **The I-5 Ramps** - The annual average daily traffic (AADT) in the study area was reviewed based on WSDOT's Traffic Count Database for the I-5 ramps showing approximately 3,000 ADT on each of the ramps to/from I-5 north of Cook Road (i.e. the southbound off-ramp and northbound on-ramp). South of Cook Road, the AADT of the I-5 ramps are approximately 5,000 and 6,000 ADT for the southbound on-ramp and northbound off-ramp, respectively. The volumes show the primary travel patterns in the vicinity of the Cook Road study intersections is to/from the south.

The study intersections are described below. The existing weekday AM and PM peak hour traffic volumes as well as the traffic control and channelization are included on Figure 2.

1. **I-5 Southbound Ramps/Cook Road** - This intersection is an existing two-way stop-controlled intersection with the southbound approach being stop controlled and free movements east-west along Cook Road. All approaches are a single shared lane with Cook Road being a two-lane road and the I-5 Ramp being one-lane, one-way southbound. The peak hour total entering volumes (TEV) at this intersection are approximately 900 vehicles in both the AM and PM peak hours. No non-motorized facilities exist at this intersection.
2. **I-5 Northbound Ramps/Cook Road** - This intersection is an existing two-way stop-controlled intersection with the northbound approach being stop controlled and free movements east-west along Cook Road. All approaches are a single shared movement lane with Cook Road being a two-lane road and the I-5 Ramp being one-lane, one-way northbound. The peak hour TEV at this intersection is approximately 1,350 and 1,430 vehicles in the AM and PM peak hours, respectively. No non-motorized facilities exist at this intersection.
3. **Old Highway 99 N/Cook Road** - This intersection is an existing traffic signal. The eastbound and westbound approaches along Cook Road as well as the northbound approach along Old Highway 99 N include a left-turn lane and shared through/right-turn lane. The southbound approach along

[1] Estimated based in the weekday PM peak hour traffic volumes along Cook Road between I-5 NB Ramps and Old Highway 99 S.

Old Highway 99 N includes separate left, through, and right-turn lanes. The peak hour TEV at this intersection is approximately 1,740 and 2,035 vehicles in the AM and PM peak hours, respectively. Signalized pedestrian crossings are provided across all legs of the intersection.

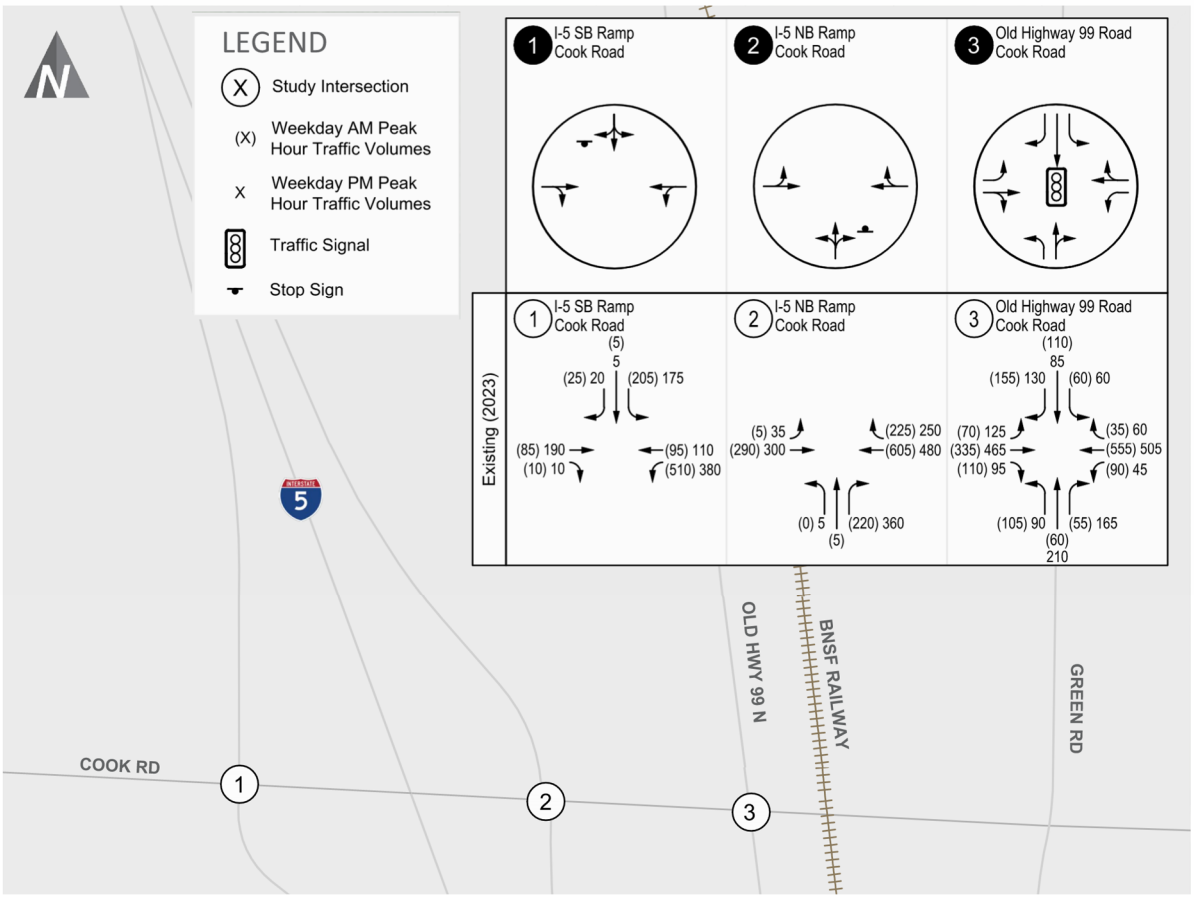


Figure 2: Existing Weekday AM and PM Peak Hour Traffic Volumes and Traffic Control and Channelization at Study Intersections

Additionally, the existing at-grade rail crossing is located approximately 75 feet east of the Old Highway 99 N/Cook Road intersection. The crossing consists of one eastbound and two westbound lane. The two westbound lanes consist of the left-turn and shared through/right-turn lanes of the westbound approach to the Old Highway 99 N/Cook Road intersection. No existing pedestrian facilities are present at the rail crossing. The crossing includes overhead warning lights, automatic gates, and an interconnect with the traffic signal at Old Highway 99 N/Cook Road to provide rail preempt at this intersection. The railroad crossing averaged 18 trains per day in the first half of 2023 (4 Amtrak and 14 non-Amtrak). Crossing blockages vary greatly but generally range between 2 to 7 minutes.

No transit facilities are provided within the study area.

Project Needs

The project area currently experiences heavy peak hour congestion, largely stemming from the demand to/from I-5. In particular, demand during the PM peak hour often exceeds the capacity of the system and results in queueing from the Old Highway 99 N/Cook Road intersection, through the I-5 northbound ramps intersection, and occasionally onto I-5 mainline. Gate closures at the railroad crossing increase this congestion. As described previously, the highest demand is to/from the south and east. The Comprehensive Plan indicates the traffic volumes at the study area intersections are forecast to continue to grow along with continued increase in impacts associated with the proximity of the railroad crossing as

well as continued growth in train activity. In 2017, the County completed a corridor study for Cook Road that evaluated short- and long-term solutions for the project area. As a result of that study, the County secured a grant through the National Highway Freight Program (NHFP) to design and build improvements matching Alternative 1 in this ICE. Long term solutions for the area have been identified in the Comprehensive Plan to include a grade separated railroad crossing.

After securing the NHFP grant, and in coordination with WSDOT, it was determined that an ICE would be required prior to starting design of any improvements. This ICE reviews interim improvements that can improve operations prior to the installation of the long-term improvement. The interim improvements include 4 Action alternatives (1 roundabout and 3 traffic signal options).

Intersection Traffic Control Alternatives

Four intersection control alternatives have been reviewed. Figure 3 provides a conceptual layout of the different alternatives. The detailed concepts are provided as well in Appendix A. The alternatives are described below in detail as well as previously summarized in Table 1.

Alternative 1: Traffic Signal

The Alternative 1 traffic signal alternative assumes the two I-5 ramp intersections are converted from side-street stop-controlled to traffic signals. Each intersection is described below:

1. **I-5 southbound ramps/Cook Rd:** Traffic signal maintaining existing channelization.
2. **I-5 northbound ramps/Cook Rd:** Traffic signal with the addition of a northbound right turn lane on the northbound off-ramp resulting in a single shared left/through/right lane and separate right turn lane. Additionally, there is an added eastbound receiving lane east of the intersection along Cook Road.
3. **Old Highway 99 N /Cook Rd:** Traffic signal with the addition of an eastbound through lane and eastbound receiving lane east of the intersection along Cook Road.

Alternative 2: Traffic Signal & added NBR at Old Hwy 99 N

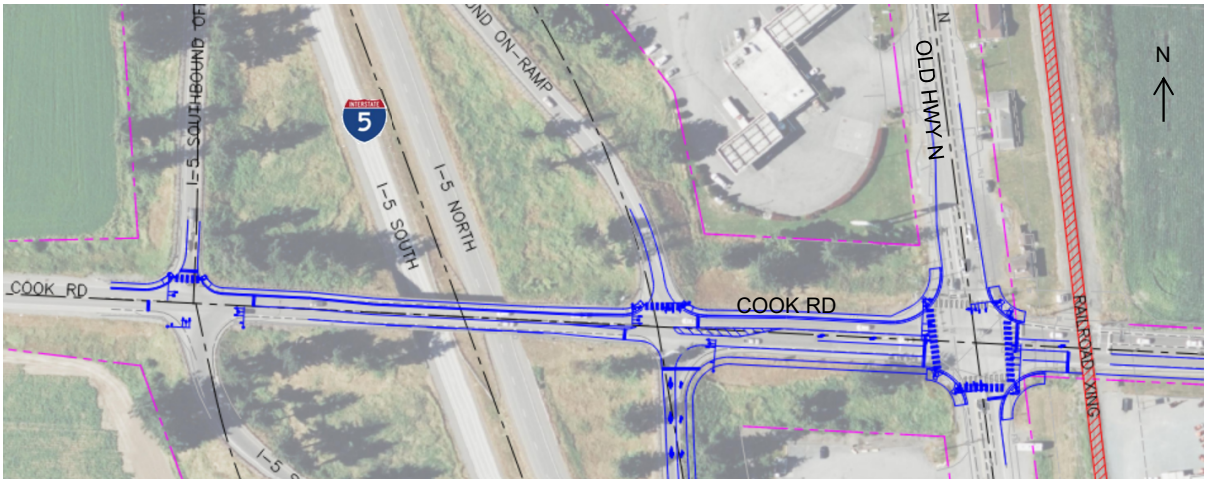
The Alternative 2 traffic signal alternative is consistent with Alternative 1 which assumes the two I-5 ramp intersections are converted from side-street stop-controlled to traffic signals but includes additional channelization modifications. The additional modifications with Alternative 2 relative to Alternative 1 are described below.

1. **I-5 southbound ramps/Cook Rd:** *Consistent with Alternative 1.*
2. **I-5 northbound ramps/Cook Rd:** *Consistent with Alternative 1.*
3. **Old Highway 99 N /Cook Rd:** Alternative 1 modifications as well as the addition of a northbound right turn lane providing separated northbound left, through, and right turn lanes for the northbound approach. This alternative provides continued movement of northbound left and through vehicles during railroad crossing events.

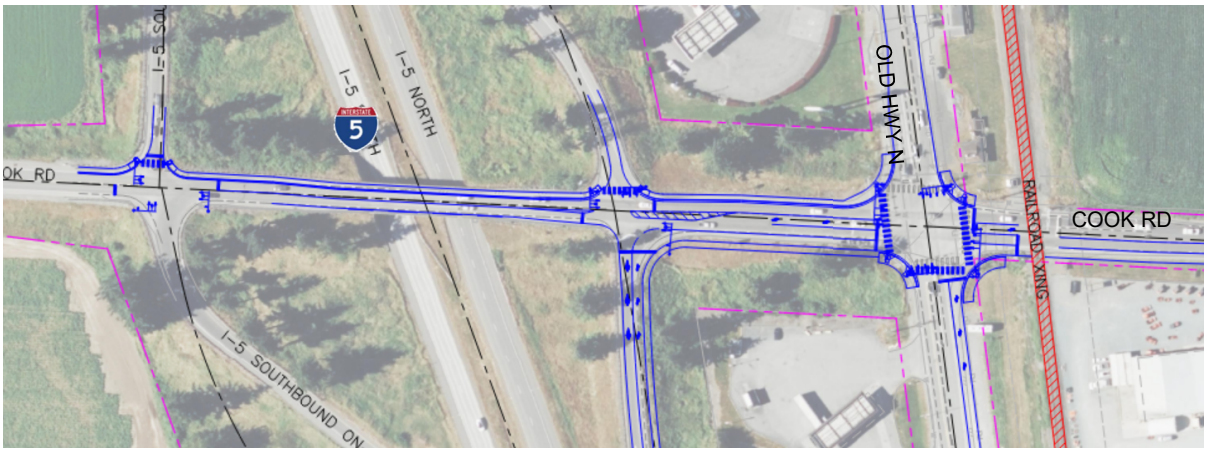
Alternative 3: Traffic Signal & Single Controller

The Alternative 3 traffic signal alternative is consistent with Alternative 2 which assumes the two I-5 ramp intersections are converted from side-street stop-controlled to traffic signals and channelization modifications. No additional channelization changes are proposed with Alternative 3 relative to Alternative 2; however, the Alternative 3 traffic signals at the intersections of Old Highway 99 N and I-5 northbound ramps along Cook Road would operate on a single controller.

Alternative 1: Traffic Signal



Alternative 2 and 3*: Traffic Signal & added NBR at Old Hwy 99 N



** Alternative 3 also includes the modification for a single controller for the intersections of Old Highway 99 N and I-5 Northbound Ramps along Cook Road.*

Alternative 4: Roundabout

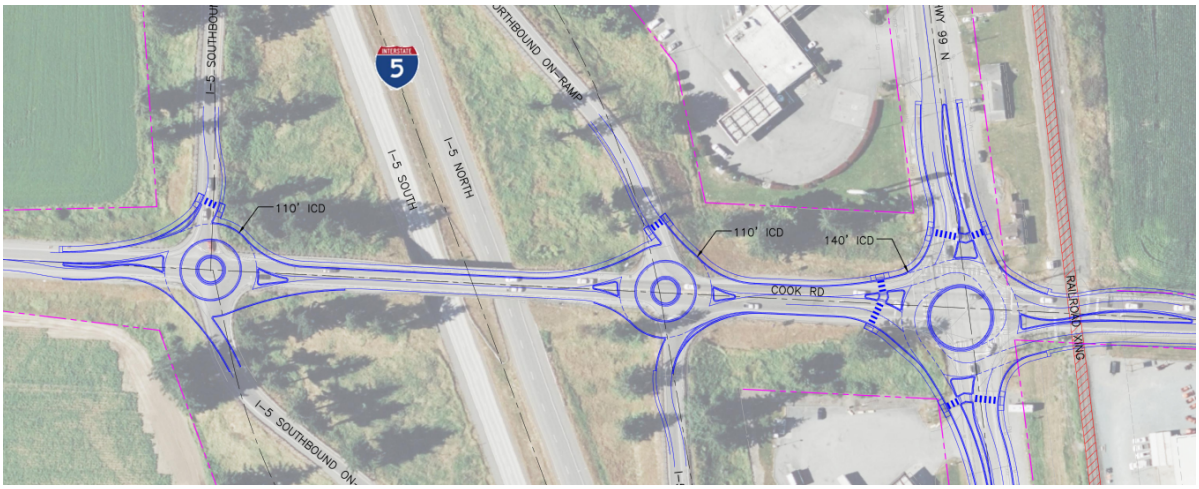


Figure 3: Alternative Concepts

Alternative 4: Roundabout

The roundabout alternative assumes the intersections are reconstructed and converted from the current traffic control (either side-street stop-controlled or signal) to roundabouts. Each intersection is described below:

1. **I-5 southbound ramps/Cook Rd:** Single lane roundabout
2. **I-5 northbound ramps/Cook Rd:** Single lane roundabout
3. **Old Highway 99 N /Cook Rd:** Multilane roundabout with 2 circulating lanes and the following lane configurations:
    - Eastbound left/through and through/right turn lanes
    - Westbound, Northbound, and Southbound approaches include a separate left turn lane and shared through/right lane
    - Single receiving lanes on all approaches with the exception of the east leg

Railroad Crossing Considerations

The proximity of the railroad crossing to the Old Highway 99 intersection presents a challenge to safety. Signalized as compared to roundabout traffic control adjacent to a crossing are reviewed below.

Signalized facilities provided for railroad crossings are familiar to motorists, promoting predictable behavior. In addition, the interconnect between the rail crossing and traffic signal allows preemption of the traffic signal including dedicated track clearance phases and conditional servicing of phases during train events. This allows traffic that does not conflict with the rail crossing to continue, reducing congestion and related crash types. Further, the interconnect to the signal system provides greater control of queues after a train event. This is anticipated to reduce congestion after the train event faster and minimize the amount of time the project area experiences heavy congestion and associated crash types.

With adjacent roundabout controlled intersections, it is anticipated that either signalization or blank out signs on select roundabout approaches for Old 99 Intersection would be needed to ensure no vehicles remain on the RR tracks during a train event. Alternative 4 was eliminated as a feasible option in part due to the larger footprint required for roundabout and additional signalization/ITS complexity in this specific context recommended with roundabout option. The remaining signalized Alternatives are presented below.

Methodology

The following section provides an overview of the methodology used to analyze the intersection control alternatives.

Horizon Years

The horizon years include an approximate opening year of 2028 and a 2045 design year. The design year is consistent with the County's travel demand model.

Performance Measures

Level of service (LOS) and queuing are used as performance measures to compare each alternative. Note the LOS and queueing operations focused on conditions without a train event. Traffic operation assumptions include:

- LOS is measured in average delay per vehicle and is reported for the intersection as a whole for signalized intersections. At unsignalized side-street, stop-controlled intersections, LOS is measured by the average delay on the worst-movement of the intersection. Traffic operations for an intersection can be described alphabetically with a range of levels of service (LOS A through F), with LOS A indicating free-flowing traffic and LOS F indicating extreme congestion and long vehicle delays. Appendix B contains a detailed explanation of LOS criteria and definitions.

- Skagit County's Comprehensive Plan (2016) identifies a LOS standard of LOS D at intersections which includes the Old Highway 99 N/Cook Road intersection. WSDOT identifies a LOS C standard along I-5 in the vicinity of the Cook Road ramps.
- During the Design Year condition, the peak hour factor (PHF) for the design year conditions was set to 1.0 for both the No Action and Action Alternatives per the *WSDOT guidelines*[2]. The existing PHF was maintained for the Opening Year conditions.
- Evaluated based on guidelines found in *WSDOT Synchro & Simtraffic Protocol (August 2018*). Operations were evaluated using *SimTraffic*.

In addition, a discussion of safety performance was conducted for each alternative.

Traffic Volume Forecasts

Future (2028) Opening Year weekday AM and PM peak hour traffic volumes were forecast by applying an annual growth rate to existing traffic volumes. An annual growth rate of 1.0 percent was applied to existing study intersection traffic volumes to estimate 2028 horizon year traffic growth based on review of historical growth in the area as well as review of growth anticipated between the County's 2018 and 2045 Travel Demand Models.

The future Design Year weekday AM and PM peak hour traffic volume forecasts are based on Skagit County's Travel Demand Model. The model contains estimates of future land use growth in the region. The travel demand models forecast weekday PM peak hour conditions. Weekday AM peak hour traffic volumes are developed through their relationship with the existing weekday PM peak hour traffic counts. Note that adjustments were made for reasonableness.

The Opening and Design Year weekday AM and PM peak hour traffic volumes are shown in Figure 4. The long-term travel demand model anticipates limited growth to/from I-5, but rather the growth is concentrated along the Cook Road and Old Highway 99 N corridors.

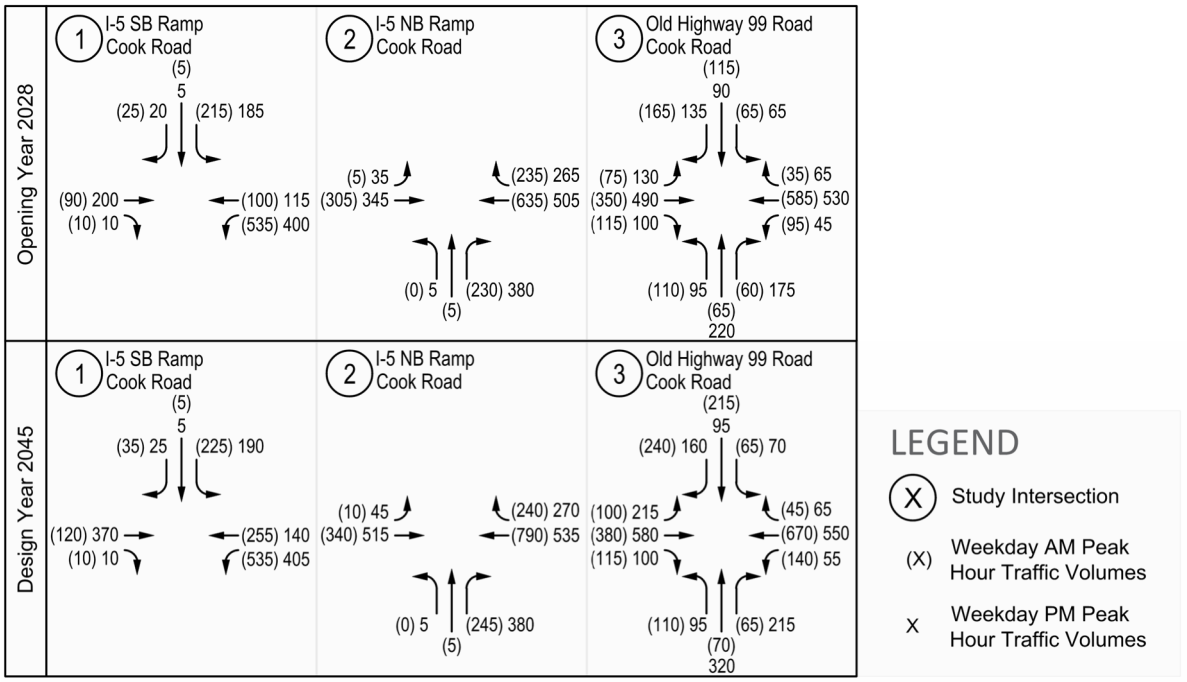


Figure 4: Future Weekday AM and PM Peak Hour Volumes

[2] *WSDOT Synchro & Simtraffic Protocol – August 2018*

Signal Timing Parameters

The following signal timing parameters were assumed for the analysis:

- Actuated-coordinated control (coordinated along the Cook Road corridor). The traffic signals under Alternatives 1 and 2 have a 120-second cycle length. The traffic signals under Alternative 3 (including the single controller for the intersections of I-5 northbound ramps and Old Highway 99 N along Cook Road) have a 140-second cycle length.
- Splits and offsets were optimized
- Left-turn movements are flashing yellow

Design Vehicle

Design concepts were developed to accommodate WB-67 truck turning movements.

Step 2: Feasibility

The alternatives were analyzed for feasibility based on the factors included in Chapter 1300 of the WSDOT Design Manual as well as consideration of site-specific issues. Table 2 summarizes the feasibility comparison of each alternative.

Table 2. Alternative Feasibility Comparison

Factor	**Alternative 1:** *Traffic Signal*	**Alternative 2:** *Traffic Signal with added NBR at Old Highway 99 N*	**Alternative 3:** *Traffic Signal & single controller*
Right-of-Way Impacts	Right-of-way acquisition would be necessary at the Old Highway 99 intersection, including the southwest, southeast, and northeast corners. In addition, additional ROW may be required east of the railroad crossing to allow for roadside grading and provide drainage ditches. Flow control and water quality facilities would require the potential need for additional right-of-way to locate the facilities under Alternative 1.	Alternative 2 is anticipated to have similar Right-of-way acquisition needs as Alternative 1. However, the added northbound right-turn lane at the Old Highway 99 intersection may require additional ROW as well as increase the amount of new/replaced impervious surfaces. This may increase the size of the needed water quality and flow control facilities and associated Right-of-way needs.	Right-of-way acquisition under Alternative 3 would be similar to that of Alternative 1.
Sensitive Area Impacts	No documented wetlands are present near the project limits. This alternative is anticipated to result in the lowest amount of new/replaced impervious surface that would require detention and treatment of stormwater.	No documented wetlands are present near the project limits. This alternative would result in a higher amount of new/replaced impervious surfaces than Alternative 1, requiring larger water quality and flow control facilities.	No documented wetlands are present near the project limits. This alternative would result in similar amounts of new/replaced impervious surfaces as Alternative 1.
Design Constraints	Alternative 1 would result in slightly better grades between the I-5 ramp terminal and Old Highway 99 intersections (4%). In addition, the more compact geometry of the signalized intersections would require minimal fill/grading and retaining walls, particularly at the two I-5 ramp terminal intersections. Alternative 1 is not anticipated to adversely impact the bridge over I-5.	Design Constraints for Alternative 2 are consistent with Alternative 1, with the exception of the existing park and ride area located on the east side of Old Highway 99, south of Cook Road. This alternative would reduce the space available for this facility and likely require the relocation or elimination of the park and ride area.	Design Constraints for Alternative 3 are consistent with Alternative 2.

Factor	**Alternative 1:** *Traffic Signal*	**Alternative 2:** *Traffic Signal with added NBR at Old Highway 99 N*	**Alternative 3:** *Traffic Signal & single controller*
Multimodal Accommodation	The signal alternative would maintain curb ramps and signalized crossings across each leg of the Old Highway 99 intersection. Curb ramps and signalized crossings across the north legs of the I-5 ramp terminal intersections would be installed. These crossings will provide pedestrian walk phases/signals. A 5-foot sidewalk along the north side of the I-5 bridge will also be provided. Crossing distances would increase across the west and east legs of the Old Highway 99 intersection.	Pedestrian facilities provided for Alternative 2 would be similar to Alternative 1 with the additional effect of an increased pedestrian crossing across the south leg of the Old Highway 99 intersection.	Pedestrian facilities provided for Alternative 3 would be similar to Alternative 2.
Safety	The ability to interconnect the traffic signal at Old Highway 99 with the railroad crossing gate system is expected to reduce the complexity and risk of vehicle/train collisions. This alternative provides facilities for railroad crossings that are familiar to motorists, promoting predictable behavior. In addition, the interconnect between the rail crossing and traffic signal allows preemption of the traffic signal including dedicated track clearance phases and conditional servicing of phases during train events. This allows traffic that does not conflict with the rail crossing to continue, reducing congestion and related crash types.	Consistent with Alternative 1 with respect to the ability to provide preemption of the traffic signal at the Old Highway 99 intersection. The additional northbound right-turn lane provides the added benefit of queue storage for right-turning vehicles and allows the traffic signal to continue to service northbound thru- and left-turning vehicles during a train event, further reducing congestion and related crash types.	Consistent with Alternative 1 with respect to the ability to provide preemption of the traffic signal at the Old Highway 99 intersection. The benefit of operating the northbound I-5 ramp terminal intersection and Old Highway 99 intersection with the same controller includes greater control of queues during and after a train event. This is anticipated to reduce congestion after the train event faster and minimize the amount of time the project area experiences heavy congestion and associated crash types.
Maintenance/ Operations	The signals would require regular maintenance, service calls, and replacement of parts as needed.	Consistent with Alternative 1.	Consistent with Alternative 1.
Implementation/ Constructability	The traffic signal would be installed with relatively little disruption to existing traffic. The existing signal at the Old Highway 99 intersection would remain in operation, while new signal equipment is installed outside of the existing roadway. Construction of the new traffic signals at the I-5 ramp terminal intersection would only require minor disruptions to traffic. Implementation of the intersection and roadway improvements would be constructed while maintaining existing lane configurations as much as possible but may require short term closures and detours.	Consistent with Alternative 1.	Consistent with Alternative 1.
Cost	Alternative 1 is estimated to cost $6,000,000.	Alternative 2 is estimated to cost $6,300,000, which is a slight increase relative to Alternative 1 to provide the added northbound right turn lane.	Alternative 3 is estimated to cost $6,300,000, consistent with Alternative 2. This alternative would remove a controller but the need to extend wires would be reduced.

Factor	**Alternative 1:** *Traffic Signal*	**Alternative 2:** *Traffic Signal with added NBR at Old Highway 99 N*	**Alternative 3:** *Traffic Signal & single controller*
Other	Note that a traffic signal warrant analysis was completed for the traffic signal alternatives (Alternatives 1-3) to confirm feasibility of the installation of a traffic signal at the existing unsignalized I-5 ramp intersections along Cook Road. Criteria establishing warrants for installation of traffic signals is outlined in the *Manual on Uniform Traffic Control Devices* (MUTCD). MUTCD Chapter 4C, Section 4C.01. Warrant 1 (Eight-Hour Vehicular Volume) and Warrant 2 (Four-Hour Vehicular Volume) were evaluated, which are the only warrants applicable. Hourly traffic volumes were developed for the analysis using the weekday PM peak hour traffic volumes for the Opening Year (2028) conditions (see Figure 4) and applying the hourly distribution from the National Cooperative Highway Research Program (NCHRP) Report 365 *Travel Estimation Techniques for Urban Planning*. The results of the warrant analysis show that Warrant 1 (Eight-Hour Vehicular Volume) and Warrant 2 (Four-Hour Vehicular Volume) are both met at both intersections under the future (2028) conditions. The traffic signal warrants are provided in Appendix C.	Consistent with Alternative 1.	Consistent with Alternative 1.

Step 3: Operational and Safety Performance Analysis

As described previously, the operations of the intersection traffic control alternatives were evaluated under an opening year of 2028 and a design year of 2045. Forecast traffic operations as well as a safety discussion are discussed in the following sections.

Traffic Operations

The intersection level of service and vehicle queuing analysis has been summarized below for the No Action and Action Alternatives. Note that the operations reflect non-train event conditions. A separate discussion relative to the operations during a train event is provided in a subsequent section.

Intersection Operations

Table 3 shows the overall intersection operations for the Action Alternatives during the weekday AM and PM peak hour under the future Opening and Design Year conditions relative to the No Action conditions. Detailed LOS worksheets are provided in Appendix D. Note that the Design Year operations reflect the PHF adjustment as described above in the methodology section.

Table 3. Weekday AM and PM Peak Hour Intersection LOS Comparison

Intersection	No Action			Alternative 1: *Traffic Signal*		Alternative 2: *Traffic Signal with added NBR at Old Highway 99 N*		Alternative 3: *Traffic Signal & Single controller*	
	LOS[1]	Delay[2]	WM[3]	LOS	Delay	LOS	Delay	LOS	Delay
Opening Year (2028)									
AM Peak Hour									
1. I-5 SB Ramp/Cook Rd	C	22	SB	B	17	B	17	B	19
2. I-5 NB Ramp/Cook Rd	A	6	NB	A	6	A	6	A	7
3. Old Hwy 99 N/Cook Rd	B	20	-	B	20	B	19	C	20
PM Peak Hour									
1. I-5 SB Ramp/Cook Rd	B	13	SB	B	17	B	15	B	17
2. I-5 NB Ramp/Cook Rd	C	17	NB	B	11	A	10	A	9
3. Old Hwy 99 N/Cook Rd	D	53	-	C	27	B	20	B	20
Design Year (2045)									
AM Peak Hour									
1. I-5 SB Ramp/Cook Rd	F	111	SB	C	24	C	24	C	23
2. I-5 NB Ramp/Cook Rd	A	8	NB	A	8	A	8	A	9
3. Old Hwy 99 N/Cook Rd	C	30	-	D	49	D	50	C	33
PM Peak Hour									
1. I-5 SB Ramp/Cook Rd	C	25	SB	C	23	C	24	D	37
2. I-5 NB Ramp/Cook Rd	F	150	NB	C	21	B	18	D	37
3. Old Hwy 99 N/Cook Rd	F	156	-	F	88	D	37	C	31

Note: Shading indicates the intersection operates below standard.
1. Level of Service (A – F) as defined by the *Highway Capacity Manual* (6th Edition). Operations evaluated using SimTraffic.
2. Average delay in seconds per vehicle.
3. Worst movement reported for unsignalized intersections. NB = northbound, SB = southbound

As shown in Table 3, under the weekday AM and PM peak hours during the Opening Year (2028) conditions, the study intersections meet the respective operational LOS standards identified above. The intersections both under the No Action and Action Alternatives operate at LOS C or better with one exception. The exception being the Old Highway 99 N/Cook Road intersection is forecast to operate at LOS D during the PM peak hour under No Action conditions.

Under Design Year (2045) conditions, Table 3 shows all study intersections meet the respective LOS standards under future (2045) conditions during the weekday AM peak hour with the exception of the I-5 Southbound Ramp/Cook Road intersection which is forecast to operate at LOS F under No Action conditions. During the PM peak hour, the intersections of I-5 Northbound Ramps and Old Highway 99 N along Cook Road are forecast to operate at LOS F under the No Action conditions, operating below standard.

Only under Alternative 2, do all study intersections meet the respective operational standards during both the AM and PM peak hours as well as under both horizon years.

Vehicle Queues

The future Opening and Design Years 95th-percentile vehicle queues for the No Action and Action Alternatives are summarized in Table 4 and Table 5 during the weekday AM and PM peak hours, respectively. The 95th-percentile queues represent the vehicle queue lengths that would only be exceeded 5 percent of the time during the peak hour. The detailed queueing worksheets are included in Appendix D.

Table 4. Weekday AM Peak Hour 95th-Percentile Vehicle Queue Comparison

Intersection	Available Storage[1] (ft)	Opening Year (2028) 95th Percentile Queue[2] (ft)				Design Year (2045) 95th Percentile Queue[2] (ft)			
		No Action	**Alt 1:** *Traffic Signal*	**Alt 2:** *Traffic Signal + NBR*	**Alt 3:** *Traffic Signal + Single Controller*	**No Action**	**Alt 1:** *Traffic Signal*	**Alt 2:** *Traffic Signal + NBR*	**Alt 3:** *Traffic Signal + Single Controller*
AM Peak Hour									
1. I-5 SB Ramp/Cook Rd									
Eastbound	*>1,000*	0	65	60	60	5	85	75	75
Westbound	*470*	130	320	330	345	150	400	420	425
Southbound	*875*	380	255	240	280	**1,820**	370	350	340
2. I-5 NB Ramp/Cook Rd									
Eastbound	*470*	80	115	125	150	120	205	245	215
Westbound	*225*	20	210	195	215	10	**250**	**255**	**235**
Northbound Through/Right	*1,180*	180	95	90	95	230	100	115	115
Northbound Right	*500*	-	70	70	70	-	70	70	85
3. Old Hwy 99 N/Cook Rd									
Eastbound Left	*150*	140	125	120	130	**170**	145	**165**	**160**
Eastbound Through	*225*	**310**	195	200	200	**330**	**245**	**260**	**240**
Westbound Left	*275*	285	220	215	265	**390**	**370**	**375**	**360**
Westbound Through	*>8,000[3]*	730	540	540	665	3,400	875	860	2,905
Northbound Left	*100*	**115**	**120**	**120**	**175**	**120**	**120**	**120**	**185**
Northbound Through	*>1,000*	215	285	205	185	250	530	395	220
Northbound Right	*300*	-	-	95	75	-	-	185	85
Southbound Left	*200*	105	105	110	115	120	120	115	115
Southbound Through	*>2,000*	260	290	305	335	630	1,380	1,330	830
Southbound Right	*100*	**140**	**140**	**140**	145	**150**	**150**	**145**	**145**

Note: **Bold** indicates the queue exceeds the available storage AND shading indicates those locations that also exceed the respective No Action queue.
1. The storage length represents the available lane length for cars to queue, rounded to the nearest 25 feet.
2. 95th Percentile queues are derived from SimTraffic, rounded to the nearest 25 feet
3. 50 ft to railroad crossing or 445 ft to Green Road; however, queuing would continue through side street stop-controlled intersections.

Under 2028 conditions, the 95th percentile queues are generally accommodated within the available storage during both the weekday AM and PM peak hours under all alternatives (No Action and Action). With the traffic signal Action Alternatives, the queues are forecast to be similar or less than the No Action condition.

Similar to 2028 conditions, under future (2045) conditions, the 95th percentile queues are generally accommodated within the available storage during both the weekday AM and PM peak hours under all alternatives (No Action and Action).

As identified above, a key consideration in the implementation of the proposed improvement is to alleviate queuing impacting I-5 northbound mainline operations. This improvement is most notable during the weekday PM peak hour (see Table 5). Table 5 shows the northbound 95th percentile queue at the I-5 ramp/Cook Road intersection reducing to be 7 vehicles or less with the signalized Alternatives 1 and 2 from 30 vehicles or more under the No Action conditions.

Table 5. Weekday PM Peak Hour 95th-Percentile Vehicle Queue Comparison

Intersection	Available Storage[1] (ft)	Opening Year (2028) 95th Percentile Queue[2] (ft)				Design Year (2045) 95th Percentile Queue[2] (ft)			
		No Action	Alt 1: *Traffic Signal*	Alt 2: *Traffic Signal + NBR*	Alt 3: *Traffic Signal + Single Controller*	No Action	Alt 1: *Traffic Signal*	Alt 2: *Traffic Signal + NBR*	Alt 3: *Traffic Signal + Single Controller*
1. I-5 SB Ramp/Cook Rd									
Eastbound	*>1,000*	5	80	85	95	30	190	220	360
Westbound	*470*	120	260	230	255	170	330	390	420
Southbound	*875*	265	225	210	235	470	305	265	375
2. I-5 NB Ramp/Cook Rd									
Eastbound	*470*	225	300	255	230	455	**515**	**505**	**575**
Westbound	*225*	10	**250**	**255**	200	15	**320**	**310**	**240**
Northbound Through/Right	*1,180*	690	135	130	150	**3,110**	185	160	490
Northbound Right	*500*	-	95	85	110	-	120	115	450
3. Old Hwy 99 N/Cook Rd									
Eastbound Left	*150*	**180**	**165**	150	**165**	**175**	**175**	**180**	**180**
Eastbound Through	*225*	**335**	**270**	215	**265**	**310**	**315**	**310**	**335**
Westbound Left	*275*	235	210	195	180	**290**	**295**	**280**	245
Westbound Through	*>8,000[3]*	835	725	540	620	1,790	760	870	980
Northbound Left	*100*	**125**	**115**	**120**	**155**	**130**	**125**	**125**	**200**
Northbound Through	*>1,000*	**1,430**	525	340	250	**3,280**	**2,330**	905	445
Northbound Right	*300*	-	-	190	85	-	-	290	260
Southbound Left	*200*	100	85	110	95	110	100	110	105
Southbound Through	*>2,000*	155	155	200	185	195	185	210	195
Southbound Right	*100*	**120**	**115**	**125**	**125**	**130**	**125**	**130**	**125**

Note: **Bold** indicates the queue exceeds the available storage AND shading indicates those locations that also exceed the respective No Action queue.
1. The storage length represents the available lane length for cars to queue, rounded to the nearest 25 feet.
2. 95th Percentile queues are derived from SimTraffic, rounded to the nearest 25 feet
3. 50 ft to railroad crossing or 445 ft to Green Road; however, queuing would continue through side street stop-controlled intersections.

Safety Performance Analysis

This section summarizes the five-year crash history at the study intersections and provides a vehicular safety comparison for the alternatives.

Analysis of Existing Intersection Crashes

Crash records over the most recent complete 5-year period were reviewed at the northbound and southbound I-5 ramps intersections along Cook Road to identify potential safety issues within the vicinity of the study area. Collisions along the I-5 northbound and southbound ramp segments as well as the I-5 mainlines[3] were also reviewed to identify safety issues related to queueing during train events. Reported crash data was provided by WSDOT for the period of January 1, 2018 to December 31, 2022 for the study area. Table 6 provides a summary of the total number, type, and severity of the reported collisions.

[3] Mainlines included collisions reported within 0.75 miles (~4,000 feet) of the ramp milepost.

Table 6. Five-Year Collision Summary (By Collision Type) – 2018 to 2022

Location	Collision Type						Severity			Total	Average Annual
	Approach Turn	Rear End	Ped/ Bike	Angle	Sideswipe	Fixed Object	PDO[1]	Injury	Fatality		
Intersections											
1. I-5 SB Ramp/Cook Rd	1	4	0	4	0	5	12	2	0	14	**2.8**
2. I-5 NB Ramp/Cook Rd	0	4	0	7	0	3	10	4	0	14	**2.8**
3. Old Hwy 99 N/Cook Rd	6	7	0	7	4	0	19	5	0	24	**4.8**
Roadway Segments											
I-5 Southbound											
Ramp *(Cook Rd to I-5 Mainline)*	0	4	0	0	0	1	3	2	0	5	**1.0**
Total Mainline *(MP 232.98-233.73)*	0	0	0	0	1	8	9	0	0	9	**1.8**
Associated with Train Event[2]	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	***0***
I-5 Northbound											
Ramp *(Cook Rd to I-5 Mainline)*	0	10	0	0	0	1	8	3	0	11	**2.2**
Total Mainline *(MP 231.95 - 232.70)*	0	5	0	0	1	8	13	1	0	14	**2.8**
Associated with Train Event[2]	*0*	*5*	*0*	*0*	*0*	*0*	*4*	*1*	*0*	*5*	***1.0***

Source: WSDOT, 2023.
Note: Under 23 U.S. Code § 409 and 23 U.S. Code § 148, safety data, reports, surveys, schedules, lists compiled or collected for the purpose of identifying, evaluating, or planning the safety enhancement of potential crash sites, hazardous roadway conditions, or railway-highway crossings are not subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data.
1. PDO = property damage only (i.e. no apparent injury)
2. Train event assumed collision notes slowing or stopped vehicle involved. Note collisions only include respective direction of travel (e.g. northbound only includes vehicles traveling south to north).

The collision history review above shows that there were on average 3 collisions reported per year at the unsignalized southbound and northbound I-5 ramp intersections along Cook Road, respectively. The signalized Old Highway 99 N/Cook Road intersection in the study area showed an average annual of 5 collisions reported per year. Of the total collisions in the study area, the majority were rear-end and entering at an angle collisions and 80 percent of the overall reported collisions resulted in property damage only.

None of the reported collisions in the study area during the 5-year period reviewed (2018-2022) resulted in fatality nor were any reported that involved either a pedestrian or bicyclist. However, following the review period (June 2023) there has been one reported collision involving a bicyclist which occurred at the Old Highway 99 N/Cook Road intersection. The collision was a northbound left-turning vehicle striking a southbound cyclist and resulted in an injury. The cause of the collision was likely driver inattention. The alternatives would provide for modifications at all intersections including the Old Highway 99 N/Cook Road intersection where the recent collision involving a cyclist occurred.

In addition to the study intersections, Northbound I-5 had an average of 2.2 collisions per year along the ramp with an additional 1.0 collisions along the mainline associated with slowing or stopped traffic within the vicinity of the Cook Ramp interchange with nearly all of these collisions being rear-end collisions. Rear-end collision are typical of congested conditions and queueing.

Southbound I-5 had an average of 1.0 collisions per year along the ramp with no collisions identified on the mainline associated with slowing or stopped traffic within the vicinity of the Cook Ramp interchange.

In addition to reviewing the reported collisions, a discussion with a Washington State Patrol (WSP) sergeant[4] provided additional insight into existing safety conditions at the interchange based on daily observations in the vicinity. The interchange was identified to be along a known high collision area such that patrols are there regularly. There are daily weekday occurrences of eastbound queuing that occurs

[4] Sergeant Jon McKee, #165, Washington State Patrol, Field Operations Bureau – Burlington

along Cook Road and results in queues extending onto the off-ramps, consistently on the northbound ramp but can also extend onto the southbound ramp as well. Additionally, it is estimated that 2-3 days a week, the northbound queues will extend onto the I-5 northbound mainline. Given the existing stop-controlled traffic control at the ramp intersections, queuing along Cook Road does not provide needed gaps in the flow of traffic to clear the queues. Train events only exacerbate these challenges. The collision summary above supports these observations, with northbound ramp and mainline rear-end collisions (commonly congestion related collisions) identified to be an average of 3 collisions per year.

Additional discussion regarding the different alternatives and the multimodal considerations are provided below.

Comparison of Crash Reduction

This section summarizes the crash reduction for each alternative based on the predicted fatal and injury crash frequency and crash severity distributions. Analysis of the traffic safety among the options involves the usage of HSM spreadsheets[5]. HSM spreadsheets were developed by the TRB Highway Safety Performance Committee and are used to calculate expected and predicted crash rates by severity by inputting intersection parameters such as AADT by approach, number of lanes, lighting availability, and other parameters. Full details including calculations and severity distributions are shown in Appendix E. Table 7 below summarizes the findings completed for the Opening Year future condition.

Note that this analysis does not consider the train event. Additional discussion of safety with a train event is provided in a subsequent section (Railroad Safety and Operations).

Table 7. Predicted Crash Frequency for Alternative (Injury and Fatal) Summary

	Opening Year 2028		
	No Action[1,2]	**Alt 1-3:** *Traffic Signal Alternatives[2]*	***Annual Crash Reduction*** *(Action Alternatives relative to No Action)*
1. I-5 SB Ramp/Cook Rd	0.6	0.4	-0.2
2. I-5 NB Ramp/Cook Rd	0.9	0.7	-0.2
3. Old Hwy 99 N/Cook Rd	0.7	0.7	0

Note: Collisions reflect predicted injury and fatal crashes per year.
1. Existing assuming the existing intersection channelization.
2. Based on a combined CMF calculated per the HSM spreadsheet.

As shown in Table 7, the Action Alternatives are anticipated to reduce the annual injury and fatal crash types at the two ramp intersections relative to the No Action condition which would change the traffic control from the existing side street stop controlled to a traffic signal. No change in annual injury and fatal crash types is predicted at the Old Highway 99 N/Cook Road intersection. Overall, the action alternatives result in similar safety improvements at the intersections.

In addition to the crash reduction analysis above, it is important to reiterate a project objective is to alleviate any queueing impacts to the I-5 mainline that occurs today and results in safety concerns including identified collisions as shown and discussed above. The action alternatives allow for signal timing prioritization to minimize northbound queueing.

Multimodal Safety and Operations

With the action alternatives, signalized crossings would be maintained at the Old Highway 99 N/Cook Road intersection with crossing distances ranging between 3 and 4 lanes. Additionally, curb ramps and signalized crossings would be installed across the north legs of the I-5 ramp terminal intersections. These crossings will provide pedestrian walk phases/signals. Finally, a 5-foot sidewalk would be added along the north side of the I-5 bridge.

[5] http://safetyperformance.org/tools/

Railroad Safety and Operations

As identified above, signalized facilities provided for railroad crossings are familiar to motorists, promoting predictable behavior. In addition, the interconnect between the rail crossing and traffic signal allows preemption of the traffic signal including dedicated track clearance phases and conditional servicing of phases during train events. This allows traffic that does not conflict with the rail crossing to continue, reducing congestion and related crash types. Further, the interconnect to the signal system provides greater control of queues after a train event. This is anticipated to reduce congestion after the train event faster and minimize the amount of time the project area experiences heavy congestion and associated crash types.

The signalized alternatives are anticipated to provide reduced queueing with the train event relative to the No Action condition. Furthermore, Alternatives 2 and 3 add a northbound right-turn lane at the Old Highway 99 N/Cook Road intersection, allowing for continued processing of vehicles during the train event unlike the other alternatives by adding capacity and separation of the movements.

Step 4: Alternative Evaluation

All Action Alternatives will improve operations in all future analysis years. Of the signalized alternatives, Alternative 2 is forecast to meet the operational standards in both the opening year (2028) and design year (2045). In addition to operational benefits, signalization of the intersections allows for prioritization of the ramps to minimize queueing impacts to the I-5 mainline which occur today.

Additionally, as noted previously, the improvements are an interim condition until such time a grade separated railroad crossing is installed. Given the temporary nature of the improvements, the less invasive signalization (Alternatives 1-3) are feasible interim improvements.

Step 5: Selection

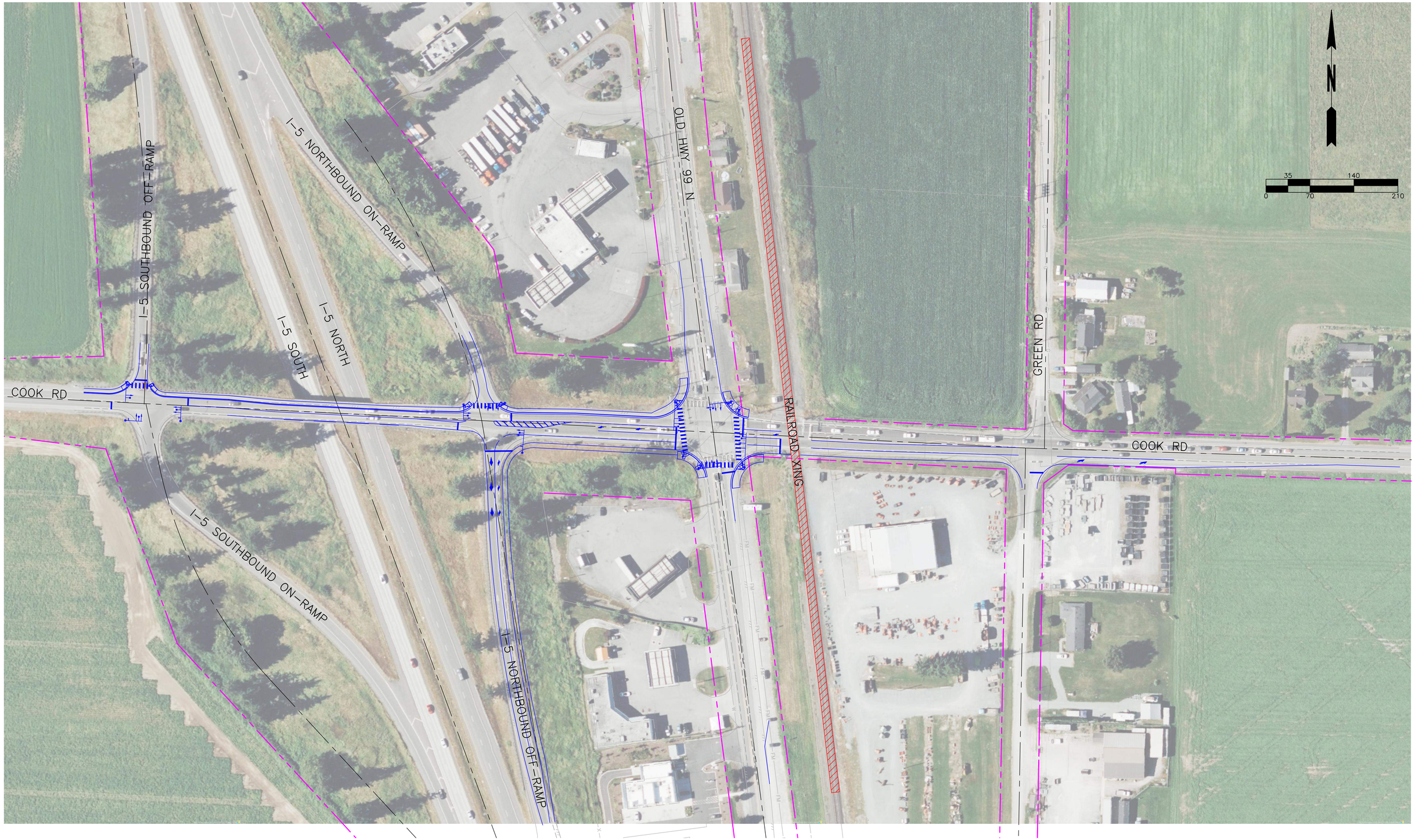
The recommendation for the intersection improvements is the **Alternative 2 traffic signal alternative.** This alternative would include the following:

- Install traffic signals at the 2 ramp intersections,
- Add a northbound right turn lane at the I-5 northbound ramp intersection,
- Widen Cook Road to include an additional eastbound through lane east of the I-5 northbound ramp intersection to east of Green Road, and
- Add a northbound right-turn lane at the Old Highway 99 N intersection.
- Rebuild traffic signal at Old Highway 99 N/Cook Road intersection.

Alternative 2 meets the operational standards at all study intersections during both future opening and design year conditions in the AM and PM peak hours. The 95th percentile queueing is also improved with this alternative relative to the other alternatives and signalization of the intersections allows for prioritization of the ramps to minimize impacts to the I-5 mainline. Additionally, this alternative is consistent with the grant funding application and is compatible with the train crossing (acceptable by BNSF Railroad operators).

Finally, as this is an interim condition with long-term plans to include grade separation of the railroad crossing, the selected alternative is a reasonable option for providing lower cost improvements while meeting the project needs as described above.

Appendix A: Intersection Alternatives Concept Illustrations



Alternative 1 - Signalized Intersections

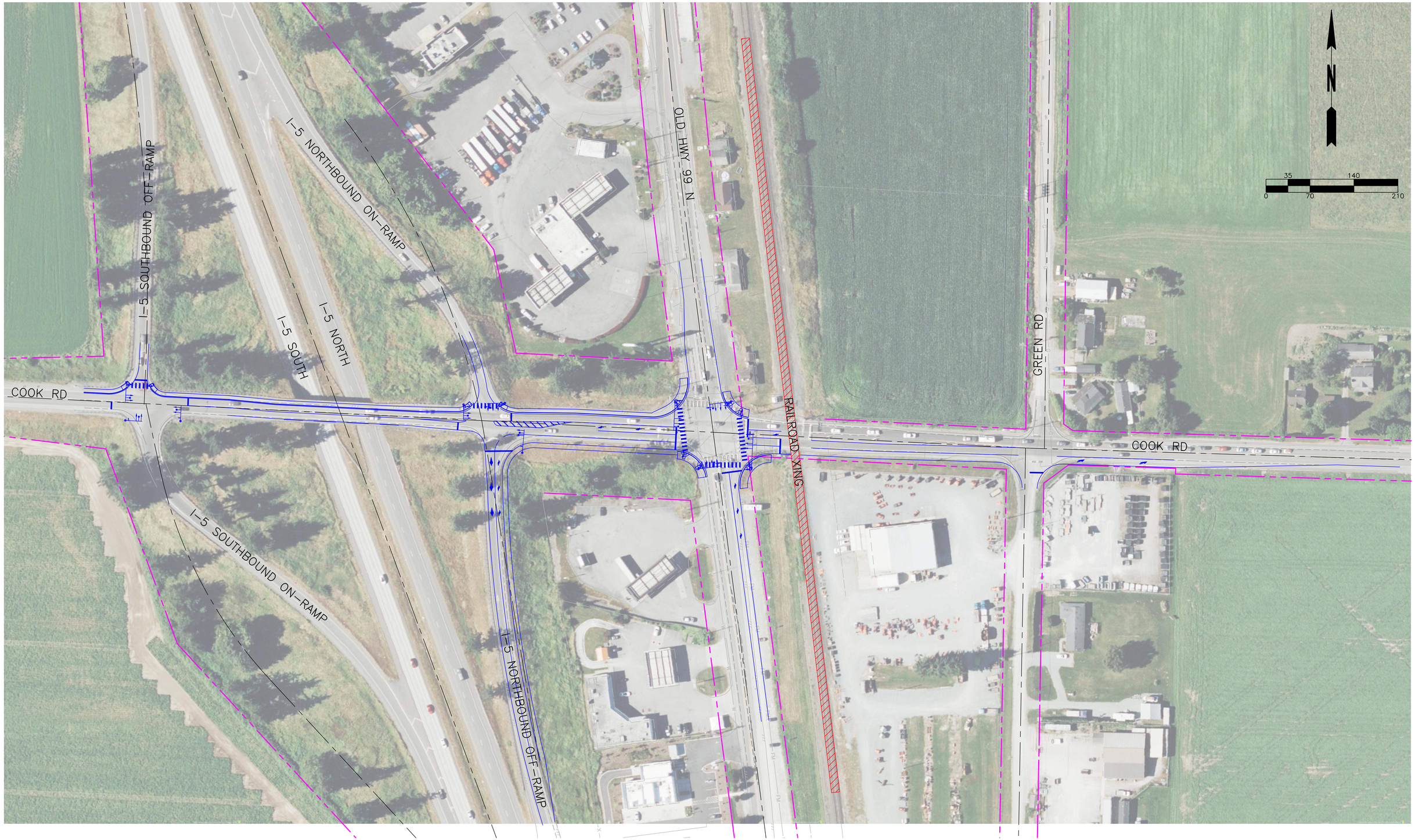
1.23051.00 - Cook Rd and I-5 Interchange Improvements

August 11, 2023

FIGURE
1

transpogroup
WHAT TRANSPORTATION CAN BE.

Aug 11, 2023 - 2:38pm santiagom M:\23\1.23051.00 - Cook Rd and I-5 Interchange Improvements\Engineering\CAD\Conceptual\23051-TG-CONCEPT-SIGNAL.dwg Layout: Alt2



Alternative 2 - Signalized Intersections with NB Right-Turn at Old Hwy 99

1.23051.00 - Cook Rd and I-5 Interchange Improvements

August 11, 2023

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WHAT TRANSPORTATION CAN BE.

FIGURE
2

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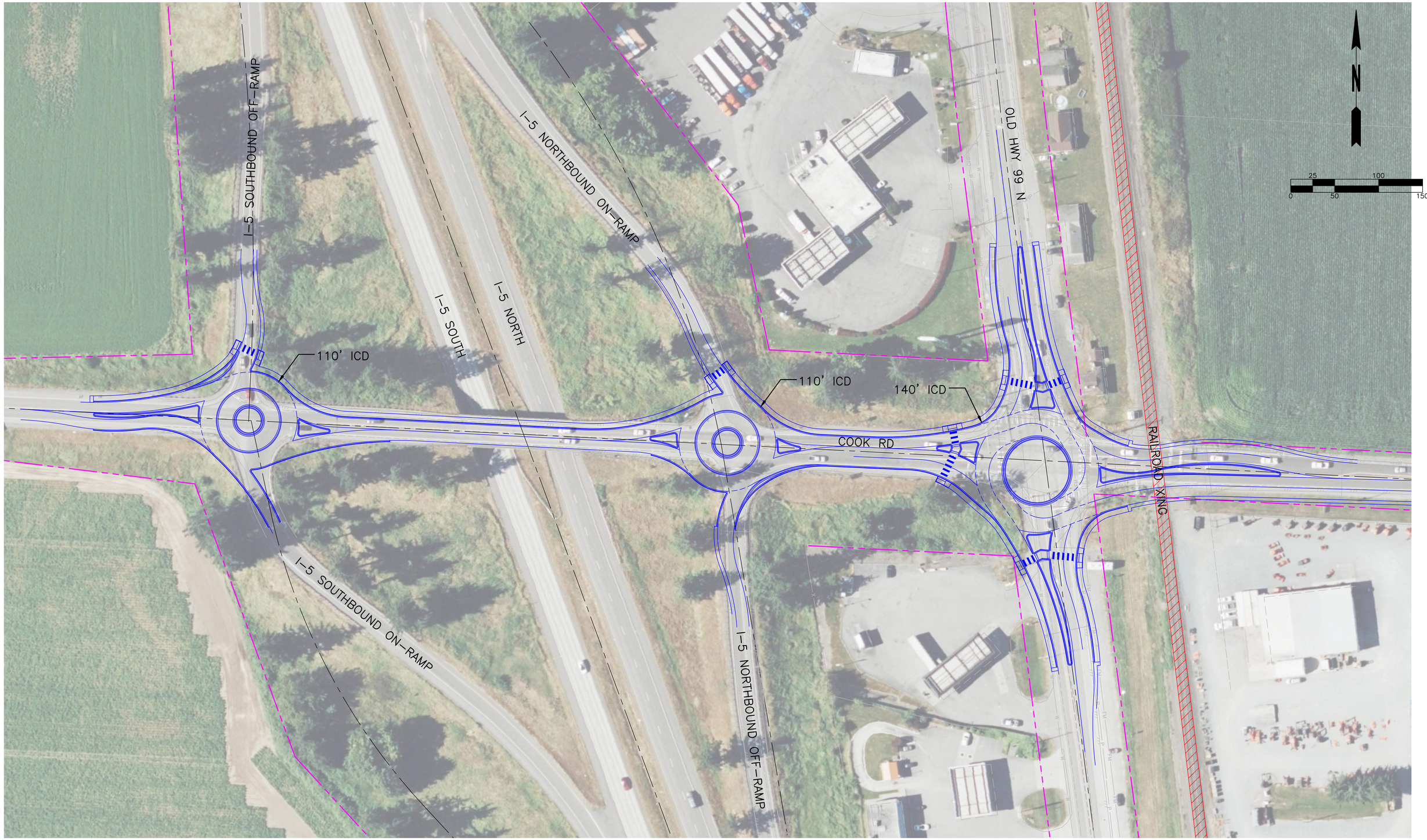

Alternative 4 - Roundabouts

1.23051.00 - Cook Rd and I-5 Interchange Improvements

August 10, 2023

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WHAT TRANSPORTATION CAN BE.

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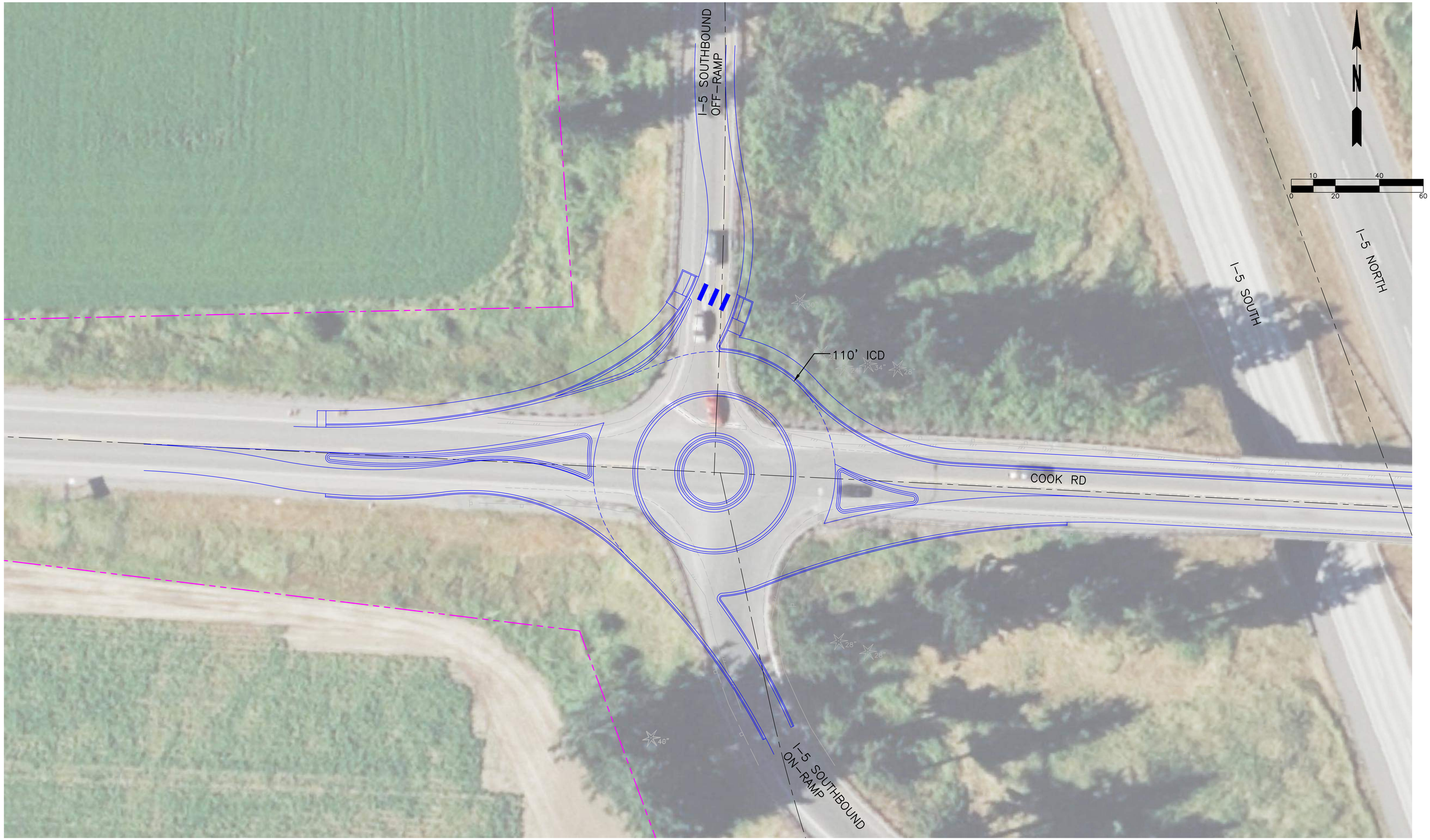

Cook Rd & I-5 Southbound Ramps - Roundabout Horizontal Layout

August 10, 2023

1.23051.00 - Cook Rd and I-5 Interchange Improvements

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WHAT TRANSPORTATION CAN BE.

FIGURE
2

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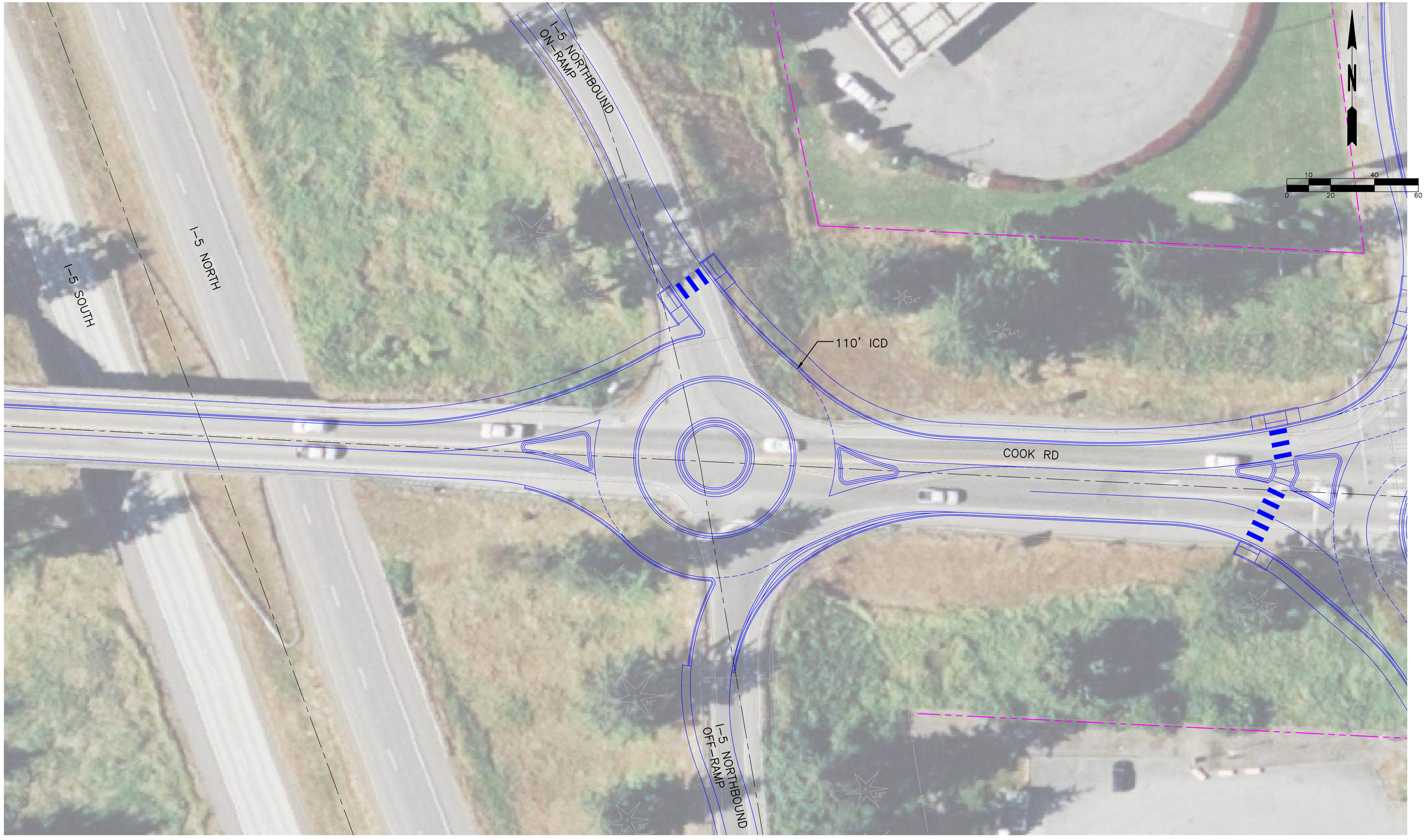

Cook Rd & I-5 Northbound Ramps - Roundabout Horizontal Layout

1.23051.00 - Cook Rd and I-5 Interchange Improvements

August 10, 2023

transpogroup
WHAT TRANSPORTATION CAN BE.

FIGURE
3

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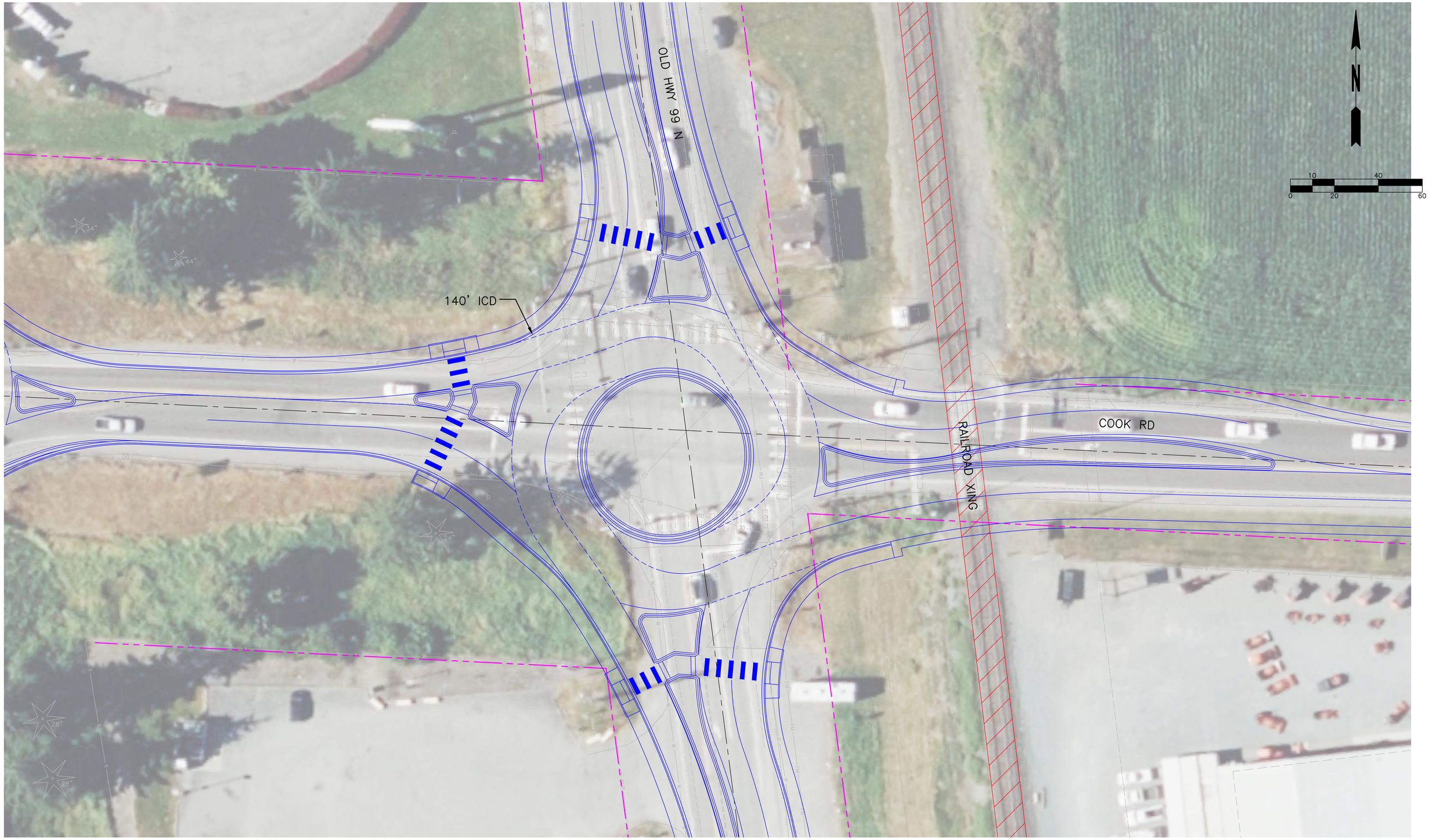


Cook Rd & Old Highway 99 N - Roundabout Horizontal Layout

1.23051.00 - Cook Rd and I-5 Interchange Improvements

August 10, 2023

transpogroup
WHAT TRANSPORTATION CAN BE.

FIGURE
4

Aug 10, 2023 - 2:34pm victorm M:\23\1.23051.00 - Cook Rd and I-5 Interchange Improvements\Engineering\CAD\Conceptual\23051-TG-CONCEPT-RAB.dwg Layout: RAB (4)

Appendix B: LOS Definitions

Highway Capacity Manual 2010/6th Edition

Signalized intersection level of service (LOS) is defined in terms of a weighted average control delay for the entire intersection. Control delay quantifies the increase in travel time that a vehicle experiences due to the traffic signal control as well as provides a surrogate measure for driver discomfort and fuel consumption. Signalized intersection LOS is stated in terms of average control delay per vehicle (in seconds) during a specified time period (e.g., weekday PM peak hour). Control delay is a complex measure based on many variables, including signal phasing and coordination (i.e., progression of movements through the intersection and along the corridor), signal cycle length, and traffic volumes with respect to intersection capacity and resulting queues. Table 1 summarizes the LOS criteria for signalized intersections, as described in the *Highway Capacity Manual 2010* and 6th Edition (Transportation Research Board, 2010 and 2016, respectively).

Table 1. Level of Service Criteria for Signalized Intersections

Level of Service	Average Control Delay (seconds/vehicle)	General Description
A	≤10	Free Flow
B	>10 – 20	Stable Flow (slight delays)
C	>20 – 35	Stable flow (acceptable delays)
D	>35 – 55	Approaching unstable flow (tolerable delay, occasionally wait through more than one signal cycle before proceeding)
E	>55 – 80	Unstable flow (intolerable delay)
F[1]	>80	Forced flow (congested and queues fail to clear)

Source: *Highway Capacity Manual 2010 and 6th Edition*, Transportation Research Board, 2010 and 2016, respectively.

1. If the volume-to-capacity (v/c) ratio for a lane group exceeds 1.0 LOS F is assigned to the individual lane group. LOS for overall approach or intersection is determined solely by the control delay.

Unsignalized intersection LOS criteria can be further reduced into two intersection types: all-way stop and two-way stop control. All-way stop control intersection LOS is expressed in terms of the weighted average control delay of the overall intersection or by approach. Two-way stop-controlled intersection LOS is defined in terms of the average control delay for each minor-street movement (or shared movement) as well as major-street left-turns. This approach is because major-street through vehicles are assumed to experience zero delay, a weighted average of all movements results in very low overall average delay, and this calculated low delay could mask deficiencies of minor movements. Table 2 shows LOS criteria for unsignalized intersections.

Table 2. Level of Service Criteria for Unsignalized Intersections

Level of Service	Average Control Delay (seconds/vehicle)
A	0 – 10
B	>10 – 15
C	>15 – 25
D	>25 – 35
E	>35 – 50
F[1]	>50

Source: *Highway Capacity Manual 2010 and 6th Edition*, Transportation Research Board, 2010 and 2016, respectively.

1. If the volume-to-capacity (v/c) ratio exceeds 1.0, LOS F is assigned an individual lane group for all unsignalized intersections, or minor street approach at two-way stop-controlled intersections. Overall intersection LOS is determined solely by control delay.

Appendix C: Signal Warrants

Warrants Summary

Information			
Analyst	Transpo	Intersection	Cook Rd/I-5 SB Ramps
Agency/Co		Jurisdiction	Skagit/WSDOT
Date Performed	8/9/2023	Units	U.S. Customary
Project ID	Cook Rd ICE	Time Period Analyzed	
East/West Street	Cook Rd	North/South Street	I-5 SB Ramps
File Name	Warrants2	Major Street	East-West

Project Description *Cook Rd ICE*

General				Roadway Network	
Major Street Speed (mph)	50	☑	Population < 10,000	Two Major Routes	☐
Nearest Signal (ft)	0	☐	Coordinated Signal System	Weekend Count	☐
Crashes (per year)	0	☐	Adequate Trials of Alternatives	5-yr Growth Factor	0

Geometry and Traffic	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N	0	1	0	0	1	0	0	0	0	0	1	0
Lane usage		TR			LT						LTR	
Vehicle Volume Averages (vph)	0	147	7	295	84	0	0	0	0	136	3	14
Peds (ped/h) / Gaps (gaps/h)	--	0 / 0	--	--	0 / 0	--	--	0 / 0	--	--	0 / 0	--
Delay (s/veh) / (veh-hr)	--	0 / 0	--	--	0 / 0	--	--	0 / 0	--	--	0 / 0	--

Warrant 1: Eight-Hour Vehicular Volume	☑
1 A. Minimum Vehicular Volumes (Both major approaches --and-- higher minor approach) --or--	☑
1 B. Interruption of Continuous Traffic (Both major approaches --and-- higher minor approach) --or--	☐
1 (56%) Vehicular --and-- Interruption Volumes (Both major approaches --and-- higher minor approach)	☑
Warrant 2: Four-Hour Vehicular Volume	☑
2 A. Four-Hour Vehicular Volumes (Both major approaches --and-- higher minor approach)	☑
Warrant 3: Peak Hour	☑
3 A. Peak-Hour Conditions (Minor delay --and-- minor volume --and-- total volume) --or--	☐
3 B. Peak- Hour Vehicular Volumes (Both major approaches --and-- higher minor approach)	☑
Warrant 4: Pedestrian Volume	☐
4 A. Four Hour Volumes --or--	☐
4 B. One-Hour Volumes	☐
Warrant 5: School Crossing	☐
5. Student Volumes --and--	☐
5. Gaps Same Period	☐
Warrant 6: Coordinated Signal System	☐
6. Degree of Platooning (Predominant direction or both directions)	☐
Warrant 7: Crash Experience	☐
7 A. Adequate trials of alternatives, observance and enforcement failed --and--	☐
7 B. Reported crashes susceptible to correction by signal (12-month period) --and--	☐
7 C. (56%) Volumes for Warrants 1A, 1B --or-- 4 are satisfied	☑

Warrant 8: Roadway Network	☐
8 A. Weekday Volume (Peak hour total --and-- projected warrants 1, 2 or 3) --or--	☐
8 B. Weekend Volume (Five hours total)	☐
Warrant 9: Grade Crossing	☐
9 A. Grade Crossing within 140 ft --and--	☐
9 B. Peak-Hour Vehicular Volumes	☐

 HCS7™ Warrants Version 7.2.1 Generated: 8/9/2023 11:36 AM

Warrants Summary

Information			
Analyst	Transpo	Intersection	Cook Rd/I-5 NB Ramps
Agency/Co		Jurisdiction	Skagit/WSDOT
Date Performed	8/9/2023	Units	U.S. Customary
Project ID	Cook Rd ICE	Time Period Analyzed	
East/West Street	Cook Rd	North/South Street	I-5 NB Ramps
File Name	Warrants1	Major Street	East-West

Project Description *Cook Rd ICE*

General				Roadway Network	
Major Street Speed (mph)	50	☑	Population < 10,000	Two Major Routes	☐
Nearest Signal (ft)	250	☐	Coordinated Signal System	Weekend Count	☐
Crashes (per year)	0	☐	Adequate Trials of Alternatives	5-yr Growth Factor	0

Geometry and Traffic	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N	0	1	0	0	1	0	0	1	0	0	0	0
Lane usage		LT			TR			LTR				
Vehicle Volume Averages (vph)	25	254	0	0	372	195	3	0	282	0	0	0
Peds (ped/h) / Gaps (gaps/h)	--	0 / 0	--	--	0 / 0	--	--	0 / 0	--	--	0 / 0	--
Delay (s/veh) / (veh-hr)	--	0 / 0	--	--	0 / 0	--	--	0 / 0	--	--	0 / 0	--

Warrant 1: Eight-Hour Vehicular Volume	☑
1 A. Minimum Vehicular Volumes (Both major approaches --and-- higher minor approach) --or--	☑
1 B. Interruption of Continuous Traffic (Both major approaches --and-- higher minor approach) --or--	☑
1 (56%) Vehicular --and-- Interruption Volumes (Both major approaches --and-- higher minor approach)	☑
Warrant 2: Four-Hour Vehicular Volume	☑
2 A. Four-Hour Vehicular Volumes (Both major approaches --and-- higher minor approach)	☑
Warrant 3: Peak Hour	☑
3 A. Peak-Hour Conditions (Minor delay --and-- minor volume --and-- total volume) --or--	☐
3 B. Peak- Hour Vehicular Volumes (Both major approaches --and-- higher minor approach)	☑
Warrant 4: Pedestrian Volume	☐
4 A. Four Hour Volumes --or--	☐
4 B. One-Hour Volumes	☐
Warrant 5: School Crossing	☐
5. Student Volumes --and--	☐
5. Gaps Same Period	☐
Warrant 6: Coordinated Signal System	☐
6. Degree of Platooning (Predominant direction or both directions)	☐
Warrant 7: Crash Experience	☐
7 A. Adequate trials of alternatives, observance and enforcement failed --and--	☐
7 B. Reported crashes susceptible to correction by signal (12-month period) --and--	☐
7 C. (56%) Volumes for Warrants 1A, 1B --or-- 4 are satisfied	☑

Warrant 8: Roadway Network	☐
8 A. Weekday Volume (Peak hour total --and-- projected warrants 1, 2 or 3) --or--	☐
8 B. Weekend Volume (Five hours total)	☐
Warrant 9: Grade Crossing	☐
9 A. Grade Crossing within 140 ft --and--	☐
9 B. Peak-Hour Vehicular Volumes	☐

 HCS7™ Warrants Version 7.2.1 Generated: 8/9/2023 11:03 AM

Appendix D: LOS Worksheets

1: I-5 SB Ramp & Cook Road Performance by movement

Movement	EBT	EBR	WBL	WBT	SBL2	SBL	SBR	All
Denied Del/Veh (s)	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.1
Total Del/Veh (s)	0.7	0.1	5.6	5.0	75.7	61.3	54.9	21.8

2: I-5 NB Ramp & Cook Road Performance by movement

Movement	EBL	EBT	WBT	WBR	NBT	NBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.3	0.2	0.1
Total Del/Veh (s)	22.4	2.9	4.8	3.0	39.5	14.5	5.9

3: Old Highway 99 Road & Cook Road Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.2	0.2	0.2	0.0	0.0	0.0	1.0	0.3	0.3	2.7	0.6	2.7
Total Del/Veh (s)	30.5	23.2	16.9	20.0	10.5	6.2	31.3	32.2	16.4	27.7	34.4	19.2

3: Old Highway 99 Road & Cook Road Performance by movement

Movement	All
Denied Del/Veh (s)	0.5
Total Del/Veh (s)	19.7

12: Cook Road Performance by movement

Movement	EBT	WBT	All
Denied Del/Veh (s)	0.0	0.6	0.4
Total Del/Veh (s)	1.5	34.5	21.6

Total Network Performance

Denied Del/Veh (s)	0.8
Total Del/Veh (s)	48.3

Intersection: 1: I-5 SB Ramp & Cook Road

Movement	WB	SB
Directions Served	LT	<LR
Maximum Queue (ft)	180	411
Average Queue (ft)	56	190
95th Queue (ft)	132	383
Link Distance (ft)	475	1700
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 2: I-5 NB Ramp & Cook Road

Movement	EB	WB	NB
Directions Served	LT	TR	LTR
Maximum Queue (ft)	150	21	216
Average Queue (ft)	16	1	90
95th Queue (ft)	82	20	182
Link Distance (ft)	475	266	2774
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 3: Old Highway 99 Road & Cook Road

Movement	EB	EB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	T	R
Maximum Queue (ft)	150	284	75	108	100	287	109	305	120
Average Queue (ft)	61	196	47	75	69	96	46	124	83
95th Queue (ft)	139	311	80	94	116	216	103	261	140
Link Distance (ft)		266	67	67		2703		1578	
Upstream Blk Time (%)		5	7	41					
Queuing Penalty (veh)		24	25	148					
Storage Bay Dist (ft)	125				75		85		95
Storage Blk Time (%)	1	22			13	11	2	13	6
Queuing Penalty (veh)	2	16			17	12	6	29	11

1: I-5 SB Ramp & Cook Road Performance by movement

Movement	EBT	EBR	WBL	WBT	SBL2	SBL	SBR	All
Denied Del/Veh (s)	0.2	0.2	0.0	0.0	0.2	0.2	0.2	0.1
Total Del/Veh (s)	0.7	0.2	6.0	5.4	42.9	43.5	30.8	13.0

2: I-5 NB Ramp & Cook Road Performance by movement

Movement	EBL	EBT	WBT	WBR	NBL	NBR	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.1	0.3	0.3	0.1
Total Del/Veh (s)	25.9	11.7	5.1	3.1	72.7	76.0	24.8

3: Old Highway 99 Road & Cook Road Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.1	0.1	0.3	0.0	0.0	0.5	1.1	0.4	0.4	2.6	0.6	2.7
Total Del/Veh (s)	46.7	26.2	20.1	26.6	13.5	8.4	152.6	155.1	141.0	36.7	30.7	17.0

3: Old Highway 99 Road & Cook Road Performance by movement

Movement	All
Denied Del/Veh (s)	0.5
Total Del/Veh (s)	52.5

12: Cook Road Performance by movement

Movement	EBT	WBT	All
Denied Del/Veh (s)	0.0	0.5	0.2
Total Del/Veh (s)	1.5	47.9	23.4

Total Network Performance

Denied Del/Veh (s)	0.7
Total Del/Veh (s)	86.4

Intersection: 1: I-5 SB Ramp & Cook Road

Movement	EB	WB	SB
Directions Served	TR	LT	<LR
Maximum Queue (ft)	3	164	308
Average Queue (ft)	0	54	123
95th Queue (ft)	3	121	263
Link Distance (ft)	581	475	1700
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 2: I-5 NB Ramp & Cook Road

Movement	EB	WB	NB
Directions Served	LT	TR	LTR
Maximum Queue (ft)	317	25	678
Average Queue (ft)	88	1	304
95th Queue (ft)	225	11	691
Link Distance (ft)	475	266	2774
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 3: Old Highway 99 Road & Cook Road

Movement	EB	EB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	T	R
Maximum Queue (ft)	150	286	67	125	100	1135	109	200	119
Average Queue (ft)	100	255	30	78	66	699	50	69	66
95th Queue (ft)	178	333	64	103	125	1431	98	155	122
Link Distance (ft)		266	67	67		2703		1578	
Upstream Blk Time (%)		15	2	50					
Queuing Penalty (veh)		108	6	159					
Storage Bay Dist (ft)	125				75		85		95
Storage Blk Time (%)	4	32			6	66	3	5	4
Queuing Penalty (veh)	24	42			24	63	7	9	7

1: I-5 SB Ramp & Cook Road Performance by movement

Movement	EBT	EBR	WBL	WBT	SBL2	SBL	SBR	All
Denied Del/Veh (s)	0.2	0.1	0.1	0.1	30.0	37.4	34.5	7.1
Total Del/Veh (s)	0.7	0.1	6.1	5.7	475.1	473.4	415.4	111.1

2: I-5 NB Ramp & Cook Road Performance by movement

Movement	EBL	EBT	WBT	WBR	NBT	NBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.3	0.2	0.1
Total Del/Veh (s)	28.4	5.5	4.9	3.0	38.2	21.8	7.7

3: Old Highway 99 Road & Cook Road Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.8	0.3	0.4	0.0	0.0	0.0	1.0	0.3	0.3	2.6	0.9	2.6
Total Del/Veh (s)	48.2	31.0	23.6	27.6	13.0	8.5	41.9	33.2	18.1	51.7	55.4	41.5

3: Old Highway 99 Road & Cook Road Performance by movement

Movement	All
Denied Del/Veh (s)	0.7
Total Del/Veh (s)	30.2

12: Cook Road Performance by movement

Movement	EBT	WBT	All
Denied Del/Veh (s)	0.0	1.2	0.8
Total Del/Veh (s)	1.6	192.4	123.8

Total Network Performance

Denied Del/Veh (s)	4.6
Total Del/Veh (s)	155.9

Intersection: 1: I-5 SB Ramp & Cook Road

Movement	EB	WB	SB
Directions Served	TR	LT	<LR
Maximum Queue (ft)	7	206	1318
Average Queue (ft)	0	67	905
95th Queue (ft)	5	149	1821
Link Distance (ft)	581	475	1700
Upstream Blk Time (%)			15
Queuing Penalty (veh)			0
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 2: I-5 NB Ramp & Cook Road

Movement	EB	WB	NB
Directions Served	LT	TR	LTR
Maximum Queue (ft)	184	15	302
Average Queue (ft)	35	1	110
95th Queue (ft)	117	7	232
Link Distance (ft)	475	266	2774
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 3: Old Highway 99 Road & Cook Road

Movement	EB	EB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	T	R
Maximum Queue (ft)	150	285	83	126	100	284	109	684	120
Average Queue (ft)	89	234	60	84	77	114	50	341	106
95th Queue (ft)	170	328	88	112	118	247	118	632	147
Link Distance (ft)		266	67	67		2703		1578	
Upstream Blk Time (%)		10	21	55					
Queuing Penalty (veh)		59	91	236					
Storage Bay Dist (ft)	125				75		85		95
Storage Blk Time (%)	1	32			19	14	4	35	18
Queuing Penalty (veh)	7	32			25	15	19	106	52

1: I-5 SB Ramp & Cook Road Performance by movement

Movement	EBT	EBR	WBL	WBT	SBL2	SBL	SBR	All
Denied Del/Veh (s)	0.3	0.2	0.0	0.0	0.2	0.1	0.2	0.2
Total Del/Veh (s)	1.3	0.4	8.5	7.9	111.0	103.2	97.7	25.4

2: I-5 NB Ramp & Cook Road Performance by movement

Movement	EBL	EBT	WBT	WBR	NBL	NBR	All
Denied Del/Veh (s)	0.4	0.3	0.1	0.1	15.8	29.7	6.8
Total Del/Veh (s)	40.2	27.9	5.2	3.3	579.1	597.8	150.1

3: Old Highway 99 Road & Cook Road Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	180.7	198.7	190.9	2.7	0.6	2.7
Total Del/Veh (s)	59.8	29.5	23.8	26.8	15.5	9.2	544.6	547.6	540.9	43.8	33.3	16.9

3: Old Highway 99 Road & Cook Road Performance by movement

Movement	All
Denied Del/Veh (s)	51.2
Total Del/Veh (s)	155.5

12: Cook Road Performance by movement

Movement	EBT	WBT	All
Denied Del/Veh (s)	0.0	0.6	0.3
Total Del/Veh (s)	1.4	138.5	67.9

Total Network Performance

Denied Del/Veh (s)	51.0
Total Del/Veh (s)	282.5

Intersection: 1: I-5 SB Ramp & Cook Road

Movement	EB	WB	SB
Directions Served	TR	LT	<LR
Maximum Queue (ft)	55	226	499
Average Queue (ft)	4	85	221
95th Queue (ft)	31	169	471
Link Distance (ft)	581	475	1700
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 2: I-5 NB Ramp & Cook Road

Movement	EB	WB	NB
Directions Served	LT	TR	LTR
Maximum Queue (ft)	468	30	2526
Average Queue (ft)	213	2	1748
95th Queue (ft)	453	13	3107
Link Distance (ft)	475	266	2774
Upstream Blk Time (%)	1		18
Queuing Penalty (veh)	6		0
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 3: Old Highway 99 Road & Cook Road

Movement	EB	EB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	T	R
Maximum Queue (ft)	150	288	72	125	100	2759	109	251	120
Average Queue (ft)	132	274	33	83	62	2415	55	86	74
95th Queue (ft)	176	307	67	111	127	3285	109	195	127
Link Distance (ft)		266	67	67		2703		1578	
Upstream Blk Time (%)		24	3	58		62			
Queuing Penalty (veh)		218	10	196		0			
Storage Bay Dist (ft)	125				75		85		95
Storage Blk Time (%)	18	35			6	73	5	6	4
Queuing Penalty (veh)	120	75			31	70	14	14	7

1: I-5 SB Ramp & Cook Road Performance by movement

Movement	EBT	EBR	WBL	WBT	SBL2	SBL	SBR	All
Denied Del/Veh (s)	0.1	0.2	0.2	0.1	0.2	0.4	0.2	0.2
Total Del/Veh (s)	5.3	2.3	13.2	11.8	34.4	32.2	25.0	17.2

2: I-5 NB Ramp & Cook Road Performance by movement

Movement	EBL	EBT	WBT	WBR	NBT	NBR	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.1	0.1	0.1	0.1
Total Del/Veh (s)	27.5	4.8	7.1	4.5	54.2	7.1	6.3

3: Old Highway 99 Road & Cook Road Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.1	0.0	0.0	0.0	0.0	0.0	2.1	0.3	0.4	3.3	0.7	3.3
Total Del/Veh (s)	23.6	13.5	5.1	13.6	8.0	4.3	53.9	49.5	23.1	42.1	48.1	22.4

3: Old Highway 99 Road & Cook Road Performance by movement

Movement	All
Denied Del/Veh (s)	0.6
Total Del/Veh (s)	19.5

12: Cook Road Performance by movement

Movement	EBT	WBT	All
Denied Del/Veh (s)	0.0	0.0	0.0
Total Del/Veh (s)	1.0	16.0	10.0

Total Network Performance

Denied Del/Veh (s)	0.9
Total Del/Veh (s)	41.9

Intersection: 1: I-5 SB Ramp & Cook Road

Movement	EB	WB	SB
Directions Served	TR	LT	<LR
Maximum Queue (ft)	92	402	320
Average Queue (ft)	22	170	141
95th Queue (ft)	63	322	256
Link Distance (ft)	581	475	1700
Upstream Blk Time (%)		0	
Queuing Penalty (veh)		1	
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 2: I-5 NB Ramp & Cook Road

Movement	EB	WB	NB	NB
Directions Served	LT	TR	LTR	R
Maximum Queue (ft)	189	254	114	81
Average Queue (ft)	33	80	53	36
95th Queue (ft)	113	209	94	68
Link Distance (ft)	475	251	2711	2711
Upstream Blk Time (%)		0		
Queuing Penalty (veh)		3		
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 3: Old Highway 99 Road & Cook Road

Movement	EB	EB	EB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	L	TR	L	TR	L	T	R
Maximum Queue (ft)	149	233	217	71	94	100	354	109	355	120
Average Queue (ft)	57	100	58	38	68	79	131	47	146	87
95th Queue (ft)	127	194	147	72	85	118	285	105	291	141
Link Distance (ft)		251	251	66	66		2642		1578	
Upstream Blk Time (%)		0	0	4	30					
Queuing Penalty (veh)		1	0	14	107					
Storage Bay Dist (ft)	125					75		85		95
Storage Blk Time (%)	0	6				24	17	3	16	7
Queuing Penalty (veh)	0	4				30	19	9	36	12

1: I-5 SB Ramp & Cook Road Performance by movement

Movement	EBT	EBR	WBL	WBT	SBL2	SBL	SBR	All
Denied Del/Veh (s)	0.2	0.2	0.0	0.0	0.2	0.2	0.3	0.1
Total Del/Veh (s)	4.9	2.7	14.4	13.9	33.6	28.9	25.2	16.6

2: I-5 NB Ramp & Cook Road Performance by movement

Movement	EBL	EBT	WBT	WBR	NBL	NBR	All
Denied Del/Veh (s)	0.0	0.0	0.2	0.1	0.1	0.1	0.1
Total Del/Veh (s)	35.2	17.8	9.3	6.1	36.6	9.4	11.4

3: Old Highway 99 Road & Cook Road Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.5	0.5	3.3	0.6	3.4
Total Del/Veh (s)	40.6	17.6	7.2	19.6	13.1	7.6	56.6	59.6	47.5	33.4	33.3	17.9

3: Old Highway 99 Road & Cook Road Performance by movement

Movement	All
Denied Del/Veh (s)	0.5
Total Del/Veh (s)	26.9

12: Cook Road Performance by movement

Movement	EBT	WBT	All
Denied Del/Veh (s)	0.0	0.0	0.0
Total Del/Veh (s)	1.1	42.5	20.6

Total Network Performance

Denied Del/Veh (s)	0.8
Total Del/Veh (s)	56.4

Intersection: 1: I-5 SB Ramp & Cook Road

Movement	EB	WB	SB
Directions Served	TR	LT	<LR
Maximum Queue (ft)	107	322	287
Average Queue (ft)	35	137	121
95th Queue (ft)	81	261	226
Link Distance (ft)	581	475	1700
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 2: I-5 NB Ramp & Cook Road

Movement	EB	WB	NB	NB
Directions Served	LT	TR	LTR	R
Maximum Queue (ft)	385	260	178	147
Average Queue (ft)	126	101	74	44
95th Queue (ft)	301	249	133	94
Link Distance (ft)	475	251	2711	2711
Upstream Blk Time (%)	1	1		
Queuing Penalty (veh)	2	8		
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 3: Old Highway 99 Road & Cook Road

Movement	EB	EB	EB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	L	TR	L	TR	L	T	R
Maximum Queue (ft)	150	277	256	67	108	100	594	104	209	118
Average Queue (ft)	94	158	112	22	74	59	308	40	67	61
95th Queue (ft)	166	269	237	53	96	117	527	86	156	114
Link Distance (ft)		251	251	66	66		2642		1578	
Upstream Blk Time (%)		1	0	1	49					
Queuing Penalty (veh)		4	1	4	157					
Storage Bay Dist (ft)	125					75		85		95
Storage Blk Time (%)	3	11				6	52	1	5	4
Queuing Penalty (veh)	8	15				24	49	3	9	6

1: I-5 SB Ramp & Cook Road Performance by movement

Movement	EBT	EBR	WBL	WBT	SBL2	SBL	SBR	All
Denied Del/Veh (s)	0.2	0.1	0.3	0.2	0.3	0.2	0.2	0.3
Total Del/Veh (s)	5.9	1.9	16.7	16.0	56.6	50.3	46.3	24.1

2: I-5 NB Ramp & Cook Road Performance by movement

Movement	EBL	EBT	WBT	WBR	NBT	NBR	All
Denied Del/Veh (s)	0.0	0.1	0.1	0.1	0.1	0.1	0.1
Total Del/Veh (s)	36.8	8.6	7.7	5.0	51.0	8.8	7.9

3: Old Highway 99 Road & Cook Road Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.1	0.0	0.0	0.0	0.0	0.0	2.2	0.4	0.4	4.1	2.4	4.2
Total Del/Veh (s)	40.5	18.6	9.1	18.3	10.3	6.8	110.4	85.3	61.4	114.9	133.3	110.7

3: Old Highway 99 Road & Cook Road Performance by movement

Movement	All
Denied Del/Veh (s)	1.0
Total Del/Veh (s)	48.8

12: Cook Road Performance by movement

Movement	EBT	WBT	All
Denied Del/Veh (s)	0.0	0.0	0.0
Total Del/Veh (s)	1.2	51.9	32.6

Total Network Performance

Denied Del/Veh (s)	1.4
Total Del/Veh (s)	94.7

Intersection: 1: I-5 SB Ramp & Cook Road

Movement	EB	WB	SB
Directions Served	TR	LT	<LR
Maximum Queue (ft)	127	440	445
Average Queue (ft)	29	223	202
95th Queue (ft)	83	398	371
Link Distance (ft)	581	475	1700
Upstream Blk Time (%)		0	
Queuing Penalty (veh)		1	
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 2: I-5 NB Ramp & Cook Road

Movement	EB	WB	NB	NB
Directions Served	LT	TR	LTR	R
Maximum Queue (ft)	307	258	121	82
Average Queue (ft)	57	94	58	37
95th Queue (ft)	204	251	101	70
Link Distance (ft)	475	251	2711	2711
Upstream Blk Time (%)	0	1		
Queuing Penalty (veh)	1	7		
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 3: Old Highway 99 Road & Cook Road

Movement	EB	EB	EB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	L	TR	L	TR	L	T	R
Maximum Queue (ft)	149	262	244	76	116	100	553	110	1124	120
Average Queue (ft)	72	141	100	52	74	85	229	47	648	106
95th Queue (ft)	144	243	217	86	94	119	528	119	1380	147
Link Distance (ft)		251	251	66	66		2642		1578	
Upstream Blk Time (%)		1	0	13	47				5	
Queuing Penalty (veh)		2	1	55	200				0	
Storage Bay Dist (ft)	125					75		85		95
Storage Blk Time (%)	1	9				44	26	3	46	23
Queuing Penalty (veh)	2	9				59	29	11	141	63

1: I-5 SB Ramp & Cook Road Performance by movement

Movement	EBT	EBR	WBL	WBT	SBL2	SBL	SBR	All
Denied Del/Veh (s)	0.3	0.3	0.0	0.0	0.2	0.2	0.2	0.2
Total Del/Veh (s)	9.7	7.2	22.4	21.2	47.7	41.6	42.7	22.7

2: I-5 NB Ramp & Cook Road Performance by movement

Movement	EBL	EBT	WBT	WBR	NBL	NBR	All
Denied Del/Veh (s)	0.3	0.9	0.1	0.1	0.1	0.1	0.4
Total Del/Veh (s)	52.4	35.0	11.7	8.5	46.6	17.5	21.0

3: Old Highway 99 Road & Cook Road Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.6	0.7	3.2	0.7	3.3
Total Del/Veh (s)	61.2	24.0	11.0	32.2	17.8	10.6	258.2	261.7	248.6	38.1	33.1	17.2

3: Old Highway 99 Road & Cook Road Performance by movement

Movement	All
Denied Del/Veh (s)	0.6
Total Del/Veh (s)	87.9

12: Cook Road Performance by movement

Movement	EBT	WBT	All
Denied Del/Veh (s)	0.0	0.0	0.0
Total Del/Veh (s)	1.3	136.3	56.5

Total Network Performance

Denied Del/Veh (s)	1.2
Total Del/Veh (s)	214.5

Intersection: 1: I-5 SB Ramp & Cook Road

Movement	EB	WB	SB
Directions Served	TR	LT	<LR
Maximum Queue (ft)	238	370	356
Average Queue (ft)	79	189	147
95th Queue (ft)	192	331	306
Link Distance (ft)	581	475	1700
Upstream Blk Time (%)		0	
Queuing Penalty (veh)		1	
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 2: I-5 NB Ramp & Cook Road

Movement	EB	WB	NB	NB
Directions Served	LT	TR	LTR	R
Maximum Queue (ft)	491	261	221	169
Average Queue (ft)	267	156	99	54
95th Queue (ft)	512	318	184	122
Link Distance (ft)	475	251	2711	2711
Upstream Blk Time (%)	5	3		
Queuing Penalty (veh)	25	23		
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 3: Old Highway 99 Road & Cook Road

Movement	EB	EB	EB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	L	TR	L	TR	L	T	R
Maximum Queue (ft)	150	290	285	70	113	100	1980	109	250	119
Average Queue (ft)	139	229	186	32	77	60	1364	47	77	67
95th Queue (ft)	174	315	316	69	99	123	2332	98	183	123
Link Distance (ft)		251	251	66	66		2642		1578	
Upstream Blk Time (%)		9	2	5	64		0			
Queuing Penalty (veh)		43	9	16	216		0			
Storage Bay Dist (ft)	125					75		85		95
Storage Blk Time (%)	27	19				5	66	4	5	4
Queuing Penalty (veh)	78	41				29	62	10	12	7

1: I-5 SB Ramp & Cook Road Performance by movement

Movement	EBT	EBR	WBL	WBT	SBL2	SBL	SBR	All
Denied Del/Veh (s)	0.2	0.2	0.1	0.2	0.2	0.3	0.2	0.2
Total Del/Veh (s)	5.1	2.2	13.3	11.6	33.8	41.2	26.7	17.3

2: I-5 NB Ramp & Cook Road Performance by movement

Movement	EBL	EBT	WBT	WBR	NBT	NBR	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.1	0.2	0.1	0.1
Total Del/Veh (s)	23.6	4.8	6.8	4.2	54.3	7.1	6.2

3: Old Highway 99 Road & Cook Road Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	3.4	0.6	3.4	3.2	0.7	3.3
Total Del/Veh (s)	25.0	13.5	5.2	13.3	7.5	3.4	52.9	48.7	6.5	40.2	48.2	22.2

3: Old Highway 99 Road & Cook Road Performance by movement

Movement	All
Denied Del/Veh (s)	0.8
Total Del/Veh (s)	18.7

12: Cook Road Performance by movement

Movement	EBT	WBT	All
Denied Del/Veh (s)	0.0	0.0	0.0
Total Del/Veh (s)	1.0	16.8	10.4

Total Network Performance

Denied Del/Veh (s)	1.1
Total Del/Veh (s)	41.2

Intersection: 1: I-5 SB Ramp & Cook Road

Movement	EB	WB	SB
Directions Served	TR	LT	<LR
Maximum Queue (ft)	89	396	291
Average Queue (ft)	21	170	136
95th Queue (ft)	62	327	240
Link Distance (ft)	581	475	1700
Upstream Blk Time (%)		0	
Queuing Penalty (veh)		0	
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 2: I-5 NB Ramp & Cook Road

Movement	EB	WB	NB	NB
Directions Served	LT	TR	LTR	R
Maximum Queue (ft)	176	236	114	84
Average Queue (ft)	39	76	53	35
95th Queue (ft)	125	195	92	68
Link Distance (ft)	475	250	1722	1722
Upstream Blk Time (%)		0		
Queuing Penalty (veh)		1		
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 3: Old Highway 99 Road & Cook Road

Movement	EB	EB	EB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	L	TR	L	T	R	L	T	R
Maximum Queue (ft)	143	249	226	70	74	100	244	135	109	393	120
Average Queue (ft)	54	98	64	36	64	75	90	34	51	141	83
95th Queue (ft)	121	202	164	69	75	118	204	93	110	303	137
Link Distance (ft)		250	250	53	53		1639			1578	
Upstream Blk Time (%)		0	0	6	30						
Queuing Penalty (veh)		0	0	22	109						
Storage Bay Dist (ft)	125					75		200	85		95
Storage Blk Time (%)	0	6				22	8	0	3	15	7
Queuing Penalty (veh)	0	4				28	14	0	10	35	12

1: I-5 SB Ramp & Cook Road Performance by movement

Movement	EBT	EBR	WBL	WBT	SBL2	SBL	SBR	All
Denied Del/Veh (s)	0.2	0.3	0.0	0.1	0.2	0.3	0.2	0.1
Total Del/Veh (s)	4.6	3.4	12.5	12.2	31.1	26.8	19.1	14.6

2: I-5 NB Ramp & Cook Road Performance by movement

Movement	EBL	EBT	WBT	WBR	NBL	NBR	All
Denied Del/Veh (s)	0.0	0.1	0.2	0.2	0.2	0.1	0.2
Total Del/Veh (s)	34.1	14.4	8.9	6.0	40.9	8.9	10.3

3: Old Highway 99 Road & Cook Road Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	3.1	0.8	3.1	3.4	0.6	3.3
Total Del/Veh (s)	30.0	12.3	4.6	13.9	9.3	4.9	46.3	48.2	9.7	50.4	45.9	19.8

3: Old Highway 99 Road & Cook Road Performance by movement

Movement	All
Denied Del/Veh (s)	0.8
Total Del/Veh (s)	20.1

12: Cook Road Performance by movement

Movement	EBT	WBT	All
Denied Del/Veh (s)	0.0	0.0	0.0
Total Del/Veh (s)	1.0	21.9	10.8

Total Network Performance

Denied Del/Veh (s)	1.1
Total Del/Veh (s)	43.4

Intersection: 1: I-5 SB Ramp & Cook Road

Movement	EB	WB	SB
Directions Served	TR	LT	<LR
Maximum Queue (ft)	114	318	249
Average Queue (ft)	35	117	112
95th Queue (ft)	84	227	210
Link Distance (ft)	581	475	1700
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 2: I-5 NB Ramp & Cook Road

Movement	EB	WB	NB	NB
Directions Served	LT	TR	LTR	R
Maximum Queue (ft)	340	259	157	131
Average Queue (ft)	109	108	72	40
95th Queue (ft)	256	255	127	84
Link Distance (ft)	475	250	1722	1722
Upstream Blk Time (%)	0	1		
Queuing Penalty (veh)	0	7		
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 3: Old Highway 99 Road & Cook Road

Movement	EB	EB	EB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	L	TR	L	T	R	L	T	R
Maximum Queue (ft)	149	257	233	58	92	100	459	225	109	256	119
Average Queue (ft)	79	115	67	23	66	67	178	74	53	89	69
95th Queue (ft)	148	215	173	52	79	122	338	187	107	197	126
Link Distance (ft)		250	250	53	53		1639			1578	
Upstream Blk Time (%)		0	0	2	35						
Queuing Penalty (veh)		1	1	6	112						
Storage Bay Dist (ft)	125					75		200	85		95
Storage Blk Time (%)	2	6				8	37	0	5	9	4
Queuing Penalty (veh)	5	7				33	100	0	11	18	6

1: I-5 SB Ramp & Cook Road Performance by movement

Movement	EBT	EBR	WBL	WBT	SBL2	SBL	SBR	All
Denied Del/Veh (s)	0.2	0.1	0.4	0.3	0.3	0.2	0.2	0.3
Total Del/Veh (s)	5.3	2.4	17.1	16.5	53.5	61.9	41.9	23.5

2: I-5 NB Ramp & Cook Road Performance by movement

Movement	EBL	EBT	WBT	WBR	NBT	NBR	All
Denied Del/Veh (s)	0.0	0.1	0.1	0.1	0.2	0.1	0.1
Total Del/Veh (s)	44.0	10.8	7.6	5.1	62.4	9.0	8.4

3: Old Highway 99 Road & Cook Road Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	3.4	0.6	3.5	3.2	1.1	3.2
Total Del/Veh (s)	50.6	19.9	9.2	18.4	9.7	5.3	96.7	73.5	17.5	123.7	141.2	120.7

3: Old Highway 99 Road & Cook Road Performance by movement

Movement	All
Denied Del/Veh (s)	0.9
Total Del/Veh (s)	49.7

12: Cook Road Performance by movement

Movement	EBT	WBT	All
Denied Del/Veh (s)	0.0	0.0	0.0
Total Del/Veh (s)	1.3	63.6	40.0

Total Network Performance

Denied Del/Veh (s)	1.3
Total Del/Veh (s)	104.3

Intersection: 1: I-5 SB Ramp & Cook Road

Movement	EB	WB	SB
Directions Served	TR	LT	<LR
Maximum Queue (ft)	107	461	411
Average Queue (ft)	27	237	195
95th Queue (ft)	74	418	348
Link Distance (ft)	581	475	1700
Upstream Blk Time (%)		0	
Queuing Penalty (veh)		2	
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 2: I-5 NB Ramp & Cook Road

Movement	EB	WB	NB	NB
Directions Served	LT	TR	LTR	R
Maximum Queue (ft)	343	258	136	93
Average Queue (ft)	72	98	62	36
95th Queue (ft)	243	254	113	69
Link Distance (ft)	475	250	1722	1722
Upstream Blk Time (%)	0	1		
Queuing Penalty (veh)	1	6		
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 3: Old Highway 99 Road & Cook Road

Movement	EB	EB	EB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	L	TR	L	T	R	L	T	R
Maximum Queue (ft)	150	273	255	74	95	100	430	224	110	1255	120
Average Queue (ft)	88	153	108	50	68	83	152	62	43	712	109
95th Queue (ft)	165	260	227	83	83	118	394	186	113	1327	146
Link Distance (ft)		250	250	53	53		1639			1578	
Upstream Blk Time (%)		1	0	20	47					1	
Queuing Penalty (veh)		3	1	84	202					0	
Storage Bay Dist (ft)	125					75		200	85		95
Storage Blk Time (%)	5	11				44	11	0	2	51	24
Queuing Penalty (veh)	9	11				59	20	0	11	156	67

1: I-5 SB Ramp & Cook Road Performance by movement

Movement	EBT	EBR	WBL	WBT	SBL2	SBL	SBR	All
Denied Del/Veh (s)	0.4	0.4	0.1	0.1	0.2	0.2	0.2	0.2
Total Del/Veh (s)	10.0	8.4	26.2	25.8	45.9	45.2	33.1	24.3

2: I-5 NB Ramp & Cook Road Performance by movement

Movement	EBL	EBT	WBT	WBR	NBL	NBR	All
Denied Del/Veh (s)	0.0	0.3	0.1	0.2	0.2	0.1	0.2
Total Del/Veh (s)	50.1	30.9	10.8	7.5	33.9	13.9	18.0

3: Old Highway 99 Road & Cook Road Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	3.1	1.0	3.0	3.3	0.7	3.3
Total Del/Veh (s)	46.4	16.8	7.3	18.5	12.7	7.6	90.5	100.1	50.0	57.8	44.7	22.2

3: Old Highway 99 Road & Cook Road Performance by movement

Movement	All
Denied Del/Veh (s)	0.8
Total Del/Veh (s)	36.7

12: Cook Road Performance by movement

Movement	EBT	WBT	All
Denied Del/Veh (s)	0.0	0.0	0.0
Total Del/Veh (s)	1.3	79.2	35.6

Total Network Performance

Denied Del/Veh (s)	1.2
Total Del/Veh (s)	90.8

Intersection: 1: I-5 SB Ramp & Cook Road

Movement	EB	WB	SB
Directions Served	TR	LT	<LR
Maximum Queue (ft)	285	438	294
Average Queue (ft)	82	218	151
95th Queue (ft)	221	391	266
Link Distance (ft)	581	475	1700
Upstream Blk Time (%)	0	1	
Queuing Penalty (veh)	0	4	
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 2: I-5 NB Ramp & Cook Road

Movement	EB	WB	NB	NB
Directions Served	LT	TR	LTR	R
Maximum Queue (ft)	480	262	206	173
Average Queue (ft)	257	145	92	51
95th Queue (ft)	505	308	161	115
Link Distance (ft)	475	250	1722	1722
Upstream Blk Time (%)	3	2		
Queuing Penalty (veh)	19	17		
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 3: Old Highway 99 Road & Cook Road

Movement	EB	EB	EB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	L	TR	L	T	R	L	T	R
Maximum Queue (ft)	150	286	265	68	94	100	863	225	109	257	120
Average Queue (ft)	125	186	137	29	68	64	475	157	55	89	73
95th Queue (ft)	178	310	283	61	81	126	906	292	110	209	128
Link Distance (ft)		250	250	53	53		1639			1578	
Upstream Blk Time (%)		4	1	4	52						
Queuing Penalty (veh)		17	3	14	175						
Storage Bay Dist (ft)	125					75		200	85		95
Storage Blk Time (%)	16	12				8	63	0	6	8	6
Queuing Penalty (veh)	47	26				44	195	1	16	19	11

1: I-5 SB Ramp & Cook Road Performance by movement

Movement	EBT	EBR	WBL	WBT	SBL	SBT	SBR	All
Denied Del/Veh (s)	0.2	0.2	0.2	0.1	0.2	0.4	0.3	0.2
Total Del/Veh (s)	5.0	2.5	14.2	12.8	38.8	31.8	27.5	18.9

2: I-5 NB Ramp & Cook Road Performance by movement

Movement	EBL	EBT	WBT	WBR	NBT	NBR	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.1	0.2	0.1	0.1
Total Del/Veh (s)	34.8	6.0	8.1	5.2	66.5	7.7	7.3

3: Old Highway 99 Road & Cook Road Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	3.4	0.6	3.4	3.4	0.7	3.3
Total Del/Veh (s)	29.2	14.8	6.5	13.8	8.5	4.7	57.9	43.6	4.6	42.8	50.4	25.1

3: Old Highway 99 Road & Cook Road Performance by movement

Movement	All
Denied Del/Veh (s)	0.8
Total Del/Veh (s)	20.2

12: Cook Road Performance by movement

Movement	EBT	WBT	All
Denied Del/Veh (s)	0.0	0.0	0.0
Total Del/Veh (s)	1.1	22.8	14.1

Total Network Performance

Denied Del/Veh (s)	1.1
Total Del/Veh (s)	46.4

Intersection: 1: I-5 SB Ramp & Cook Road

Movement	EB	WB	SB
Directions Served	TR	LT	LTR
Maximum Queue (ft)	91	401	332
Average Queue (ft)	20	181	155
95th Queue (ft)	62	346	278
Link Distance (ft)	574	474	1699
Upstream Blk Time (%)		0	
Queuing Penalty (veh)		1	
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 2: I-5 NB Ramp & Cook Road

Movement	EB	WB	NB	NB
Directions Served	LT	TR	LTR	R
Maximum Queue (ft)	238	253	129	101
Average Queue (ft)	38	84	55	37
95th Queue (ft)	150	217	96	72
Link Distance (ft)	474	250	1722	1722
Upstream Blk Time (%)		1		
Queuing Penalty (veh)		12		
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 3: Old Highway 99 Road & Cook Road

Movement	EB	EB	EB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	L	TR	L	T	R	L	T	R
Maximum Queue (ft)	147	244	222	71	89	174	277	103	109	436	120
Average Queue (ft)	60	100	68	39	66	100	70	26	51	160	85
95th Queue (ft)	128	201	162	73	79	177	185	74	114	333	143
Link Distance (ft)		250	250	53	53		1639			1578	
Upstream Blk Time (%)		0	0	7	35						
Queuing Penalty (veh)		1	0	24	127						
Storage Bay Dist (ft)	125					150		350	85		95
Storage Blk Time (%)	1	5				7	0		4	16	8
Queuing Penalty (veh)	1	4				8	1		12	38	14

1: I-5 SB Ramp & Cook Road Performance by movement

Movement	EBT	EBR	WBL	WBT	SBL	SBT	SBR	All
Denied Del/Veh (s)	0.2	0.3	0.0	0.1	0.2	0.1	0.2	0.1
Total Del/Veh (s)	5.1	2.1	14.0	13.7	38.5	43.5	28.6	17.3

2: I-5 NB Ramp & Cook Road Performance by movement

Movement	EBL	EBT	WBT	WBR	NBL	NBR	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.1	0.1	0.1	0.1
Total Del/Veh (s)	23.5	10.1	7.8	5.1	64.2	11.8	9.4

3: Old Highway 99 Road & Cook Road Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.1	0.0	3.2	0.8	3.1	3.3	0.6	3.4
Total Del/Veh (s)	36.9	15.6	6.5	15.2	10.3	5.8	39.4	42.3	6.4	37.1	41.9	18.4

3: Old Highway 99 Road & Cook Road Performance by movement

Movement	All
Denied Del/Veh (s)	0.8
Total Del/Veh (s)	19.7

12: Cook Road Performance by movement

Movement	EBT	WBT	All
Denied Del/Veh (s)	0.0	0.0	0.0
Total Del/Veh (s)	1.2	24.4	12.2

Total Network Performance

Denied Del/Veh (s)	1.1
Total Del/Veh (s)	44.1

Intersection: 1: I-5 SB Ramp & Cook Road

Movement	EB	WB	SB
Directions Served	TR	LT	LTR
Maximum Queue (ft)	130	327	281
Average Queue (ft)	36	136	128
95th Queue (ft)	93	256	234
Link Distance (ft)	574	474	1699
Upstream Blk Time (%)		0	
Queuing Penalty (veh)		0	
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 2: I-5 NB Ramp & Cook Road

Movement	EB	WB	NB	NB
Directions Served	LT	TR	LTR	R
Maximum Queue (ft)	292	243	190	165
Average Queue (ft)	95	86	83	49
95th Queue (ft)	231	200	148	109
Link Distance (ft)	474	250	1722	1722
Upstream Blk Time (%)	0	0		
Queuing Penalty (veh)	1	1		
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 3: Old Highway 99 Road & Cook Road

Movement	EB	EB	EB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	L	TR	L	T	R	L	T	R
Maximum Queue (ft)	149	270	260	62	94	174	312	144	109	263	119
Average Queue (ft)	91	153	105	22	67	70	139	45	45	77	66
95th Queue (ft)	163	264	225	52	81	153	251	87	95	186	125
Link Distance (ft)		250	250	53	53		1639			1578	
Upstream Blk Time (%)		1	0	2	40						
Queuing Penalty (veh)		3	1	6	127						
Storage Bay Dist (ft)	125					150		350	85		95
Storage Blk Time (%)	4	9				0	9	0	3	6	4
Queuing Penalty (veh)	10	12				0	23	0	6	13	7

1: I-5 SB Ramp & Cook Road Performance by movement

Movement	EBT	EBR	WBL	WBT	SBL	SBT	SBR	All
Denied Del/Veh (s)	0.2	0.1	0.3	0.3	0.2	0.2	0.2	0.3
Total Del/Veh (s)	5.0	2.1	17.0	16.5	54.2	52.9	39.2	23.3

2: I-5 NB Ramp & Cook Road Performance by movement

Movement	EBL	EBT	WBT	WBR	NBT	NBR	All
Denied Del/Veh (s)	0.1	0.0	0.1	0.1	0.1	0.1	0.1
Total Del/Veh (s)	47.4	10.0	8.5	5.4	61.0	9.7	8.9

3: Old Highway 99 Road & Cook Road Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.5	3.5	3.1	0.9	3.2
Total Del/Veh (s)	52.9	19.3	8.3	21.1	10.2	5.5	73.7	38.1	4.9	68.7	83.9	62.4

3: Old Highway 99 Road & Cook Road Performance by movement

Movement	All
Denied Del/Veh (s)	0.8
Total Del/Veh (s)	33.3

12: Cook Road Performance by movement

Movement	EBT	WBT	All
Denied Del/Veh (s)	0.0	0.0	0.0
Total Del/Veh (s)	1.2	73.1	45.3

Total Network Performance

Denied Del/Veh (s)	1.3
Total Del/Veh (s)	109.5

Intersection: 1: I-5 SB Ramp & Cook Road

Movement	EB	WB	SB
Directions Served	TR	LT	LTR
Maximum Queue (ft)	115	469	393
Average Queue (ft)	24	227	194
95th Queue (ft)	72	426	338
Link Distance (ft)	574	474	1699
Upstream Blk Time (%)		0	
Queuing Penalty (veh)		2	
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 2: I-5 NB Ramp & Cook Road

Movement	EB	WB	NB	NB
Directions Served	LT	TR	LTR	R
Maximum Queue (ft)	330	260	147	127
Average Queue (ft)	66	114	63	41
95th Queue (ft)	216	237	116	84
Link Distance (ft)	474	250	1722	1722
Upstream Blk Time (%)	0	1		
Queuing Penalty (veh)	0	9		
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 3: Old Highway 99 Road & Cook Road

Movement	EB	EB	EB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	L	TR	L	T	R	L	T	R
Maximum Queue (ft)	154	261	249	74	91	174	300	103	109	815	120
Average Queue (ft)	87	134	95	51	67	107	80	29	46	431	107
95th Queue (ft)	160	241	211	83	79	185	218	87	117	828	146
Link Distance (ft)		250	250	53	53		1639			1578	
Upstream Blk Time (%)		1	0	21	50						
Queuing Penalty (veh)		4	1	91	213						
Storage Bay Dist (ft)	125					150		350	85		95
Storage Blk Time (%)	6	9				11	1		3	41	19
Queuing Penalty (veh)	12	9				15	1		14	125	54

1: I-5 SB Ramp & Cook Road Performance by movement

Movement	EBT	EBR	WBL	WBT	SBL	SBT	SBR	All
Denied Del/Veh (s)	6.4	12.0	0.3	0.2	0.2	0.2	0.2	2.4
Total Del/Veh (s)	25.7	28.0	30.6	30.2	71.7	85.2	63.7	36.5

2: I-5 NB Ramp & Cook Road Performance by movement

Movement	EBL	EBT	WBT	WBR	NBL	NBR	All
Denied Del/Veh (s)	0.0	2.0	0.2	0.1	0.2	0.2	0.7
Total Del/Veh (s)	56.3	47.1	10.1	7.2	167.8	77.0	36.9

3: Old Highway 99 Road & Cook Road Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	3.1	1.0	3.1	3.4	0.7	3.3
Total Del/Veh (s)	88.5	23.8	11.7	19.4	11.2	6.5	58.2	56.5	11.1	45.8	39.1	19.8

3: Old Highway 99 Road & Cook Road Performance by movement

Movement	All
Denied Del/Veh (s)	0.8
Total Del/Veh (s)	30.8

12: Cook Road Performance by movement

Movement	EBT	WBT	All
Denied Del/Veh (s)	0.0	0.0	0.0
Total Del/Veh (s)	1.3	35.2	16.3

Total Network Performance

Denied Del/Veh (s)	2.4
Total Del/Veh (s)	83.8

Intersection: 1: I-5 SB Ramp & Cook Road

Movement	EB	WB	SB
Directions Served	TR	LT	LTR
Maximum Queue (ft)	332	450	372
Average Queue (ft)	126	223	181
95th Queue (ft)	359	421	375
Link Distance (ft)	574	474	1699
Upstream Blk Time (%)	4	2	
Queuing Penalty (veh)	0	10	
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 2: I-5 NB Ramp & Cook Road

Movement	EB	WB	NB	NB
Directions Served	LT	TR	LTR	R
Maximum Queue (ft)	479	248	425	397
Average Queue (ft)	289	128	212	172
95th Queue (ft)	575	239	491	449
Link Distance (ft)	474	250	1722	1722
Upstream Blk Time (%)	12	1		
Queuing Penalty (veh)	65	12		
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 3: Old Highway 99 Road & Cook Road

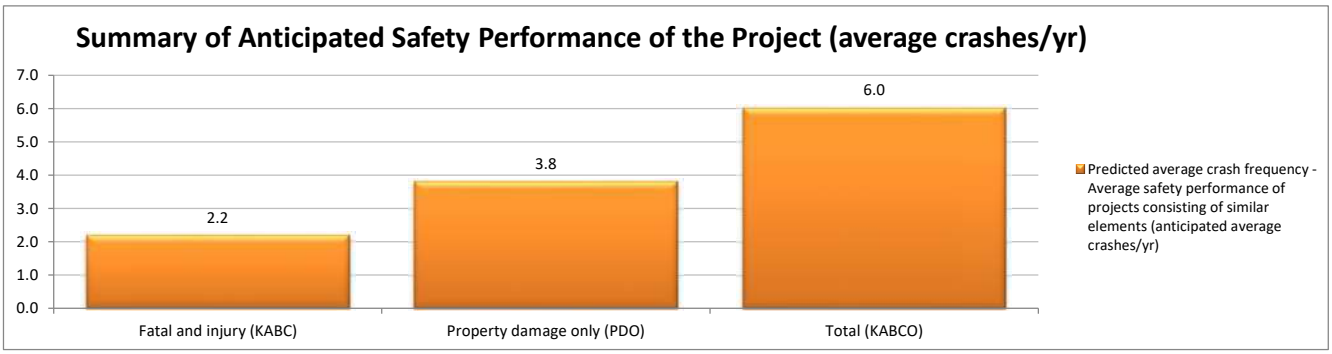
Movement	EB	EB	EB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	L	TR	L	T	R	L	T	R
Maximum Queue (ft)	150	295	282	68	94	174	569	349	109	255	120
Average Queue (ft)	139	239	206	27	68	98	252	90	54	86	70
95th Queue (ft)	178	331	334	58	82	202	446	262	104	194	126
Link Distance (ft)		250	250	53	53		1639			1578	
Upstream Blk Time (%)		23	6	4	44						
Queuing Penalty (veh)		102	26	14	147						
Storage Bay Dist (ft)	125					150		350	85		95
Storage Blk Time (%)	49	15				1	30	0	4	7	5
Queuing Penalty (veh)	143	31				6	94	0	10	15	9

Appendix E: Safety Analysis

PROJECT SAFETY PERFORMANCE SUMMARY REPORT

General Information	
Project Name	Cook Road ICE
Project Description	ICE - No Action
Reference Number	Cook Road
Analyst	Transpo Group
Agency/Company	WSDOT
Contact Email	0
Contact Phone	-
Date Completed	01/00/00

PROJECT SUMMARY



Project Element	Total Crashes/yr (KABCO)	Fatal and Injury Crashes/yr (KABC)	Property Damage Only Crashes/yr (PDO)
	Predicted average crash frequency $N_{predicted\ (KABCO)}$	Predicted average crash frequency $N_{predicted\ (KABC)}$	Predicted average crash frequency $N_{predicted\ (O)}$
INDIVIDUAL INTERSECTIONS			
Intersection 1	1.5	0.6	0.9
Intersection 2	2.4	0.9	1.5
Intersection 3	2.1	0.7	1.4
COMBINED (sum of column)	6.0	2.2	3.8

PROJECT SUMMARY -- Site-Specific EB Method Summary Results for Urban and Suburban Arterial Project

Crash severity level	$N_{predicted(PROJECT)}$ Predicted average crash frequency - Average safety performance of projects consisting of similar elements (anticipated average crashes/yr)
Fatal and injury (KABC)	2.2
Property damage only (PDO)	3.8
Total (KABCO)	6.0

HSM1 Extended Spreadsheet for Part C Chapter 12 v.9

Discussion of Results

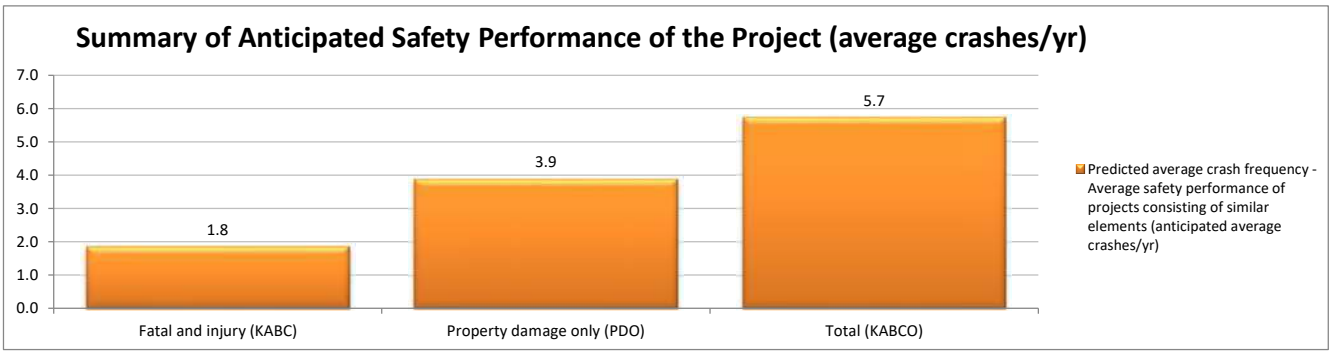
Given the potential effects of project characteristics on safety performance, results indicate that:

1. It is anticipated that a typical project such as this will, on average, experience 6 crashes per year (2.2 fatal and injury crashes per year; and 3.8 property damage only crashes per year).

PROJECT SAFETY PERFORMANCE SUMMARY REPORT

General Information	
Project Name	Cook Road ICE
Project Description	ICE - Alt 1 (Traffic Signal)
Reference Number	Cook Road
Analyst	Transpo Group
Agency/Company	WSDOT
Contact Email	0
Contact Phone	-
Date Completed	01/00/00

PROJECT SUMMARY



Project Element	Total Crashes/yr (KABCO)	Fatal and Injury Crashes/yr (KABC)	Property Damage Only Crashes/yr (PDO)
	Predicted average crash frequency $N_{predicted\ (KABCO)}$	Predicted average crash frequency $N_{predicted\ (KABC)}$	Predicted average crash frequency $N_{predicted\ (O)}$
INDIVIDUAL INTERSECTIONS			
Intersection 1	1.3	0.4	0.9
Intersection 2	2.3	0.7	1.5
Intersection 3	2.1	0.7	1.4
COMBINED (sum of column)	5.7	1.8	3.9

PROJECT SUMMARY -- Site-Specific EB Method Summary Results for Urban and Suburban Arterial Project

Crash severity level	$N_{predicted(PROJECT)}$ Predicted average crash frequency - Average safety performance of projects consisting of similar elements (anticipated average crashes/yr)
Fatal and injury (KABC)	1.8
Property damage only (PDO)	3.9
Total (KABCO)	5.7

HSM1 Extended Spreadsheet for Part C Chapter 12 v.9

Discussion of Results

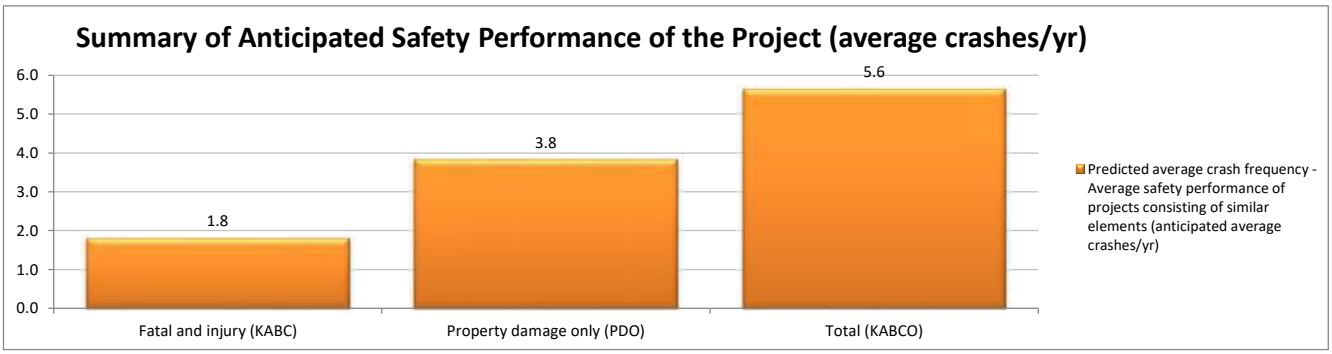
Given the potential effects of project characteristics on safety performance, results indicate that:

1. It is anticipated that a typical project such as this will, on average, experience 5.7 crashes per year (1.8 fatal and injury crashes per year; and 3.9 property damage only crashes per year).

PROJECT SAFETY PERFORMANCE SUMMARY REPORT

General Information	
Project Name	Cook Road ICE
Project Description	ICE - Alt 2/3 (Traffic Signal)
Reference Number	Cook Road
Analyst	Transpo Group
Agency/Company	WSDOT
Contact Email	0
Contact Phone	-
Date Completed	01/00/00

PROJECT SUMMARY



Project Element	Total Crashes/yr (KABCO) Predicted average crash frequency $N_{predicted\ (KABCO)}$	Fatal and Injury Crashes/yr (KABC) Predicted average crash frequency $N_{predicted\ (KABC)}$	Property Damage Only Crashes/yr (PDO) Predicted average crash frequency $N_{predicted\ (O)}$
INDIVIDUAL INTERSECTIONS			
Intersection 1	1.3	0.4	0.9
Intersection 2	2.3	0.7	1.5
Intersection 3	2.0	0.7	1.4
COMBINED (sum of column)	5.6	1.8	3.8

PROJECT SUMMARY -- Site-Specific EB Method Summary Results for Urban and Suburban Arterial Project

Crash severity level	$N_{predicted(PROJECT)}$ Predicted average crash frequency - Average safety performance of projects consisting of similar elements (anticipated average crashes/yr)
Fatal and injury (KABC)	1.8
Property damage only (PDO)	3.8
Total (KABCO)	5.6

HSM1 Extended Spreadsheet for Part C Chapter 12 v.9

Discussion of Results

Given the potential effects of project characteristics on safety performance, results indicate that:

1. It is anticipated that a typical project such as this will, on average, experience 5.6 crashes per year (1.8 fatal and injury crashes per year; and 3.8 property damage only crashes per year).