LEVEL 2 ALTERNATIVES EVALUATION

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SUBJECT: US 20 Albany Study – Level 2 Alternatives Evaluation Memo DKS P#23072-000

INTRODUCTION

As part of the US 20 Albany study, a selection of project alternatives were selected and passed through fatal flaw evaluation (Tier 1 Screening) to determine which merited more detailed evaluation and consideration. The Project Management Team (PMT) consisting of ODOT and City of Albany met on October 10, 2023, to complete the Tier 1 Screening Process and agreed upon the alternative advancing to Level 2 Evaluation. The purpose of this memorandum is to present the outcomes of the detailed evaluation of these projects against the study evaluation criteria.

The Level 2 Evaluation builds on the Tier 1 screening by applying more rigorous transportation engineering analysis and evaluation criteria, ultimately providing a final recommended list of improvements for the corridor. The key findings and proposed recommendations from the Level 2 Evaluation target the corridor needs summarized in Figure 1.

This memorandum is organized into the following sections:

- Evaluation Criteria – Overview of how the study evaluation criteria was implemented to evaluate proposed project alternatives
- Evaluation Tools, including:
    - Level of Traffic Stress Description
    - Summary of the corridor operations analysis tool (Vissim) was developed and calibrated
    - Description of project bundle assumptions used for simulation evaluation
- System Operations Summary – Review of the simulation results, including:
    - Future No-Build System Conditions
    - Project Bundle System Conditions
- Level 2 Evaluation Results – separated into the following locations
    - Springhill Street/US 20

- 1st Avenue/Lyon Street and Lyon Street Bridge
- 2nd and 3rd Avenue at Lyon Street
- 1st and 2nd Avenue at Ellsworth Street
- Downtown Unsignalized Intersections
- 9th Avenue/Lyon Street/OR 99E
- Ellsworth Street/Lyon Street Bike Facilities

- Recommendations Summary

FIGURE 1: SCREENING LOCATIONS AND NEEDS

EVALUATION CRITERIA

This section outlines the two-tiered screening and evaluation process used to develop and refine proposed projects for the US 20 corridor.

TIER 1 SCREENING

The first screening applied a simplified, qualitative version of the project evaluation criteria that was developed by the PMT to align with the goals and objectives that guide this planning process. Each proposed project alternative was evaluated using the following performance measures:

- Motor Vehicle Operations
- On-Street Parking
- Pedestrian Benefit
- Bicycle Benefit
- Transit Benefit
- Turning Impacts/Driveway Access
- Safety
- Cost

A handful of alternatives that had a negative impact or were clearly outperformed by similar and lower cost alternatives were removed during the Tier 1 screening, including curb extensions throughout the corridor and a transit-only approach at Albany Transit Center.

LEVEL 2 EVALUATION

Each advanced project alternative was evaluated against the Level 2 Evaluation criteria using the performance measures outlined in Table 1. Each criterion is a more comprehensive assessment of potential benefits and trade-offs associated with project alternatives using a combination of qualitative and quantitative analysis.

TABLE 1: LEVEL 2 EVALUATION CRITERIA

EVALUATION CRITERIA		PERFORMANCE MEASURE	EVALUATION METHOD
MOTOR VEHICLE OPERATIONS	Increases/reduces travel times	US 20 Corridor PM Peak Hour Travel Times (minutes)	Vissim
	Increases/reduces queue lengths for major movements	PM Peak Hour Queue lengths for major movements	Vissim

EVALUATION CRITERIA		PERFORMANCE MEASURE	EVALUATION METHOD
MOTOR VEHICLE OPERATIONS	Increases/reduces delay and volume-to-capacity (v/c) relative to Operating Standards	Intersection delay and v/c ratio	Vissim – Delay Synchro – v/c
	Increases/reduces the risk of neighborhood cut through traffic	Unserved PM peak period demand by intersection approach	Vissim
	Increases/reduces congestion in Downtown or North Albany	PM Peak Period System Delay per vehicle	Vissim
ON-STREET PARKING IMPACT	Increases/reduces number of on-street parking stalls	Change in street parking spaces	Quantitative Assessment based on Conceptual Layout
	Increases/reduces number of on-street parking spaces in downtown business district	Change in street parking spaces in downtown business district	Quantitative Assessment based on Conceptual Layout
PEDESTRIAN FACILITIES	Increases/reduces pedestrian crossing timing	Change in crosswalk length (ft)	Quantitative Assessment based on Conceptual Layout
	Increases/reduces sidewalk width	Change in sidewalk width (ft)	Conceptual layout
	Increases/reduces estimated number of conflict points	Change in pedestrian/vehicle conflict points	Conceptual layout
BICYCLE FACILITIES	Increases/reduces bicycle safety/connectivity between specified locations	Change in Bicycle LTS caused by project	LTS Analysis
	Increases/reduces bicycle travel time between specified locations	Change in PM Peak Period Bicycle Travel time on US 20 Corridor	Vissim

EVALUATION CRITERIA		PERFORMANCE MEASURE	EVALUATION METHOD
TRANSIT FACILITIES	Increases/reduces transit travel times between specific destinations	Change in PM Peak Period Transit Travel time on US 20 Corridor	Vissim
	Enhances/degrades accessibility to transit facilities	Qualitative measure	Qualitative measure from Conceptual layout
PROPERTY IMPACTS/ACQUISITION	Estimated property/right of way acquisition	Estimate ROW needed (sq ft)	Conceptual layout
MAINTAIN/ENHANCE EMERGENCY VEHICLE ACCESS AND RESPONSE	Ability to accommodate emergency vehicle access and projected reduction in emergency vehicle response times	Qualitative measure	Qualitative measure from Conceptual layout
TURNING CONFLICTS/DRIVEWAY ACCESS	Median restrictions	Length (ft) of medians with limitations	Quantitative Assessment based on Conceptual Layout
	Driveways Impacts	Number of driveways impacted	Quantitative Assessment based on Conceptual Layout
	Increases/reduces out-of-direction travel (projected vehicle hours of delay)	Projected PM Peak Period vehicle hours of delay	Vissim
SAFETY	Increases/reduces estimated number of crashes per year	Expected change in crashes due to project	ODOT CRF List[1]
IMPACTS TO PARKS	Creates/reduces park areas	Estimated Park area impacted (sq ft)	Quantitative Assessment based on Conceptual Layout

[1] ODOT CRF List (January 2023) full access online: https://www.oregon.gov/odot/Engineering/ARTS/CRF-List.xlsx

EVALUATION CRITERIA		PERFORMANCE MEASURE	EVALUATION METHOD
	Increases/reduces visual appearance	Qualitative measure	Qualitative measure from Conceptual layout
IMPACTS TO LANDSCAPING	Creates/reduces landscaping coverage	Qualitative measure	Qualitative measure from Conceptual layout
	Street tree impacts	Number of street trees removed	Quantitative Assessment based on Conceptual Layout
COMMUNITY LIVABILITY	Improves/degrades multi-modal access to downtown business district and/or North Albany	Change in Pedestrian and Bicycle LTS caused by project	LTS Analysis/Conceptual layout
ECONOMIC VITALITY	Projected vehicle hours of delay	PM Peak Period system vehicle hours of delay	Vissim microsimulation
CONSISTENCY WITH CITY/STATE STANDARDS	Does the proposed alternative require a design exception?	Qualitative measure	Qualitative Assessment
IMPACTS TO HISTORICAL RESOURCES	Avoid or minimize adverse permanent and temporary impacts to identified historical resources	Qualitative measure	Qualitative Assessment
IMPACTS TO CULTURAL RESOURCES	Likelihood of adverse impact to cultural resources	Qualitative measure	Qualitative Assessment
IMPACTS TO ENVIRONMENTAL RESOURCES	Increases impacts to environmental resources	Qualitative measure	Qualitative Assessment
SOCIETAL BENEFITS	Overall benefits (safety, economic, environmental, etc.)	Qualitative measure	Qualitative Assessment
PROJECT COST	Estimated Cost	Estimated Improvement Capital Cost in 2023 dollars	Quantitative Assessment

Note that the level of traffic stress (LTS) was analyzed for proposed pedestrian and bicycle facilities in the study area using methodology from the ODOT Analysis and Procedures Manual (APM). LTS rates the stress of roadway segments based on characteristics such as motor vehicle traffic volumes and speeds, presence of walking and bicycling facilities, and degree of separation between motorized and nonmotorized users. The possible scores range from 1 to 4, with 1 representing the lowest stress and 4 representing the highest stress.

Each improvement project considered in the Level 2 Evaluation was analyzed against all applicable criteria from Table 1. The results of the applicable performance measures evaluated for alternative were rolled up into the main categories (Motor Vehicle Operations, On-Street Parking Impacts, Bicycle Facilities, etc.) and identified as:

- Significant Benefit **(++)** – At least one performance measure changed from not meeting (No-Build conditions) to meeting standards or improved by 25% or more.
- Some Benefit (+) – Most performance measures showed improvement, but none met the "Significant Benefit" thresholds.
- Significant Impact **(--)** – At least one performance measure changed from meeting (No-Build conditions) to not meeting standards or degraded by 25% or more.
- Some impact (-) – Most performance measures showed impacts, but none met the "Significant Impact" thresholds.
- No Change – no discernable change in any performance measures for the category

EVALUATION TOOLS

The methods and application of the tools used to evaluate the majority of the quantitative performance measures outlined in the prior section were summarized in the Existing and Future Baseline Conditions Memorandum. This memorandum includes descriptions of the Highway Capacity Manual (HCM) analysis performed with Synchro, the development of future year traffic forecasts, and the safety analysis methods. This memorandum addresses the additional tools used to complete the Level 2 Evaluation.

LEVEL OF TRAFFIC STRESS (LTS)

The level of traffic stress (LTS) was analyzed for proposed pedestrian and bicycle facilities in the study area using methodology from the ODOT Analysis and Procedures Manual (APM). LTS rates the stress of roadway segments based on characteristics such as motor vehicle traffic volumes and speeds, presence of walking and bicycling facilities, and degree of separation between motorized and nonmotorized users. The possible scores range from 1 to 4, with 1 representing the lowest stress and 4 representing the highest stress.

MICROSIMULATION (VISSIM)

The project team developed a Vissim model for the study corridor, extending from the US/20 North Albany Road intersection southward to the US 20 intersection with OR 99E. The model was calibrated to the 30th Highest Hour PM Peak Hour conditions using the seasonally adjusted traffic counts used for the Highway Capacity Manual (HCM) analysis presented in the Existing and Future Baseline Conditions Memorandum. The model calibration followed the ODOT Vissim Protocol guidelines, aligning corridor travel times, queuing, and traffic throughput at study intersections with Google Travel Time data, field observations, and intersection turn movement counts. The Vissim model included a 4-6 PM analysis period, with 15-minute traffic volume distributions to capture peak hour vehicle arrival profiles. The Vissim model also includes:

- Detailed intersection geometry, including crosswalks and Leading Pedestrian Interval (LPI) signal phasing
- Unsignalized crosswalks along Ellsworth Street and Lyon Street
- Heavy Vehicles (trucks)
- Transit stops and routes for Lines 2, 3, and the US 20 Commuter Line
- Bicycle facilities and bicycle riders, including the sharrows on Ellsworth Street (including the bridge) and Lyon Street
- Trip Origin-Destination (vehicle routing) based on Replica Data

A Future No-Build (year 2043) Vissim model was built from the calibrated Existing conditions model, using the traffic volume forecasts described in the Existing and Future Baseline Conditions Memorandum. This model was validated to ensure the network was performing reasonably and was then used as the basis for comparison against proposed corridor improvements.

The detailed descriptions and results for the Vissim model data, development, existing conditions calibration, and Future No-Build assumptions are included in the Albany US 20 Study Vissim Model Memorandum, which is included as Appendix A of this memorandum.

PROJECT BUNDLE DESCRIPTIONS

Many alternatives passed through the Tier 1 Screening to the Level 2 Evaluation. To better understand the corridor-wide/system level impacts and benefits of these alternatives, three Project Bundles were created to allow the proposed improvements to be analyzed in the Vissim model. These project bundles all include every non-conflicting proposed improvement, i.e. projects that do not preclude any of the other proposed projects. Competing/conflicting projects were distributed across the three project Bundles. Note that project bundles were created for analysis purposes only and are not intended to be considered as “alternatives”.

The composition of the project bundles is summarized in Table 2.

TABLE 2: ANALYSIS PROJECT BUNDLES COMPOSITION

LOCATION	#	DESCRIPTION	ANALYSIS PROJECT BUNDLE		
			#1	#2	#3
SPRINGHILL/US 20	1A	Re-stripe to allow Dual SBL turn	X	X	X
	1C	SBL Truck Route to US 20 via Hickory	X		
	1D	US 20 Superelevation Correction		X	X
LYON STREET BRIDGE	2F	2-way multi-use path on Lyon St Bridge	X	X	X
1ST/LYON	2C	Dual WBR, Single WBT on 1st	X		
	2D	WBR + WBTR on 1st		X	
	2E	WBR + WBTR, shift bike lane to south side of 1st			X
1ST & 2ND AVE/ELLSWORTH ST	4B	Signal Timing Updates	X	X	X
	4C	New SBL turn lane at 2nd/Ellsworth	X	X	X
2ND & 3RD AVE/LYON ST	3B	Signal Timing Updates	X	X	X
DOWNTOWN UNSIGNALIZED INTERSECTIONS	6B	RRFBs at 4th & 5th/ Ellsworth, 4th & 5th & 6th/Lyon	X	X	X
9TH/LYON/OR 99E	5A	Dual northbound 99E Off-Ramp	X	X	X
CORRIDOR BIKE FACILITIES	7A	2-way cycle track on Lyon (east side)	X		
	7B	1-way cycle track on Lyon & Ellsworth		X	
	7C	Buffered bike lanes on Lyon & Ellsworth			X

As shown in Table 2, only three locations (Springhill/US 20, 1st/Lyon Street, and Ellsworth/Lyon Street Corridor Bike Facilities) have conflicting alternatives, with all other locations including the same proposed improvements across the three analysis project bundles. The proposed improvements at these three locations are the only contributors to differences in the Vissim model system results across the three analysis project bundles.

The three analysis project bundles were coded as three separate scenarios in the Vissim model. Each scenario used the same traffic volume forecasts and vehicle routing assumptions as the

Future No-Build scenario. The Vissim coding assumptions for the analysis project bundle scenarios are summarized in the Albany US 20 Study Vissim Model Memorandum (Appendix A).

SYSTEM OPERATIONS SUMMARY

As noted in the prior section, 2043 PM peak period No-Build and analysis project bundles scenarios were coded and analyzed using the Vissim model. The key system bottlenecks and the analysis project bundles effects on these bottlenecks are summarized in the following sections.

FUTURE NO-BUILD SYSTEM CONDITIONS

Based on the 2043 PM Peak Period Vissim model, the following system bottlenecks were identified along the US 20 corridor with the project Study Area:

- The 1st and 2nd Avenue intersections with Ellsworth Street (US 20) continue to act as a system bottleneck under future (year 2043) traffic conditions. By 4:00 PM, southbound green time constraints at these intersections combines with heavy competing side street traffic demand and causes queues to spill back to the Springhill Drive intersection across the river. These queues compound the queues on the southbound approach of Springhill Drive, which is already attempting to serve traffic demand beyond the intersection capacity. Queues on eastbound US 20 extend back through North Albany Road by 4:45 PM, and beyond the study area extents by 5:15 PM. At 6 PM, despite the traffic demand decreasing from the Peak Hour period, 11% (nearly 200 vehicles) of the eastbound US 20 traffic demand remains queued up beyond the study area extents west of North Albany Road. In addition, 15% (185 vehicles) of the southbound Springhill Drive traffic remains queued beyond the study area. This system bottleneck also results in the Ellsworth Street bridge serving less than 83% of the forecasted future traffic demand from 4-6 PM.
- Eastbound 2nd Avenue queues beyond the project study area by 4:00 PM, due to increased conflicts and queuing on the city blocks between 1st and 2nd Avenue on Lyon Street (which blocks eastbound left turns from 2nd Avenue) and queues between Ellsworth and Lyon Street on 2nd Avenue. The combined impacts of these queues, which are caused in large part by signal timing prioritized to progress the US 20 through movements on Lyon Street and Ellsworth Street, result in sustained queues on 2nd Avenue eastbound that fail to dissipate by 6:00 PM, leading to 14% (approximately 170 vehicles) of unserved vehicle demand on this approach.
- The 1st Avenue and Lyon Street intersection continue to act as a critical system bottleneck under 2043 conditions, with the brunt of the capacity constraint impact experienced on the 1st Avenue westbound approach. Anticipated increases in bicycle and pedestrian activity at this intersection in the future further limits the westbound right turn capacity (by about 5%), and combined with increased traffic demand on 1st Avenue, results in queues that spill back well beyond the study area by 4:00 PM. These queues do not dissipate by 6:00 PM, with 33% (nearly 600 vehicles) remaining in queue and unserved. Indirectly, the constraint benefits northbound travel on Lyon Street in the model, but this highlights a larger corridor concern, as this level of queuing is not considered a realistic future condition, with drivers likely to search for other routes to access Lyon Street. This would cause more traffic on side streets such as 3rd and 4th Avenue, along with heavier usage of the OR 99E southbound off-ramp to Lyon Street, creating long queues Lyon Street, OR 99E southbound, 1st Avenue westbound, 3rd Avenue

westbound, and 4th Avenue westbound. This system bottleneck also results in the Lyon Street bridge only serving 90% of the forecasted future traffic demand from 4-6 PM.

- The OR 99E northbound off-ramp queues back to the mainline by 4:15 PM and does not begin to clear until 6:00 PM.
- System wide, the key bottlenecks described in this section increase the average delay per vehicle within the study area from 1.5 minutes to 9.7 minutes, a nearly 650% increase from present day to year 2043 conditions.

The 2043 No-Build Vissim simulation results tabulating and graphically presenting the summarized system bottleneck information are included in the appendices of the Albany US 20 Study Vissim Model Memorandum, which is included as Appendix A of this memorandum.

PROJECT BUNDLE SYSTEM CONDITIONS

The project bundles outline in the prior section of this memorandum were analyzed for 2043 PM peak period conditions. The changes to the system bottlenecks described for the 2043 No-Build conditions are summarized as follows:

- All three bundles improve the operations at the 1st and 2nd Avenue intersections with Ellsworth Street (US 20) due to the added southbound left turn land at 2nd Avenue and Ellsworth and increased southbound green time at 1st Avenue and Ellsworth. The Ellsworth Street queues do not spill back to Springhill Drive until about 5:30 PM, minimally impact the southbound left turn at Springhill Drive, and are dissipating by 6:00 PM. The southbound US 20 demand crossing the Ellsworth Street bridge is fully served in all the project bundles, with approximately 500 more vehicles successfully crossing from 4-6 PM compared to No-Build conditions.
- The combined benefits of the re-striped second southbound left turn lane and the reduced downstream queuing on Ellsworth Street reduce the queuing on southbound Springhill Drive across all the project bundles, with the 4-6 PM traffic demand fully served, 185 more vehicles than under the No-Build condition.
- The increased southbound throughput on the Ellsworth Street Bridge (15% increase over No-Build conditions) with all the project bundles exposes additional bottlenecks further to the south, particularly at the 9th Avenue/Lyon Street/OR 99E intersection. The queues from this bottleneck extend north through 4th Avenue by 5:30-5:45 PM across the project bundles but begin to dissipate by 6:00 PM.
- The three proposed alternatives for the 1st Avenue and Lyon Street intersection all improve the westbound right turn queues on 1st Avenue over No-Build conditions, serving the entire 4-6 PM traffic demand for this movement, nearly 600 more vehicles than No-Build conditions. The exclusive dual right turn alternative evaluated in Project Bundle 1 provides the shortest queues and least delay on 1st Avenue. However, the improved 1st Avenue operations result in the worst queuing performance (of the project bundles) on 2nd Avenue, as both 1st and 2nd Avenue vehicles are competing for the same limited capacity on the Lyon Street bridge. The alternative with a westbound right turn and shared through-right configuration coupled with a shift of the existing bike lane to the south side of 1st Avenue results in the most balanced operations across the 1st Avenue, 2nd Avenue, and Lyon Street approaches to the Lyon Street Bridge.
- The improved capacity at the 1st Avenue and Lyon Street intersection across all the project bundles results in increased throughput on the Lyon Street Bridge, with 500 more vehicles

crossing the bridge from 4-6 PM compared against No-Build conditions. These additional vehicles expose the bottleneck at the westbound US 20 approach to the Springhill Drive intersection. The westbound right turn operates nearly at free flow capacity and draws heavy demand. The storage for this movement is limited and westbound through queues often spill back far enough to block the right turn bay opening during red phases. While the dual southbound left turn striping allows for shorter conflicting phases at this intersection, the limited right turn storage still creates a bottleneck issue, as westbound US 20 queues propagate very rapidly across the bridge under these queuing conditions. These queues spill back down Lyon Street and extend to 9th Street/OR 99E from 4:45-5:15 PM before beginning to dissipate.

- The improvement to the OR 99E northbound off-ramp provides independent benefit to the 9th Avenue/Lyon Street/OR 99E intersection, but the combination of queuing impacts from westbound US 20 at Springhill Drive and increased southbound throughput at 2nd Avenue and Ellsworth Street lead to additional queuing at this intersection compared to No-Build conditions within the Vissim model. However, the amount of side street queuing on 1st Avenue under No-Build conditions indicate that more vehicles would shift to OR 99E to access the Lyon Street Bridge, likely resulting in much worse operations at the 9th Avenue/Lyon Street/OR 99E intersection compared to the project bundles conditions.
- Based on the Vissim analysis of the project bundles, all three Lyon Street and Ellsworth Street bicycle facility alternatives have minimal impacts on the overall corridor operations, including operations at the system bottlenecks.
- System wide, the benefits of the improvements incorporated into the project bundles decreases average PM peak period vehicle delay across the corridor from 9.7 minutes to 3.2-4.4 minutes for the project bundles.

The 2043 Project Bundle Vissim simulation results tabulating and graphically presenting the summarized system bottleneck information are included in the appendices of the Albany US 20 Study Vissim Model Memorandum, which is included as Appendix A of this memorandum.

LEVEL 2 EVALUATION RESULTS

The Level 2 Evaluation results are summarized by location in the following sections, as shown below:

- Springhill Drive/US 20
- Lyon Street Bridge
- 1st Avenue/Lyon Street
- 2nd and 3rd Avenue at Lyon Street
- 1st and 2nd Avenue at Ellsworth Street
- Downtown Unsignalized Intersections
- 9th Avenue/Lyon Street/OR 99E
- Ellsworth/Lyon Street Bike Facilities

Each section focuses on the performance of the improvements evaluated against the Level 2 Evaluation criteria. The layouts for each proposed alternative are included in Appendix C of this memorandum.

SPRINGHILL DRIVE/US 20

Springhill Drive serves as a key north-south route through North Albany on the west side of the Willamette River to Albany and Corvallis via US 20. In a previously conducted safety study of the corridor (2016), the local community reported experiencing long delays caused by the heavy truck traffic. It was also noted that the US 20 cross slopes (superelevation) of this intersection make it difficult to turn during snow/ice[2]. The existing superelevation is 11%, nearly twice as steep as the 6% needed for the existing curve and roadway design speed. This issue also occasionally leads to semi-trucks rolling over while completing the southbound left turn. Continued housing growth in North Albany has increased the southbound left turn traffic demand considerably, and future growth will continue to push this intersection over the capacity of the current configuration.

ALTERNATIVES

Figure 2 summarizes the improvement projects evaluated against the Level 2 Criteria. The estimated project costs are included as well, along with other recommended improvements that tie in to the proposed alternatives for US 20/Springhill Drive. The alternatives include:

1A Restripe to allow southbound dual left turn lanes on Springhill Drive at US 20.

1B Extend the US 20 dilemma zone for the signal at Springhill Drive.

1C Establish a temporary truck route down Hickory Street to North Albany Road, accommodating the southbound left turn for trucks at US 20 and Springhill Drive (see Figure 3).

1D Adjust the US 20 Superelevation at the Springhill Drive intersection from 11% to 6%.

[2] US 20 Highway Safety Study – Corvallis City Limits to Springhill Road, Albany (2016) full access online: https://www.co.benton.or.us/sites/default/files/fileattachments/public_works/page/4213/us20_safety_study_final_report_as_submitted.pdf

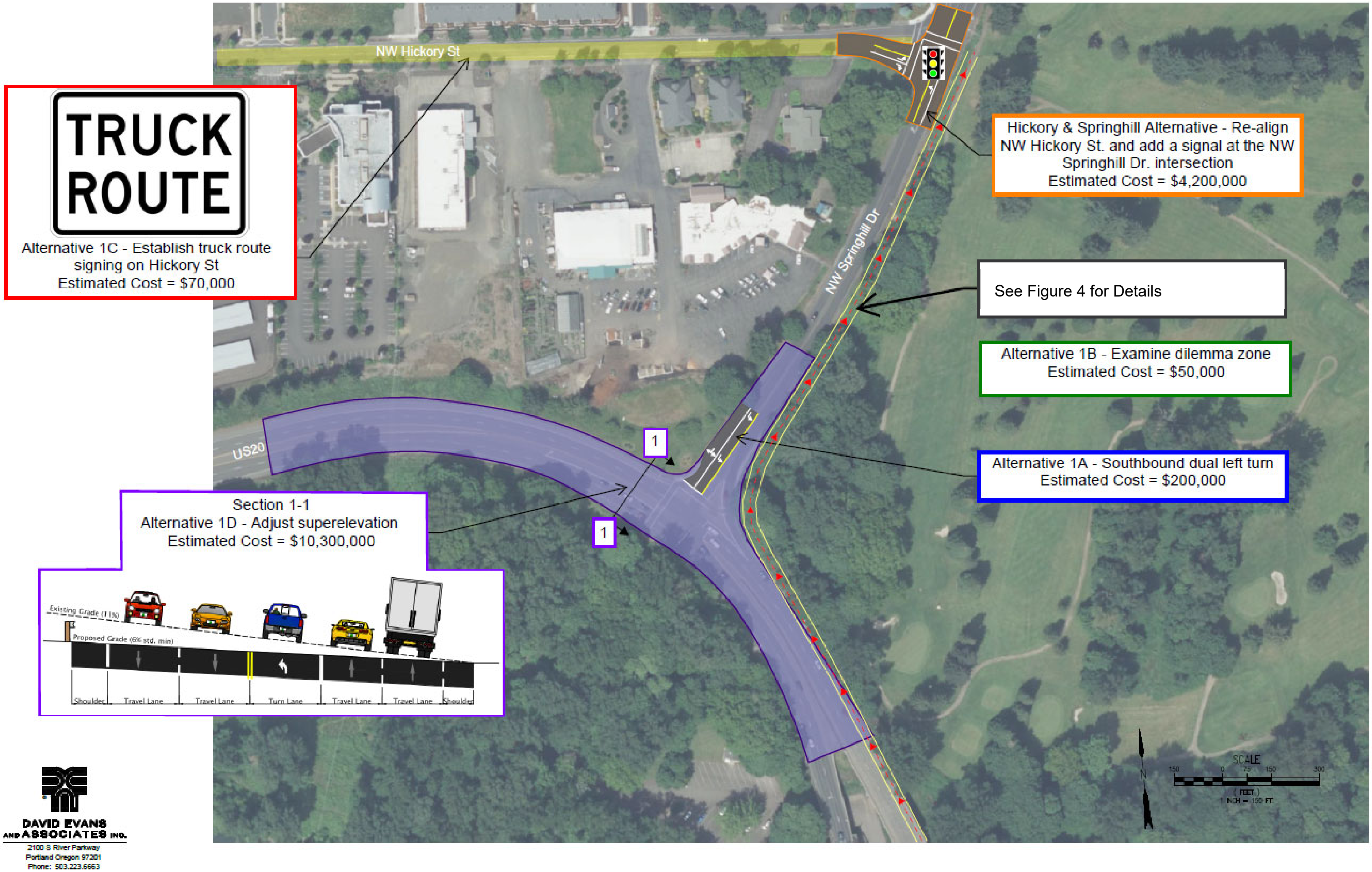

FIGURE 2: PROPOSED ALTERNATIVES AT US 20/SPRINGHILL DRIVE

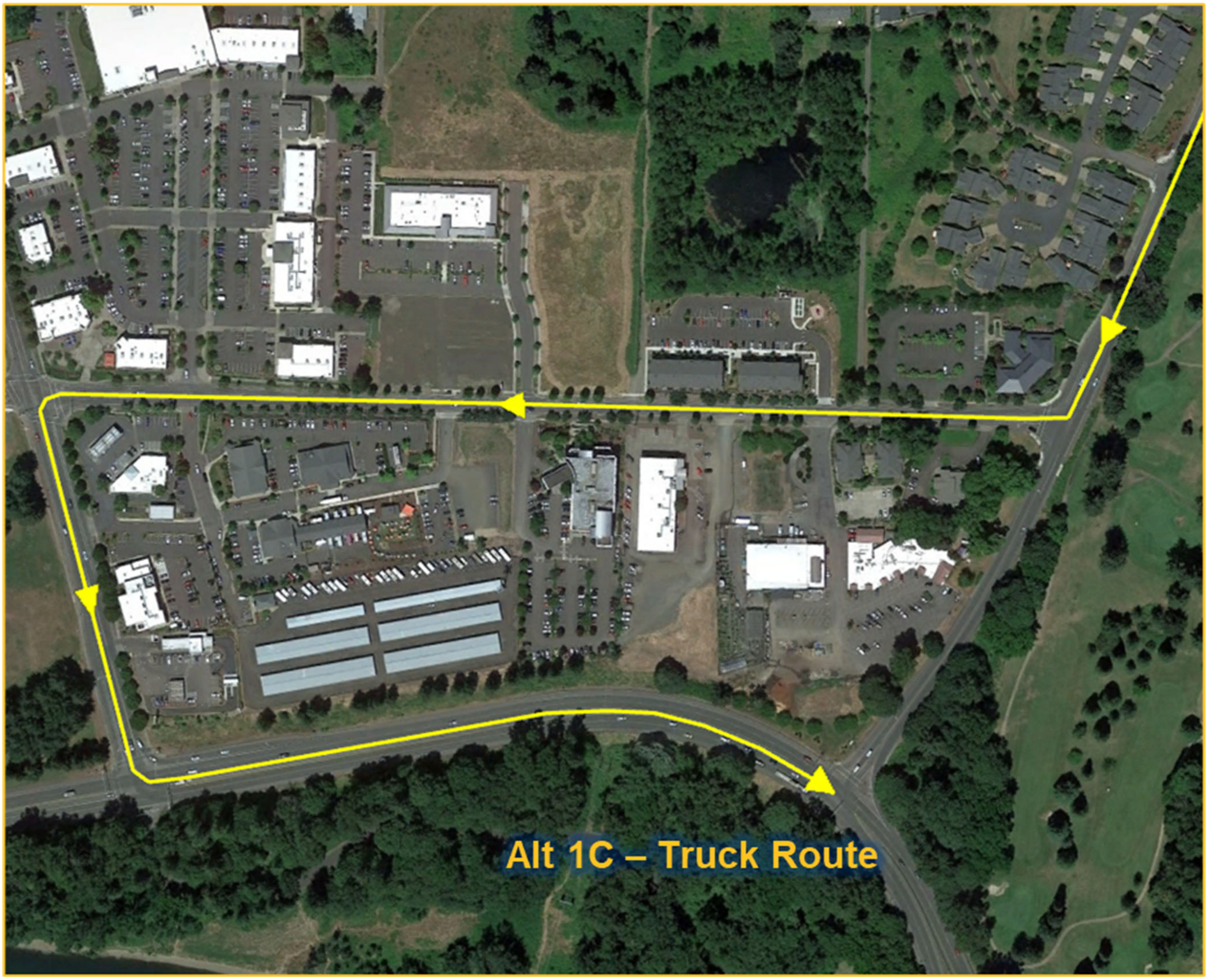

FIGURE 3: ALTERNATIVE 1C - TEMPORARY TUCK ROUTE

In addition, a new project was identified for the Springhill Drive and Hickory Street intersection. This project would re-align the Hickory Street leg of the existing intersection to correct the existing skew angle, add a new signal, and enhance the east-west pedestrian crossing to connect the proposed MUP to the planned Hickory Street path. This project is outside the US 20 Project Study Area but is recommended for inclusion in the upcoming City of Albany Transportation System Plan to fill a key active transportation system gap and improve traffic safety at this location.

LEVEL 2 EVALUATION

The Level 2 Evaluation of the US 20/Springhill Drive alternatives is summarized below. Only criteria applicable to the alternatives were evaluated.

Motor Vehicle Operations

Extending the US 20 signal's dilemma zone (Alternative 1B) is a safety-oriented improvement and is not expected to have any quantified benefits or impacts to motor vehicle operations. Alternatives 1C (Hickory Truck Route) and 1D (US 20 Superelevation Correction) do not significantly impact traffic operations but are necessary to re-stripe southbound Springhill Drive to allow for dual southbound left turns (Alternative 1A).

The PM peak hour intersection delay was evaluated in the Vissim analysis, and the results for these locations are included in the appendices to the Albany US 20 Study Vissim Model Memorandum, which is included as Appendix A to this memorandum. Due to other proposed projects throughout the US 20 corridor, the isolated intersection delay performance measures for these intersections are not directly reflective of the alternatives evaluated at these locations. Implementing the dual left turns provides sufficient capacity to serve the entire southbound Springhill Drive traffic demand under 2043 4-6 PM peak period conditions, improving over No-Build where only 85% of this same demand can enter the intersection. Overall, the improvements to this intersection reduce queueing on Springhill Drive while also reducing red time for US 20 movements and are therefore assumed to contribute to the net decrease in delay for the US 20 corridor system and to improve travel times on the US 20 corridor.

Table 3 summarizes the HCM 2000 based v/c ratios for the two signalized intersections most directly benefiting/impacted by the proposed improvements to US 20/Springhill Drive.

TABLE 3: US 20/SPRINGHILL DRIVE ALTERNATIVES V/C RATIOS

ALTERNATIVE	DESCRIPTION	LOCATION	AM V/C	PM V/C
NO-BUILD	No changes from existing	North Albany Road/US 20	0.83	0.84
ALT 1A+1C	Springhill dual SBL + Truck Route	North Albany Road/US 20	0.85	0.87
ALT 1A+1D	Springhill dual SBL + Superelevation Correction	North Albany Road/US 20	0.83	0.84
NO-BUILD	No changes from existing	Springhill Dr/US 20	**1.02**	**1.03**
ALT 1A+1C	Springhill dual SBL + Truck Route	Springhill Dr/US 20	0.85	0.85
ALT 1A+1D	Springhill dual SBL + Superelevation Correction	Springhill Dr/US 20	0.86	0.86

As shown in Table 3, the truck route (Alternative 1C) degrades the capacity of the North Albany Road intersection while the superelevation correction (Alternative 1D) does not. Overall, the added southbound left turn capacity brings the US 20/Springhill Drive intersection back below capacity under both AM and PM 2043 conditions.

Safety

All four alternatives provide expected safety benefits at US 20/Springhill Drive. The re-striping of the Springhill Drive approach to allow dual left turns (Alternative 1A+1C or 1D) is expected to decrease crash frequency of all injury crashes reduces by 29%[3]. In addition, the substandard superelevation on US 20 through the intersection increases the risk of overturning crashes for vehicles taking the southbound left turn. Reducing superelevation to the standard minimum, as part of Alternative 1D, can reduce the frequency of overturning crashes.

Within the five-year study period (2017-2021), 29 of the 34 intersection crashes observed at US 20/Springhill Drive were rear-ends. The extended dilemma zone on US 20 is expected to reduce this specific crash type by granting drivers the appropriate amount of decision time to safely navigate through the intersection.

Economic Vitality

As noted in the Motor vehicle discussion, re-striping to a dual southbound left turn (Alternative 1A) contributes to significant improvements to system delay. However, the truck route on Hickory (Alternative 1C) forces out of direction truck travel and independently impacts economic vitality, particularly when compared against the superelevation correction (Alternative 1D) alternative, which improves truck safety while also allowing the benefits of Alternative 1A.

Consistency with City/State Adopted Plans

A couple of City plans, including the North Albany Refinement Plan and the City's Transportation System Plan (TSP), anticipated this intersection would exceed capacity into the future and had proposed re-striping for a dual southbound left turn.[4] The City's TSP had also proposed adjusting the superelevation to meet standards.[5]

Societal Benefits

The dilemma zone adjustment provides safety benefits, and the combination of the dual southbound left turn with either temporary truck route or the superelevation adjustment enhances motor vehicle operations and reduces congestion at Springhill Drive and North Albany Road. Therefore, all the proposed alternatives provide significant societal benefits.

Summary of Level 2 Evaluation

The Level 2 Evaluation results for the US 20/Springhill Drive intersection alternatives are summarized by anticipated level of benefit/impact in Table 4. Only applicable criteria are included in the table.

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[3] ODOT CRF List – Countermeasure #H63

[4] North Albany Refinement Plan (2003) full access online:
https://www.oregon.gov/ODOT/Planning/TPOD/facility_plan/refinement_plans/city_of_albany_refinement_plan_2003.pdf

[5] Abany Transportation System Plan (2010) full access online:
https://www.albanyoregon.gov/images/stories/publicworks/engineering/tsp/albanytsp_022410.pdf

TABLE 4: US 20/SPRINGHILL DRIVE LEVEL 2 EVALUATION RESULTS SUMMARY

APPLICABLE SCREENING CRITERIA	ALT 1A	ALT 1B	ALT 1C	ALT 1D
MOTOR VEHICLE OPERATIONS	(++)	No Change	(++)	(++)
SAFETY	(++)	(++)	(+)	(++)
ECONOMIC VITALITY	(++)	No Change	(-)	(++)
CONSISTENCY WITH CITY/STATE STANDARDS	(++)	No Change	No Change	(++)
SOCIETAL BENEFITS	(++)	(++)	(+)	(++)
PROJECT COST	$200,000	$50,000	$70,000	$10,300,000

As shown in Table 4, the only alternative with anticipated negative impacts is the temporary truck route on Hickory (Alternative 1C), which is expected to impact truck travel times and cause undesirable freight/passenger vehicle conflicts along the detour route. The benefits of dual southbound left turn (Alternative 1A) are significant at both the intersection and system level under future conditions, but this alternative cannot be implemented without either the Hickory truck route or the US 20 superelevation correction (Alternative 1D). Based on safety and freight benefits, the superelevation correction is preferred over the Hickory truck route and is recommended as a near term solution as soon as funding is available. The Hickory truck route is only recommended as a short-term, temporary solution if funding for the superelevation is not obtained before the US 20/Springhill Drive intersection reaches capacity, at which time the dual left turn lane alternative would be implemented. Given existing safety and motor vehicle conditions at this location, the dual left turn re-striping (Alternative 1A) and adjustments to the US 20 dilemma zone (Alternative 1B) are both considered short-term improvement needs.

LYON STREET BRIDGE

The Lyon Street Bridge currently provides limited facilities and protection for bicycles and pedestrians. Based on input from City staff and ODOT, the following alternative was evaluated to improve these issues.

ALTERNATIVES

The only alternative evaluated for this location was a reconfiguration of the Lyon Street bridge deck to include a MUP that continues up Springhill Drive to Hickory Street (Alternative 2F), as shown in **Error! Reference source not found.**. The bridge cross section would include 10-foot MUP with a vertical concrete barrier beside a 4-foot shoulder, two 12-foot travel lanes, and a 2-foot shy distance from bridge barrier.

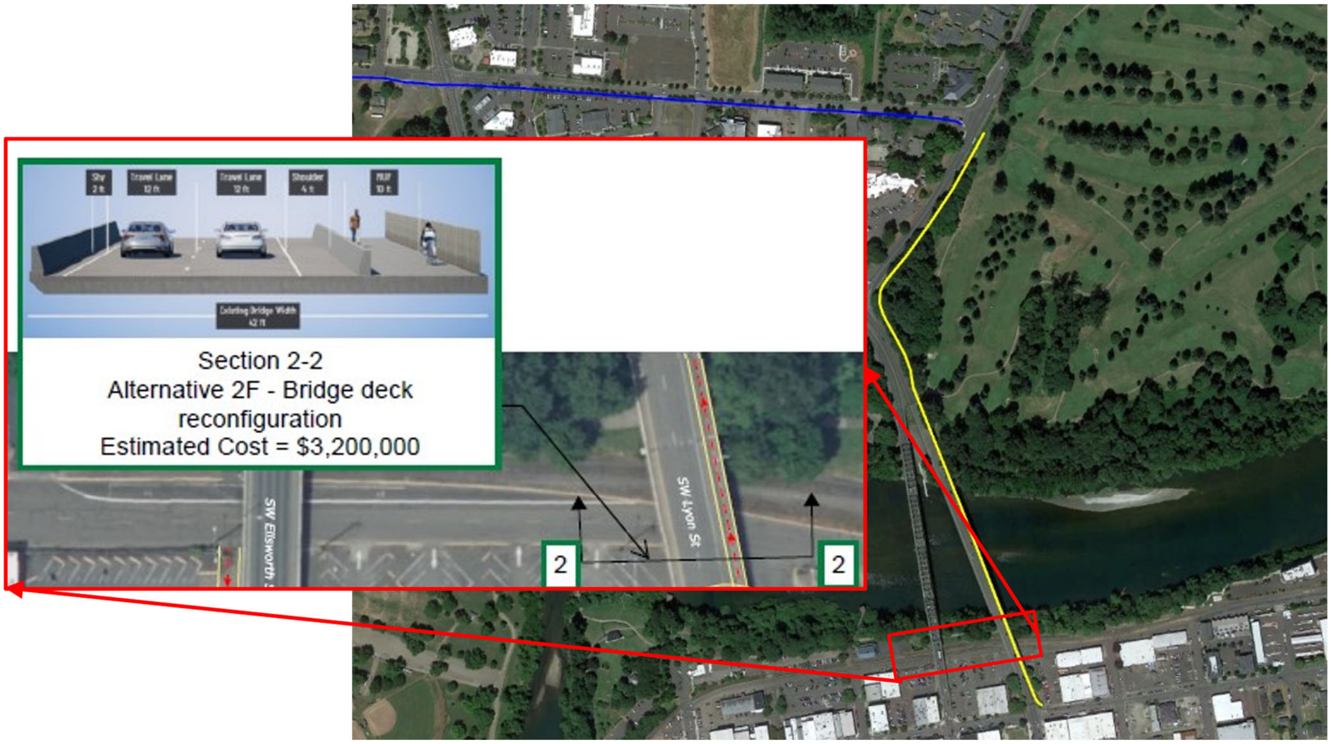

FIGURE 4: LYON STREET BRIDGE ALTERNATIVE

Alternative 2F would fit within the existing bridge deck and would not require any significant changes to the existing structure. Since US 20 is a Reduction Review Route, this improvement would require Mobility Advisory Committee (MAC) approval.

LEVEL 2 EVALUATION

The Level 2 Evaluation of the Lyon Street Bridge improvement is summarized below. Only criteria applicable to the proposed improvement were evaluated.

Pedestrian Facilities

Pedestrian facilities are significantly benefited by the proposed Lyon Street Bridge MUP (Alternative 2F). An MUP with a buffer reduces the level of stress for people walking to the lowest level.[6]

Bicycle Facilities

[6] On a two-lane roadway, 10-15' total buffering width (landscaping, shoulder, and bike lane) needed to achieve PLTS 1, otherwise PLTS 2. For 25 mph roadway, landscaping and/or vertical separation needed for PLTS 1, no buffer or a solid surface buffer result in PLTS 2.

The proposed MUP would significantly enhance safety and comfort for people biking across the river.[7] Bicycle Level of traffic stress on the Lyon Street Bridge would drop from Level 4 to Level 1.

Safety

The installation of a MUP (Alternative 2F) on the Lyon Street bridge and up to Hickory Street reduces the risk of bicycle/pedestrian crashes by 59%, significantly enhancing safety for bicyclists and pedestrians crossing the river[8]. In addition, the bi-directional MUP allows cyclists to shift from the limited active transportation facilities on the Ellsworth Street bridge over to the improved Lyon Street bridge facilities, further improving safety in the corridor.

Community Livability Improvements

The MUP promotes multi-modal travel, providing a low stress walking and biking connection between North Albany and Downtown Albany.

Societal Benefits

The proposed MUP project improves bicycle and pedestrian safety and comfort for the Willamette River crossing, encouraging shifts away from auto focused modes of travel.

Summary of Level 2 Evaluation

The Level 2 Evaluation results for the Lyon Street Bridge alternative is summarized by anticipated level of benefit/impact in Table 4. Only applicable criteria are included in the table.

TABLE 5: LYON STREET BRIDGE LEVEL 2 EVALUATION RESULTS SUMMARY

APPLICABLE SCREENING CRITERIA	ALT 2F
PEDESTRIAN FACILITIES	(++)
BICYCLE FACILITIES	(++)
SAFETY	(++)
COMMUNITY LIVABILITY IMPROVEMENTS	(++)
SOCIETAL BENEFITS	(++)
PROJECT COST	$3,200,000

[7] Physically separated bicycle lanes (separated from motor vehicles by landscaped buffers, curbs, bollards, bioswales, on-street parking or other vertical delineators) are generally classified as BLTS 1. At 25 mph, on-street bike lanes with no separation would need to be ≥ 7' to reach BLTS 1, otherwise BLTS 3. If adjacent to a parking lane, the bike lane width in addition to parking with would have to be ≥ 15' to reach BLTS 2, otherwise BLTS 3.

[8] ODOT CRF List – Countermeasure #BP273

Based on the project benefits identified in the Level 2 Evaluation, the Lyon Street Bridge MUP (Alternative 2F) is recommended for implementation as a near-term project.

1ST AVENUE/LYON STREET

The intersection at 1st Avenue/Lyon Street, which is expected to fail in the next five years, is a critical bottleneck on the corridor. The westbound right turn traffic demand is expected to increase in the future, pushing the intersection well over capacity and creating extensive queuing and delays on both Lyon Street and 1st Avenue. In addition, this congestion will lead to more traffic shifting to the Oregon 99E (OR 99E) eastbound off-ramp, and to local streets such as 3rd and 4th Street. The existing bike facility on 1st Avenue essentially terminates in favor of the existing westbound right turn lane at Lyon Street, creating an unsafe condition for cyclists attempting to either access Ellsworth Street to the west or routing north across the river.

ALTERNATIVES

The following list of alternatives were considered for this intersection (shown in Figures 5 through 7):

2A Close the north crosswalk at Lyon Street and 1st Avenue and replace it with a new multi-use path connection under the Lyon Street Bridge and across to Ellsworth Street. ODOT does not support the closure of the north crosswalk at Lyon Street and 1st Avenue, so this alternative was only included as an option in case the operational alternatives at Lyon Street and 1st Avenue could not function with that crossing in place. As shown in the subsequent evaluation results, these alternatives could function with the crosswalk in place, so Alternative 2A was not evaluated further.

2C Change westbound lane geometry to TH, RT, RT and add a curb extension on the west leg. Add a pedestrian phase to the crossing on the north leg.

2D Remove one westbound approach lane and change lane geometry to TH-RT, RT. Add a curb extension on the west leg. Add a pedestrian/bicycle phase to the crossing on the north leg.

2E Remove one westbound approach lane and change lane geometry to TH-RT, RT. Add a curb extension on the west leg. Shift the bike lane to the south side of 1st Avenue and install a bike box on the westbound approach for bikes to cross up to the bridge. Add a pedestrian phase to the crossing on the north leg.

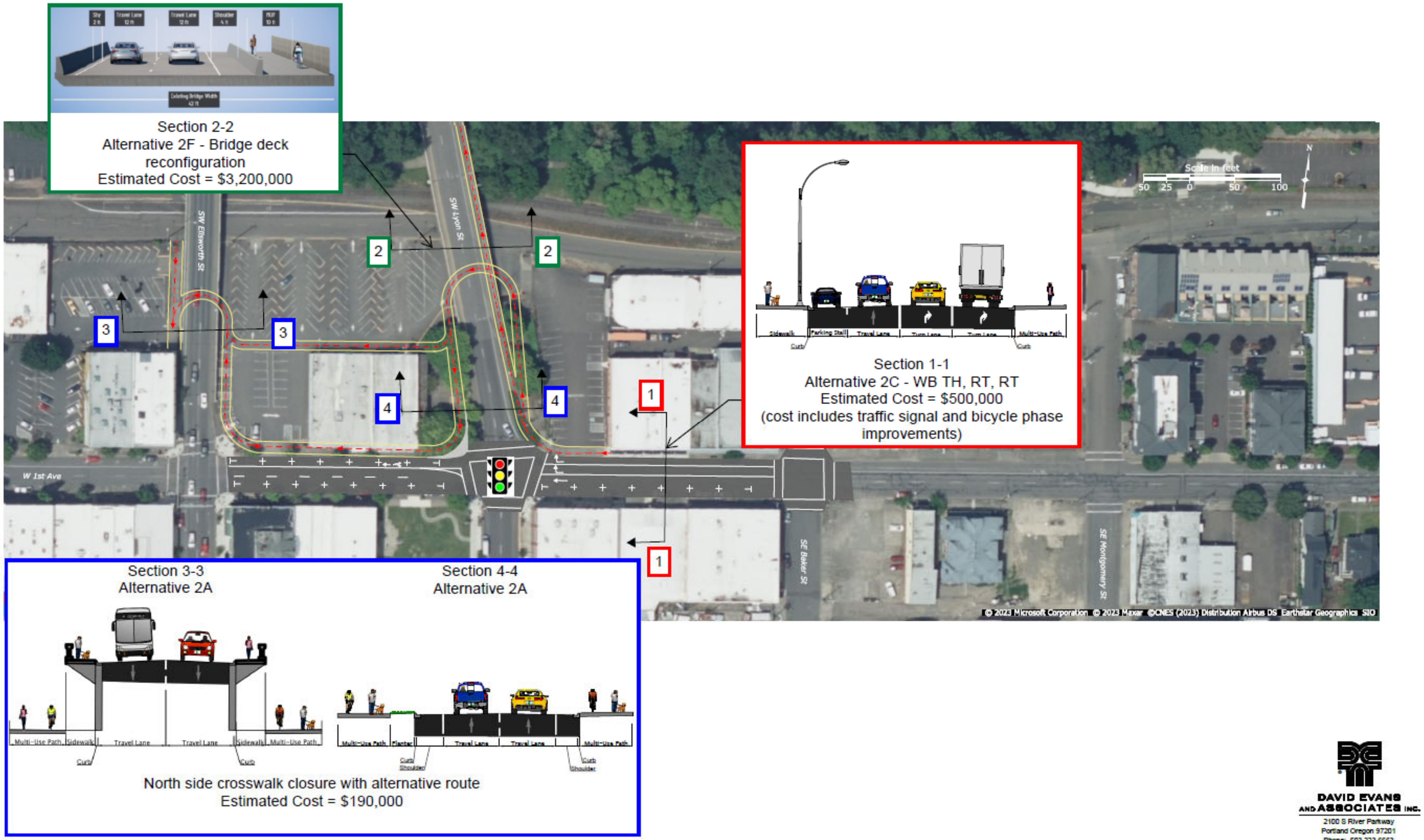

FIGURE 5: LYON ST AND 1ST AVE - ALTERNATIVE 2C

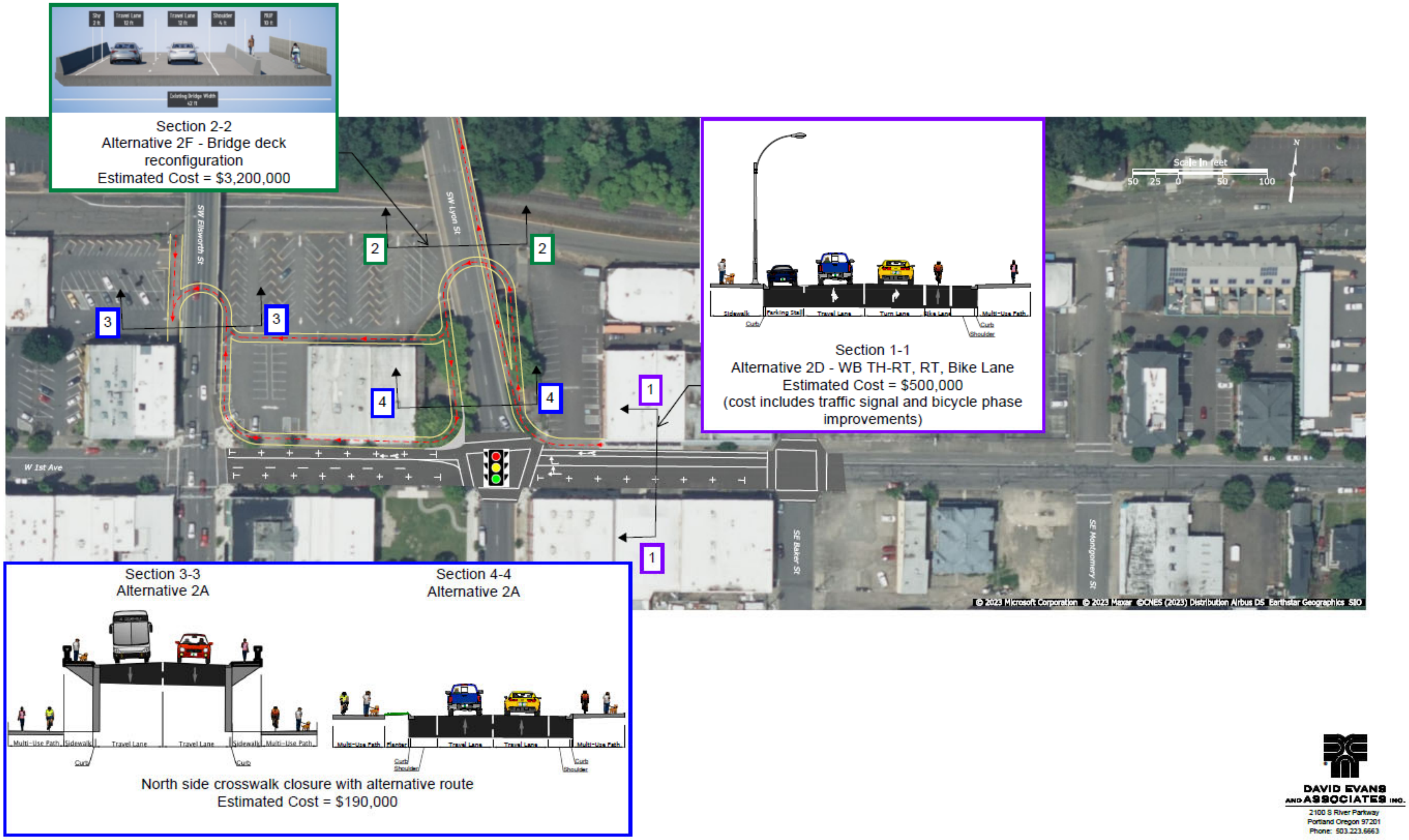

FIGURE 6: LYON ST AND 1ST AVE - ALTERNATIVE 2D

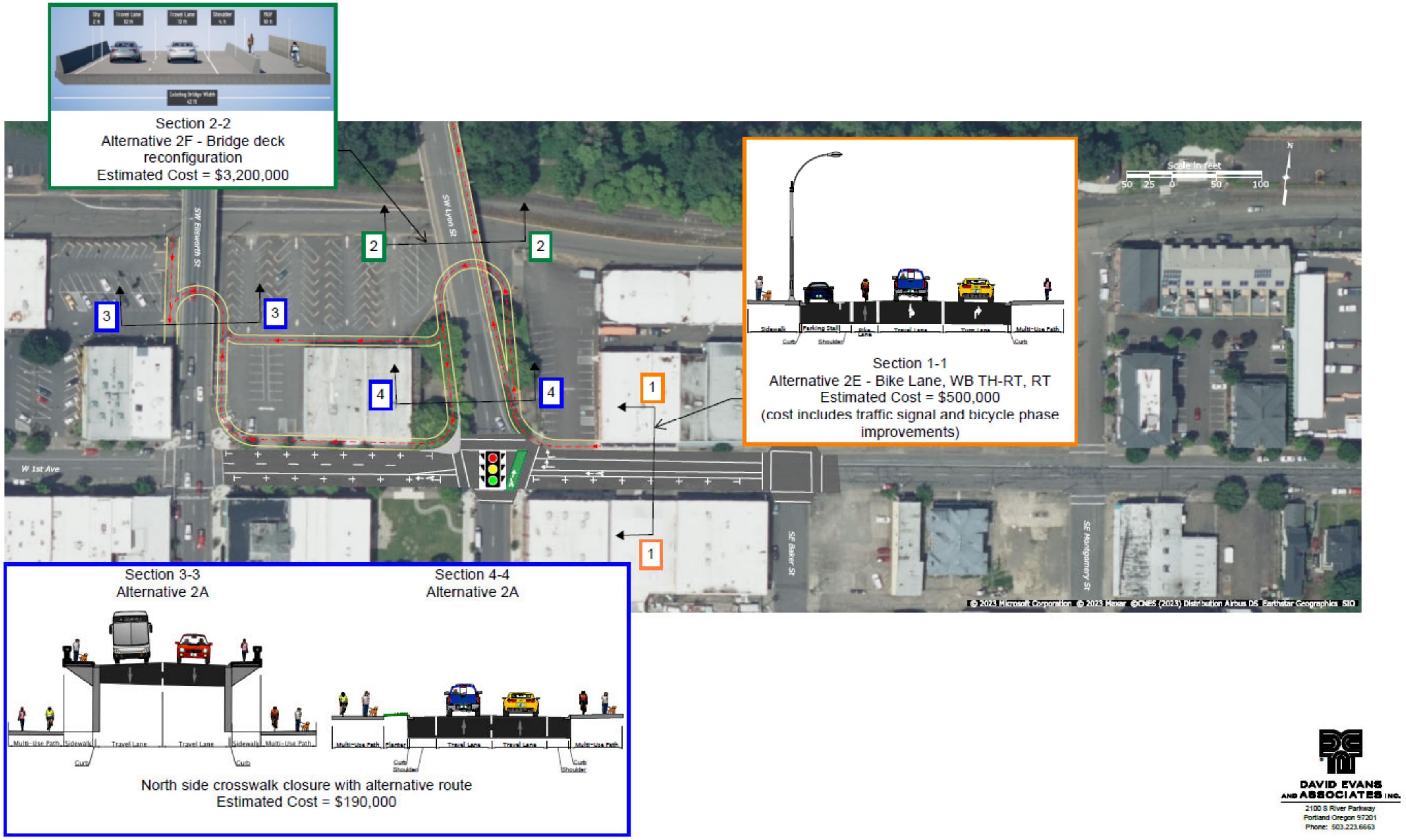

FIGURE 7: LYON ST AND 1ST AVE - ALTERNATIVE 2E

LEVEL 2 EVALUATION

The Level 2 Evaluation of the Lyon Street/1st Avenue intersection alternatives is summarized below. Only criteria applicable to the alternatives were evaluated.

Motor Vehicle Operations

Under 2043 No-Build conditions, from 4-6 PM only 67% of the forecasted traffic demand for the westbound right turn at Lyon Street/1st Avenue was served. All proposed alternatives reduce the 1st Avenue westbound through lanes from two to one, re-purposing the existing roadway cross section to better serve the high demand for the westbound right turn.

The PM peak hour intersection delay was evaluated in the Vissim analysis, and the results for the 1st Avenue/Lyon Street intersection are summarized in Table 6.

TABLE 6: LYON STREET/1ST AVENUE ALTERNATIVES – YEAR 2043 PM PEAK HOUR DELAY

LYON STREET/1ST AVENUE MOVEMENT	NO-BUILD	ALT 2C	ALT 2D	ALT 2E
WESTBOUND RIGHT TURN	670 s/veh	93 s/veh	352 s/veh	370 s/veh
INTERSECTION TOTAL	169 s/veh	33 s/veh	121 s/veh	124 s/veh

As detailed in the prior System Operations Summary section, the exclusive dual right turn lane alternative (Alternative 2C), while providing the best operations for the Lyon Street/1st Avenue intersection in isolation, performs worse than the other alternatives along Lyon Street northbound and 2nd Avenue eastbound. Alternative 2E provides the best balance in delay between Lyon Street and 1st Avenue and has more flexibility in signal timing compared to Alternative 2D due to the bike lane being shifted out of conflict with the westbound right turn movement.

As discussed previously in the System Operations Summary section, all three proposed alternatives provide sufficient capacity to serve the forecasted 2043 PM peak period demand, which significantly improves queueing system wide over No-Build conditions, where only 67% of the westbound right turn demand is served. This lessens the risk of neighborhood cut-through traffic on 3rd and 4th Avenue. System wide, all three alternatives contribute to decreasing the average delay per vehicle and increasing throughput on the Lyon Street Bridge.

Table 7 summarizes the HCM 2000 based v/c ratios for the alternatives at Lyon Street/1st Avenue signal.

TABLE 7: LYON STREET/1ST AVENUE ALTERNATIVES V/C RATIOS

ALTERNATIVE	DESCRIPTION	AM V/C	PM V/C
NO-BUILD	No changes from existing	**1.03**	**1.31**
ALT 2C	Exclusive dual right turn lanes with protected ped/bike phasing	0.83	**1.09**
ALT 2D	Right+Through/Right configuration with protected ped/bike phasing	0.88	**1.23**
ALT 2E	Right+Through/Right configuration with protected ped phasing (bike lane on the south side of 1st Avenue	0.87	**1.17**

As shown in Table 7, all three alternatives improve the capacity of the Lyon Street/1st Avenue intersection. While none of the alternatives fully meet the intersection mobility standards, all provide a significant upgrade over the forecasted No-Build conditions, with the exclusive dual westbound right turn (Alternative 2C) providing the largest improvement. Shifting the 1st Avenue bike lane to the south side of the road reduces conflicts for the westbound right turn, resulting in a more capacity for Alternative 2E compared to Alternative 2D.

On-street Parking Impacts

All proposed alternatives include the removal of five on-street parking stalls along the north side of 1st Avenue to maintain sufficient storage for the westbound right turn lanes. The parking spaces are already used as queued vehicle storage during AM and PM peak hour conditions.

Pedestrian Facilities

Alternative 2C would include an exclusive pedestrian phase for the north crosswalk at Lyon Steet/1st Avenue, holding the westbound right turn to allow the pedestrians to cross safely. Alternatives 2D and 2E would include an exclusive pedestrian phase for this crosswalk, holding all westbound movements. Alternatives 2E and 2D both provide opportunity for a shorter crosswalk on the east leg of the intersection, and all three alternatives include a pedestrian refuge island on the northwest corner of the intersection, shortening the west leg crosswalk. The existing Leading Pedestrian Interval (LPI) for northbound Lyon Street would be maintained, protecting the west leg crosswalk with time for pedestrians to enter the driver's line-of-sight before vehicles are given a green indication.[9]

Bicycle Facilities

Shifting the bicycle lane to the south side of 1st Avenue, as part of Alternative 2E, eliminates the conflict with westbound right-turning vehicles. Additionally, a green bike lane across the east led of the intersection to cross up to the bridge will increase visibility of people on bicycles and reduce

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[9] FHWA Proven Safety Countermeasures – Leading Pedestrian Interval: https://highways.dot.gov/safety/proven-safety-countermeasures/leading-pedestrian-interval#:~:text=A%20leading%20pedestrian%20interval%20(LPI,to%20turn%20right%20or%20left.

vehicle encroachment in the dedicated bicycle facility. This alternative is considered significantly beneficial to bicycles.

Alternative 2D maintains a protected bike lane, but still does not completely mitigate the westbound vehicle right turn hook conflict with 1st Avenue bicycles traveling through the intersection. Therefore, this alternative is considered somewhat beneficial to bicyclists.

Alternative 2C cannot feasibly contain a bike lane on 1st Avenue approaching the intersection, forcing bikes to use the existing sidewalk, which is already constrained by street trees and other obstacles. This is considered a significant impact to bicycles at this location.

Safety

Improving safety for people biking or walking through this section was a top priority considering seven of the nine bicycle and pedestrian crashes (2017-2021) took place on the Ellsworth Street-Lyon Street couplet between 1st Avenue and 2nd Avenue.

Bicycle/pedestrian crash frequency reduces 55% with a leading pedestrian interval/pedestrian phase, as part of all three alternatives.

Curb extensions, proposed as part of all the alternatives, reduce all crash types by 30%[10]. Shifting the bicycle lane to the south side of 1st Avenue, as part of Alternative 2E, eliminates the conflict point with westbound right turns. Plus, urban green bicycle lanes at conflict points reduces bicycle crashes by 39%. Therefore, Alternative 2E is considered a significant safety benefit, while Alternatives 2D and 2C are considered a somewhat significant improvement.

Community Livability Improvements

The improvements to overall bicycle and pedestrian connectivity from Alternative 2D and 2E through this congestion challenged intersection enhances community livability, while the impacts of routing bikes onto the 1st Avenue sidewalk negate the other benefits provided by Alternative 2C.

Economic Vitality

As noted in the Motor vehicle discussion, the three alternatives improve delay and queuing for the US 20 corridor, including improvements to freight travel throughout the corridor.

Consistency with City/State Adopted Plans

The City's TSP recommended a similar project at this location, re-striping the westbound approach to allow for a dual right turn movement.[11]

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[10] ODOT CRF List – Countermeasure #I33

[11] Abany Transportation System Plan (2010) full access online: https://www.albanyoregon.gov/images/stories/publicworks/engineering/tsp/albanytsp_022410.pdf

Societal Benefits

All the proposed alternatives enhance freight, motor vehicle, and transit by reducing congestion, queuing, and delay on the US 20 corridor. In addition, Alternatives 2D and 2E provide improvement for active transportation modes at Lyon Street/1st Avenue.

Summary of Level 2 Evaluation

The Level 2 Evaluation results for the Lyon Street/1st Avenue intersection alternatives are summarized by anticipated level of benefit/impact in Table 8. Only applicable criteria are included in the table.

TABLE 8: LYON STREET/1ST AVENUE LEVEL 2 EVALUATION RESULTS SUMMARY

APPLICABLE SCREENING CRITERIA	ALT 2C	ALT 2D	ALT 2E
MOTOR VEHICLE OPERATIONS	**(++)**	**(++)**	**(++)**
ON-STREET PARKING IMPACTS	(-)	(-)	(-)
PEDESTRIAN FACILITIES	(+)	(+)	(+)
BICYCLE FACILITIES	(-)	(+)	**(++)**
SAFETY	(+)	(+)	**(++)**
COMMUNITY LIVABILITY IMPROVEMENTS	(+)	(+)	**(++)**
ECONOMIC VITALITY	**(++)**	**(++)**	**(++)**
CONSISTENCY WITH CITY/STATE STANDARDS	**(++)**	**(++)**	**(++)**
SOCIETAL BENEFITS	(+)	**(++)**	**(++)**
PROJECT COST	$500,000	$500,000	$500,000

As shown in Table 8, across the applicable Level 2 Evaluation Criteria, Alternative 2E performs the best, providing the best safety, livability, and bicycle facility benefits. Shifting the bike lane to the south side of 1st Avenue is a larger scale project, and Alternative 2D provides many similar benefits without precluding Alternative 2E. Therefore, Alternative 2D is recommended for immediate implementation, while Alternative 2E is recommended as the ultimate solution to address increasing traffic and bicycle demand on 1st Avenue. Alternative 2C is not recommended for implementation due to impacts to bicycles on 1st Avenue.

2ND AND 3RD AVENUE AT LYON STREET

Based on the latest report (2021), this section was identified within the top 15 percent Safety Priority Index System (SPIS) locations in the state. The most recent five years of crash data (2017-

2021) indicates that one of the leading contributors to the many rear ends, angle/turning crashes, and one pedestrian crash resulting in serious injury was disregarding the traffic signal.

ALTERNATIVES

Alternative **3B,** updating signal timing to better balance green time based on forecasted traffic volume changes, was the alternative evaluated at these intersections. The intersection green times were adjusted to better balance Lyon Street versus side street traffic.

LEVEL 2 EVALUATION

Various signal timing adjustments were tested in Vissim, but these adjustments indicated little to no independent operational benefit to the corridor. The alternatives implemented at Ellsworth Street/2nd Avenue and Lyon Street/1st Avenue impact operations at these intersections. Therefore, rather than evaluate the individual benefits of signal timing adjustments to these intersections, the recommendation is to re-optimize the signal timing at the Lyon Street signals at 2nd and 3rd Avenue when recommended improvements at Ellsworth Street/2nd Avenue and Lyon Street/1st Avenue are implemented.

1ST AND 2ND AVENUE/ELLSWORTH STREET

The 1st and 2nd Avenue intersections with Ellsworth Street create the critical southbound US 20 bottleneck detailed in the System Operation Summary section of this memorandum. The limited green time for Ellsworth Street at 1st Avenue combines with the high southbound left turning volume at 2nd Avenue to create Ellsworth Street/US 20 vehicle queues back through N Albany Road. These queues result in 11% of 4-6 PM future eastbound US 20 demand remaining unserved at 6PM. These queuing issues are compounded at 2nd Avenue due to the limited queue storage between Ellsworth and Lyon Street, and on Lyon Street between 1st and 2nd Avenue. Eastbound 2nd Avenue quickly becomes congested as traffic on this street competes with northbound Lyon Street traffic, which in turn competes with westbound right turning traffic from 1st Avenue. Approximately 14% of the 2nd Avenue traffic demand is unserved from 4-6 PM. The 1st and 2nd Avenue/Ellsworth Street bottleneck limits the capacity of the Ellsworth Street bridge, and growth in future traffic demand (primarily coming from North Albany) is queued back out of the system during the PM peak period. The combined delay times through this section could also cause more eastbound to northbound traffic to shift to local streets such as 3rd and 4th Avenue.

ALTERNATIVES

The alternatives considered for this section are shown in Figure 8 and include the following:

4B Upgrade signal timing to adjust the side street split at Ellsworth Street/1st Avenue from 25 seconds to 21 seconds by reducing the pedestrian walk time.

4C Add southbound left turn lane at Ellsworth Street and 2nd Avenue by removing a half block of parking on both sides of Ellsworth Street between 1st and 2nd Avenue. Add an exclusive left turn phase and protected pedestrian phase for the east crosswalk. This alternative would likely require public outreach to accustom users to pedestrian activated crossings.

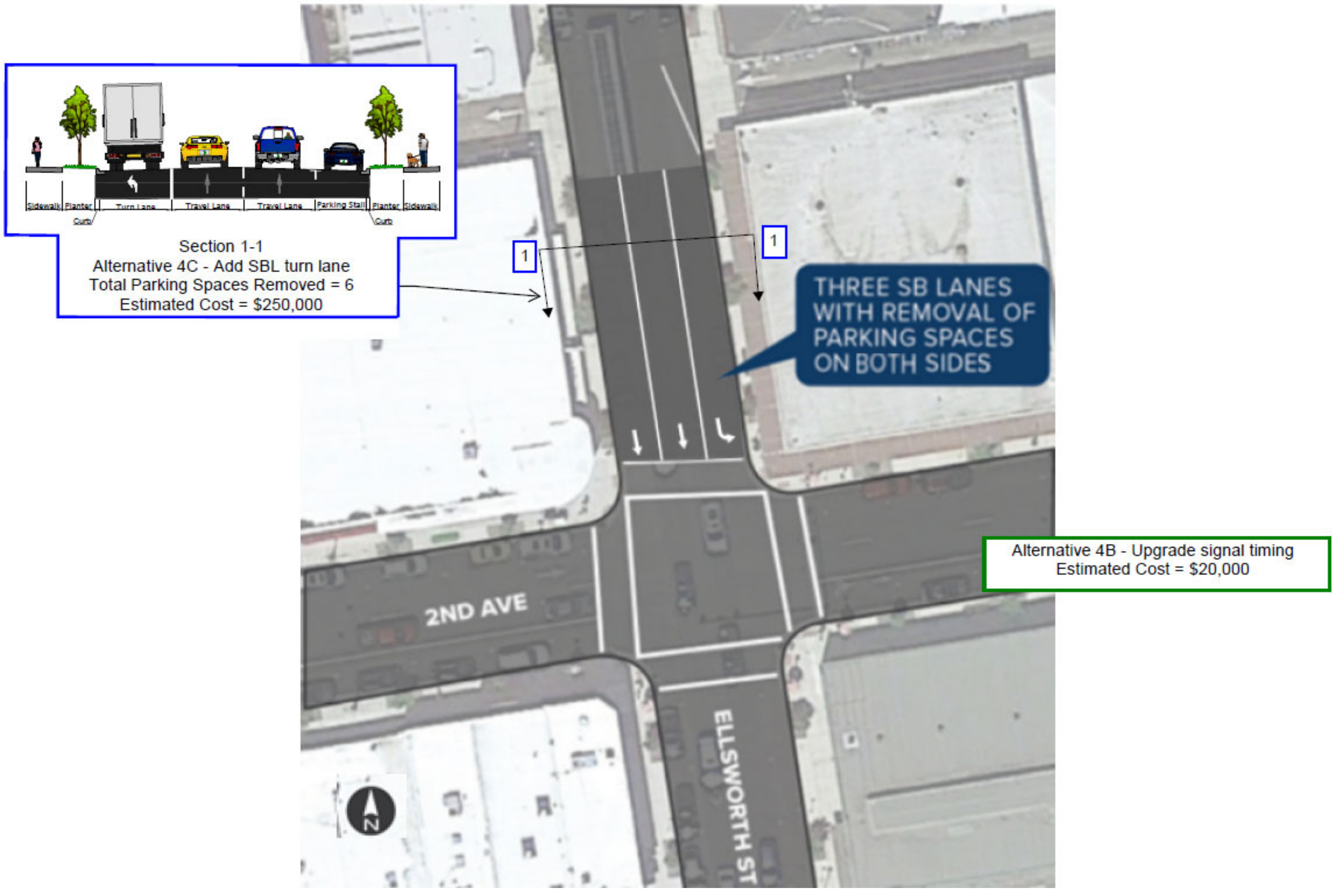

FIGURE 8: ELLSWORTH STREET/2ND AVENUE - ALTERNATIVES

LEVEL 2 EVALUATION

The Level 2 Evaluation of the Ellsworth Street and 1st and 2nd Avenue intersections alternatives are summarized below. Only criteria applicable to the alternatives were evaluated.

Motor Vehicle Operations

The side street signal timing adjustments (Alternative 4B) provides additional southbound green time to Ellsworth Street, increasing the capacity of the Ellsworth Street bridge.

The exclusive southbound left turn lane (Alternative 4C) adds capacity to the Ellsworth Street/2nd Avenue intersection. This improvement replaces the LPI with a protected pedestrian phase on the east crosswalk, which adds additional green time to the southbound through movement. The left turn lane increases the intersection capacity, further improving southbound throughput over the Ellsworth Bridge, and decreases queuing and delay on southbound US delay. 2nd Avenue eastbound is now able to receive additional green time, improving the queuing on this approach to Ellsworth Street, with only 2-4% of the 4-6 PM future traffic demand unserved, compared to 14% under No-Build conditions. This lessens the risk of neighborhood cut-through traffic on 3rd and 4th Avenue.

The PM peak hour intersection delay was evaluated in the Vissim analysis, and the results for the Ellsworth Street and 1st and 2nd Avenue intersections are summarized in Table 9.

TABLE 9: ELLSWORTH STREET/1ST AND 2ND AVENUE – YEAR 2043 PM PEAK HOUR DELAY

INTERSECTION	NO-BUILD	ALT 4B+4C
ELLSWORTH STREET/1ST AVENUE	670 s/veh	93 s/veh
ELLSWORTH STREET/2ND AVENUE	169 s/veh	33 s/veh

As detailed in the prior System Operations Summary section, the benefits of both the signal timing adjustment (Alternative 4B) and the southbound left turn lane at Ellsworth Street/2nd Avenue both contribute to decreased queuing and vehicle delay across the US 20 corridor, particularly for southbound movements. Therefore, the benefits to these performance measures are more extensive than those summarized in Table 9.

Table 10 summarizes the HCM 2000 based v/c ratios for the proposed improvement at the Ellsworth Street/2nd Avenue signal.

TABLE 10: ELLSWORTH STREET/2ND AVENUE ALTERNATIVE V/C RATIOS

ALTERNATIVE	DESCRIPTION	AM V/C	PM V/C
NO-BUILD	No change from existing	0.97	0.93
ALT 4C	Added southbound left turn lane with protected ped phase	0.74	0.74

As shown in Table 10, Alternative 4C significantly improves the capacity of the Ellsworth Street/2nd Avenue intersection under future forecasted conditions.

On-street parking

A total of three on-street parking stalls will be removed from each side of Ellsworth Street between 1st and 2nd Avenue to make room for the additional southbound left turn lane as part of Alternative 4C.

Pedestrian Facilities

The proposed southbound left turn lane at the Ellsworth Street/2nd Avenue intersection (Alternative 4C) improves pedestrian facilities by providing a protected pedestrian phase for the east crosswalk at this intersection.

Safety

Upgrading signal timings to include more volume balanced appropriate splits could reduce all crash types by reducing congestion and maximizing vehicle throughout. Similarly, an exclusive left turn lane can improve safety by enhancing motor vehicle operations.

Economic Vitality Benefits

Both proposed alternatives maximize vehicle throughput and reduce overall congestion and delay.

Consistency with City/State Adopted Plans

The City TSP recommended similar projects, including both signal timing updates and the new southbound left turn lane.

Summary of Level 2 Evaluation

The Level 2 Evaluation results for the Ellsworth Street and 1st and 2nd Avenue intersections alternatives are summarized by anticipated level of benefit/impact in Table 11. Only applicable criteria are included in the table.

TABLE 11: ELLSWORTH STREET/1ST AND 2ND AVENUE LEVEL 2 EVALUATION RESULTS SUMMARY

APPLICABLE SCREENING CRITERIA	ALT 4B	ALT 4C
MOTOR VEHICLE OPERATIONS	**(++)**	**(++)**
ON-STREET PARKING IMPACTS	**No Change**	(-)
PEDESTRIAN FACILITIES	**No Change**	**(++)**
SAFETY	(+)	**(++)**
ECONOMIC VITALITY	**(++)**	**(++)**
CONSISTENCY WITH CITY/STATE STANDARDS	**(++)**	**(++)**
PROJECT COST	$20,000	$250,000

Based on the impacts summarized above for each proposed alternative and their relative cost, both Alternative 4B and 4C should be considered for short-term implementation.

DOWNTOWN UNSIGNALIZED INTERSECTIONS (4TH AVENUE, 5TH AVENUE, AND 6TH AVENUE)

The downtown unsignalized intersections in this section are currently marked with standard crosswalks. However, it is a challenge for bicyclists and pedestrians to cross US 20 due to limited visibility, vehicle congestion, and a long crossing distance.

ALTERNATIVES

The alternative considered for these intersections is to add Rapid Rectangular Flashing Beacons (RRFBs) on upstream crossings (Alternative 5B). The proposed locations and total estimated cost for the five crossings are shown in Figure 9.

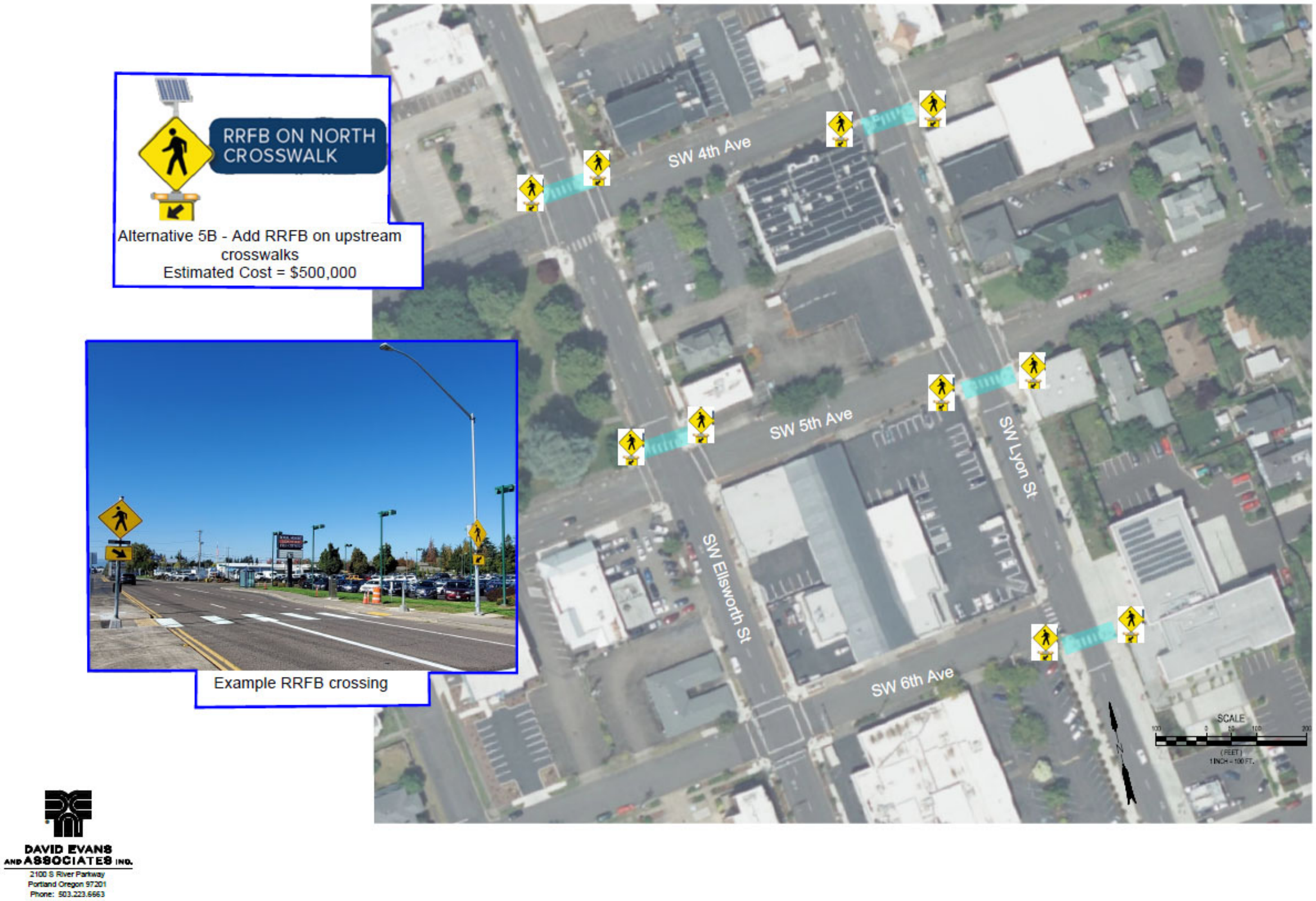

FIGURE 9: UNSIGNALIZED INTERSECTIONS - ALTERNATIVE 5B

LEVEL 2 EVALUATION

The Level 2 Evaluation of the Downtown Unsignalized Intersections alternatives are summarized below. Only criteria applicable to the alternatives were evaluated.

Motor Vehicle Operations

As crosswalks currently exist at the proposed RRFB crossing locations, little to no impact is foreseen on motor vehicle operations.

Pedestrian FACILITIES

Multiple RRFBs can improve pedestrian travel time within the downtown business district and encourage more linked trips.

Bicycle FACILITIES

Installation of RRFBs drastically improves safety for bicycles crossing the major roadways of Lyon Street and Ellsworth Street.

Transit Facilities

Accessibility to transit facilities is improved by providing low-stress crossings within the downtown business district.

Safety

Although no bicycle/pedestrian involved crashes were recorded within this segment during the study period, the installation of multiple RRFBs along a corridor can help maintain vehicle speeds low, increase consciousness of multimodal activity presence, and contribute to a low-stress multimodal network.

Community livability

Multimodal activity can be enhanced within the downtown business district by providing low-stress crossings and connectivity.

Consistency with City/state Adopted Plans

This alternative is consistent with the City's adopted plans. The City TSP identified the need for increased frequency of pedestrian crossings on high-volume roadways. A low-stress network within the downtown business district also meets the City's TSP goals to reduce reliance on motor vehicles and provide greater opportunities for linked trips.

Social Benefits

Strategically placed signalized crossings encourage more multi-modal travel and linked trips through the downtown business district by granting multiple safe low-stress crossings.

Summary of Level 2 Evaluation

The Level 2 Evaluation results for the Downtown Unsignalized Intersections alternative is summarized by anticipated level of benefit/impact in Table 12. Only applicable criteria are included in the table.

TABLE 12: UNSIGNALIZED DOWNTOWN INTERSECTIONS LEVEL 2 EVALUATION RESULTS SUMMARY

APPLICABLE SCREENING CRITERIA	ALT 2F
MOTOR VEHICLE OPERATIONS	**No Change**
PEDESTRIAN FACILITIES	**(++)**
BICYCLE FACILITIES	(+)
TRANSIT FACILITIES	(+)
SAFETY	**(++)**
COMMUNITY LIVABILITY	**(++)**
CONSISTENCY WITH CITY/STATE STANDARDS	**(++)**
SOCIETAL BENEFITS	**(++)**
PROJECT COST	$500,000

In consideration of the benefits described above and relative cost, Alternative 5B should be considered for implementation.

9TH AVENUE/LYON STREET/OR 99E

This location is one of the projected key bottlenecks in the future no-build scenario. As discussed in the Systems Operations Summary section, traffic operations upstream on Ellsworth Street significantly impact the amount of traffic able to reach this intersection during the PM peak period. The primary identified issue at this location is queue spillback on both OR 99E off-ramps, which receive limited green time during the peak periods.

ALTERNATIVES

The proposed alternative for this location is to add a second lane to the 99E off-ramp that continues through the intersection to northbound Lyon Street. The concept would incorporate MUP on OR 99E overpass providing access to local roadways, including Baker Street and Montogomery Street.

Figure 10 displays an aerial of this segment, including the proposed cross sections for the OR 99E underpass and northbound off ramp, and shows a zoomed in view of the layout through the OR 99E underpass.

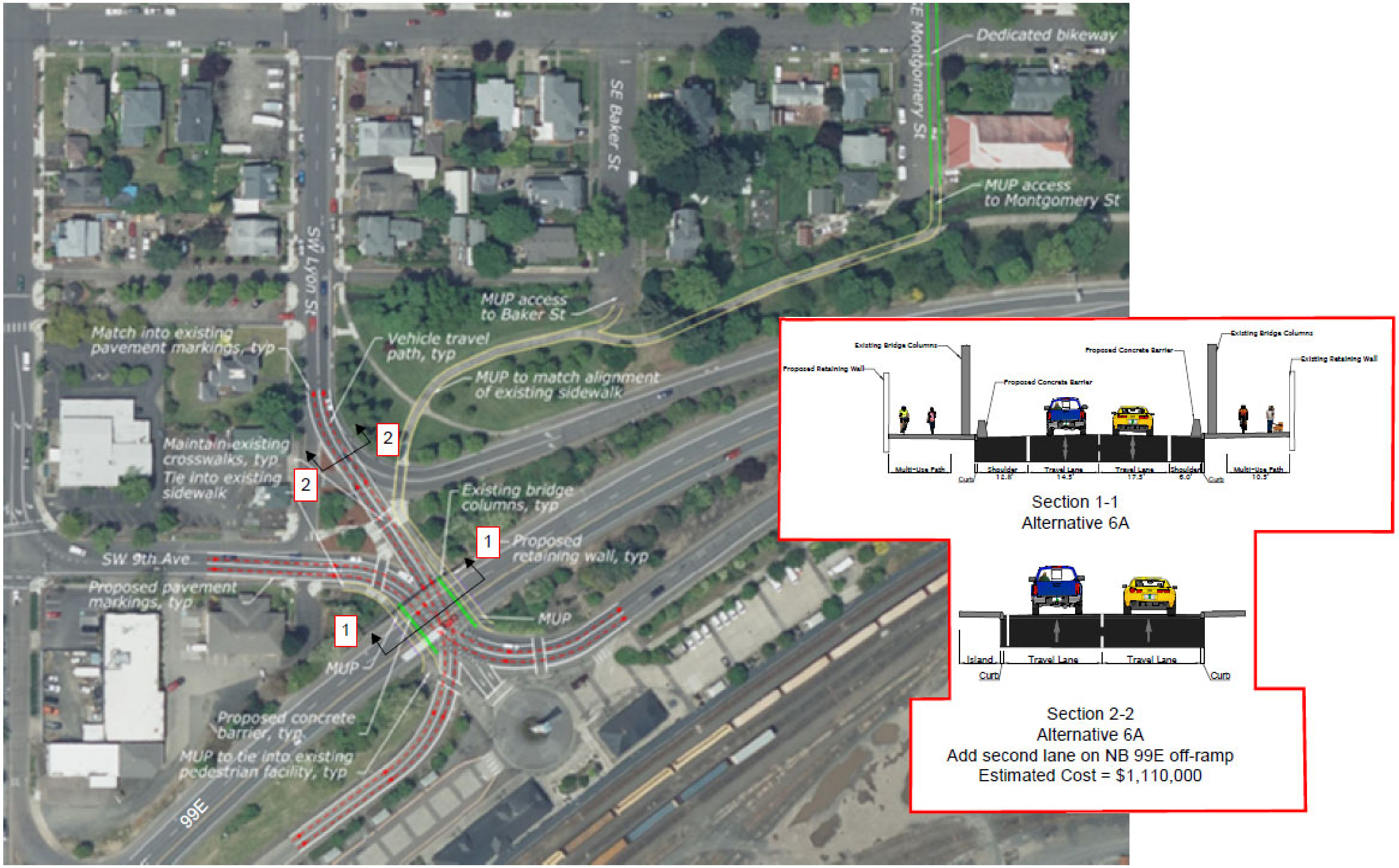

FIGURE 10: 9TH AVE/LYON ST/OR 99E RAMPS - ALTERNATIVE 6A

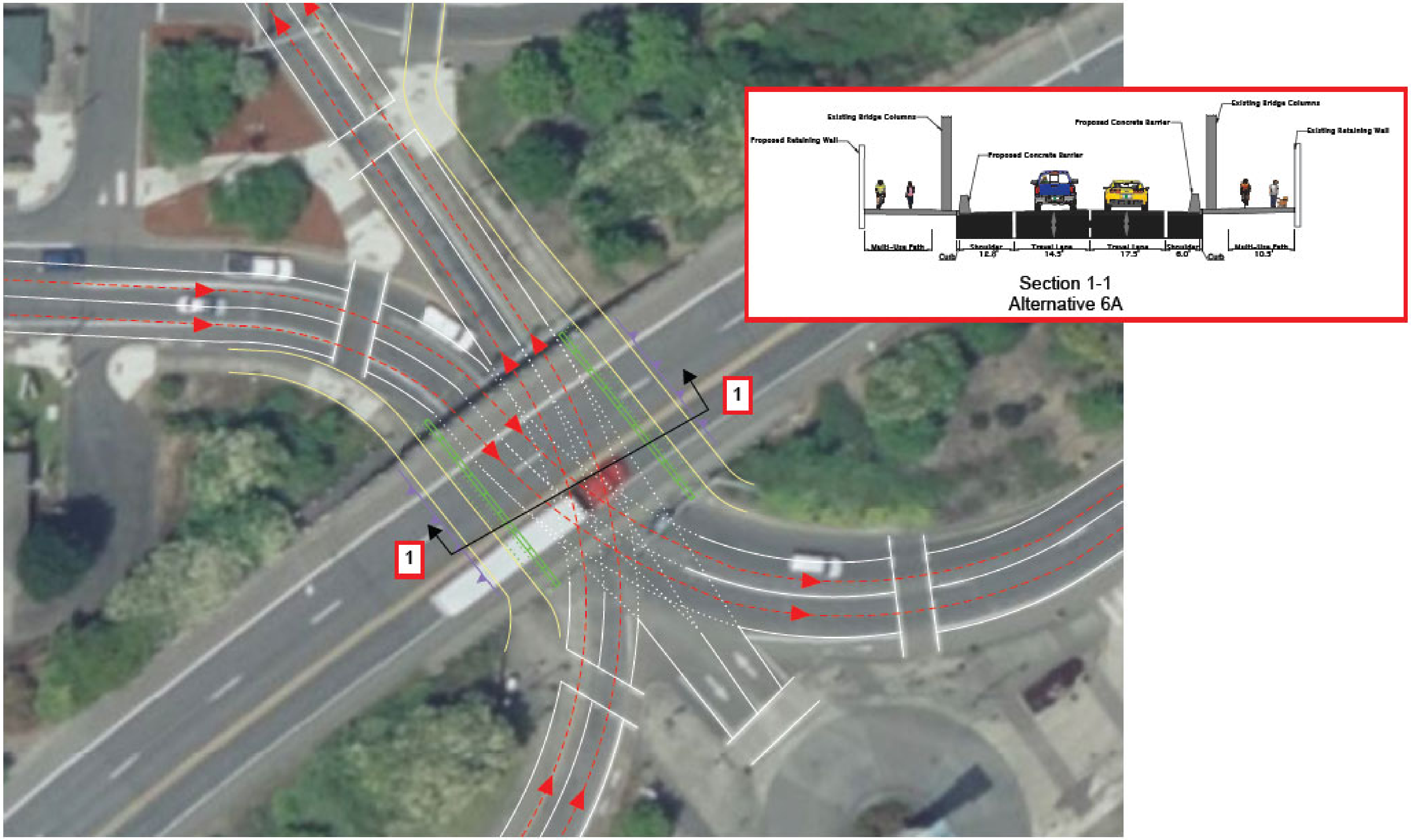

FIGURE 11: 9TH AVE/LYON ST/OR 99E RAMPS - ALTERNATIVE 6A ZOOMED IN VIEW

LEVEL 2 EVALUATION

The Level 2 Evaluation of the at 9th Avenue/Lyon Street/OR 99E Ramps alternative is summarized below. Only criteria applicable to the alternative were evaluated.

Motor Vehicle Operations

The additional off-ramp lane helps reduce congestion at this intersection. Adding the 2nd lane on the northbound OR 99E Off-Ramp allows for reduced green time for this off-ramp, which is then re-balanced to the other movements at the interchange. The benefits of these changes are summarized in Table 13, which summarizes the HCM 2000 based v/c ratios for the proposed improvement at 9th Avenue/Lyon Street/OR 99E Ramps signal.

TABLE 13: 9TH AVENUE/LYON STREET/OR 99E RAMPS ALTERNATIVE V/C RATIOS

ALTERNATIVE	DESCRIPTION	AM V/C	PM V/C
NO-BUILD	No change from existing	0.69	**1.10**
ALT 6A	Dual northbound OR 99E off-ramp	0.55	0.86

The added lane improves the flexibility of the signal timing at the intersection to better manage queue spillback on both OR 99E off-ramps and reduces the risk of neighborhood cut-through travel on 3rd and 4th Avenue by improving the OR 99E to US 20 regional connection.

Pedestrian Facilities

The concept plan includes a barrier protected mixed use path on both sides of the roadway through the OR 99E underpass. The proposed concrete barrier in addition to the existing bridge columns will provide vertical separation between motor vehicles and users of the MUP on either side of the OR 99E underpass, reducing the Pedestrian LTS to the lowest level.

Bicycle Facilities

The MUP expands connectivity of the bicycle low-stress network between the downtown business district and the Albany Transit Center.

Transit Facilities

Multimodal access to/from the Albany Transit Center is considerably improved with the integration of the MUP on both sides of the overpass.

Safety

Installation of a MUP significantly reduces conflict points, while bicycle and pedestrian crash risk is expected to decrease by 63%[12].

[12] ODOT CRF List – Countermeasure #BP27

Community Livability

Multimodal connectivity between the downtown business district and/or North Albany is enhanced with MUP tied into the Albany Transit Center. The additional off-ramp lane helps reduce northbound queueing and congestion from OR 99E onto Lyon Street.

Economic Vitality

The proposed alternative improves capacity at a key regional intersection, benefiting the regional connection between OR 99E and US 20. This will improve truck travel to/from the US 20 corridor, promoting economic vitality for the region.

Consistency with City/state Adopted Plans

Implementing an MUP leading to the downtown business district and near major destinations meets the City's TSP goals to reduce reliance on motor vehicles and provide greater opportunities for linked trips.

Social Benefits

The additional off-ramp lane reduces congestion at this intersection, and the MUP enhances bicycle/pedestrian safety while promoting multimodal travel for people with various experience levels.

Summary of Level 2 Evaluation

The Level 2 Evaluation results for the 9th Avenue/Lyon Street/OR 99E Ramps alternative is summarized by anticipated level of benefit/impact in Table 14. Only applicable criteria are included in the table.

TABLE 14: 9TH AVENUE/LYON STREET/OR 99E RAMPS LEVEL 2 EVALUATION RESULTS SUMMARY

APPLICABLE SCREENING CRITERIA	ALT 6A
MOTOR VEHICLE OPERATIONS	(++)
PEDESTRIAN FACILITIES	(++)
BICYCLE FACILITIES	(++)
TRANSIT FACILITIES	(++)
SAFETY	(++)
COMMUNITY LIVABILITY	(++)
ECONOMIC VITALITY	(+)
CONSISTENCY WITH CITY/STATE STANDARDS	(++)
SOCIETAL BENEFITS	(++)
PROJECT COST	$1,110,000

The vehicle capacity issues at this location have not yet occurred but will with expected traffic growth in the future. Therefore, Alternative 6A is recommended for long-term implementation.

LYON/ELLSWORTH BICYCLE FACILITIES

Bicycle facilities are proposed along the Lyon-Ellsworth couplet in order to integrate a low-stress network for bicyclists from North Albany to/from the downtown business district. The current bicycle LTS on this corridor is 4 through the couplet because the roadway is shared with a high-volume of motorized vehicles.

ALTERNATIVES

The following list of alternatives were considered:

7A Install a two-way cycle track on east side of Lyon Street. This option would involve removing landscaping and one parking lane on the east side of Lyon Street. This track would connect OR 99E to the Lyon Street bridge through Albany's downtown area.

7B Install two one-way cycle tracks on one side of Lyon Street and Ellsworth Street. This option requires removal of the parking lanes on the east side of Lyon Street and the west side of Ellsworth Street.

7C Install buffered bike lanes on one side of Lyon Street and Ellsworth Street. This option requires removal of the parking lanes on the east side of Lyon Street and the west side of Ellsworth Street.

7D Implement a neighborhood bikeway on Montgomery Street connecting to the Lyon Street bridge via 1st Avenue.

Figure 12 summarizes the proposed alternatives considered in the Level 2 evaluation, and Figure 13 through Figure 15 show detail the impacts and costs of the couplet alternatives.

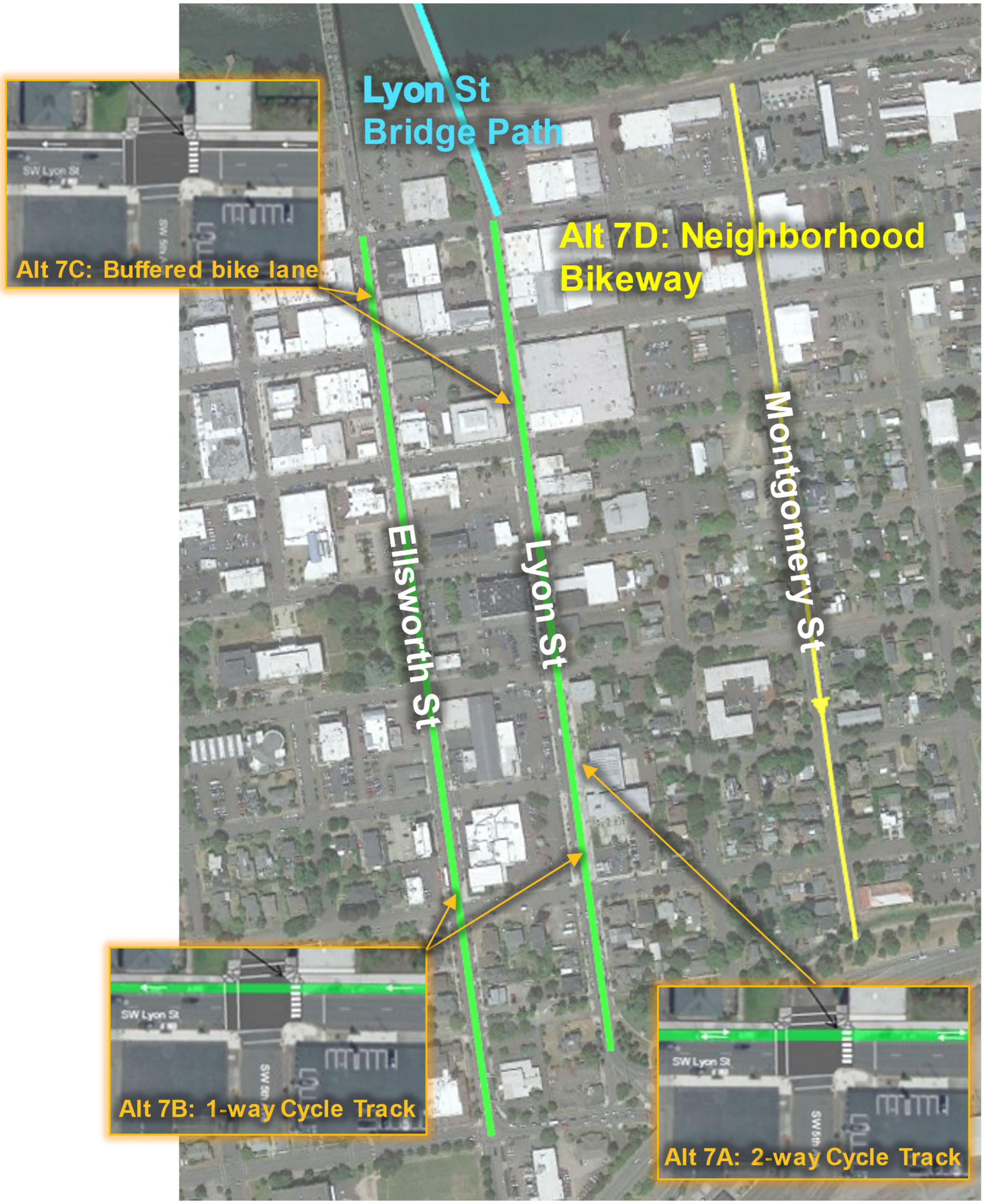

FIGURE 12: LYON/ELLSWORTH STREET BICYCLE FACILITIES - ALTERNATIVES

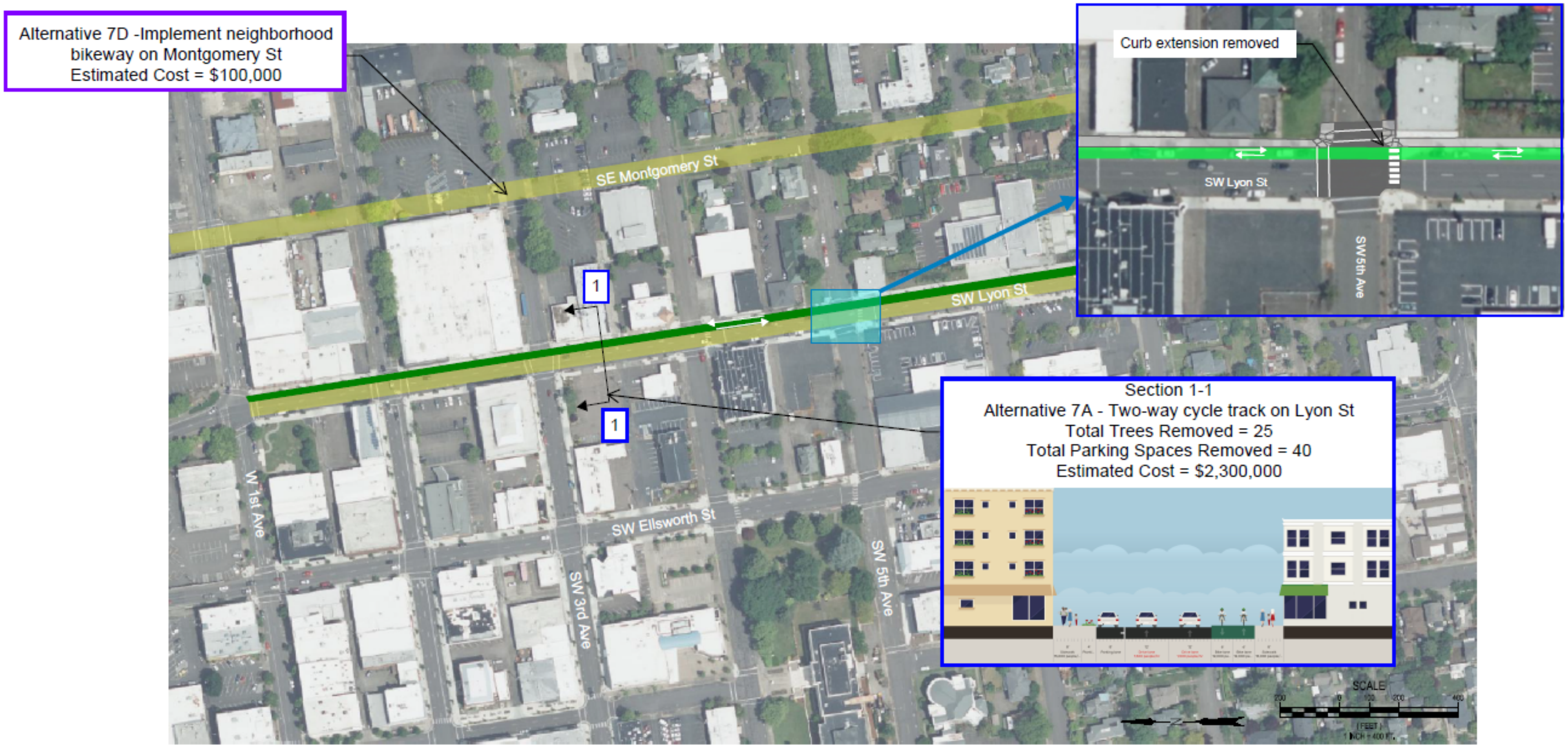

FIGURE 13: ELLSWORTH/LYON STREET BICYCLE FACILITIES – ALTERNATIVE 7A

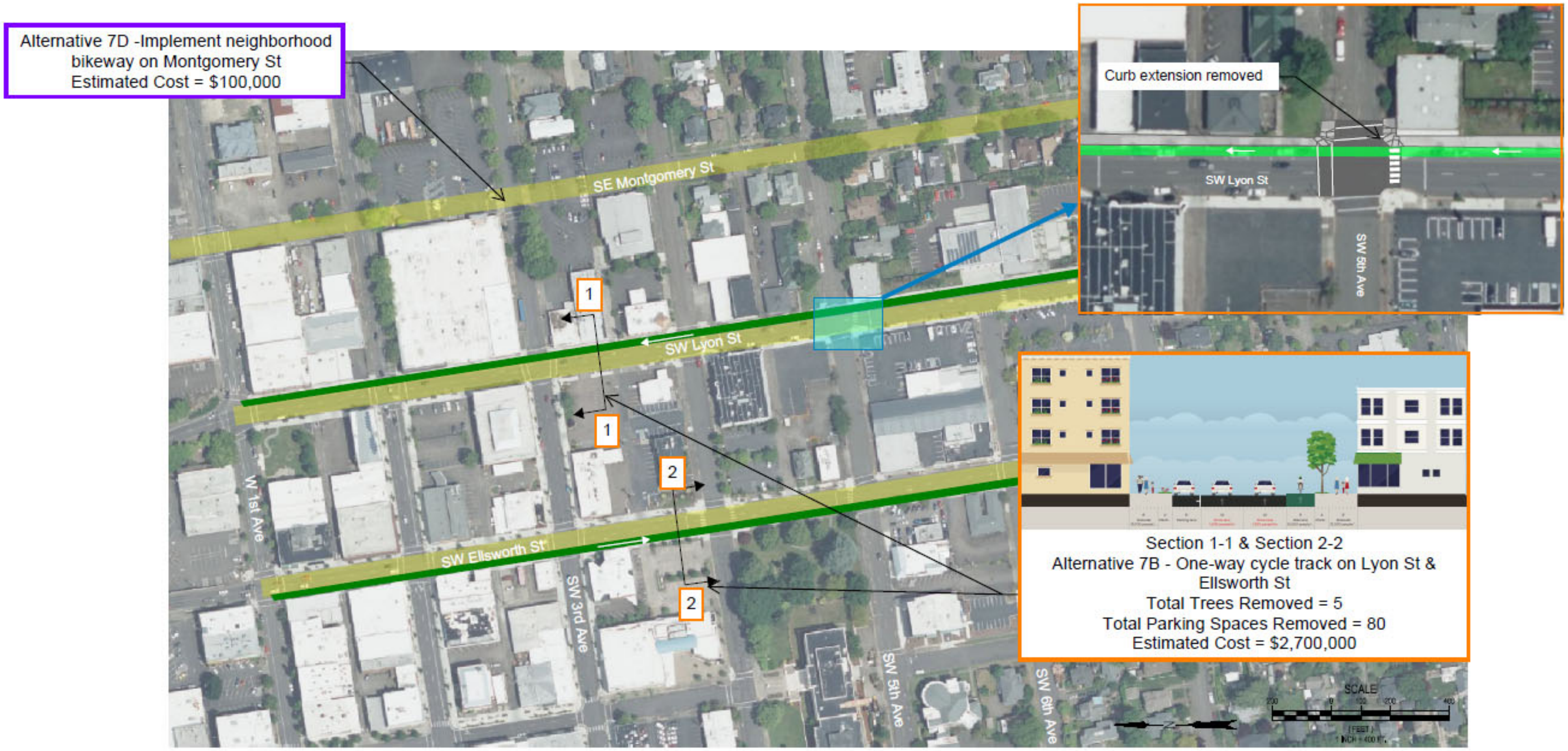

FIGURE 14: ELLSWORTH/LYON STREET BICYCLE FACILITIES – ALTERNATIVE 7B

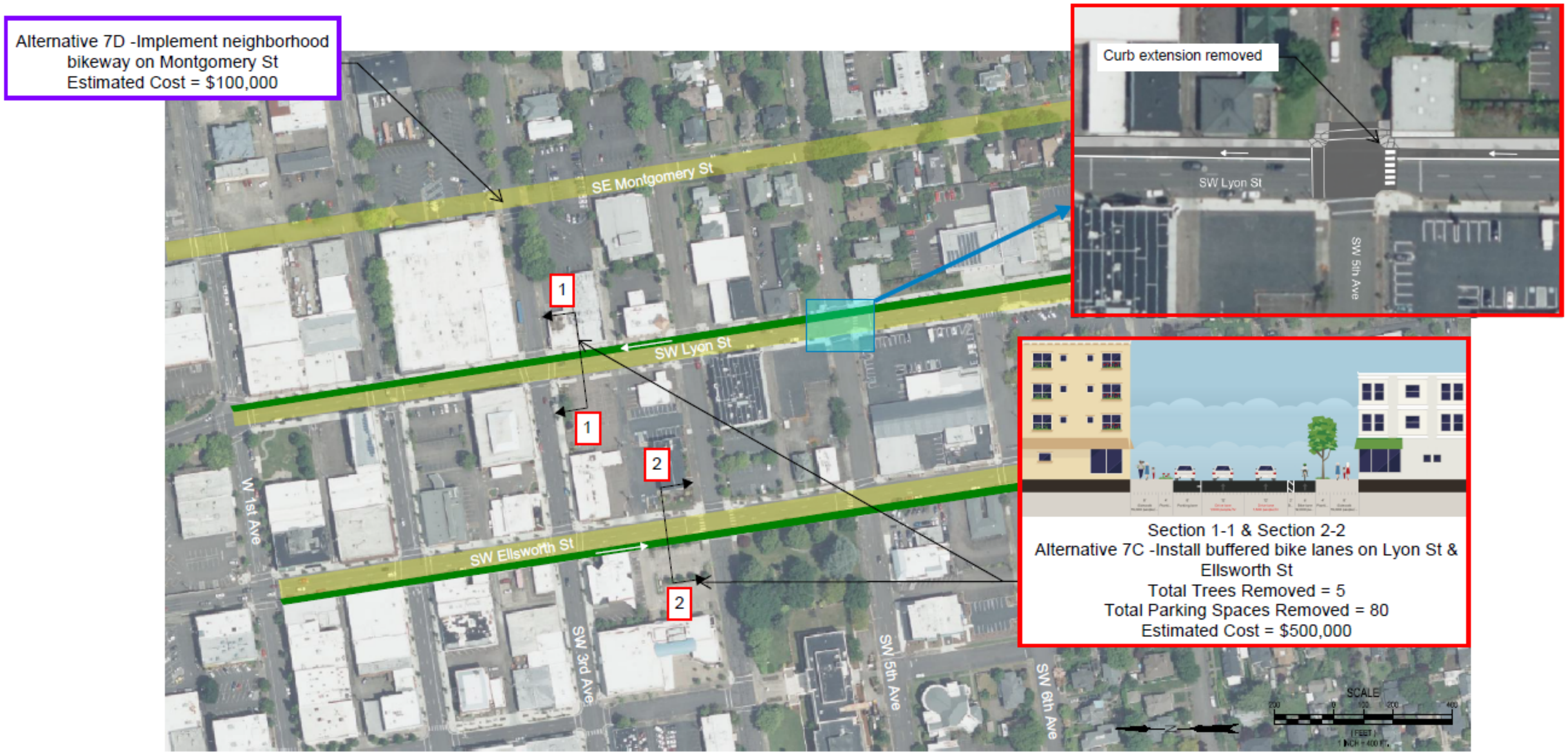

FIGURE 15: ELLSWORTH/LYON STREET BICYCLE FACILITIES – ALTERNATIVE 7C

LEVEL 2 EVALUATION

The Level 2 Evaluation of the Lyon/Ellsworth Street active transportation facility alternatives is summarized below. Only criteria applicable to the alternatives were evaluated.

Motor Vehicle Operations

All proposed alternatives on Lyon and Ellsworth Street shift bicycles off the existing shared vehicle lanes, reducing conflicts and improving vehicle travel times. The proposed facilities do not have any anticipated negative operational impacts at the intersections along the couplet.

On-Street Parking

All proposed alternatives on Lyon and Ellsworth Street would require on-street parking stalls to be removed to grant spacing for bicycle facilities. The two-way cycle track (Alternative 7A) would remove 40 parking spaces along one side of Lyon Street, while the one-way cycle tracks and buffered bicycle lanes (Alternatives 7B and 7C) remove a total of 80 on-street parking spaces.

Bicycle Facilities

The exclusive bicycle facilities (Alternatives 7A, 7B, and 7C) eliminate conflict points with motor vehicles and overall help increase visibility of multimodal travel through the corridor.

A neighborhood bikeway, as part Alternative 7D, designates the low volume Montgomery Street corridor as a street for bicycle travel priority. This neighborhood bikeway would use signs, pavement markings, and speed and volume management measures to discourage through trips by motor vehicles.[13]

Safety

Cycle tracks reduce bicycle crashes of all severities by 59%[14]. Buffered bicycle lanes reduce bicycle crashes of all severities by 47%[15]. Neighborhood greenway applications decrease bicycle and pedestrian crash risk by 63%[16].

Impacts to Landscaping

All proposed alternatives on Lyon and Ellsworth Street would require removal of landscaping to grant spacing for continuous facilities. The two-way cycle track (Alternative 7A) would have 25 trees removed, while the one-way cycle tracks and buffered bicycle lanes (Alternatives 7B and 7C, respectively) would remove five trees.

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[13] NACTO Urban Bikeway Design Guide – Bicycle Boulevards: https://nacto.org/publication/urban-bikeway-design-guide/bicycle-boulevards/

[14] ODOT CRF List – Countermeasure #BP23

[15] ODOT CRF List – Countermeasure #BP24

[16] ODOT CRF List – Countermeasure #BP27

Community Livability

All proposed alternatives lead to the proposed MUP at 9th Avenue/Lyon Street leading to the Albany Transit Center. Alternative 7A provides the most direct connection to this MUP, limiting the amount of turns bicycles are required to make to complete the US 20 corridor route.

Consistency with City/state Adopted Plans

These proposed alternatives meet the City's TSP goals to reduce reliance on motor vehicles and provide greater opportunities for linked trips between North Albany and the downtown business district.

Social Benefits

All of the proposed alternatives enhance bicycle/pedestrian safety while promoting multimodal travel for people with various experience levels.

Summary of Level 2 Evaluation

The Level 2 Evaluation results for the US 20/Springhill Drive intersection alternatives are summarized by anticipated level of benefit/impact in Table 15. Only applicable criteria are included in the table.

TABLE 15: LYON/ELLSWORTH STREET ACTIVE TRANSPORTATION FACILITIES LEVEL 2 EVALUATION RESULTS SUMMARY

APPLICABLE SCREENING CRITERIA	ALT 7A	ALT 7B	ALT 7C	ALT 7D
MOTOR VEHICLE OPERATIONS	(+)	(+)	(+)	**No Change**
ON-STREET PARKING	(-)	**(--)**	**(--)**	**No Change**
BICYCLE FACILITIES	**(++)**	**(++)**	**(++)**	**(++)**
SAFETY	**(++)**	**(++)**	**(+)**	**(++)**
IMPACTS TO LANDSCAPING	**(--)**	(-)	(-)	**No Change**
COMMUNITY LIVABILITY	**(++)**	(+)	(+)	**(++)**
CONSISTENCY WITH CITY/STATE STANDARDS	**(++)**	**(++)**	**(++)**	**(++)**
SOCIETAL BENEFITS	**(++)**	**(++)**	(+)	**(++)**
PROJECT COST	$2,300,000	$2,700,000	$500,000	$100,000

As shown in Table 15, all four alternatives provide significant benefits to the community. Alternative 7D does not conflict with the other alternatives and is recommended for near-term implementation. Alternatives 7A, 7B, and 7C will all be considered in the upcoming City of Albany Transportation System Plan Update. Note that if Alternative 7B is selected as the ultimate solution, Alternative 7C could be implemented in the near term as Phase 1 of the project with minimal throw-away cost.

RECOMMENDATIONS SUMMARY

Table 16 provides the complete list of project recommendations, broken down by section. These recommendations include priority, defined as follows:

- Short-Term - 0-5 years
- Long-Term - 5-20 years
- Temporary - only implement for <2 years
- Select in TSP Update - preferred alternative and implementation timeline to by finalized in the upcoming TSP Update

TABLE 16: RECOMMENDED PROJECT FOR IMPLEMENTATION

LOCATION	ALT	DESCRIPTION	PRIORITY
SPRINGHILL DRIVE/US 20	1A	Restripe to allow SB dual left turn	Short-Term
	1B	Examine dilemma zone	Short-Term
	1C	Establish truck route down Hickory Road to North Albany Road to redirect southbound trucks	Temporary
	1D	Fix superelevation	Short-Term
1ST AVENUE/LYON STREET AND LYON STREET BRIDGE	2D	Change WB lane geometry to TH-Rt, RT, add curb extension on Northeast corner	Short-Term
	2E	Shift bike lane to south side of 1st Avenue	Long-Term
	2F	Reconfigure the bridge deck to include a multi-use path that continues up Springhill Dr to Hickory St	Short-Term
2ND & 3RD AVE/LYON ST	3B	Adjust signal timing	Short-Term
1ST & 2ND AVE/ ELLSWORTH ST	4B	Adjust signal timing	Short-Term
	4C	Remove half block of parking and add left turn lane at 2nd/Ellsworth SB approach	Short-Term
DOWNTOWN UNSIGNALIZED INTERSECTIONS	5B	Add RRFBs on upstream crossing	Short-Term
9TH AVE/LYON STREET/OR 99E RAMPS	6A	Widen to dual lanes on OR 99E northbound off-ramp, add in MUPs on both side of the OR 99E underpass	Long-Term
LYON-ELLSWORTH COUPLET BIKE FACILITIES	7A	Two-way cycle track on Lyon Street	Select in the TSP Update
	7B	1-way cycle tracks on Lyon and Ellsworth	
	7C	Buffered bike lanes on Lyon and Ellsworth	
	7D	Montgomery Neighborhood Bikeway	Short-Term

APPENDICES

APPENDIX A – ALBANY US 20 VISSIM REPORT

APPENDIX B – PROPOSED ALTERNATIVES SYNCHRO RESULTS

APPENDIX C – ALTERNATIVES SCHEMATICS

APPENDIX D – ADDITIONAL ALTERNATIVES ADDENDUM

APPENDIX A - ALBANY US 20 VISSIM REPORT

DKS 1050 SW 6TH AVENUE, SUITE 600 • PORTLAND, OR 97204 • 503.243.3500 • DKSASSOCIATES.COM

TECHNICAL MEMORANDUM

DATE: February 14, 2024

TO: Rob Emmons | City of Albany

Ron Irish | City of Albany

FROM: Anders Hart | DKS Associates

Aaron Berger, PE | DKS Associates

Scott Mansur, PE | DKS Associates

SUBJECT: Albany US 20 Corridor Study - Vissim Calibration, Future No-Build, and Project Bundles Analysis Report Project #23072-000

This memorandum documents the development and calibration of the Existing Conditions PM Peak period Vissim model for the Albany US 20 Study. In addition, this document includes the 2043 No-Build and Build Project Bundles development, validation, and results.

PROJECT DESCRIPTION

The purpose of the Albany US 20 Corridor Study is to analyze operational and safety improvements for a segment of US 20 within the city of Albany and to develop recommendations for operational, safety, and active transportation solutions along the corridor.

The primary purpose of the project Vissim analysis is to understand and test system impacts and interactions between localized solutions along the US 20 corridor. This model is intended to refine the preferred alternative projects and support the Level 2 Alternatives Evaluation process.

EXISTING CONDITIONS MODEL DEVELOPMENT AND CALIBRATION

STUDY AREA AND MODEL AREA

The Vissim study intersections are shown in Figure 1. These intersections are the primary locations for volume calibration within the model. The model extents are outlined in Figure 2. The model includes 11 signalized intersections and three unsignalized study intersections. The model also includes driveways that influence the arrival patterns, lane utilization, and queueing at the study intersections, per the ODOT Vissim Protocol guidelines[1]. Performance measures are reported only for the study intersections.

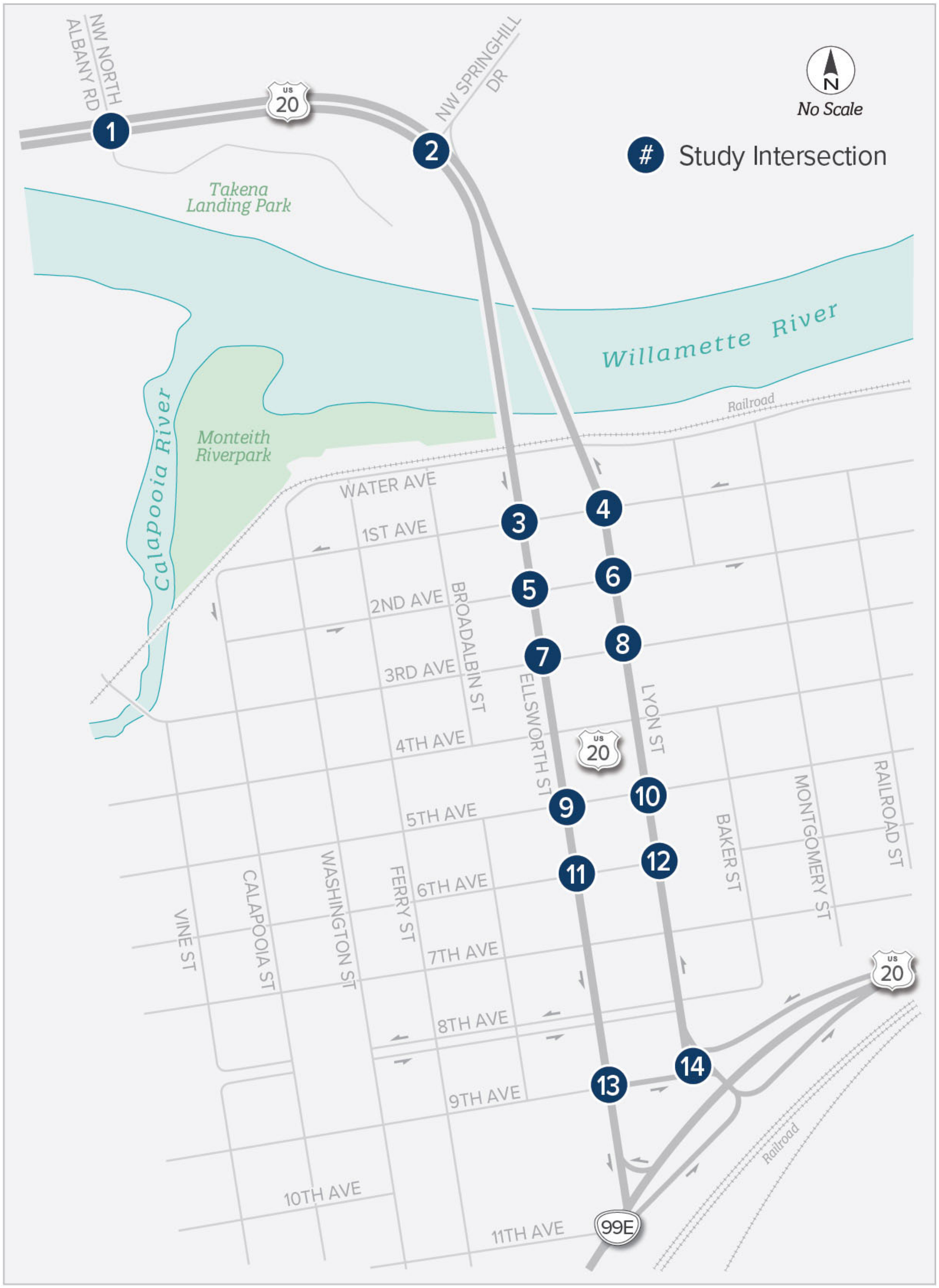

FIGURE 1: STUDY INTERSECTIONS

[1] Protocol for Vissim Simulation, June 2011, Oregon Department of Transportation

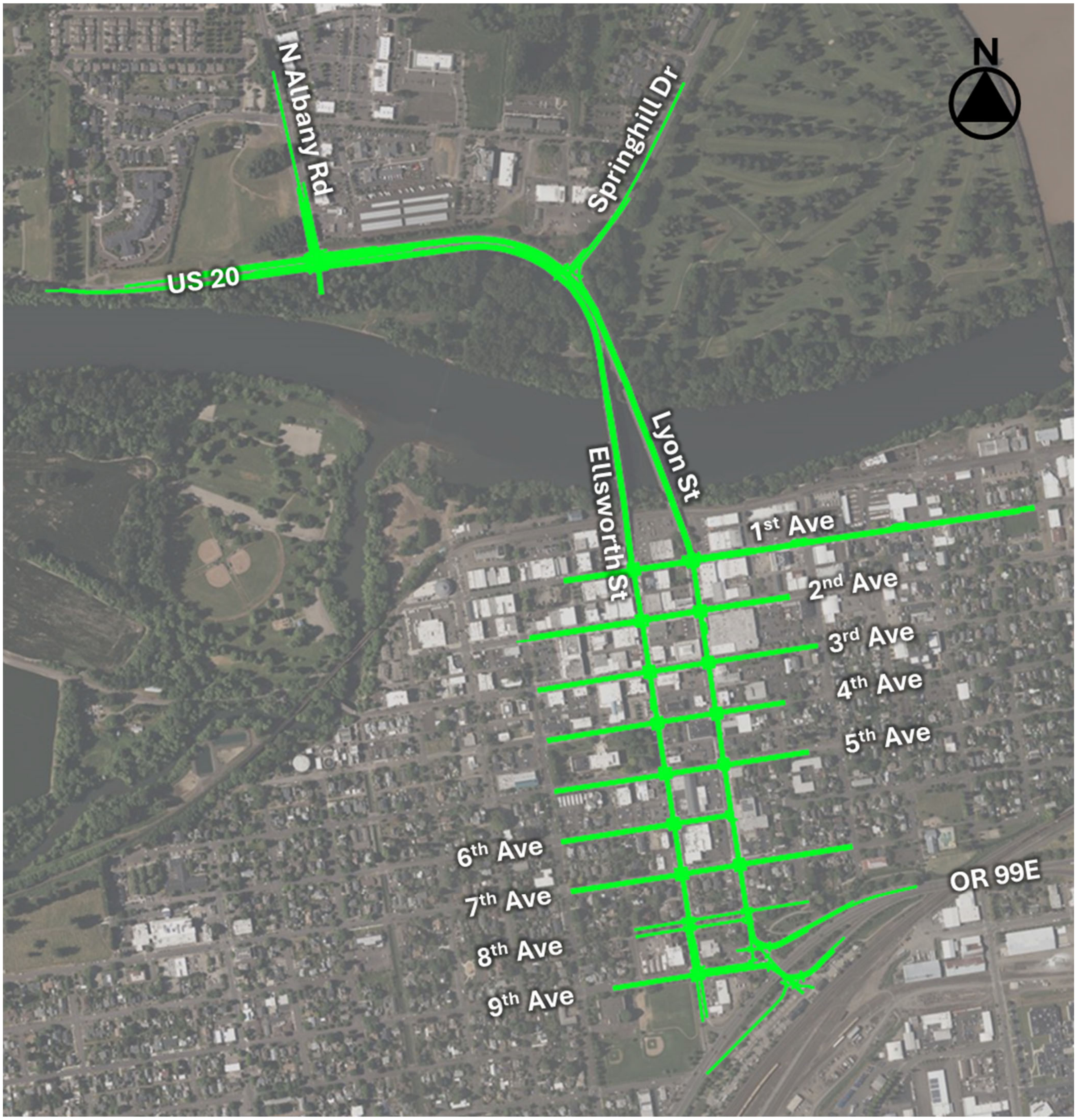

FIGURE 2: VISSIM MODEL EXTENTS

DATA COLLECTION SUMMARY

The following data was collected to develop and calibrate the base year Vissim model:

- **Roadway Geometry Data**: This included roadway segment lengths, number of lanes, lengths of storage bays and tapers, intersection geometry, pedestrian crossing locations and widths, and transit stop locations. This data was primarily obtained from aerial imagery and Google Street View and was verified with field observations.

- **Traffic Control Data**: This included posted speeds, stop bar and stop sign locations, traffic signal locations, traffic signal timing data, and detector plans. The signal timing data was obtained from ODOT, who maintains all the signals within the model. The remaining data was obtained from aerial imagery and Google Street View and was verified with field observations.

- **Traffic Volume Data**: PM Peak period (4-6 PM) traffic Count data was compiled for all the Vissim model study intersections to serve as inputs for the existing year PM peak hour Vissim model. Traffic counts were collected on May 3, 2023, and included 5-minute volume profiles. Study intersection traffic count locations, collection dates, and intersection-specific peak hours are shown in Table 1. Bicycle, pedestrian, and heavy vehicle percentage data was also compiled from these counts, which are provided in Appendix A. These counts were balanced and seasonally adjusted to the 30 highest annual hours (30 HV) using a factor of 1.03. The count data indicated a system-wide peak hour of 4:45-5:45 PM. The seasonally adjusted and balanced PM Peak hour volumes at the study intersections are shown in Figure 3. Count data for the Lyon St & 6th Ave and SW Ellsworth & 6th Avenue intersections were estimated using a combination of estimated volumes and turn percentages from Replica data and May 2023 counts at other locations. Count data for the 2nd and 3rd Avenue intersections with SW Lyon Street and SW Ellsworth Street were taken from the 2014 Albany Transportation System Plan and factored based on May 2023 counts at other locations.

TABLE 1: STUDY INTERSECTION COUNT LOCATION, DATE, AND INTERSECTION PEAK HOUR

#	INTERSECTION	DATE COLLECTED	INTERSECTION SPECIFIC PEAK HOUR
1	US 20 & North Albany Rd	Wednesday, May 3, 2022	4:45-5:45 p.m.
2	US 20 & Springhill Dr	Wednesday, May 3, 2022	4:45-5:45 p.m.
3	1st Ave/Ellsworth S (US 20)	Wednesday, May 3, 2022	4:55 p.m.-5:55 p.m.
4	1st Ave/Lyon St (US 20)	Wednesday, May 3, 2022	4:10-5:10 p.m.
5	2nd Ave/Ellsworth St (US 20)	Factored 2014 counts	N/A
6	2nd Ave/Lyon St (US 20)	Factored 2014 counts	N/A
7	3rd Ave/Ellsworth St (US 20)	Factored 2014 counts	N/A
8	3rd Ave/Lyon St (US 20)	Factored 2014 counts	N/A

#	INTERSECTION	DATE COLLECTED	INTERSECTION SPECIFIC PEAK HOUR
9	5th Ave/Ellsworth St (US 20)	Wednesday, May 3, 2022	4:30-5:30 p.m.
10	5th Avenue/Lyon St (US 20)	Wednesday, May 3, 2022	4:25-5:25 p.m.
11	6th Ave/Ellsworth St (US 20)	Estimated (Replica)	N/A
12	6th Ave/Lyon St (US 20)	Estimated (Replica)	N/A
13	9th Ave/Ellsworth St (US 20)	Wednesday, May 3, 2022	4:25-5:25 p.m.
14	9th Ave/Lyon St/OR 99E Ramps	Wednesday, May 3, 2022	4:35-5:35 p.m.

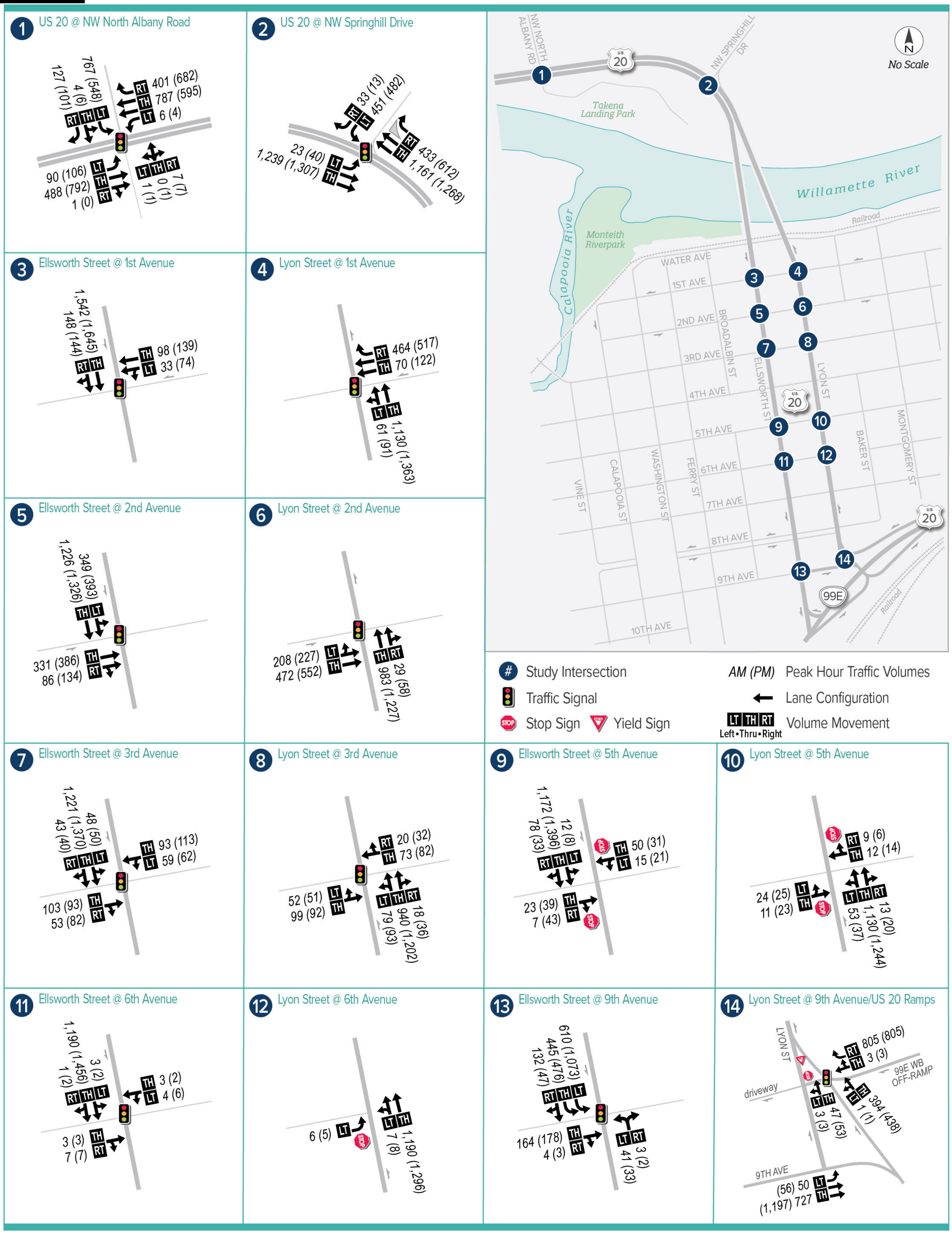

FIGURE 3: EXISTING A.M. AND P.M. PEAK HOUR BALANCED COUNTS

- **Transit Data:** This included bus schedules, headways, and stop locations. Local transit routes within the Vissim model study area include Line 2 (Regular Service East), Line 3 (Regular Service West), and the US 20 Commuter. This data was obtained from the City of Albany website.

- **Field Observations**: The project team performed field observations in the study area during the weekday p.m. peak period[2]. Field observations were used to help verify roadway geometry and traffic control data, as well as to identify queuing issues and areas of congestion.

- **Origin Destination (O-D) data development**: In addition to the turn movement count data at the study intersections, the Vissim model requires origin-destination (O-D) data to route the traffic through the network (i.e., the origin location and the destination location of each vehicle). This routing information was developed with O-D data from Replica.

- **Queueing Data**: Queue lengths throughout the study area were noted during field observations. In addition, PM peak hour Google Traffic map data was reviewed for the project study area to assess system queueing. This data is saved in Appendix B.

MODEL DEVELOPMENT SUMMARY

The Vissim model development process used two documents as guidance, including The Federal Highway Administration's (FHWA's) Traffic Analysis Toolbox Volume iii: Guidelines for Applying Traffic Microsimulation Modeling Software[3] and the ODOT Protocol for Vissim Simulation. This section describes the steps completed in the existing (or base) year 2023 PM peak period model development process.

NETWORK CODING

This step involved coding the geometry of the entire network. Network objects and attributes added in this step include the following:

1. Physical roadway (links and connectors)
2. Intersection geometry (links and connectors)
3. Pedestrian links
4. Bicycle links

[2] Field observations conducted on Wednesday, August 3, 2023.
[3] Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software, Federal Highway Administration, August 2003.

5. Traffic control (speed distributions and decisions, reduced speed areas, conflict areas, priority rules, stop signs, signal heads, detectors, and signal timing)

Desired speed distributions were developed using the ODOT Vissim protocol methods for links without measured speed data based on posted speed.

TRAFFIC DEMAND AND ROUTING

The first step in demand development was to develop a Visum model encompassing the extents of the Vissim model, with Traffic Analysis Zones (TAZ) representing all of the network entry and exit points. O-D Matrix Estimation (ODME) was used in this Visum subarea model to develop an O-D matrix based on the PM peak hour balanced turning movement volumes. O-D data from Replica from Fall 2022 (the most recent data available) provided the initial seed trip distribution. The result of this process was a PM peak hour O-D matrix representing the desired routes through the model area and calibrated to the balanced volumes and Replica data.

The O-D data was assigned to the Visum network, which was aligned geometrically with the Vissim model. The vehicle routing information from the Visum model was then exported to the Vissim model as hourly volume inputs and static vehicle routing.

Pedestrian counts were used as pedestrian inputs for all intersections and crossing locations within the Vissim model. Pedestrian counts were rounded up to the nearest 10 to provide a more conservative estimate of pedestrian activity within the model network.

Bicycle routes were used to guide bikes north on Lyon Street and south on Ellsworth Street using the sharrow lanes. Bikes approaching the Ellsworth Street Bridge were given a 50/50 split partial route, with half using the sidewalk and half using the sharrow on the bridge. Bicycle volumes were rounded up to the nearest 10.

TRAFFIC VOLUME PEAKING PROFILE

The initial PM peak hour volume inputs in Vissim (from the demand development process described above) were modified to include a "peaking profile" of 15-minute volume flow rate increments and extended out to cover the 4-6 PM peak period, as well as a 15-minute seeding period. The peaking profiles were generated based on traffic counts. All input locations with volumes greater than 50 vehicles per hour (vph) were assigned a profile unique to a corresponding traffic count. The traffic counts for all other approaches representing side streets with volumes less than 50 vph were added together and used to develop a typical low volume approach profile for the model. Field observations and traffic counts show that none of the side streets had radically different peaking profiles that would have an impact on corridor operations. The volume profiles used for the model are included in Appendix C.

VEHICLE COMPOSITIONS

The volume inputs included heavy vehicle percentages based on the count data. The heavy vehicle percentages were rounded to the nearest one percent from the existing counts, and the percentages were applied to the corresponding volume inputs within the model network. The heavy vehicle fleet was modified from the Vissim defaults to be consistent with the ODOT Vissim protocol.

SIMULATION PERIOD AND SEEDING PERIOD

The FHWA's Traffic Analysis Toolbox recommends a seeding period equal to or greater than twice the estimated travel time at free-flow conditions to traverse the entire network. The free flow travel time is approximately 3 minutes. To be conservative and allow for the congestion levels and queues to develop to peak conditions, a seeding period of 15 minutes was chosen. The Vissim simulation period included the 15-minute seeding period (initialization period) followed by the entire two-hour analysis period (4-6 PM). The volume rate for the 4:00-4:15 PM period was used for the seeding period flow rate. Measures of effectiveness were collected for the one-hour system peak period.

ERROR CHECKING

The error checking portion of the model development focused on fixing coding errors before the calibration process began. Error checking is a process that includes a review of the coded data and a review of the animation. All coded data (geometry, speeds, signal timing data, stop and yield controls, transit data, and traffic volumes) was reviewed by the model developer and quality control reviewer.

A review of the animation was conducted to determine locations where conflict areas or priority rules might be missing, where signal timing may not be operating correctly, or any other locations where generally coded parameters may have been overlooked. No significant error messages, such as vehicle input not generating all vehicles or vehicles getting diffused from the network were generated.

CALIBRATION AND VALIDATION

Upon the completion of the error checking, the Vissim model was calibrated following the traffic volume and travel time calibration criteria in the ODOT Simulation Protocol. Additionally, the model was visually validated against queue observations. The model calibration and validation was based on 10 simulation runs.

The following calibration targets were used for the existing year Vissim model:

- A quantitative comparison between volume data and model outputs aligning with the ODOT Vissim Protocol calibration criteria for traffic volume GEH and travel time target criteria.
- A qualitative comparison (visual inspection and validation) of queuing and general operations along the entire study area based on field observations and Google Traffic Maps of conditions collected during traffic counts.

To best replicate field conditions, the Vissim model calibration process implemented a variety of standard techniques where appropriate, including:

- Lane change distance on turning movement connectors to capture upstream lane positioning, including the following locations:
  - Southbound left turn at Ellsworth Street/2nd Avenue – Set to 1200 feet
  - Eastbound left turn at Lyon Street/2nd Avenue – Set to 1500 feet
  - Westbound right turn at Lyon Street/1st Avenue – Set to 2000 feet
  - Westbound right turn at US 20/Springhill Drive – Set to 1500 feet
  - Westbound right turn at US 20/North Albany Road – Set to 1500 feet
  - OR 99E northbound on-ramp lane drop – Set to 720 feet
- Intersection "keep clear" zones through congested intersections, particularly the 1st and 2nd Avenue intersections with Lyon and Ellsworth Street, and at the 9th Avenue/Lyon Street/OR 99E Ramps intersection.
- Increased turning speeds for turning movements with larger than typical radii. The westbound right turn movement at Lyon Street and 1st Avenue was set to an average speed of 12 mph (for non-heavy vehicles rather than the more typical right turn speed of 9 mph, to reflect the wider radius of this movement.

The model used the following vehicle driving behaviors:

- "Urban" - this driving behavior used the Wiedermann 74 model with default parameters and was applied to all motor vehicle facilities within the model, except for the OR 99E northbound on-ramp.
- "Merge" - this driving behavior used the Wiedermann 99 model with default parameters, with the following adjustments. The safety reduction factor was adjusted to 0.30, and the gap time distribution (CC1) was set to an average of 0.90 seconds. This driving behavior was used for the two to one lane merge section of the northbound on-ramp to OR 99E.
- "Footpath (no interaction)" – This driving behavior was applied to pedestrians on crosswalks throughout the model and involves no interaction between pedestrians.
- "Cycle Track (free overtaking)" – This driving behavior was used for all bicycle facilities, including for bicycles using the sharrows on the Ellsworth Bridge, Ellsworth Street, and Lyon Street. The overtaking setting allows bicycles to pass other cyclists based on their desired speed.

VOLUME/DENSITY

The initial calibration target set was for traffic volumes. Per the ODOT Vissim Protocol guidelines, individual turn movements greater than 100 vehicles per hour must be calibrated within an acceptable GEH Statistic[4]. The GEH statistic was calculated for all study intersections. The traffic volume calibration results are documented in Appendix D. The total throughput at all study intersections passed the GEH statistic check. All movements with a volume greater than 100 vehicle per hour also passed the GEH statistic check.

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[4] The GEH Statistic is a universal measure to compare model inputs and outputs. It is a continuous volume tolerance formula was developed to avoid the pitfalls associated with using a simple percentage comparison of a wide range of volumes.

QUEUING

The simulation model was also used to measure delay relative to desired speed as an indicator of queue length. The figures in Appendix D show the relative delay (queues) for each 15-minute interval during the 4:00-6:00 PM analysis period, as averaged over 10 simulations. The colors shown in these figures indicate the following approximate queue states:

- Dark Green = Free flow, no delay
- Light Green = Slight slowing
- Yellow = Increased slowing, but not yet stop and go
- Orange = Furthest extent of stop and go queues
- Red = Fluctuates between low-speed flow and stopped queue
- Dark Red = Stop and go queue during the entire 15-minute peak interval

As part of the calibration process, these maps were compared to the Google Typical Traffic maps and were found to approximate the existing summer traffic trends.

VEHICLE TRAVEL TIMES

The simulation model was used to measure vehicle travel times between the northern and southern extents. For travel time measurements, the northern extent was located near the US 20 / NW N Albany Road and the southern extent was the OR 99E ramps. Google travel times for weekdays during the 4:45-5:45 PM period[5] were used to validate the model results. As shown in Table 2, the model travel times are within 15% of the observed travel times.

TABLE 2: OBSERVED AND MODEL PEAK-HOUR (4:45-5:45 P.M.) TRAVEL TIMES

DIRECTION	AVERAGE PM PEAK HOUR GOOGLE API TRAVEL TIME (SEC)	VISSIM TRAVEL TIME (SEC)	PERCENT DIFFERENCE
NORTHBOUND (OR 99E TO N ALBANY RD)	193	174	-9.9%
SOUTHBOUND (N ALBANY RD TO OR 99E)	298	264	-11.6%

BASE YEAR MODEL MEASURES OF EFFECTIVENESS

The following measures of effectiveness were collected from the base year model and summarized in Appendix D:

- Average and 95th percentile motor vehicle queue lengths
- Vehicle delay

[5] Southbound Google travel times were collected on Wednesday, July 26 and Wednesday, August 2 2023 and northbound Google travel times were collected on Wednesday, July 26 and Thursday, July 27 2023.

- Congestion plots
- Latent demand

To calculate 95th percentile queues, queue length data was collected from Vissim using queue counters on critical approaches and a 120-second interval to reflect queues that form while traffic flow is impeded. The 95th percentile queue was then calculated using a percentile function. The delay measurements were calculated over the system peak hour interval (4:45-5:45 p.m.) for each simulation run at each signalized study intersection. Delay reported for a study intersection is measured upstream to the next intersection and not through the intersection. Congestion plots were created based on relative speed.

EXISTING CONDITIONS CALIBRATION SUMMARY

As presented in this memo, the existing conditions model meets the calibration targets for volume throughput that GEH for all turn volumes > 100 vph and all model entry/exit locations. Model validation is further confirmed via queuing observations as documented by the Vissim Queue Delay plots (included in Section 4 of the Appendix) compared to the Google Traffic map (included in Section 2 of the Appendix), showing consistent patterns over each 15-minute interval. Based on the information presented in this memorandum, the existing conditions model is calibrated according to the ODOT Vissim Protocol and is ready for use to support the Albany US 20 Corridor Study.

2043 NO BUILD

NO-BUILD NETWORK ASSUMPTIONS

The No Build network is identical to the Existing Conditions network, as it is intended to represent future conditions with no projects.

NO-BUILD VOLUME DEVELOPMENT

Future traffic volumes were forecasted for the year 2043 at the project study intersections using 2019 base year and 2043 future year scenarios of the Corvallis Albany Lebanon Model (CALM). The model's 2043 future transportation network included financially constrained projects listed in the Statewide Transportation Improvement Program, the Albany Area Metropolitan Planning Organization (AAMPO) and Corvalis Area Metropolitan Planning Organization (CAMPO) Regional Transportation Plans (RTPs), and the most recent land use assumptions. There were no notable improvements projects in the AAMPO Financially Constrained List project list in the vicinity of the study area that are expected to influence traffic volumes.

Raw link level volumes from the model were post-processed using methodology outlined in NCHRP Report 765: Analytical Travel Forecasting Approaches for Project-Level Planning and Design. The No Build volumes are shown in Figure 4.

FIGURE 4: 2043 NO BUILD TRAFFIC VOLUMES

These forecasted volumes were coupled with the O-D data calibrated for Existing Conditions to run an updated ODME in Visum, developing updated vehicle routing information. This data was again exported back into Vissim as hourly routes and inputs. The same 15-minute peaking profiles as the Existing Conditions model (described in the Model Development Summary section above) were applied to the 2043 volume forecasts.

Pedestrian volumes were increased by 50% and bicycle volumes were increased by 100% from the Existing Conditions to conservatively capture future growth.

NO-BUILD KEY FINDINGS

The 2043 No-Build PM Vissim model scenario was run for 10 random seeds, and the results were averaged to produce both system level and local intersection performance metrics. These metrics include:

- Unserved demand by input location
- System Measures
- GEH statistics for study intersections
- Intersection Delay
- Queuing Results
- Travel Time Results
- Congestion Plots

Based on these performance measures (included in Appendices E and F) and visual observations of the No-Build simulations, the following system bottlenecks were identified along the US 20 corridor with the project Study Area:

- The 1st and 2nd Avenue intersections with Ellsworth Street (US 20) continue to act as a system bottleneck under future (year 2043) forecast traffic conditions. By 4:00 PM, the constraints to southbound green time at these intersections coupled with heavy competing side street traffic command causes queues to spill back to the Springhill Drive intersection across the river. These queues impact the southbound approach of Springhill Drive, which is independently attempting to serve side street demand beyond the intersection capacity. Queues on eastbound US 20 extend back through North Albany Road by 4:45 PM, and beyond the study Area extents by 5:15 PM. At 6 PM, even with the traffic demand decreasing from the Peak Hour period, 11% (nearly 200 vehicles) of the eastbound US 20 traffic demand remains queued up beyond the study area extends west of North Albany Road, in addition to 15% (185 vehicles) of the southbound Springhill Drive traffic. This system bottleneck also results in the Ellsworth Street bridge serving less than 83% of the forecasted future traffic demand from 4-6 PM.
- Eastbound 2nd Avenue queues beyond the project study area by 4:00 PM, due to increased conflicting and queuing on the city blocks between 1st and 2nd Avenue on Lyon Street, which blocks eastbound left turns from 2nd Avenue, and between Ellsworth and Lyon Street on 2nd Avenue. The combined queueing impacts of these queues, which are caused in large part by signal timing prioritized to progress the US 20 through movements on Lyon Street and Ellsworth Street, result in sustained queues on 2nd Avenue eastbound that fail to dissipate by 6:00 PM, leading to 14% (approximately 170 vehicles) of unserved vehicle demand.

- The 1st Avenue and Lyon Street intersections continues to act as a critical system bottleneck under 2043 conditions, with the brunt of the capacity constraint impact felt on the 1st Avenue westbound approach. Anticipated increases in bicycle and pedestrian activity at this intersection in the future further limit the westbound right turn capacity (by about 5%), and coupled with increased traffic demand on 1st Avenue, result in queues that spill back well beyond the study area by 4:00 PM. These queues do not dissipate by 6:00 PM, with 33% (nearly 600 vehicles) of demand remaining in queue and unserved. Indirectly, the constraint benefits northbound travel on Lyon Street in the model, but this highlights a larger corridor concern, as this level of queuing is not considered a realistic future condition, with drivers likely to search for other routes to access Lyon Street. This would cause more traffic on side streets such as 3rd and 4th Avenue, along with heavier usage of the OR 99E southbound off-ramp to Lyon Street, creating long queues Lyon Street, OR 99E southbound, 1st Avenue westbound, 3rd Avenue westbound, and 4th Avenue westbound. This system bottleneck also results in the Lyon Street bridge only serving 90% of the forecasted future traffic demand from 4-6 PM.
- The OR 99E northbound off-ramp queues back to the mainline by 4:15 PM and does not begin to clear until 6:00 PM.
- System wide, the key bottlenecks described in this section increased the average delay per vehicle with the study area from 1.5 minutes to 9.7 minutes, a nearly 650% increase from present day to year 2043 conditions.

NO-BUILD SYSTEM PERFORMANCE MEASURES

Table 3 compares the Existing Conditions and 2043 No Build system performance measures. It shows that unserved demand, vehicle delay, and average delay per vehicle all are expected to increase dramatically under No Build conditions due to the bottlenecks described previously.

TABLE 3: SYSTEM PERFORMANCE MEASURES FOR EXISTING CONDITITIONS AND 2043 NO BUILD

MEASURE	EXISTING (2023)	NO BUILD (2043)	% CHANGE
UNSERVED DEMAND (VEHICLES)	0	1,152	-
IN-SYSTEM DELAY (VEHICLE-HOURS)	274	977	+257%
OUT-OF-SYSTEM DELAY (VEHICLE-HOURS)	0	1,152	-
TOTAL DELAY (VEHICLE-HOURS)	274	2,129	+677%
AVERAGE DELAY/VEHICLE (MINUTES/VEHICLE)	1.5	9.8	+553%

NO-BUILD QUEUING AND DELAY

Figures showing 2043 No Build average/95th-percentile peak-hour and peak-hour average delay are included in Appendix E. The key findings related to queuing and delay are described in the Key Findings Section.

NO-BUILD VEHICLE TRAVEL TIMES

Table 4 shows the peak-hour corridor travel times for Existing Conditions and 2043 No Build conditions. However, vehicle travel time results are not fully accurate performance measures when large proportions of the vehicle demand go unserved.

TABLE 4: PEAK-HOUR EXISTING AND 2043 NO BUILD VEHICLE TRAVEL TIMES

DIRECTION	EXISTING (2023)	NO BUILD (2043)	% CHANGE
NORTHBOUND US 20 (SEC)	174	244	+40%
SOUTHBOUND US 20 (SEC)	264	571	+116%

The No-Build vehicle travel time results do not fully capture the corridor congestion, as many vehicles are prevented from even entering the US 20 corridor by the bottlenecks outlined in the Key Findings Section.

NO-BUILD VALIDATION MEASURES

Full GEH results are found in Appendix E. They show that several movements have high GEH statistics, which aligns with the bottleneck locations discussed above. Key movements unable to serve the full No-Build demand include the westbound right at 1st Avenue/Lyon Street, the southbound through at 2nd Avenue/Ellsworth Street, and the eastbound through at 2nd Avenue/Ellsworth Street.

PROJECT BUNDLE ANALYSIS

PROJECT BUNDLES NETWORK ASSUMPTIONS

Alternatives 1-3 are “project bundles” with various improvements meant to improve operations and facilitate multimodal safety on the corridor. The following sections describe common and differing projects in each Alternative.

COMMON ELEMENTS ACROSS ALL PROJECT BUNDLES

All three project bundles included the following changes over the No-Build Vissim model:

- Dual southbound left turn lanes at Springhill Drive
- A two-way multi-use path on the Lyon Street Bridge

- Signal-timing updates at the 1st and 2nd Avenue intersections with Lyon Street and Ellsworth Street (reduce walking time)
- A southbound left turn lane at 2nd Avenue/Ellsworth Street and protected pedestrian phase holding the southbound left turn
- RRFBs at 4th and 5h Avenues and Ellsworth Street and 4th, 5th, and 6th Avenue and Lyon Street
- Dual northbound lanes on the OR 99E off-ramp

PROJECT BUNDLE 1 ASSUMPTIONS

The following network changes were made exclusive to Project Bundle 1:

- A truck route along NW Hickory Street to divert southbound trucks away from Springhill Drive to N Albany Road, coded with a added link from Springhill Drive to N Albany Road and a partial route for trucks to re-direct the southbound left turn movement onto N Albany Road
- Dual westbound right turn lanes at 1st Avenue/Lyon Street, one westbound through lane, protected bike/pedestrian phase that holds the westbound right turn
- A two-way cycle track on the east side of Lyon Street

PROJECT BUNDLE 2 ASSUMPTIONS

The following network changes were made exclusive to Project Bundle 2:

- One westbound right lane, one westbound right/through lane, and a bike lane on the north side of 1st Avenue at Lyon Street, along with a protected bike/pedestrian phase that holds the westbound approach
- One-way cycle tracks on Lyon Street and Ellsworth Streets (the east and west sides, respectively)

PROJECT BUNDLE 3 ASSUMPTIONS

The following network changes were made exclusive to Project Bundle 3:

- One westbound right turn lane, one westbound right/though lane, and a bike lane on the south side 1st Avenue at Lyon Street, along with a protected pedestrian phase that holds the westbound approach
- Buffered bike lanes on Lyon and Ellsworth Streets (the east and west sides, respectively)

PROJECT BUNDLES VOLUME DEVELOPMENT

All alternatives used the same volumes as the 2043 No Build scenario described previously.

PROJECT BUNDLES KEY FINDINGS

The 2043 Project Bundles 1, 2, and 3 Vissim model scenarios were each run for 10 random seeds, and the results were averaged to produce both system level and local intersection performance metrics. These metrics include:

- Unserved demand by input location
- System Measures
- GEH statistics for study intersections
- Intersection Delay
- Queuing Results
- Travel Time Results
- Congestion Plots

Based on these performance measures (included in Appendices F through J) and visual observations of the Project Bundle simulations, the following changes to the system bottlenecks caused by the projects modeled in the bundles were identified along the US 20 corridor with the project Study Area:

- All three bundles improve the operations at the 1st and 2nd Avenue intersections with Ellsworth Street (US 20) due to the added southbound left turn land at 2nd Avenue and Ellsworth and increased southbound green time at 1st Avenue and Ellsworth. The Ellsworth Street queues do not spill back to Springhill Drive until about 5:30 PM, minimally impact the southbound left turn at Springhill Drive, and are dissipating by 6:00 PM. The southbound US 20 demand crossing the Ellsworth Street bridge is fully served in all the project bundles, with approximately 500 more vehicles successfully crossing from 4-6 PM compared to No-Build conditions.
- The combined benefits of the re-striped second southbound left turn lane and the reduced downstream queuing on Ellsworth Street reduce the queuing on southbound Springhill Drive across all the project bundles, with the 4-6 PM traffic demand fully served, 185 more vehicles than under the No-Build condition.
- The increased southbound throughput on the Ellsworth Street Bridge with all the project bundles exposes additional bottlenecks further to the south, particularly at the 9th Avenue/Lyon Street/OR 99E intersection. The queues from this bottleneck extend north through 4th Avenue by 5:30-5:45 across the project bundles but begin to dissipate by 6:00 PM.
- The three proposed alternatives for the 1st Avenue and Lyon Street intersection all improve the westbound right turn queues on 1st Avenue over No-Build conditions, serving the entire 4-6 PM traffic demand for this movement, nearly 600 more vehicles than No-Build conditions. The exclusive dual right turn alternative evaluated in Project Bundle 1 provides the shortest queues and least delay on 1st Avenue. However, the improved 1st Avenue operations result in the worst queuing performance (of the project bundles) on 2nd Avenue, as both 1st and 2nd Avenue vehicles are competing for the same limited capacity on the Lyon Street bridge. The alternative with a westbound right turn and shared through-right configuration coupled with a shift of the existing bike lane to the south side of 1st Avenue results in the most balanced operations across the 1st Avenue, 2nd Avenue, and Lyon Street approaches to the Lyon Street Bridge.
- The improved capacity at the 1st Avenue and Lyon Street intersection across all the project bundles results in increased throughput on the Lyon Street Bridge, with 500 more vehicles crossing the bridge from 4-6 PM compared against No-Build conditions. These additional vehicles expose the bottleneck at the westbound US 20 approach to the Springhill Drive intersection. The westbound right turn operates nearly at free flow capacity and draws heavy demand. The storage for this movement is limited and westbound through queues often spill back far enough to block the right turn bay opening during red phases. While the dual southbound left turn striping allows for shorter conflicting phases at this intersection, the

limited right turn storage still creates a bottleneck issue, as westbound US 20 queues propagate very rapidly across the bridge under these queuing conditions. These queues spill back down Lyon Street and extend to 9th Street/OR 99E from 4:45-5:15 PM before beginning to dissipate.

- The improvement to the OR 99E northbound off-ramp provides independent benefit to the 9th Avenue/Lyon Street/OR 99E intersection, but the combination of queuing impacts from westbound US 20 at Springhill Drive and increased southbound throughput at 2nd Avenue and Ellsworth Street lead to additional queuing at this intersection compared to No-Build conditions within the Vissim model. However, the amount of side street queuing on 1st Avenue under No-Build conditions indicate that more vehicles would shift to OR 99E to access the Lyon Street Bridge, likely resulting in much worse operations at the 9th Avenue/Lyon Street/OR 99E intersection compared to the project bundles conditions.
- Based on the Vissim analysis of the project bundles, all three Lyon Street and Ellsworth Street bicycle facility alternatives have minimal impacts on the overall corridor operations, including operations at the system bottlenecks.
- System wide, the benefits of the improvements incorporated into the project bundles decreases average PM peak period vehicle delay across the corridor from 9.7 minutes to 3.2-4.4 minutes for the project bundles.

PROJECT BUNDLES SYSTEM PERFORMANCE MEASURES

Table 5 shows the system performance measures for the 2043 and Project Bundles 1-3. All three Project Bundles have significantly lower delay and unserved (latent) demand compared to the 2043 No Build scenario due to the improvement outlined in the Project Bundles Key Findings Section.

TABLE 5: SYSTEM PERFORMANCE MEASURES FOR NO BUILD AND ALTERNATIVES

MEASURE	NO BUILD	ALT. 1	ALT. 2	ALT. 3
UNSERVED DEMAND (VEHICLES)	1,152	53	89	32
IN-SYSTEM DELAY (VEHICLE-HOURS)	977	628	860	699
OUT-OF-SYSTEM DELAY (VEHICLE-HOURS)	1,152	66	121	45
TOTAL DELAY (VEHICLE-HOURS)	2,129	694	981	744
AVERAGE DELAY/VEHICLE (MINUTES/VEHICLE)	9.8	3.2	4.5	3.4

PROJECT BUNDLES VEHICLE TRAVEL TIME

Table 6 shows that Project Bundles 1-3 have lower southbound travel times compared to the 2043 No Build scenario, but higher northbound travel times. This is due to increased northbound throughput onto Lyon Street bridge in the in the Project Bundles, which, as described in the Project

Bundles Key Findings Section, causes queue spillback along Lyon Street, resulting in increasing travel times relative to the 2043 No Build condition. Full travel time results are found in Appendix J.

TABLE 6. NO BUILD AND ALTERNATIVES 1-3 CORRIDOR TRAVEL TIMES

DIRECTION	NO BUILD	ALT. 1	ALT. 2	ALT 3
NORTHBOUND US 20 (SEC)	244	305	335	279
SOUTHBOUND US 20 (SEC)	571	356	411	331

PROJECT BUNDLES VALIDATION MEASURES

Peak-hour GEH results for Project Bundles 1-3 are found in Appendices G through I. The GEH measures at the corridor study intersection align with the key bottleneck described in the Project Bundles Key Findings Section.

APPENDIX

CONTENTS

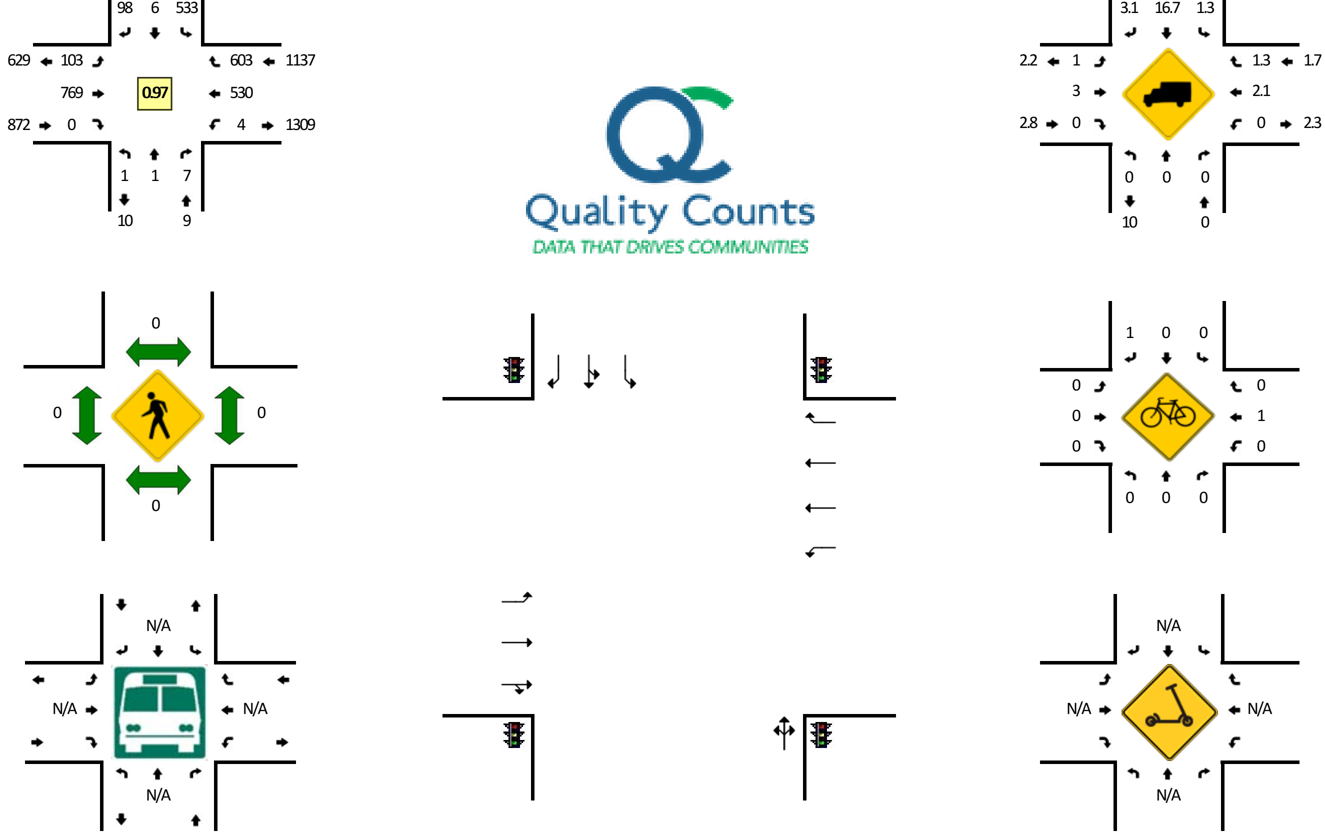
APPENDIX A: TRAFFIC COUNTS AND REPLICA ESTIMATES

PM PEAK HOUR COUNTS AND REPLICA ESTIMATES

Type of peak hour being reported: Intersection Peak | Method for determining peak hour: Total Entering Volume

LOCATION: NW North Albany Rd -- Albany-Corvallis Hwy (US20) | **QC JOB #:** 16184214
CITY/STATE: Albany, OR | **DATE:** Wed, May 3 2023

Peak-Hour: 4:45 PM -- 5:45 PM
Peak 15-Min: 5:30 PM -- 5:45 PM



15-Min Count Period Beginning At	NW North Albany Rd (Northbound) Left	Thru	Right	U	NW North Albany Rd (Southbound) Left	Thru	Right	U	Albany-Corvallis Hwy (US20) (Eastbound) Left	Thru	Right	U	Albany-Corvallis Hwy (US20) (Westbound) Left	Thru	Right	U	Total	Hourly Totals
4:00 PM	1	0	0	0	96	1	19	0	18	169	1	0	2	160	143	0	610	
4:15 PM	0	0	4	0	125	0	13	0	20	168	0	0	3	140	140	0	613	
4:30 PM	0	2	3	0	129	2	25	0	16	176	3	0	2	171	118	0	647	
4:45 PM	1	1	0	0	150	4	26	0	24	168	0	0	1	125	158	0	658	2528
5:00 PM	0	0	3	0	128	2	27	0	26	172	0	0	0	146	152	0	656	2574
5:15 PM	0	0	0	0	120	0	18	0	28	217	0	0	1	142	129	0	655	2616
5:30 PM	0	0	4	0	135	0	27	0	25	212	0	0	2	117	164	0	686	2655
5:45 PM	0	0	3	0	133	0	21	0	24	158	0	0	0	108	153	0	600	2597

Peak 15-Min Flowrates	Northbound Left	Thru	Right	U	Southbound Left	Thru	Right	U	Eastbound Left	Thru	Right	U	Westbound Left	Thru	Right	U	Total
All Vehicles	0	0	16	0	540	0	108	0	100	848	0	0	8	468	656	0	2744
Heavy Trucks	0	0	0		4	0	4		4	16	0		0	4	4		36
Buses																	
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Scooters																	

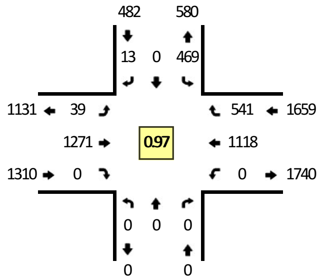
Comments:

Report generated on 5/24/2023 1:17 PM | SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak | Method for determining peak hour: Total Entering Volume

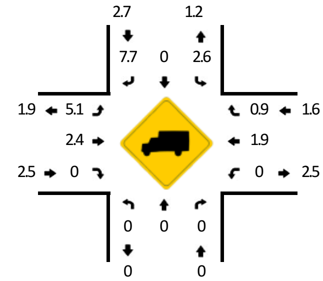
LOCATION: NW Springhill Dr -- Albany-Corvallis Hwy (US20)/N Lyon St | **QC JOB #:** 16184216

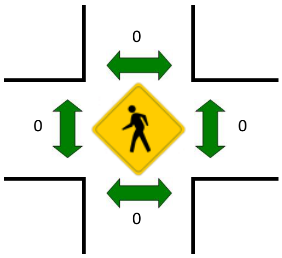
CITY/STATE: Albany, OR | **DATE:** Wed, May 3 2023

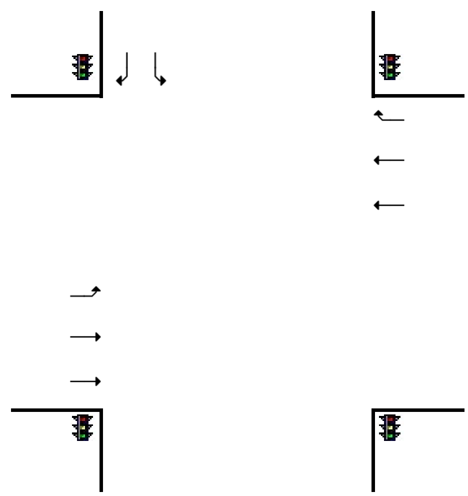


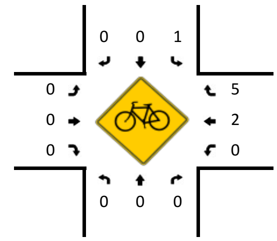
Peak-Hour: 4:45 PM -- 5:45 PM

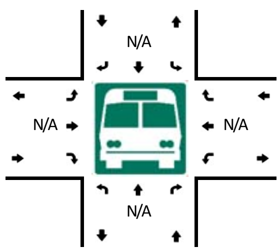
Peak 15-Min: 5:00 PM -- 5:15 PM

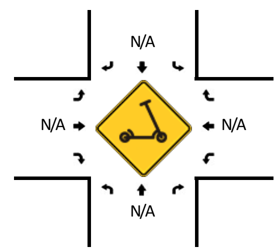












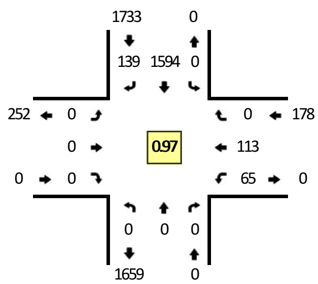
5-Min Count Period Beginning At	NW Springhill Dr (Northbound)				NW Springhill Dr (Southbound)				Albany-Corvallis Hwy (US20)/N Lyon St (Eastbound)				Albany-Corvallis Hwy (US20)/N Lyon St (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	0	0	0	0	46	0	1	0	3	62	0	0	0	87	36	0	235	
4:05 PM	0	0	0	0	35	0	0	0	3	95	0	0	0	101	43	0	277	
4:10 PM	0	0	0	0	37	0	2	0	6	103	0	0	0	120	46	0	314	
4:15 PM	0	0	0	0	36	0	3	0	0	73	0	0	0	85	45	0	242	
4:20 PM	0	0	0	0	37	0	1	0	4	114	0	0	0	103	42	0	301	
4:25 PM	0	0	0	0	41	0	2	0	4	98	0	0	0	88	38	0	271	
4:30 PM	0	0	0	0	44	0	1	0	5	103	0	0	0	73	41	0	267	
4:35 PM	0	0	0	0	33	0	0	0	3	95	0	0	0	121	51	0	303	
4:40 PM	0	0	0	0	51	0	2	0	2	86	0	0	0	81	30	0	252	
4:45 PM	0	0	0	0	36	0	1	0	3	106	0	0	0	85	36	0	267	
4:50 PM	0	0	0	0	36	0	0	0	3	127	0	0	0	108	45	0	319	
4:55 PM	0	0	0	0	34	0	0	0	2	95	0	0	0	88	36	0	255	3303
5:00 PM	0	0	0	0	49	0	1	0	3	95	0	0	0	85	59	0	292	3360
5:05 PM	0	0	0	0	46	0	2	0	3	100	0	0	0	110	48	0	309	3392
5:10 PM	0	0	0	0	36	0	4	0	2	95	0	0	0	99	49	0	285	3363
5:15 PM	0	0	0	0	43	0	0	0	3	96	0	0	0	93	50	0	285	3406
5:20 PM	0	0	0	0	37	0	1	0	5	112	0	0	0	90	46	0	291	3396
5:25 PM	0	0	0	0	32	0	0	0	5	130	0	0	0	86	49	0	302	3427
5:30 PM	0	0	0	0	44	0	2	0	2	99	0	0	0	90	50	0	287	3447
5:35 PM	0	0	0	0	42	0	0	0	3	105	0	0	0	93	33	0	276	3420
5:40 PM	0	0	0	0	34	0	2	0	5	111	0	0	0	91	40	0	283	3451
5:45 PM	0	0	0	0	29	0	1	0	0	103	0	0	0	94	36	0	263	3447
5:50 PM	0	0	0	0	38	0	2	0	3	109	0	0	0	74	41	0	267	3395
5:55 PM	0	0	0	0	32	0	0	0	2	86	0	0	0	92	33	0	245	3385

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	0	0	0	0	524	0	28	0	32	1160	0	0	0	1176	624	0	3544
Heavy Trucks	0	0	0		8	0	0		0	28	0		0	16	0		52
Buses																	
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	4	8		12
Scooters																	

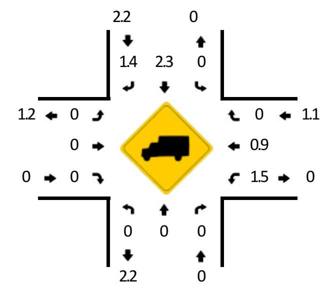
Comments:

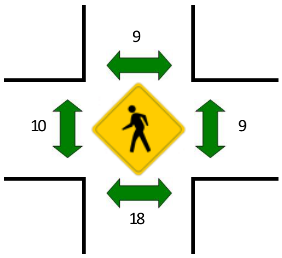
Type of peak hour being reported: Intersection Peak | Method for determining peak hour: Total Entering Volume

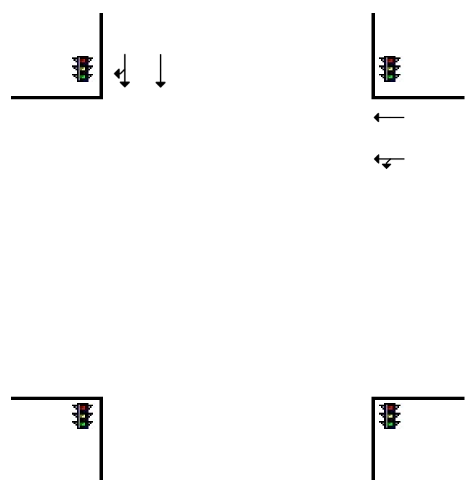
LOCATION: SW Ellsworth St -- W 1st Ave | **QC JOB #:** 16184210
CITY/STATE: Albany, OR | **DATE:** Wed, May 3 2023

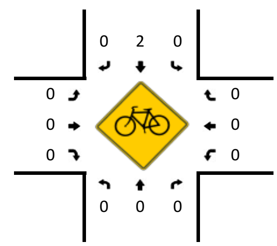


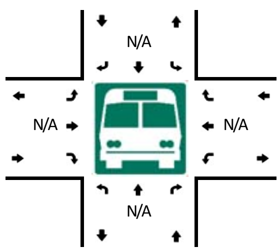
Peak-Hour: 4:55 PM -- 5:55 PM
Peak 15-Min: 5:25 PM -- 5:40 PM

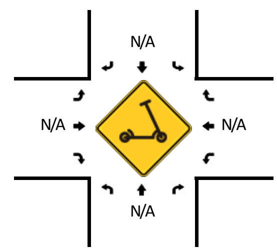












5-Min Count Period Beginning At	SW Ellsworth St (Northbound)				SW Ellsworth St (Southbound)				W 1st Ave (Eastbound)				W 1st Ave (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	0	0	0	0	0	113	14	0	0	0	0	0	3	9	0	0	139	
4:05 PM	0	0	0	0	0	98	10	0	0	0	0	0	11	14	0	0	133	
4:10 PM	0	0	0	0	0	130	11	0	0	0	0	0	2	12	0	0	155	
4:15 PM	0	0	0	0	0	119	5	0	0	0	0	0	3	19	0	0	146	
4:20 PM	0	0	0	0	0	119	15	0	0	0	0	0	7	12	0	0	153	
4:25 PM	0	0	0	0	0	119	15	0	0	0	0	0	4	13	0	0	151	
4:30 PM	0	0	0	0	0	136	11	0	0	0	0	0	5	8	0	0	160	
4:35 PM	0	0	0	0	0	124	9	0	0	0	0	0	6	13	0	0	152	
4:40 PM	0	0	0	0	0	120	13	0	0	0	0	0	5	9	0	0	147	
4:45 PM	0	0	0	0	0	116	10	0	0	0	0	0	3	17	0	0	146	
4:50 PM	0	0	0	0	0	129	16	0	0	0	0	0	3	10	0	0	158	
4:55 PM	0	0	0	0	0	138	14	0	0	0	0	0	4	11	0	0	167	1807
5:00 PM	0	0	0	0	0	127	10	0	0	0	0	0	7	7	0	0	151	1819
5:05 PM	0	0	0	0	0	125	11	0	0	0	0	0	6	8	0	0	150	1836
5:10 PM	0	0	0	0	0	145	9	0	0	0	0	0	6	13	0	0	173	1854
5:15 PM	0	0	0	0	0	136	12	0	0	0	0	0	5	7	0	0	160	1868
5:20 PM	0	0	0	0	0	128	9	0	0	0	0	0	6	5	0	0	148	1863
5:25 PM	0	0	0	0	0	133	15	0	0	0	0	0	8	10	0	0	166	1878
5:30 PM	0	0	0	0	0	144	13	0	0	0	0	0	10	8	0	0	175	1893
5:35 PM	0	0	0	0	0	126	14	0	0	0	0	0	3	8	0	0	151	1892
5:40 PM	0	0	0	0	0	115	18	0	0	0	0	0	1	11	0	0	145	1890
5:45 PM	0	0	0	0	0	140	5	0	0	0	0	0	3	16	0	0	164	1908
5:50 PM	0	0	0	0	0	137	9	0	0	0	0	0	6	9	0	0	161	1911
5:55 PM	0	0	0	0	0	133	10	0	0	0	0	0	2	9	0	0	154	1898

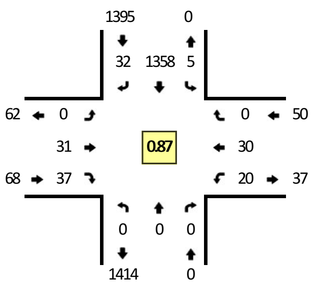
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	0	0	0	0	0	1612	168	0	0	0	0	0	84	104	0	0	1968
Heavy Trucks	0	0	0		0	36	0		0	0	0		0	0	0		36
Buses																	
Pedestrians		16				8				20				0			44
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Scooters																	

Comments:

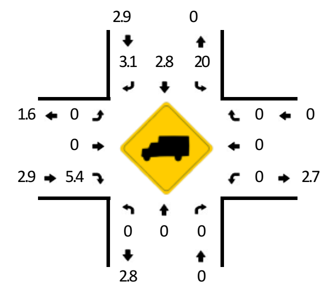
Report generated on 5/19/2023 12:05 PM | SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

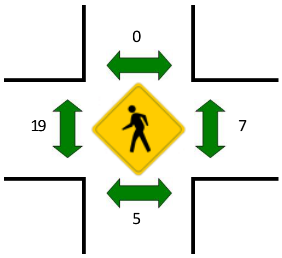
Type of peak hour being reported: Intersection Peak | Method for determining peak hour: Total Entering Volume

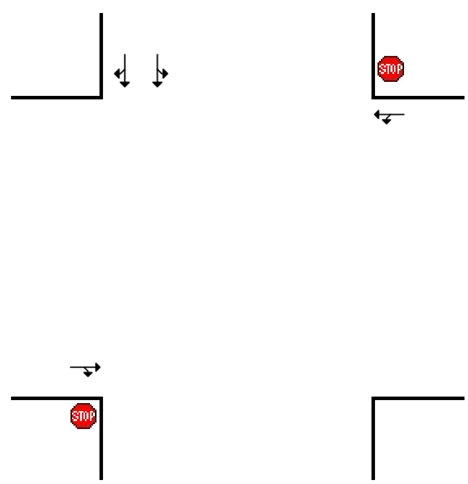
LOCATION: SW Ellsworth St -- SW 5th Ave | **QC JOB #:** 16184206
CITY/STATE: Albany, OR | **DATE:** Wed, May 3 2023

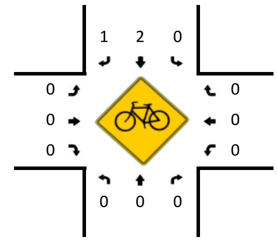


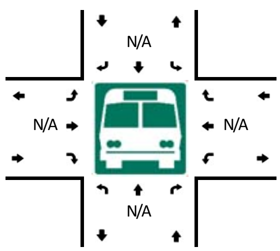
Peak-Hour: 4:30 PM -- 5:30 PM
Peak 15-Min: 5:00 PM -- 5:15 PM

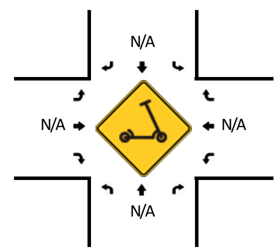












5-Min Count Period Beginning At	SW Ellsworth St (Northbound)				SW Ellsworth St (Southbound)				SW 5th Ave (Eastbound)				SW 5th Ave (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	0	0	0	0	1	97	3	0	0	2	1	0	1	1	0	0	106	
4:05 PM	0	0	0	0	1	110	4	0	0	5	2	0	0	3	0	0	125	
4:10 PM	0	0	0	0	0	104	1	0	0	4	2	0	1	3	0	0	115	
4:15 PM	0	0	0	0	2	97	1	0	0	1	2	0	1	2	0	0	106	
4:20 PM	0	0	0	0	2	92	4	0	0	4	2	0	0	3	0	1	108	
4:25 PM	0	0	0	0	0	100	3	0	0	2	4	0	0	4	0	0	113	
4:30 PM	0	0	0	0	0	114	1	0	0	4	2	0	1	8	0	0	130	
4:35 PM	0	0	0	0	0	98	0	0	0	0	4	0	2	1	0	0	105	
4:40 PM	0	0	0	0	0	99	4	0	0	2	2	0	1	2	0	1	111	
4:45 PM	0	0	0	0	0	105	4	0	0	1	2	0	2	2	0	0	116	
4:50 PM	0	0	0	0	1	105	1	0	0	1	3	0	2	2	0	0	115	
4:55 PM	0	0	0	0	1	119	1	0	0	5	3	0	5	2	0	0	136	1386
5:00 PM	0	0	0	0	0	117	5	0	0	3	6	0	0	4	0	0	135	1415
5:05 PM	0	0	0	0	0	127	4	0	0	5	8	0	2	2	0	0	148	1438
5:10 PM	0	0	0	0	1	135	5	0	0	5	2	0	0	2	0	0	150	1473
5:15 PM	0	0	0	0	1	102	2	0	0	2	1	0	3	0	0	0	111	1478
5:20 PM	0	0	0	0	0	120	3	0	0	1	1	0	0	3	0	0	128	1498
5:25 PM	0	0	0	0	1	117	2	0	0	2	3	0	1	2	0	0	128	1513
5:30 PM	0	0	0	0	1	119	1	0	0	2	0	0	0	1	0	0	124	1507
5:35 PM	0	0	0	0	0	85	2	0	0	4	2	0	1	0	0	0	94	1496
5:40 PM	0	0	0	0	1	92	0	0	0	5	2	0	0	2	0	0	102	1487
5:45 PM	0	0	0	0	2	118	1	0	0	2	0	0	1	2	0	0	126	1497
5:50 PM	0	0	0	0	0	115	1	0	0	2	0	0	0	2	0	0	120	1502
5:55 PM	0	0	0	0	1	102	3	0	0	1	2	0	0	0	0	0	109	1475

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	0	0	0	0	4	1516	56	0	0	52	64	0	8	32	0	0	1732
Heavy Trucks	0	0	0		0	36	0		0	0	8		0	0	0		44
Buses																	
Pedestrians		0				0				4				4			8
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Scooters																	

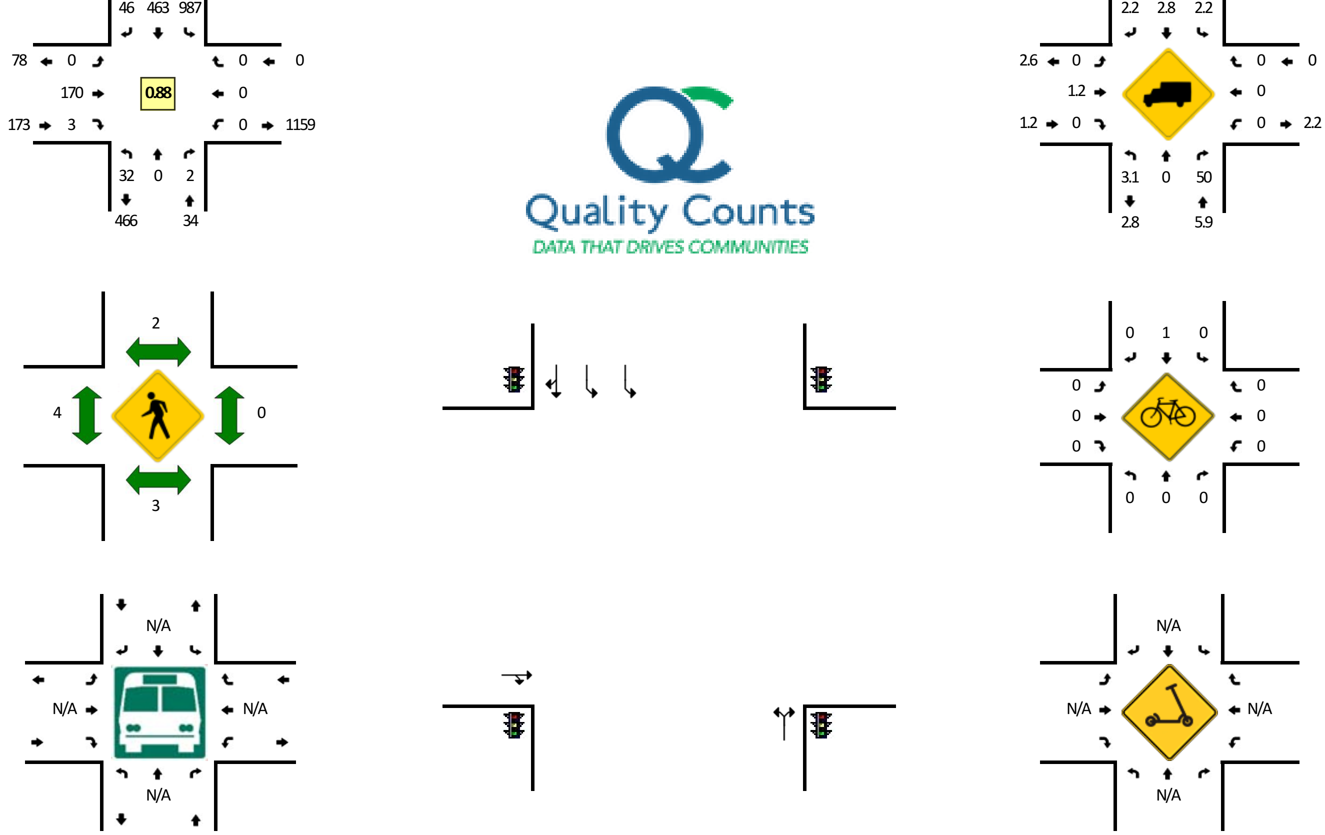
Comments:

Report generated on 5/19/2023 12:05 PM | SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak — Method for determining peak hour: Total Entering Volume

LOCATION: SW Ellsworth St -- SW 9th Ave — **QC JOB #:** 16184202
CITY/STATE: Albany, OR — **DATE:** Wed, May 3 2023

Peak-Hour: 4:25 PM -- 5:25 PM
Peak 15-Min: 5:00 PM -- 5:15 PM



5-Min Count Period Beginning At	SW Ellsworth St (Northbound) Left	Thru	Right	U	SW Ellsworth St (Southbound) Left	Thru	Right	U	SW 9th Ave (Eastbound) Left	Thru	Right	U	SW 9th Ave (Westbound) Left	Thru	Right	U	Total	Hourly Totals
4:00 PM	2	0	0	0	77	32	3	0	0	20	0	0	0	0	0	0	134	
4:05 PM	7	0	0	0	70	35	1	0	0	15	0	0	0	0	0	0	128	
4:10 PM	3	0	0	0	86	28	4	0	0	12	0	0	0	0	0	0	133	
4:15 PM	6	0	1	0	78	31	2	0	0	15	0	0	0	0	0	0	133	
4:20 PM	4	0	0	0	60	28	5	0	0	12	0	0	0	0	0	0	109	
4:25 PM	5	0	0	0	76	39	3	0	0	13	0	0	0	0	0	0	136	
4:30 PM	1	0	0	0	86	27	4	0	0	11	0	0	0	0	0	0	129	
4:35 PM	4	0	0	0	88	31	4	0	0	12	0	0	0	0	0	0	139	
4:40 PM	5	0	0	0	75	40	2	0	0	11	0	0	0	0	0	0	133	
4:45 PM	3	0	1	0	58	37	4	0	0	13	0	0	0	0	0	0	116	
4:50 PM	2	0	0	0	75	37	5	0	0	16	1	0	0	0	0	0	136	
4:55 PM	4	0	1	0	83	43	4	0	0	11	1	0	0	0	0	0	147	1573
5:00 PM	2	0	0	0	97	41	5	0	0	15	0	0	0	0	0	0	160	1599
5:05 PM	3	0	0	0	94	41	5	0	0	19	1	0	0	0	0	0	163	1634
5:10 PM	0	0	0	0	97	40	2	0	0	20	0	0	0	0	0	0	159	1660
5:15 PM	3	0	0	0	80	46	5	0	0	18	0	0	0	0	0	0	152	1679
5:20 PM	0	0	0	0	78	41	3	0	0	11	0	0	0	0	0	0	133	1703
5:25 PM	3	0	0	0	79	35	4	0	0	2	0	0	0	0	0	0	123	1690
5:30 PM	2	0	0	0	84	42	0	0	0	10	0	0	0	0	0	0	138	1699
5:35 PM	5	0	0	0	63	30	9	0	0	16	0	0	0	0	0	0	123	1683
5:40 PM	5	0	1	0	63	30	5	0	0	10	0	0	0	0	0	0	114	1664
5:45 PM	3	0	0	0	67	36	5	0	0	16	0	0	0	0	0	0	127	1675
5:50 PM	2	0	2	0	80	32	6	0	0	21	0	0	0	0	0	0	143	1682
5:55 PM	6	0	0	0	73	36	5	0	0	16	0	0	0	0	0	0	136	1671

Peak 15-Min Flowrates	Northbound Left	Thru	Right	U	Southbound Left	Thru	Right	U	Eastbound Left	Thru	Right	U	Westbound Left	Thru	Right	U	Total
All Vehicles	20	0	0	0	1152	488	48	0	0	216	4	0	0	0	0	0	1928
Heavy Trucks	4	0	0		28	12	0		0	4	0		0	0	0		48
Buses																	
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Scooters																	

Comments:

Report generated on 5/19/2023 12:05 PM — SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

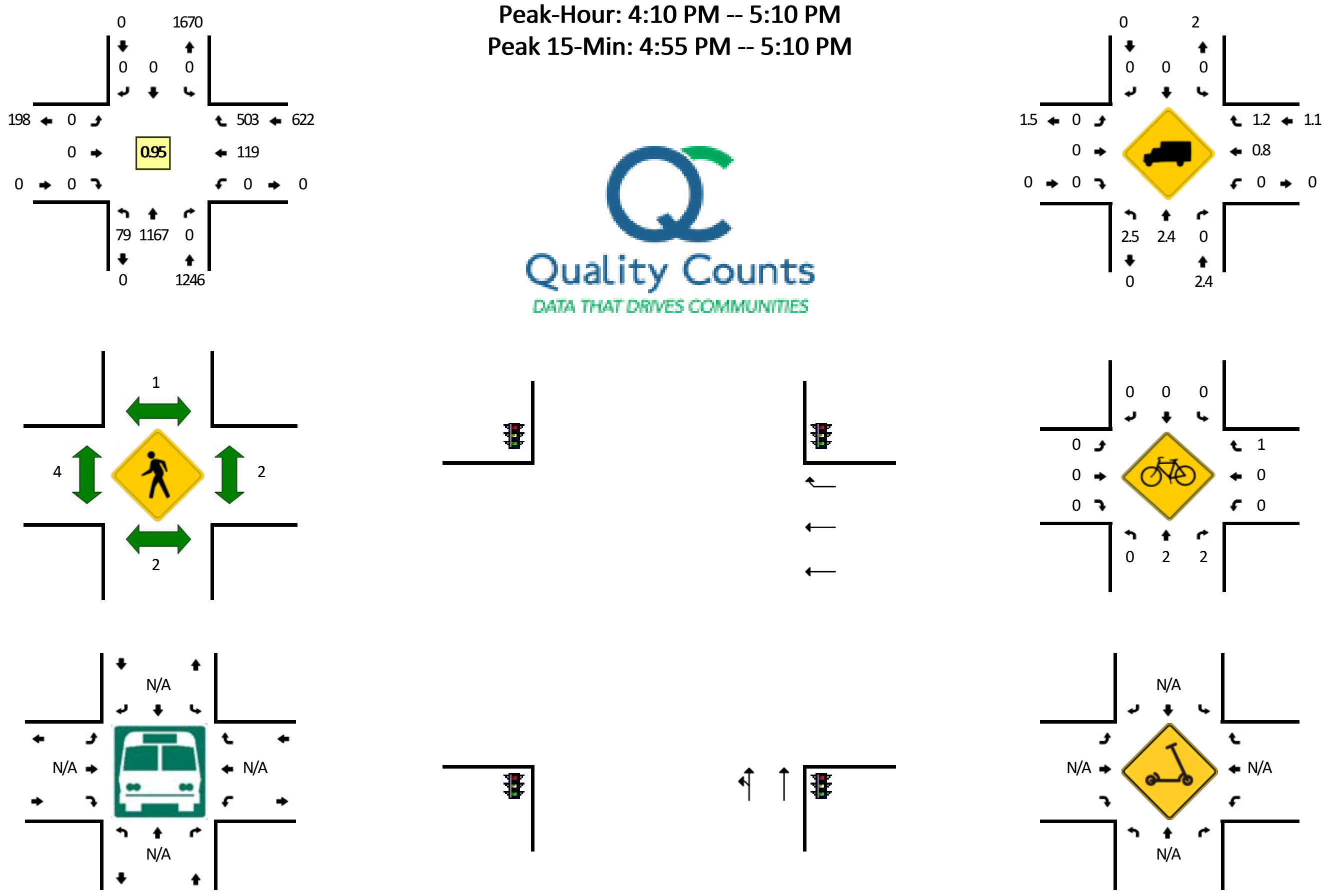
Type of peak hour being reported: Intersection Peak | Method for determining peak hour: Total Entering Volume

LOCATION: SW Lyon St -- W 1st Ave | **QC JOB #:** 16184212

CITY/STATE: Albany, OR | **DATE:** Wed, May 3 2023

Peak-Hour: 4:10 PM -- 5:10 PM

Peak 15-Min: 4:55 PM -- 5:10 PM



5-Min Count Period Beginning At	SW Lyon St (Northbound)				SW Lyon St (Southbound)				W 1st Ave (Eastbound)				W 1st Ave (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	5	101	0	0	0	0	0	0	0	0	0	0	0	11	42	0	159	
4:05 PM	13	91	0	0	0	0	0	0	0	0	0	0	0	12	47	0	163	
4:10 PM	6	103	0	0	0	0	0	0	0	0	0	0	0	8	55	0	172	
4:15 PM	8	95	0	0	0	0	0	0	0	0	0	0	0	16	45	0	164	
4:20 PM	8	96	0	0	0	0	0	0	0	0	0	0	0	12	37	0	153	
4:25 PM	7	85	0	0	0	0	0	0	0	0	0	0	0	13	49	0	154	
4:30 PM	5	75	0	0	0	0	0	0	0	0	0	0	0	5	46	0	131	
4:35 PM	6	116	0	0	0	0	0	0	0	0	0	0	0	12	40	0	174	
4:40 PM	8	94	0	0	0	0	0	0	0	0	0	0	0	8	32	0	142	
4:45 PM	7	90	0	0	0	0	0	0	0	0	0	0	0	12	25	0	134	
4:50 PM	7	98	0	0	0	0	0	0	0	0	0	0	0	3	46	0	154	
4:55 PM	6	83	0	0	0	0	0	0	0	0	0	0	0	8	42	0	139	1839
5:00 PM	4	113	0	0	0	0	0	0	0	0	0	0	0	12	35	0	164	1844
5:05 PM	7	119	0	0	0	0	0	0	0	0	0	0	0	10	51	0	187	1868
5:10 PM	6	101	0	0	0	0	0	0	0	0	0	0	0	11	41	0	159	1855
5:15 PM	8	107	0	0	0	0	0	0	0	0	0	0	0	5	37	0	157	1848
5:20 PM	3	104	0	0	0	0	0	0	0	0	0	0	0	8	33	0	148	1843
5:25 PM	5	91	0	0	0	0	0	0	0	0	0	0	0	12	45	0	153	1842
5:30 PM	5	93	0	0	0	0	0	0	0	0	0	0	0	12	42	0	152	1863
5:35 PM	3	94	0	0	0	0	0	0	0	0	0	0	0	9	44	0	150	1839
5:40 PM	5	89	0	0	0	0	0	0	0	0	0	0	0	7	41	0	142	1839
5:45 PM	11	92	0	0	0	0	0	0	0	0	0	0	0	11	39	0	153	1858
5:50 PM	6	81	0	0	0	0	0	0	0	0	0	0	0	6	39	0	132	1836
5:55 PM	12	71	0	0	0	0	0	0	0	0	0	0	0	3	42	0	128	1825

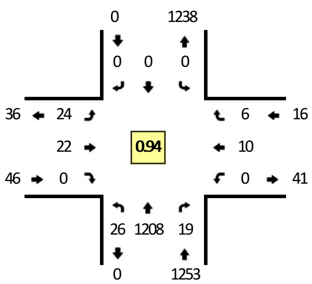
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	68	1260	0	0	0	0	0	0	0	0	0	0	0	120	512	0	1960
Heavy Trucks	0	28	0		0	0	0		0	0	0		0	4	4		36
Buses																	
Pedestrians		0				0				0				0			0
Bicycles	0	4	4		0	0	0		0	0	0		0	0	4		12
Scooters																	

Comments:

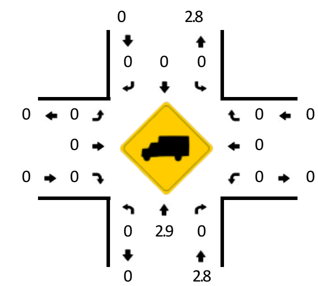
Report generated on 5/19/2023 12:05 PM | SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

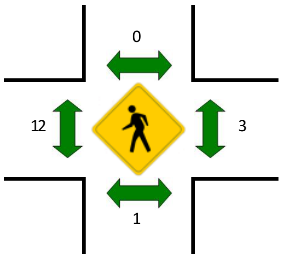
Type of peak hour being reported: Intersection Peak | Method for determining peak hour: Total Entering Volume

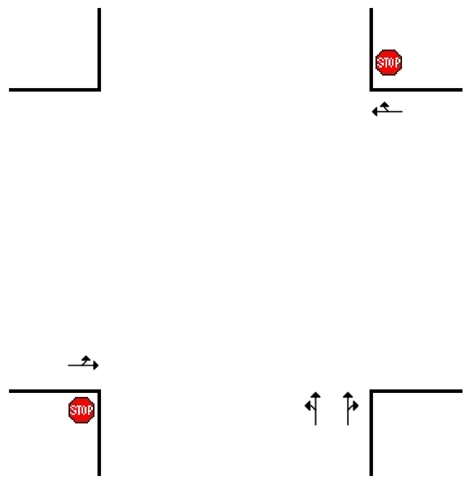
LOCATION: SW Lyon St -- SW 5th Ave | **QC JOB #:** 16184208
CITY/STATE: Albany, OR | **DATE:** Wed, May 3 2023

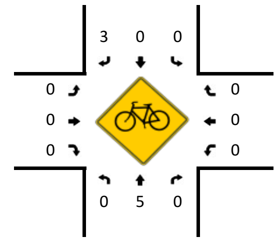


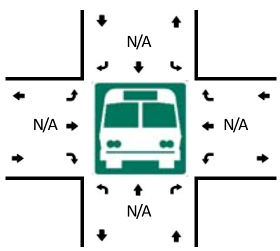
Peak-Hour: 4:25 PM -- 5:25 PM
Peak 15-Min: 5:00 PM -- 5:15 PM

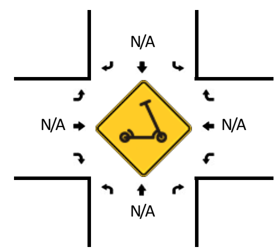












5-Min Count Period Beginning At	SW Lyon St (Northbound)				SW Lyon St (Southbound)				SW 5th Ave (Eastbound)				SW 5th Ave (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	1	95	1	0	0	0	0	0	4	1	0	0	0	0	0	0	102	
4:05 PM	2	90	2	0	0	0	0	0	5	1	0	0	0	1	1	0	102	
4:10 PM	3	105	1	0	0	0	0	0	4	0	0	0	0	1	0	0	114	
4:15 PM	2	98	2	0	0	0	0	0	1	2	0	0	0	0	0	0	105	
4:20 PM	2	87	1	0	0	0	0	0	2	3	0	0	0	1	1	0	97	
4:25 PM	3	102	1	0	0	0	0	0	3	1	0	0	0	2	0	0	112	
4:30 PM	8	96	2	0	0	0	0	0	3	1	0	0	0	1	2	0	113	
4:35 PM	1	104	2	0	0	0	0	0	1	1	0	0	0	1	0	0	110	
4:40 PM	0	99	1	0	0	0	0	0	0	2	0	0	0	1	1	0	104	
4:45 PM	2	102	0	0	0	0	0	0	2	0	0	0	0	0	0	0	106	
4:50 PM	1	97	0	0	0	0	0	0	2	0	0	0	0	2	0	0	102	
4:55 PM	3	97	3	0	0	0	0	0	3	3	0	0	0	1	2	0	112	1279
5:00 PM	3	99	4	0	0	0	0	0	0	2	0	0	0	0	0	0	108	1285
5:05 PM	1	111	1	0	0	0	0	0	5	4	0	0	0	1	0	0	123	1306
5:10 PM	1	105	3	0	0	0	0	0	3	5	0	0	0	0	0	0	117	1309
5:15 PM	0	95	0	0	0	0	0	0	1	3	0	0	0	1	0	0	100	1304
5:20 PM	3	101	2	0	0	0	0	0	1	0	0	0	0	0	1	0	108	1315
5:25 PM	3	103	0	0	0	0	0	0	1	1	0	0	0	0	1	0	109	1312
5:30 PM	0	88	3	0	0	0	0	0	1	2	0	0	0	0	0	0	94	1293
5:35 PM	0	85	0	0	0	0	0	0	3	2	0	0	0	1	0	0	91	1274
5:40 PM	3	80	1	0	0	0	0	0	3	2	0	0	0	1	0	0	90	1260
5:45 PM	2	103	2	0	0	0	0	0	3	2	0	0	0	0	0	0	112	1266
5:50 PM	2	82	1	0	0	0	0	0	2	0	0	0	0	0	0	0	87	1251
5:55 PM	0	86	2	0	0	0	0	0	1	1	0	0	0	0	1	0	91	1230

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	20	1260	32	0	0	0	0	0	32	44	0	0	0	4	0	0	1392
Heavy Trucks	0	24	0		0	0	0		0	0	0		0	0	0		24
Buses																	
Pedestrians		0				0				16				0			16
Bicycles	0	16	0		0	0	4		0	0	0		0	0	0		20
Scooters																	

Comments:

Report generated on 5/19/2023 12:05 PM | SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Location: Lyon Street/Pacific Highway Exit Ramp--SW 9th Avenue/Pacific Highway Exit Ramp
Date: 5/3/2023
Site Code: 16184204

Peak Hour: 4:35 PM - 5:35 PM
Peak 15: 5:00 PM - 5:15 PM
PHF: 0.911017

	Lyon St Southbound						Pacific Blvd WB Off Ramp Westbound						Pacific Blvd EB Ramps Northwestbound					
Start Time	Right to Dwy	Right	Thru	Left to EB Ramps	Left	U-Turn	Right to Lyon St	Right to Dwy	To 9th Ave	Left to Lyon St	Left to EB Ramps	U-Turn	Right to WB Off Ramp	Right to Lyon St	To Dwy	Left to 9th Ave	Left to Lyon St	U-Turn
04:00 PM	0	0	0	0	0	0	68	2	0	0	0	0	0	27	0	0	0	0
04:05 PM	0	0	0	0	0	0	59	0	0	0	0	0	0	39	1	0	0	0
04:10 PM	0	0	0	0	0	0	68	0	0	0	0	0	0	28	0	0	0	0
04:15 PM	0	0	0	0	0	0	63	1	0	0	0	0	0	35	0	0	0	0
04:20 PM	0	0	0	0	0	0	67	0	0	0	0	0	0	36	0	0	0	0
04:25 PM	0	0	0	0	0	0	59	0	0	0	0	0	0	40	0	0	0	0
04:30 PM	0	0	0	0	0	0	57	0	0	0	0	0	0	38	0	0	0	0
04:35 PM	0	0	0	0	0	0	71	0	0	0	0	0	0	36	0	0	0	0
04:40 PM	0	0	0	0	0	0	52	1	0	0	0	0	0	41	0	0	0	0
04:45 PM	0	0	0	0	0	0	62	1	0	0	0	0	0	38	0	0	0	0
04:50 PM	0	0	0	0	0	0	60	0	0	0	0	0	0	31	0	0	0	0
04:55 PM	0	0	0	0	0	0	58	1	0	0	0	0	0	32	0	0	0	0
05:00 PM	0	0	0	0	0	0	63	0	0	0	0	0	0	29	1	0	0	0
05:05 PM	0	0	0	0	0	0	69	0	0	0	0	0	0	35	0	0	0	0
05:10 PM	0	0	0	0	0	0	67	0	0	0	0	0	0	40	0	0	0	0
05:15 PM	0	0	0	0	0	0	57	0	0	0	0	0	0	30	0	0	0	0
05:20 PM	0	0	0	0	0	0	73	0	0	0	0	0	0	40	0	0	0	0
05:25 PM	0	0	0	0	0	0	66	0	0	0	0	0	0	34	0	0	0	0
05:30 PM	0	0	0	0	0	0	64	0	0	0	0	0	0	28	0	0	0	0
05:35 PM	0	0	0	0	0	0	58	0	0	0	0	0	0	19	0	0	0	0
05:40 PM	0	0	0	0	0	0	55	0	0	0	0	0	0	35	0	0	0	0
05:45 PM	0	0	0	0	0	0	56	0	0	0	0	0	0	40	0	0	0	0
05:50 PM	0	0	0	0	0	0	56	1	0	0	0	0	0	21	0	0	0	0
05:55 PM	0	0	0	0	0	0	65	0	0	0	0	0	0	22	0	0	0	0
Total	**0**	**0**	**0**	**0**	**0**	**0**	**1493**	**7**	**0**	**0**	**0**	**0**	**0**	**794**	**2**	**0**	**0**	**0**

	Lyon St Northbound						SW 9th Ave Eastbound						Commercial Dwy Southeastbound					
Start Time	Right to EB Ramps	Right to WB Off Ramp	Thru	Left to Dwy	Left	U-Turn	Right	Right to EB Ramps	To WB Off Ramp	Left	Left to Dwy	U-Turn	Right to 9th Ave	Right to Lyon St	To EB Ramps	Left to WB Off Ramp	Left to Lyon St	U-Turn
04:00 PM	0	0	0	0	0	0	0	102	0	5	0	0	0	0	0	0	0	0
04:05 PM	0	0	0	0	0	0	0	83	0	5	0	0	0	0	0	0	0	0
04:10 PM	0	0	0	0	0	0	0	109	0	3	0	0	0	0	0	0	0	0
04:15 PM	0	0	0	0	0	0	0	84	0	5	0	0	0	0	0	0	0	0
04:20 PM	0	0	0	0	0	0	0	76	0	2	0	0	0	0	0	0	0	0
04:25 PM	0	0	0	0	0	0	0	78	0	7	0	0	0	0	0	0	0	0
04:30 PM	0	0	0	0	0	0	0	80	0	3	0	0	0	0	0	0	0	0
04:35 PM	0	0	0	0	0	0	0	109	0	3	0	0	0	0	0	0	0	0
04:40 PM	0	0	0	0	0	0	0	79	0	1	0	0	0	0	0	0	0	0
04:45 PM	0	0	0	0	0	0	0	74	0	5	0	0	0	0	0	0	0	0
04:50 PM	0	0	0	0	0	0	0	94	0	7	0	0	0	0	0	0	0	0
04:55 PM	0	0	0	0	0	0	0	87	0	5	1	0	0	0	0	0	0	0
05:00 PM	0	0	0	0	0	0	0	110	0	4	0	0	0	0	0	0	0	0
05:05 PM	0	0	0	0	0	0	0	106	0	4	0	0	0	0	0	0	0	0
05:10 PM	0	0	0	0	0	0	0	113	0	7	1	0	0	0	0	0	0	0
05:15 PM	0	0	0	0	0	0	0	101	0	3	0	0	0	0	0	0	0	0
05:20 PM	0	0	0	0	0	0	0	83	0	3	0	0	0	0	0	0	0	0
05:25 PM	0	0	0	0	0	0	0	80	0	3	1	0	0	0	0	0	0	0
05:30 PM	0	0	0	0	0	0	0	96	0	5	0	0	0	0	0	0	0	0
05:35 PM	0	0	0	0	0	0	0	67	0	4	0	0	0	0	0	0	0	0
05:40 PM	0	0	0	0	0	0	0	80	0	3	0	0	0	0	0	0	0	0
05:45 PM	0	0	0	0	0	0	0	77	0	0	1	0	0	0	0	0	0	0
05:50 PM	0	0	0	0	0	0	0	100	0	6	1	0	0	0	0	0	0	0
05:55 PM	0	0	0	0	0	0	0	79	0	3	1	0	0	0	0	0	0	0
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2147**	**0**	**96**	**6**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

4th Avenue

Factor	0.180851				0.183515		
4th/Lyon	PM	Balancing	Final	**4th/Ellsworth**	**PM**	Balancing	Final
NBL	11			SBL	1	32	33
NBT	1253			SBT	1512	-77	1435
NBR	11			SBR	1	40	46
EBL	1	17	18	EBT	5	17	22
EBT	5	32	37	EBR	9	-8	1
WBR	7	53	60	WBT	5	6	11
WBT	14	10	24	WBL	23	-22	1

Replica NB Thru Vol	7050	Entering NB Synchro volume	1275
Replica SB Thru Vol	8250	Entering SB Synchro volume	1514

NB 5th Ave	1275	
NB 4th	1261	56
NB 3rd Ave	1331	
4th-3rd	-70	

Replica volumes

4th/Lyon	PM	**4th/Ellsworth**	**PM**
NBL	61	SBL	6
NBT	NA	SBT	NA
NBR	59	SBR	4
EBL	3	EBT	26
EBT	30	EBR	48
WBR	41	WBT	27
WBT	75	WBL	125

6th Avenue

Factor	0.181947	0.163364		0.214667	0.158876
6th/Lyon	AM	PM	**6th/Ellsworth**	**AM**	**PM**
NBT	1158	1250	SBL	2	2
NBL	7	6	SBT	1124	1410
EBL	1	3	SBR	1	2
			EBT	2	3
			EBR	7	7
			WBT	2	2
			WBL	2	6

Replica NB Thru Vol	7590
Replica SB Thru Vol	8710

Entering NB Synchro volume	1296
Entering SB Synchro volume	1469

7th Avenue

Factor	0.170751				0.168657		
7th/Lyon	PM	**Balancing**	**Final**	**7th/Ellsworth**	**PM**	**Balancing**	**Final**
NBL	72			SBL	9		
NBT	1204	+15	1219	SBT	1412		
NBR	20	-8	12	SBR	48		
EBL	47			EBT	41	2	43
EBT	5			EBR	121		
WBR	3	35	38	WBT	71	-10	61
WBT	18			WBL	20	10	30

Replica volumes

7th/Lyon	PM	**7th/Ellsworth**	**PM**
NBL	421	SBL	52
NBT	NA	SBT	NA
NBR	116	SBR	287
EBL	273	EBT	241
EBT	28	EBR	719
WBR	17	WBT	420
WBT	106	WBL	117

Replica NB Thru Vol	7610	Entering NB Synchro volume	1296
Replica SB Thru Vol	9210	Entering SB Synchro volume (calc	1553

8th Avenue

Factor	0.170302				0.168621		
8th/Lyon	PM	**Balancing**	**Final**	**8th/Ellsworth**	**PM**	**Balancing**	**Final**
NBL	3			SBL	0		
NBT	1293			SBT	1553	10	
NBR	0			SBR	0		
EBL	1	5	6	EBT	2	4	6
EBT	0			EBR	0	22	22
WBR	4			WBT	2		
WBT	0	10	10	WBL	1	10	11

Replica volumes

8th/Lyon	PM	**8th/Ellsworth**	**PM**
NBL	19	SBL	0
NBT	NA	SBT	NA
NBR	0	SBR	0
EBL	8	EBT	9
EBT	0	EBR	0
WBR	23	WBT	11
WBT	0	WBL	4

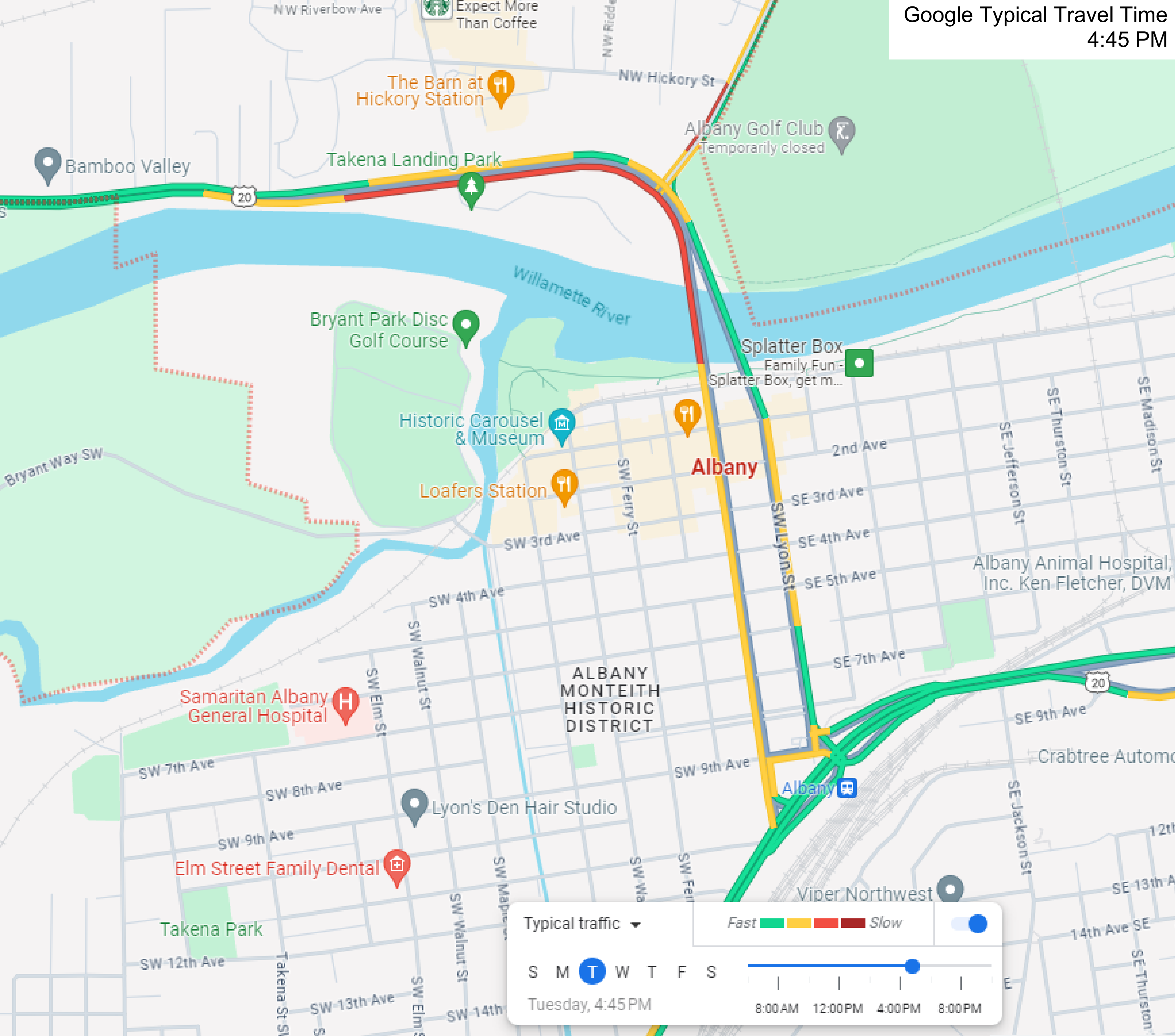
The 8th Ave link west of Lyon St doesn't connect to Lyon St, so zeroes are shown for those turns

APPENDIX B: GOOGLE TYPICAL TRAFFIC MAP


Google Typical Travel Time
4:00 PM
Thornton Lake
Life Trek
The Golf Club Of Oregon
North Albany IGA
NW Teak Loop
NW Riverbow Ave
The Barn at Hickory Station
NW Hickory St
Albany Golf Club
Temporarily closed
Takena Landing Park
Bamboo Valley
20
Willamette River
Bryant Park Disc Golf Course
Splatter Box
Historic Carousel & Museum
Albany
Loafers Station
Bryant Way SW
2nd Ave
SE 3rd Ave
SE 4th Ave
SE 5th Ave
SE 7th Ave
SE 1st Ave
SE Jefferson St
SE Thurston St
SE Madison St
Hill St SE
Main St SE
SW Ferry St
SW Lyon St
SW 3rd Ave
SW 4th Ave
Albany Animal Hospital, Inc. Ken Fletcher, DVM
SE 9th Ave
Crabtree Automotive
ALBANY MONTEITH HISTORIC DISTRICT
Samaritan Albany General Hospital
SW Elm St
SW Walnut St
SW 7th Ave
SW 8th Ave
SW 9th Ave
Lyon's Den Hair Studio
Elm Street Family Dental
SW Maple St
SW Washington St
12th Ave SE
SE 13th Ave
SE Jackson St
Viper Northwest
14th Ave SE
Takena Park
SW 12th Ave
Takena St SW
SW 13th Ave
SW Umatilla St
SW 15th Ave
US Department Of
SE Powell Way
Lafayette St SE
SE Thurston St
Regency Albany
Typical traffic
Fast
Slow
S M T W T F S
Tuesday, 4:00 PM
8:00 AM
12:00 PM
4:00 PM
8:00 PM


Google Typical Travel Time
4:15 PM
Life Trek
The Golf Club Of Oregon
North Albany IGA
NW Teak Loop
NW Riverbow Ave
The Barn at Hickory Station
NW Hickory St
Albany Golf Club
Temporarily closed
NW Juniper Ln
Bamboo Valley
Takena Landing Park
20
Willamette River
Bryant Park Disc Golf Course
Splatter Box
Historic Carousel & Museum
Bryant Way SW
Loafers Station
Albany
2nd Ave
SE 3rd Ave
SE 4th Ave
SE 5th Ave
SW 3rd Ave
SW 4th Ave
SW Ferry St
SW Lyon St
SE Jefferson St
SE Thurston St
SE Madison St
Hill St SE
Main St SE
Albany Animal Hospital, Inc. Ken Fletcher, DVM
SE 7th Ave
SE 1st
ALBANY MONTEITH HISTORIC DISTRICT
Samaritan Albany General Hospital
SW Elm St
SW Walnut St
SW 7th Ave
SW 8th Ave
SW 9th Ave
SE 9th Ave
Crabtree Automotive
Albany
Lyon's Den Hair Studio
Elm Street Family Dental
12th Ave SE
SE Jackson St
Viper Northwest
SE 13th Ave
14th Ave SE
SW Washington St
SW Maple St
SW Ferry St
Takena Park
SW 12th Ave
Takena St SW
SW 13th Ave
SW Umatilla St
13th Ave
SW 15th Ave
US Department Of Energy NETL Albany
Typical traffic
Fast
Slow
S M T W T F S
Tuesday, 4:15 PM
8:00 AM
12:00 PM
4:00 PM
8:00 PM
Lafayette St SE
SE Powell Way
SE Thurston St
Regency Albany


Google Typical Travel Time
4:30 PM
North Albany IGA
The Barn at Hickory Station
Takena Landing Park
Bamboo Valley
Peerless Pattern Works
Albany Golf Club
Temporarily closed
Willamette River
Bryant Park Disc Golf Course
Splatter Box
Historic Carousel & Museum
Loafers Station
Albany
ALBANY MONTEITH HISTORIC DISTRICT
Albany Animal Hospital, Inc. Ken Fletcher, DVM
Samaritan Albany General Hospital
Crabtree Automotive
Lyon's Den Hair Studio
Elm Street Family Dental
Viper Northwest
Takena Park
US Department Of Energy, NETL Albany...
Regency Albany
Typical traffic
Fast
Slow
S M T W T F S
Tuesday, 4:30 PM
8:00 AM
12:00 PM
4:00 PM
8:00 PM


Google Typical Travel Time
4:45 PM
NW Riverbow Ave
Expect More Than Coffee
The Barn at Hickory Station
NW Hickory St
Albany Golf Club
Temporarily closed
Bamboo Valley
Takena Landing Park
20
Willamette River
Bryant Park Disc Golf Course
Splatter Box
Family Fun - Splatter Box, get m...
Historic Carousel & Museum
Albany
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SE 4th Ave
SE 5th Ave
SE 7th Ave
SE 9th Ave
Bryant Way SW
Loafers Station
SW Ferry St
SW Lyon St
SW 3rd Ave
SW 4th Ave
SE Jefferson St
SE Thurston St
SE Madison St
Albany Animal Hospital, Inc. Ken Fletcher, DVM
SW Walnut St
SW Elm St
ALBANY MONTEITH HISTORIC DISTRICT
Samaritan Albany General Hospital
SW 7th Ave
SW 8th Ave
SW 9th Ave
Lyon's Den Hair Studio
Elm Street Family Dental
Takena Park
SW 12th Ave
SW 13th Ave
Crabtree Automo
SE Jackson St
Viper Northwest
SE 13th A
14th Ave SE
Typical traffic
Fast
Slow
S M T W T F S
Tuesday, 4:45 PM
8:00 AM
12:00 PM
4:00 PM
8:00 PM


Google Typical Travel Time
5:00 PM
North Albany IGA
Fresh Produce and Meat
NW Teak Loop
NW Riverbow Ave
Starbucks
Expect More Than Coffee
NW Ridders Ln
NW Hickory St
The Barn at Hickory Station
Albany Golf Club
Temporarily closed
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Albany Animal Hospital, Inc. Ken Fletcher, DVM
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SW 8th Ave
SW 9th Ave
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Albany
Lyon's Den Hair Studio
Elm Street Family Dental
SE Jackson St
12th Ave S
SE 13th Ave
14th Ave SE
Viper Northwest
Takena Park
SW 12th Ave
SW 13th Ave
SW 14th
Typical traffic
Fast
Slow
S M T W T F S
Tuesday, 5:00 PM
8:00 AM
12:00 PM
4:00 PM
8:00 PM


Google Typical Travel Time
5:15 PM
North Albany IGA
Fresh Produce and Meat
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SW 9th Ave
Crabtree Automotiv
Lyon's Den Hair Studio
Elm Street Family Dental
SE Jackson St
Viper Northwest
SE 13th Ave
14th Ave SE
Takena Park
SW 12th Ave
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Typical traffic
Fast
Slow
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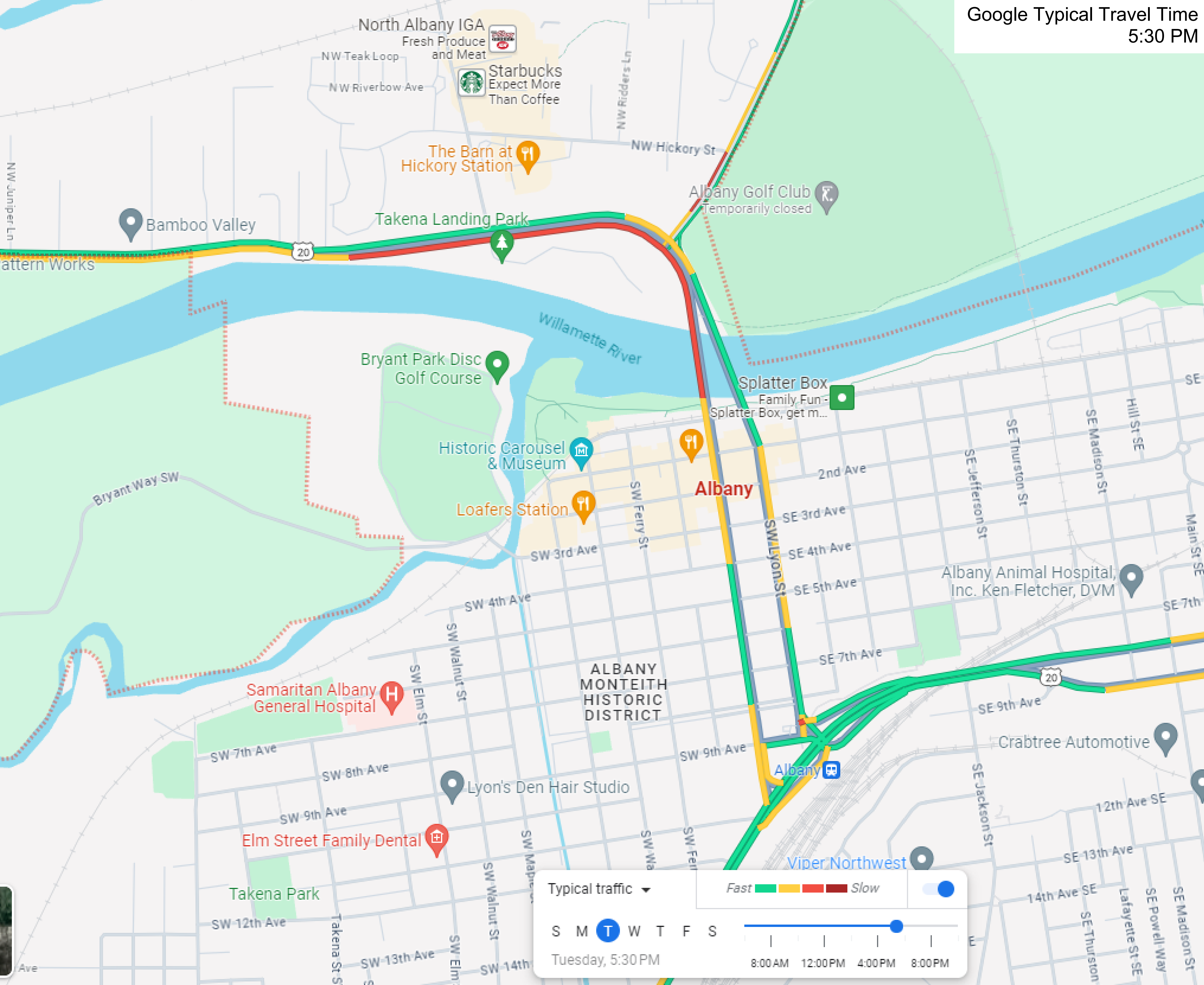
Google Typical Travel Time
5:30 PM
North Albany IGA
Fresh Produce and Meat
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NW Riverbow Ave
Starbucks
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SE Madison St
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SE 7th
SW Walnut St
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12th Ave SE
Elm Street Family Dental
SW Maple
Viper Northwest
SE 13th Ave
Takena Park
SW 12th Ave
SW 13th Ave
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14th Ave SE
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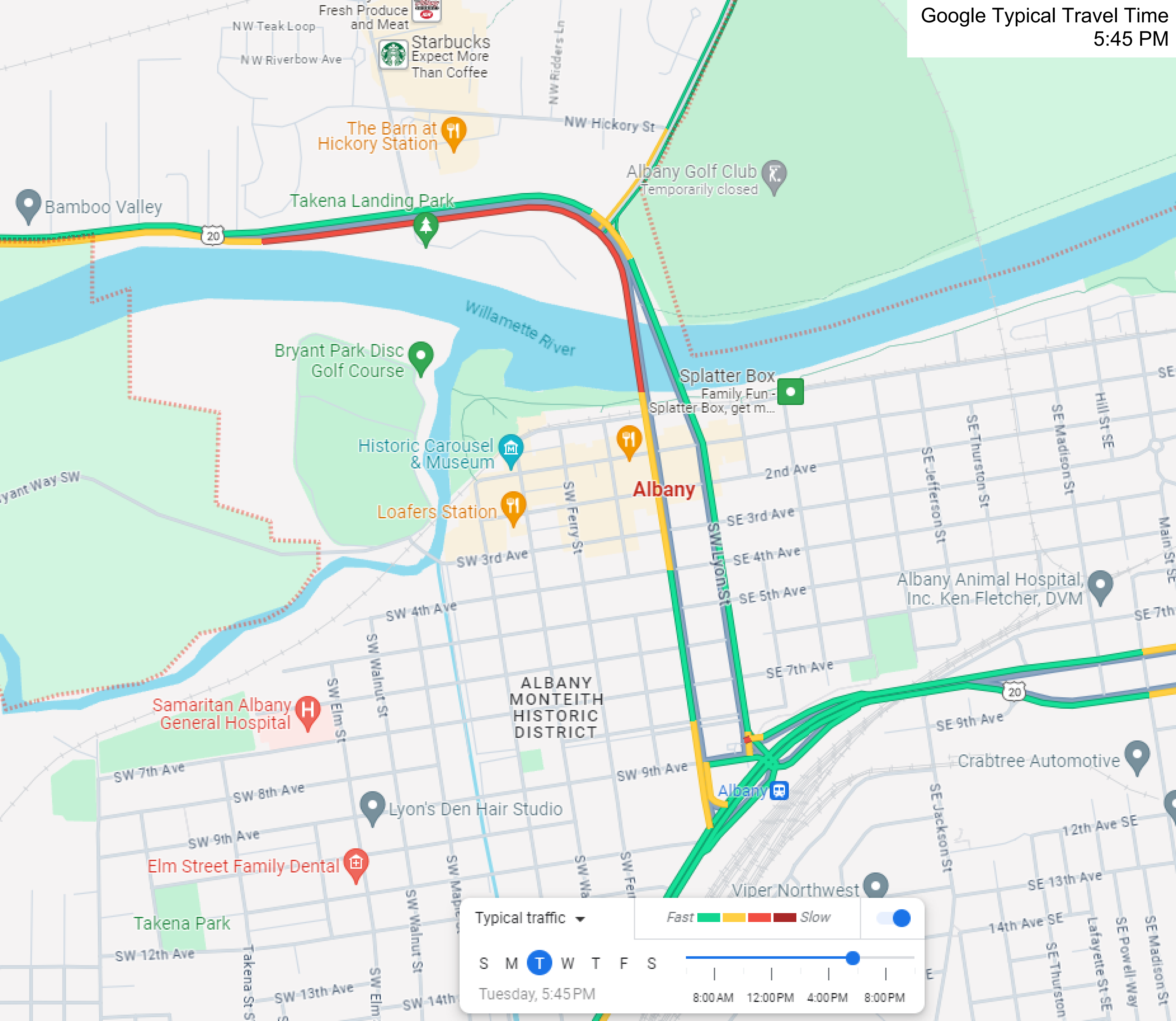

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Takena St
Lafayette St SE
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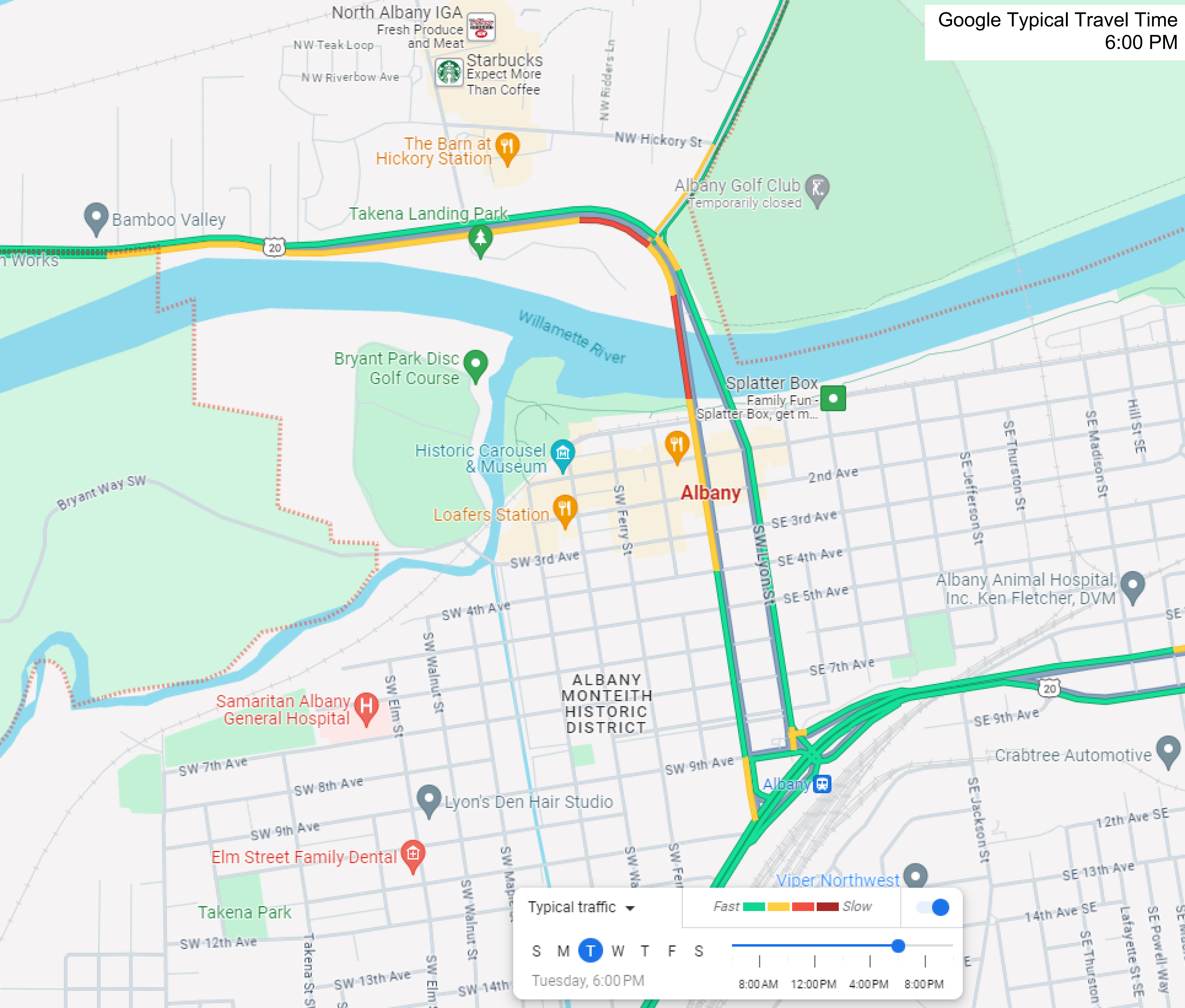
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SE 3rd Ave
SE 4th Ave
SE 5th Ave
SW Lyon St
SE Jefferson St
SE Thurston St
SE Madison St
Hill St SE
SW 3rd Ave
SW 4th Ave
Albany Animal Hospital, Inc. Ken Fletcher, DVM
SE 7th Ave
SW Walnut St
SW Elm St
ALBANY MONTEITH HISTORIC DISTRICT
Samaritan Albany General Hospital
SE 9th Ave
Crabtree Automotive
SW 7th Ave
SW 8th Ave
SW 9th Ave
Albany
Lyon's Den Hair Studio
SE Jackson St
12th Ave SE
SE 13th Ave
Elm Street Family Dental
Viper Northwest
14th Ave SE
Takena Park
SW 12th Ave
SW 13th Ave
Takena St SW
SW 14th
SE Thurston
Lafayette St SE
SE Powell Way
Typical traffic
Fast
Slow
S M T W T F S
Tuesday, 6:00 PM
8:00 AM
12:00 PM
4:00 PM
8:00 PM

APPENDIX C: EXISTING CONDITIONS VOLUME PROFILES

Input	Input Volume (15 minute Intervals)								
	Seeding Period	4:00-4:15	4:15-4:30	4:30-4:45	4:45-5:00	5:00-5:15	5:15-5:30	5:30-5:45	5:45-6:00
1st Ave - WB	189	189	186	154	147	173	151	167	151
3rd Ave - WB	34	34	33	28	26	31	27	30	27
4th Ave - WB	21	21	33	26	21	18	11	25	22
5th Ave - WB	7	7	10	8	7	6	4	8	7
7th Ave - WB	17	17	27	22	17	14	9	21	18
8th Ave - WB	4	4	6	5	4	3	2	5	4
Pacific Hwy WB off-ramp - WB	210	210	203	193	194	213	209	189	190
Albany Station - NB	1	1	2	2	1	1	1	1	1
Pacific Hwy EB off-ramp - EB	109	109	127	132	116	120	119	94	95
Ellsworth Ave - NB	10	10	16	12	10	8	5	12	10
9th Ave - EB	53	53	45	38	47	61	35	40	59
8th Ave - EB	8	8	12	10	8	7	4	10	8
7th Ave - EB	50	50	49	41	39	45	40	44	40
5th Ave - EB	19	19	18	17	18	35	12	18	8
4th Ave - EB	7	7	11	9	7	6	4	8	7
3rd Ave - EB	52	52	51	43	41	48	42	46	42
2nd Ave - EB	154	154	151	125	119	140	123	136	123
6th Ave - EB	3	3	5	4	3	3	2	4	3
North Albany Rd - NB	3	3	4	3	3	2	1	3	3
US20 w/o North Albany Rd - EB	194	194	201	198	204	252	244	188	194
North Albany Rd - SB	120	120	142	161	185	162	142	167	159
Springhill Dr - SB	124	124	123	135	110	142	116	127	105

APPENDIX D: EXISTING CONDITIONS RESULTS

GEH, DELAY, QUEUING, TRAVEL TIMES, AND LATENT DEMAND

GEH - 4:45 to 5:45 PM					
Intersection Number	Intersection Name	Movement	Input Volume	VISSIM Output Volume	GEH
1	US 20 & N Albany Rd	NBL	1	0	1.4
		NBT	0	0	0.8
		NBR	7	7	0.0
		SBL	549	546	0.1
		SBT	6	6	0.0
		SBR	101	103	0.2
		EBL	106	98	0.8
		EBT	792	785	0.2
		EBR	0	1	0.8
		WBL	4	4	0.0
		WBT	596	601	0.2
		WBR	682	674	0.3
		Total	2845	2823	0.4
2	US 20 & Springhill Dr	SBL	482	479	0.1
		SBR	13	13	0.0
		EBL	40	37	0.5
		EBT	1308	1301	0.2
		WBT	1269	1267	0.0
		WBR	612	620	0.3
		Total	3724	3715	0.1
3	Lyon & 1st	NBL	91	91	0.0
		NBT	1365	1364	0.0
		WBT	122	124	0.2
		WBR	516	515	0.1
		Total	2094	2095	0.0
4	Lyon & 2nd	NBT	1228	1230	0.1
		NBR	58	59	0.1
		EBL	228	226	0.1
		EBT	550	539	0.5
		Total	2064	2052	0.3
5	Lyon & 3rd	NBL	93	92	0.1
		NBT	1204	1203	0.0
		NBR	36	36	0.0
		EBL	50	52	0.2
		EBT	92	91	0.1
		WBT	82	82	0.0
		WBR	32	32	0.0
		Total	1590	1584	0.1
6	Lyon & 5th	NBL	34	34	0.0
		NBT	1248	1244	0.1
		NBR	20	20	0.0
		EBL	25	24	0.2
		EBT	23	22	0.1
		WBT	17	16	0.3
		WBR	6	6	0.0
		Total	1373	1363	0.3
7	Lyon & 9th	NBL	433	447	0.7
		NBU	1	0	1.4
		SBT	3	3	0.0
		SBR	802	800	0.1
		EBL	1191	1193	0.1
		EBT	5	7	0.8

GEH - 4:45 to 5:45 PM					
Intersection Number	Intersection Name	Movement	Input Volume	VISSIM Output Volume	GEH
		EBR	3	6	1.4
		EBU	52	47	0.7
		WBL	0	0	
		WBT	4	3	0.5
		Total	2494	2506	0.2
8	Ellsworth & 9th	NBL	33	31	0.4
		NBR	3	2	0.5
		SBL	1070	1071	0.0
		SBT	474	480	0.3
		SBR	47	44	0.4
		EBT	179	181	0.1
		EBR	3	0	2.4
		Total	1809	1808	0.0
9	Ellsworth & 5th	SBL	8	7	0.4
		SBT	1400	1401	0.0
		SBR	33	34	0.2
		EBT	39	37	0.4
		EBR	43	42	0.2
		WBL	17	16	0.3
		WBT	34	33	0.2
		Total	1575	1569	0.1
10	Ellsworth & 3rd	SBL	49	49	0.0
		SBT	1372	1369	0.1
		SBR	40	39	0.1
		EBT	93	94	0.1
		EBR	82	80	0.2
		WBL	62	64	0.2
		WBT	113	109	0.4
		Total	1812	1799	0.3
11	Ellsworth & 2nd	SBL	394	387	0.3
		SBT	1327	1321	0.2
		EBT	384	377	0.4
		EBR	134	133	0.1
		Total	2239	2217	0.5
12	Ellsworth & 1st	SBT	1646	1629	0.4
		SBR	144	145	0.1
		WBL	74	77	0.3
		WBT	139	139	0.0
		Total	2003	1988	0.3
13	Ellsworth & 6th	SBL	0	0	
		SBT	1459	1455	0.1
		SBR	2	3	0.6
		EBT	4	4	0.1
		EBR	7	7	0.0
		WBL	0	0	
		WBT	4	4	0.1
		Total	1476	1470	0.1

ENTRY GEH (4:45-5:45 PM)					
Entry Location	Count	Vissim Throughput	Diff	%Diff	GEH
US 20 & N Albany Rd - N	656	655	-1	-0.1%	0.0
US 20 & N Albany Rd - S	8	7	-1	-15.9%	0.5
US 20 & N Albany Rd - W	899	884	-15	-1.6%	0.5
US 20 & Springhill Dr - N	495	492	-3	-0.6%	0.1
Lyon & 1st - E	638	639	1	0.1%	0.0
Lyon & 3rd - E	114	114	0	0.0%	0.0
Lyon & 5th - E	23	22	-1	-5.2%	0.3
Lyon & 9th - N	805	803	-2	-0.2%	0.1
Lyon & 9th - S	434	447	13	3.0%	0.6
Lyon & 9th - E	4	3	-1	-25.0%	0.5
Ellsworth & 9th - S	36	33	-3	-7.6%	0.5
Ellsworth & 9th - W	182	181	-1	-0.7%	0.1
Ellsworth & 5th - W	83	79	-4	-4.4%	0.4
Ellsworth & 3rd - W	176	174	-2	-0.9%	0.1
Ellsworth & 2nd - W	519	510	-9	-1.7%	0.4
Ellsworth & 6th - W	11	11	0	0.6%	0.0
Total	**5082**	**5054**	**-28**	**-0.6%**	**0.4**

EXIT GEH (4:45-5:45 PM)					
Exit Location	**Count**	**Vissim Throughput**	**Diff**	**%Diff**	**GEH**
US 20 & N Albany Rd - N	788	772	-16	-2.1%	0.6
US 20 & N Albany Rd - S	10	11	1	6.7%	0.2
US 20 & N Albany Rd - W	698	704	6	0.9%	0.2
US 20 & Springhill Dr - N	652	657	5	0.7%	0.2
Lyon & 2nd - E	609	598	-11	-1.7%	0.4
Lyon & 3rd - E	128	127	-1	-1.1%	0.1
Lyon & 5th - E	43	42	-1	-1.8%	0.1
Lyon & 9th - N	1191	1193	2	0.2%	0.1
Lyon & 9th - S	7	9	2	28.6%	0.7
Lyon & 9th - E	5	7	2	40.0%	0.8
Ellsworth & 9th - S	477	480	3	0.6%	0.1
Ellsworth & 9th - W	80	75	-5	-5.8%	0.5
Ellsworth & 5th - W	67	67	0	0.3%	0.0
Ellsworth & 3rd - W	153	148	-5	-3.2%	0.4
Ellsworth & 1st - W	283	284	1	0.4%	0.1
Ellsworth & 6th - W	6	7	1	14.9%	0.4
Total	**5197**	**5181**	**-16**	**-0.3%**	**0.2**

PM PEAK HOUR (4:45-5:45 PM) DELAY

Intersection	Approach	Movement	Volume	Average Delay (s)
US 20 & N Albany Rd	NB	Right	7	7
		Total	**7**	**7**
	SB	Left	546	28
		Through	6	26
		Right	103	5
		Total	**655**	**25**
	EB	Left	98	47
		Through	785	11
		Right	1	18
		Total	**884**	**15**
	WB	Left	4	57
		Through	601	14
		Right	674	14
		Total	**1279**	**14**
		Total	**2825**	**17**
US 20 & Springhill Dr	SB	Left	479	51
		Right	13	28
		Total	**492**	**51**
	EB	Left	37	55
		Through	1301	19
		Total	**1338**	**20**
	WB	Through	1267	19
		Right	620	10
		Total	**1887**	**16**
		Total	**3717**	**22**
Lyon & 1st	NB	Left	91	5
		Through	1364	6
		Total	**1455**	**6**
	WB	Through	124	23
		Right	515	42
		Total	**639**	**38**
		Total	**2094**	**16**
Lyon & 2nd	NB	Through	1230	3
		Right	59	4
		Total	**1289**	**3**
	EB	Left	226	27
		Through	539	33
		Total	**765**	**31**
		Total	**2054**	**13**
	NB	Left	92	10
		Through	1203	9

PM PEAK HOUR (4:45-5:45 PM) DELAY

Intersection	Approach	Movement	Volume	Average Delay (s)
Lyon & 3rd	NB	Right	36	8
		Total	**1331**	**9**
	EB	Left	52	15
		Through	91	17
		Total	**143**	**16**
	WB	Through	82	23
		Right	32	11
		Total	**114**	**20**
		Total	**1588**	**10**
Lyon & 5th	NB	Left	34	0
		Through	1244	0
		Right	20	1
		Total	**1298**	**0**
	EB	Left	24	13
		Through	22	12
		Total	**46**	**12**
	WB	Through	16	14
		Right	6	9
		Total	**22**	**13**
		Total	**1366**	**1**
Lyon & 9th	NB	Left	447	36
		Total	**447**	**36**
	SB	Through	3	19
		Right	800	15
		Total	**803**	**15**
	EB	Left	1193	27
		Through	7	17
		Right	6	1
		U-Turn	47	6
		Total	**1253**	**26**
	WB	Through	3	46
		Total	**3**	**46**
		Total	**2506**	**24**
Ellsworth & 9th	NB	Left	31	38
		Right	2	12
		Total	**33**	**37**
	SB	Left	1071	13
		Through	480	6
		Right	44	5
		Total	**1595**	**11**
	EB	Through	181	32

PM PEAK HOUR (4:45-5:45 PM) DELAY

Intersection	Approach	Movement	Volume	Average Delay (s)
	EB	**Total**	**181**	**32**
		Total	**1809**	**13**
Ellsworth & 5th	SB	Left	7	1
		Through	1401	1
		Right	34	2
		Total	**1442**	**1**
	EB	Through	37	23
		Right	42	11
		Total	**79**	**17**
	WB	Left	16	9
		Through	33	15
		Total	**49**	**13**
		Total	**1570**	**2**
Ellsworth & 3rd	SB	Left	49	1
		Through	1369	2
		Right	39	2
		Total	**1457**	**2**
	EB	Through	94	28
		Right	80	18
		Total	**174**	**23**
	WB	Left	64	7
		Through	109	28
		Total	**173**	**20**
		Total	**1804**	**5**
Ellsworth & 2nd	SB	Left	387	5
		Through	1321	5
		Total	**1708**	**5**
	EB	Through	377	38
		Right	133	24
		Total	**510**	**34**
		Total	**2218**	**12**
Ellsworth & 1st	SB	Through	1629	72
		Right	145	75
		Total	**1774**	**72**
	WB	Left	77	34
		Through	139	23
		Total	**216**	**27**
		Total	**1990**	**67**
	SB	Through	1455	2
		Right	3	7
		Total	**1458**	**2**

PM PEAK HOUR (4:45-5:45 PM) DELAY

Intersection	Approach	Movement	Volume	Average Delay (s)
Ellsworth & 6th	EB	Through	4	26
		Right	7	5
		Total	**11**	**13**
	WB	Through	4	167
		Total	**4**	**167**
		Total	**1473**	**2**

EXISTING PM PEAK HOUR (4:45 to 5:45 PM) QUEUES (Avg/95th)

15 (45) 140 (240)

70 (155)
115 (230)

1: US 20 & N Albany Rd

195 (470)
145 (300)
5 (20)

0 (20)

0 (0) 355 (685)

30 (80)
260 (690)

2: US 20 & Springhill Dr

35 (180)
380 (830)

3: Lyon & 1st

305 (680)
50 (100)

200 (305)

235 (330)

4: Lyon & 2nd

65 (180)

45 (110)

5: Lyon & 3rd

50 (115)

195 (385)

20 (45)

6: Lyon & 5th

10 (20)

EXISTING PM PEAK HOUR (4:45 to 5:45 PM) QUEUES (Avg/95th)

	160 (335)			
310 (420)		7: Lyon & 9th		10 (25)
	240 (405)	5 (25)		

		195 (620)	295 (775)	
95 (205)		8: Ellsworth & 9th		
		25 (65)		

30 (65)		9: Ellsworth & 5th		20 (60)

		40 (80)		
75 (155)		10: Ellsworth & 3rd		65 (155)

		180 (305)		
155 (290)		11: Ellsworth & 2nd		

		1120 (1675)		
		12: Ellsworth & 1st		70 (135)

EXISTING PM PEAK HOUR (4:45 to 5:45 PM) QUEUES (Avg/95th)

50 (200)

↵ ↓ ↳

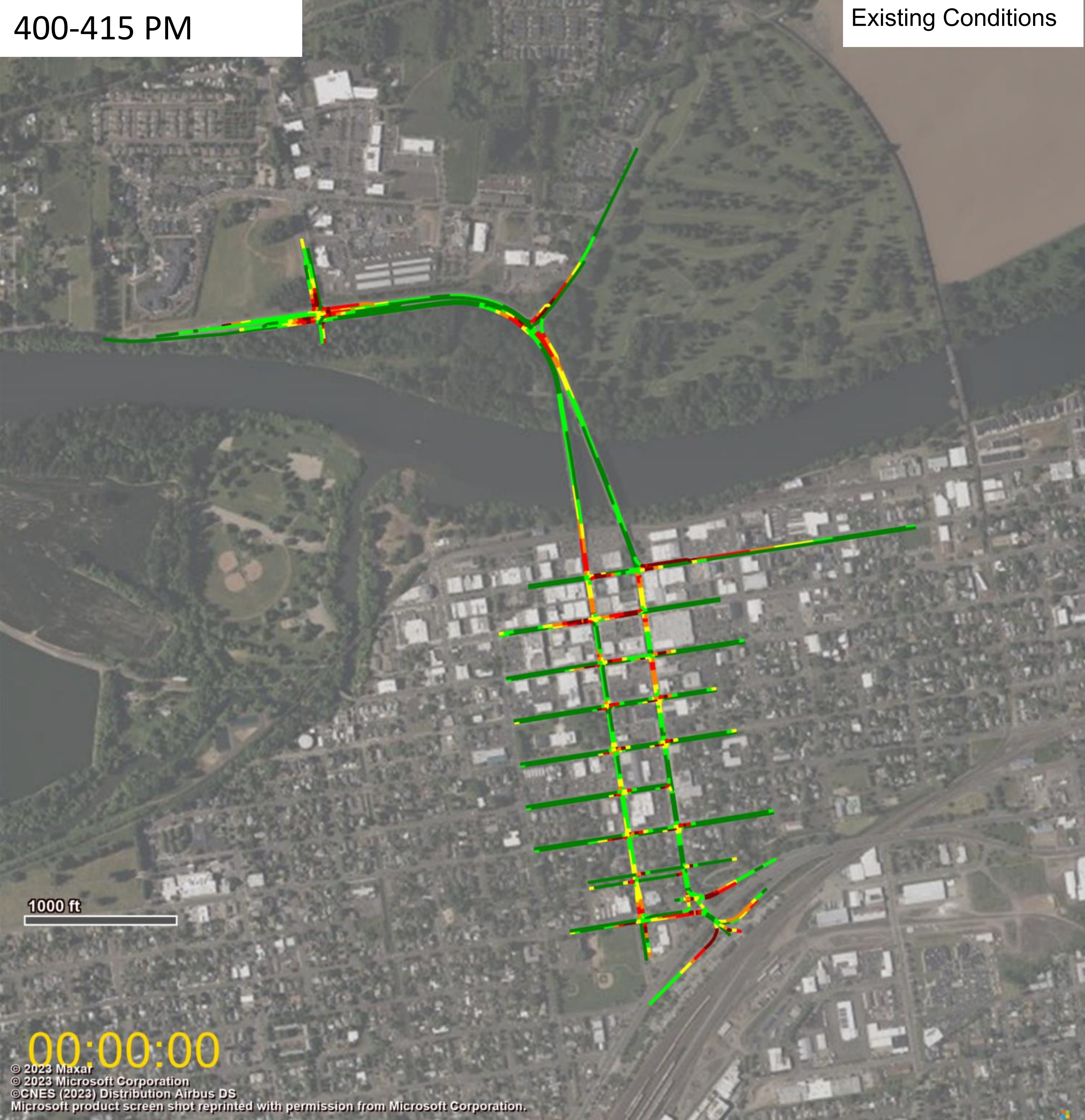
5 (20) → **13: Ellsworth & 6th** ← 5 (20)

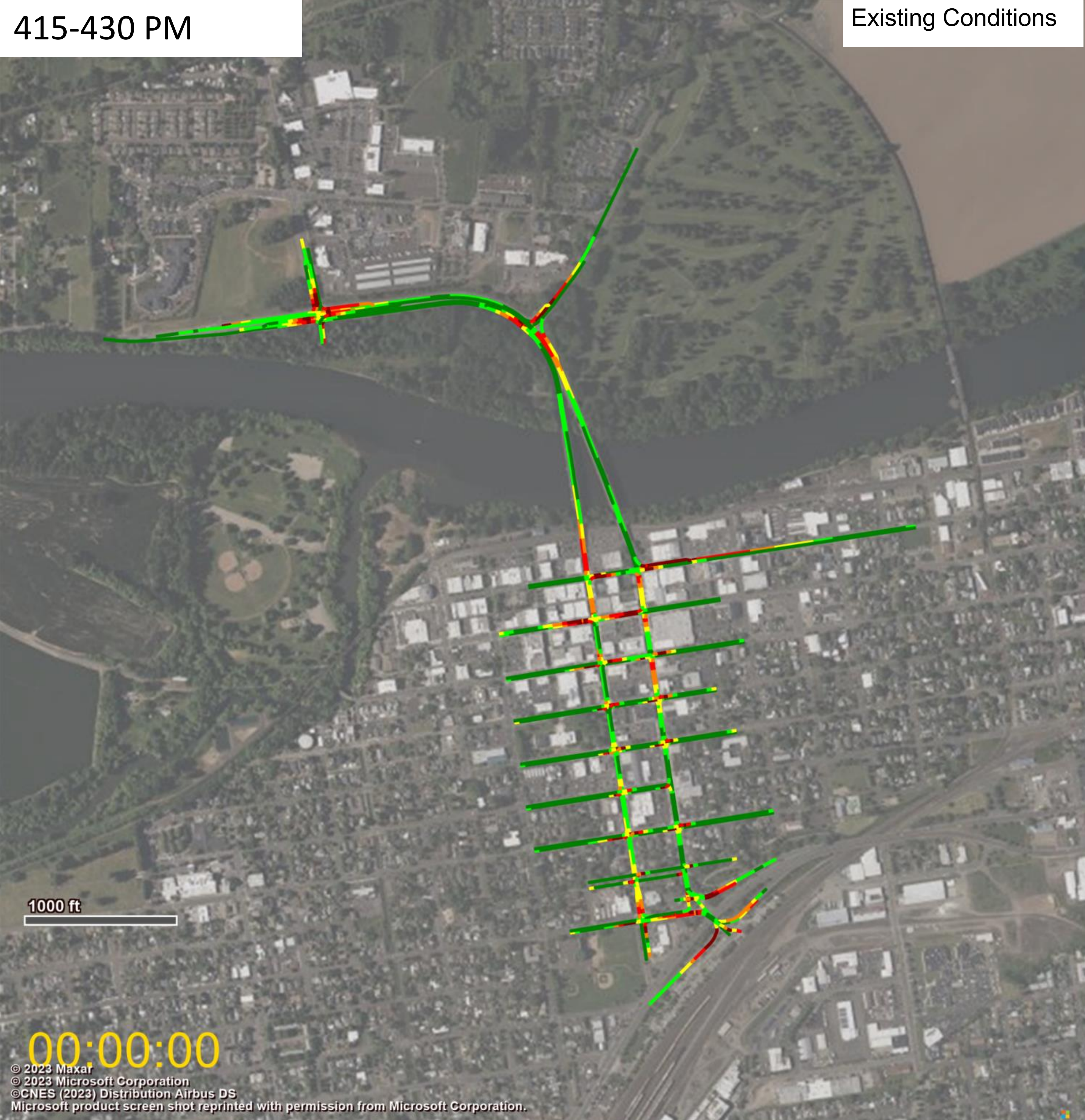
↰ ↑ ↱

Existing Vissim Travel Time Calibration Results											
Direction	From/To	Sources	Travel Time (Seconds)								
			4:00-4:15	4:15-4:30	4:30-4:45	4:45-5:00	5:00-5:15	5:15-5:30	5:30-5:45	5:45-6:00	Peak Hour (4:45-5:45 PM)
Northbound	Lyon Street north of OR 99E SB Off-Ramp/US 20 at N Albany Rd	Vissim	169	170	169	175	181	173	166	158	174
		Google Data	194	198	201	189	195	192	195	185	193
										Difference	**-9.9%**
Southbound	US 20 at N Albany Rd/OR 99E NB On-Ramp	Vissim	240	265	264	279	263	251	261	216	264
		Google Data	228	246	267	249	281	349	313	255	298
										Difference	**-11.6%**

	Average Delay / veh (sec)	Vehicle Hours of Delay (hrs)	Latent Demand (veh)	Latent Delay (veh-hrs)	Vehicle Miles Travelled (mi)	Travel Time (hrs)
Avg	583.5	274.1	0.1	0.5	9747.2	635.5
StdDev	54.4	26.7	0.3	0.1	128.8	28.4
Min	509.9	237.2	0.0	0.4	9547.6	595.8
Max	671.2	317.6	1.0	0.6	9945.6	682.3

Avg delay/veh (min/veh) **1.51**


400-415 PM
Existing Conditions
1000 ft
00:00:00


415-430 PM
Existing Conditions
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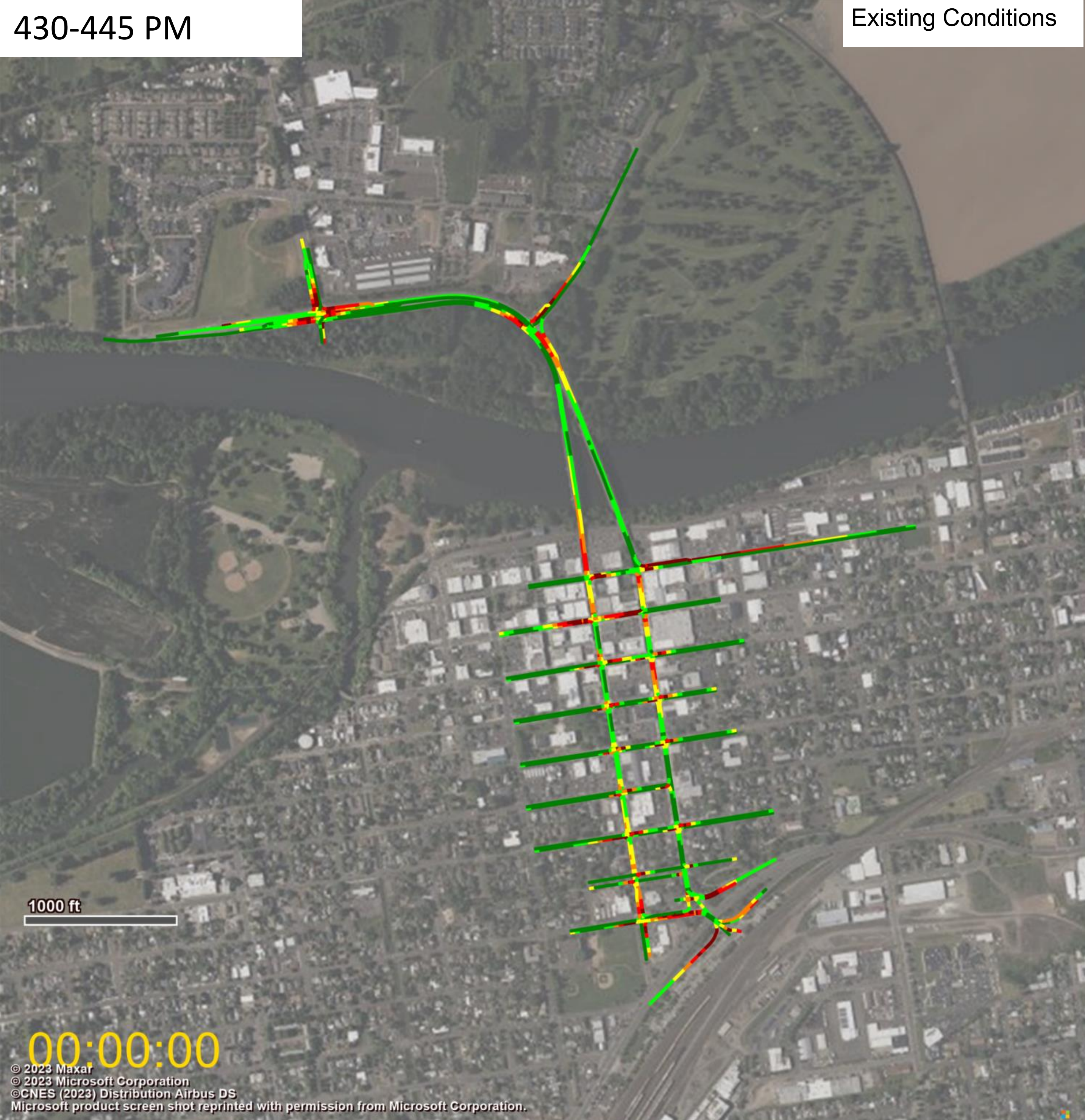
430-445 PM
Existing Conditions
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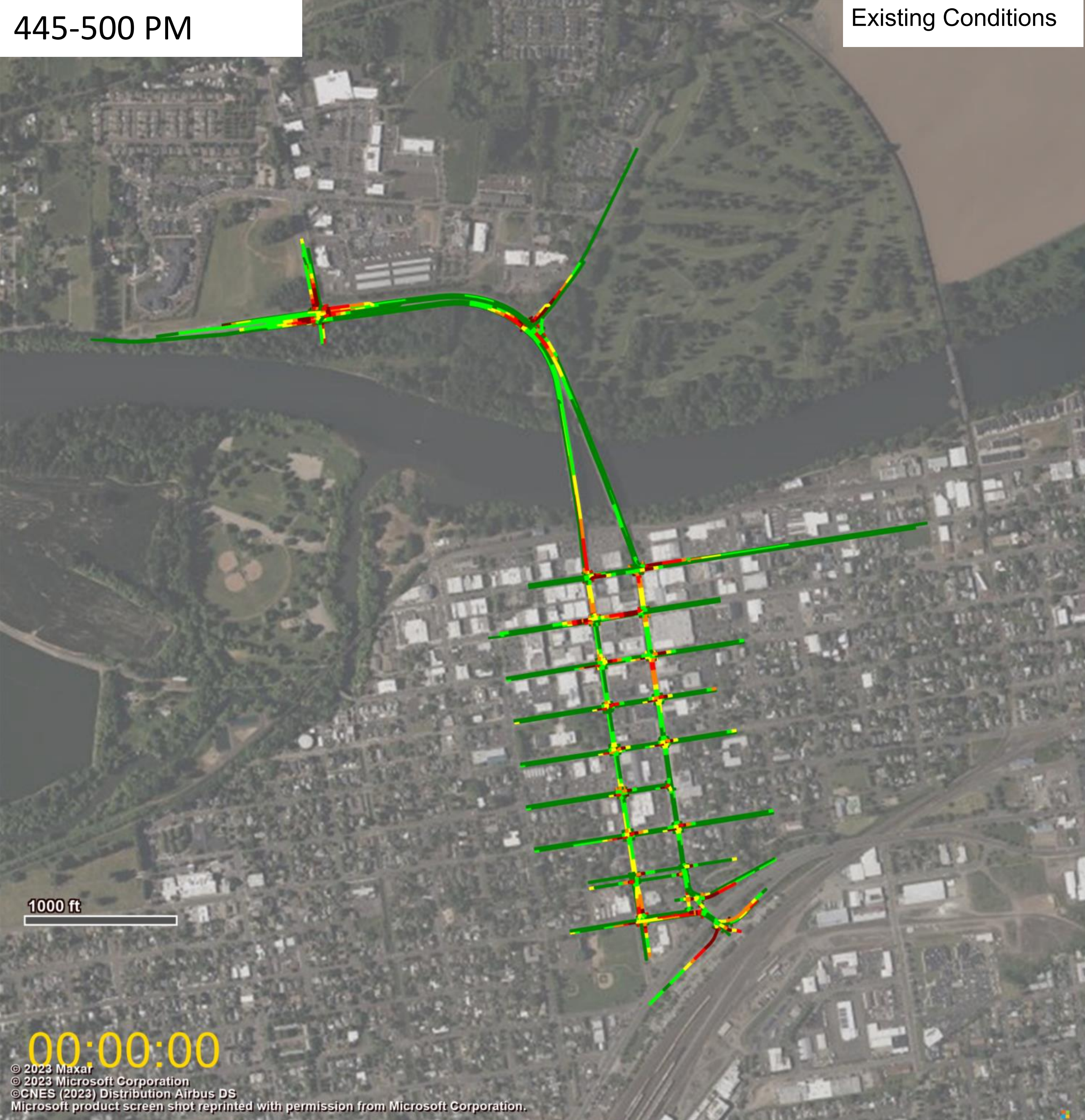
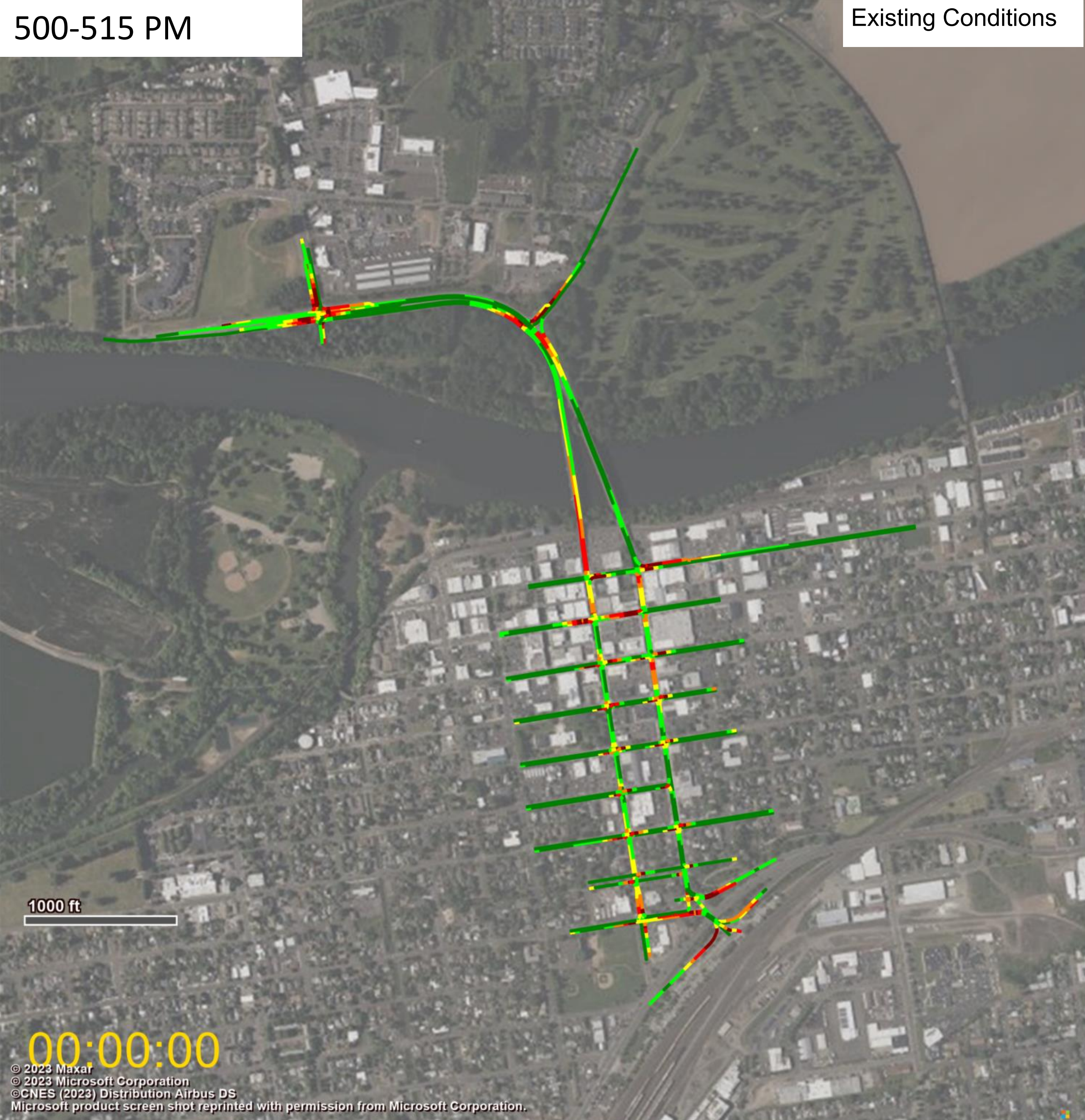


445-500 PM
Existing Conditions
1000 ft
00:00:00


500-515 PM
Existing Conditions
1000 ft
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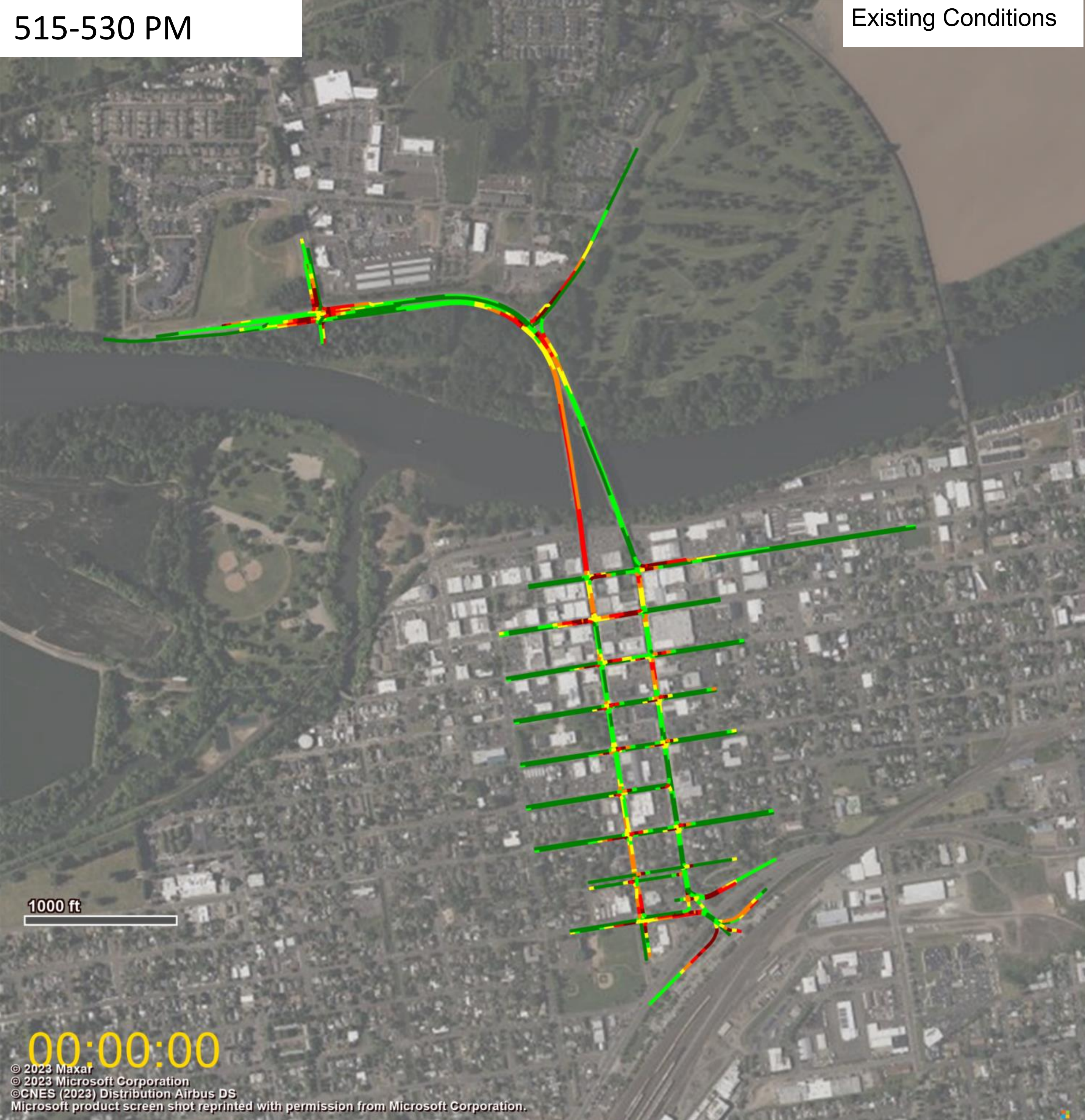
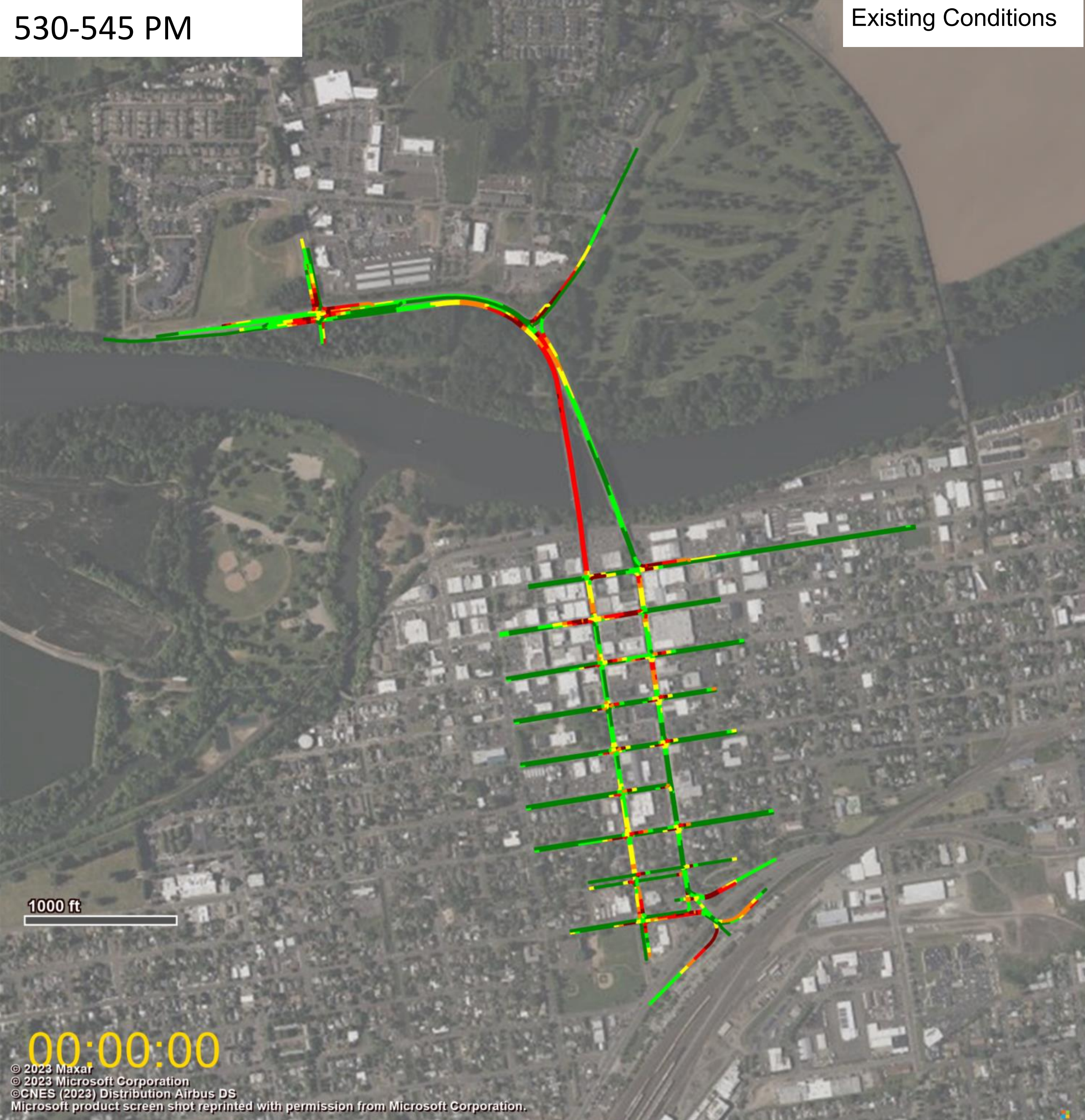


515-530 PM
Existing Conditions
1000 ft
00:00:00


530-545 PM
Existing Conditions
1000 ft
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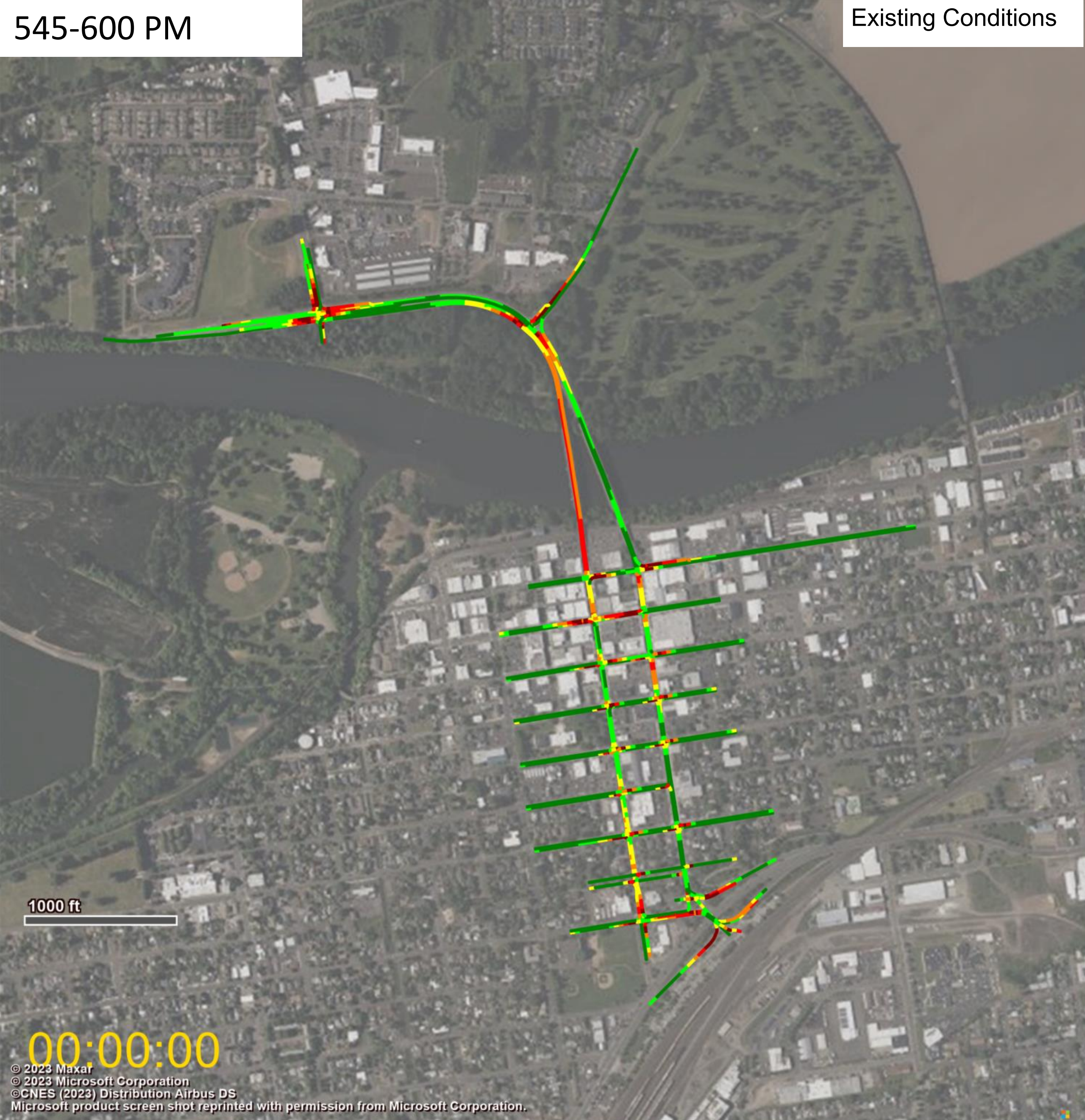
545-600 PM
Existing Conditions
1000 ft
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APPENDIX E: NO BUILD RESULTS

GEH, DELAY, QUEUING, TRAVEL TIMES, AND LATENT DEMAND

NO-BUILD GEH - 4:45 to 5:45 PM					
Intersection Number	Intersection Name	Movement	Input Volume	VISSIM Output Volume	GEH
1	US 20 & N Albany Rd	NBL	5	4	0.5
		NBT	5	5	0.0
		NBR	10	9	0.3
		SBL	625	601	1.0
		SBT	10	11	0.3
		SBR	125	121	0.4
		EBL	110	81	3.0
		EBT	840	639	7.4
		EBR	0	0	
		WBL	5	4	0.5
		WBT	805	729	2.7
		WBR	855	776	2.8
		Total	3395	2981	7.3
2	US 20 & Springhill Dr	SBL	600	452	6.5
		SBR	20	14	1.5
		EBL	45	33	1.9
		EBT	1430	1209	6.1
		WBT	1645	1493	3.8
		WBR	800	727	2.6
		Total	4540	3929	9.4
3	Lyon & 1st	NBL	85	86	0.1
		NBT	1700	1708	0.2
		WBT	130	91	3.7
		WBR	745	508	9.5
		Total	2660	2392	5.3
4	Lyon & 2nd	NBT	1500	1544	1.1
		NBR	65	69	0.5
		EBL	285	250	2.1
		EBT	665	544	4.9
		Total	2515	2407	2.2
5	Lyon & 3rd	NBL	95	98	0.3
		NBT	1460	1502	1.1
		NBR	40	39	0.2
		EBL	65	67	0.2
		EBT	95	89	0.6
		WBT	85	80	0.6
		WBR	40	42	0.3
		Total	1880	1915	0.8
6	Lyon & 5th	NBL	40	39	0.2
		NBT	1485	1526	1.1
		NBR	35	36	0.2
		EBL	40	40	0.0
		EBT	45	44	0.1
		WBT	20	22	0.4
		WBR	10	9	0.3
		Total	1675	1715	1.0
7	Lyon & 9th	NBL	605	628	0.9
		NBU	5	6	0.4
		SBT	5	5	0.0
		SBR	895	886	0.3
		EBL	1285	1162	3.5
		EBT	5	6	0.4

NO-BUILD GEH - 4:45 to 5:45 PM					
Intersection Number	Intersection Name	Movement	Input Volume	VISSIM Output Volume	GEH
		EBR	5	2	1.6
		EBU	55	50	0.7
		WBL	0	0	
		WBT	5	3	1.0
		Total	2865	2748	2.2
8	Ellsworth & 9th	NBL	45	44	0.1
		NBR	10	10	0.0
		SBL	1130	996	4.1
		SBT	510	451	2.7
		SBR	55	44	1.6
		EBT	210	210	0.0
		EBR	5	6	0.4
		Total	1965	1761	4.7
9	Ellsworth & 5th	SBL	30	27	0.6
		SBT	1500	1268	6.2
		SBR	40	32	1.3
		EBT	55	57	0.3
		EBR	55	54	0.1
		WBL	25	22	0.6
		WBT	35	39	0.7
		Total	1740	1497	6.0
10	Ellsworth & 3rd	SBL	60	52	1.1
		SBT	1480	1236	6.6
		SBR	40	32	1.3
		EBT	100	103	0.3
		EBR	85	83	0.2
		WBL	65	59	0.8
		WBT	115	117	0.2
		Total	1945	1683	6.2
11	Ellsworth & 2nd	SBL	490	391	4.7
		SBT	1440	1192	6.8
		EBT	460	319	7.1
		EBR	140	105	3.2
		Total	2530	2007	11.0
12	Ellsworth & 1st	SBT	1855	1529	7.9
		SBR	175	149	2.0
		WBL	75	53	2.8
		WBT	140	122	1.6
		Total	2245	1853	8.7
13	Ellsworth & 6th	SBL	5	0	3.2
		SBT	1560	1332	6.0
		SBR	15	12	0.8
		EBT	5	6	0.4
		EBR	25	23	0.4
		WBL	10	4	2.3
		WBT	10	14	1.2
		Total	1630	1392	6.1

NO-BUILD PM PEAK HOUR (4:45-5:45 PM) DELAY				
Intersection	**Approach**	**Movement**	**Volume**	**Average Delay (s)**
US 20 & N Albany Rd	NB	Left	4	62
		Through	5	59
		Right	9	24
		Total	**18**	**42**
	SB	Left	601	75
		Through	11	72
		Right	121	20
		Total	**733**	**66**
	EB	Left	81	163
		Through	639	223
		Total	**720**	**216**
	WB	Left	4	73
		Through	729	15
		Right	776	17
		Total	**1509**	**16**
		Total	**2980**	**77**
US 20 & Springhill Dr	SB	Left	452	291
		Right	14	262
		Total	**466**	**290**
	EB	Left	33	211
		Through	1209	200
		Total	**1242**	**201**
	WB	Through	1493	38
		Right	727	31
		Total	**2220**	**36**
		Total	**3928**	**118**
Lyon & 1st	NB	Left	86	5
		Through	1708	8
		Total	**1794**	**8**
	WB	Through	91	541
		Right	508	670
		Total	**599**	**651**
		Total	**2393**	**169**
Lyon & 2nd	NB	Through	1544	7
		Right	69	8
		Total	**1613**	**7**
	EB	Left	250	47
		Through	544	40
		Total	**794**	**42**
		Total	**2407**	**19**
		Left	98	14

NO-BUILD PM PEAK HOUR (4:45-5:45 PM) DELAY				
Intersection	**Approach**	**Movement**	**Volume**	**Average Delay (s)**
Lyon & 3rd	**NB**	Through	1502	14
		Right	39	13
		Total	**1639**	**14**
	EB	Left	67	16
		Through	89	18
		Total	**156**	**17**
	WB	Through	80	25
		Right	42	12
		Total	**122**	**21**
		Total	**1917**	**15**
Lyon & 5th	**NB**	Left	39	5
		Through	1526	5
		Right	36	5
		Total	**1601**	**5**
	EB	Left	40	92
		Through	44	89
		Total	**84**	**91**
	WB	Through	22	25
		Right	9	20
		Total	**31**	**23**
		Total	**1716**	**10**
Lyon & 9th	**NB**	Left	628	100
		U-Turn	6	99
		Total	**634**	**100**
	SB	Through	5	26
		Right	886	22
		Total	**891**	**22**
	EB	Left	1162	36
		Through	6	22
		Right	2	3
		U-Turn	50	13
		Total	**1220**	**35**
	WB	Through	3	53
		Total	**3**	**53**
		Total	**2748**	**46**
Ellsworth & 9th	**NB**	Left	44	39
		Right	10	18
		Total	**54**	**35**
	SB	Left	996	22
		Through	451	10
		Right	44	8

NO-BUILD PM PEAK HOUR (4:45-5:45 PM) DELAY				
Intersection	**Approach**	**Movement**	**Volume**	**Average Delay (s)**
		Total	**1491**	**18**
	EB	Through	210	40
		Right	6	22
		Total	**216**	**40**
		Total	**1761**	**21**
Ellsworth & 5th	SB	Left	27	5
		Through	1268	3
		Right	32	3
		Total	**1327**	**3**
	EB	Through	57	43
		Right	54	27
		Total	**111**	**35**
	WB	Left	22	9
		Through	39	14
		Total	**61**	**12**
		Total	**1499**	**6**
Ellsworth & 3rd	SB	Left	52	1
		Through	1236	2
		Right	32	2
		Total	**1320**	**2**
	EB	Through	103	30
		Right	83	21
		Total	**186**	**26**
	WB	Left	59	8
		Through	117	26
		Total	**176**	**20**
		Total	**1682**	**6**
Ellsworth & 2nd	SB	Left	391	4
		Through	1192	3
		Total	**1583**	**3**
	EB	Through	319	317
		Right	105	246
		Total	**424**	**300**
		Total	**2007**	**66**
Ellsworth & 1st	SB	Through	1529	135
		Right	149	144
		Total	**1678**	**136**
	WB	Left	53	38
		Through	122	27
		Total	**175**	**30**
		Total	**1853**	**126**

NO-BUILD PM PEAK HOUR (4:45-5:45 PM) DELAY				
Intersection	**Approach**	**Movement**	**Volume**	**Average Delay (s)**
Ellsworth & 6th	**SB**	Through	1332	6
		Right	12	6
		Total	**1344**	**6**
	EB	Through	6	31
		Right	23	20
		Total	**29**	**22**
	WB	Left	4	112
		Through	14	86
		Total	**18**	**92**
		Total	**1391**	**8**

TABLE: QUEUE COUNTERS (Avg/95th)

	25 (80) 405 (1065)	
65 (150) 1055 (1420)	1: US 20 & N Albany Rd	250 (600) 130 (280) 5 (20)
	10 (45)	

	0 (5) 1150 (1250)	
30 (85) 1270 (1470)	2: US 20 & Springhill Dr	150 (910) 950 (1745)

	3: Lyon & 1st	1710 (1855) 55 (135)
	250 (305)	

285 (350)	4: Lyon & 2nd	
	190 (310)	

50 (115)	5: Lyon & 3rd	50 (110)
	495 (1260)	

95 (350)	6: Lyon & 5th	15 (40)

TABLE: QUEUE COUNTERS (Avg/95th)

Intersection	Southbound	Eastbound	Westbound	Northbound
7: Lyon & 9th	250 (560)	345 (425)	5 (35)	605 (685) 20 (70)
8: Ellsworth & 9th	305 (875) 435 (875)	125 (290)		35 (85)
9: Ellsworth & 5th		60 (275)	20 (50)	
10: Ellsworth & 3rd	115 (880)	85 (185)	70 (155)	
11: Ellsworth & 2nd	125 (305)	570 (615)		
12: Ellsworth & 1st	1525 (1695)		70 (160)	

TABLE: QUEUE COUNTERS (Avg/95th)

Intersection	13: Ellsworth & 6th
Southbound	135 (705)
Eastbound	15 (55)
Westbound	20 (70)
Northbound	

No-Build Vissim Travel Time Results											
Direction	From/To	Scenario	Travel Time (Seconds)								
			4:00-4:15	4:15-4:30	4:30-4:45	4:45-5:00	5:00-5:15	5:15-5:30	5:30-5:45	5:45-6:00	Peak Hour (4:45-5:45 PM)
Northbound	Lyon Street north of OR 99E SB Off-Ramp/US 20 at N Albany Rd	Existing	169	170	169	175	181	173	166	158	174
		No-Build	227	243	272	250	245	239	241	216	244
										Difference	**40.3%**
Southbound	US 20 at N Albany Rd/OR 99E NB On-Ramp	Existing	240	265	264	279	263	251	261	216	264
		No-Build	318	408	489	538	599	602	547	557	571
										Difference	**116.8%**

	Average Delay / veh (sec)	Vehicle Hours of Delay (hrs)	Latent Demand (veh)	Latent Delay (veh-hrs)	Vehicle Miles Travelled (mi)	Travel Time (hrs)
Avg	1622.6	976.9	1152.4	1151.5	10637.7	1368.8
StdDev	69.2	46.2	52.5	78.8	158.5	45.6
Min	1504.7	901.8	1044.0	1023.4	10403.7	1294.9
Max	1725.3	1045.9	1237.0	1291.4	10885.1	1436.6

Avg delay/veh (min/veh) **9.75**

400-415 PM
2043 No Build
1000 ft
00:00:00


415-430 PM
2043 No Build
1000 ft
00:00:00
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430-445 PM
2043 No Build
1000 ft
00:00:00
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445-500 PM
2043 No Build
1000 ft
00:00:00
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500-515 PM
2043 No Build
1000 ft
00:00:00
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515-530 PM
2043 No Build
1000 ft
00:00:00
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530-545 PM
2043 No Build
1000 ft
00:00:00
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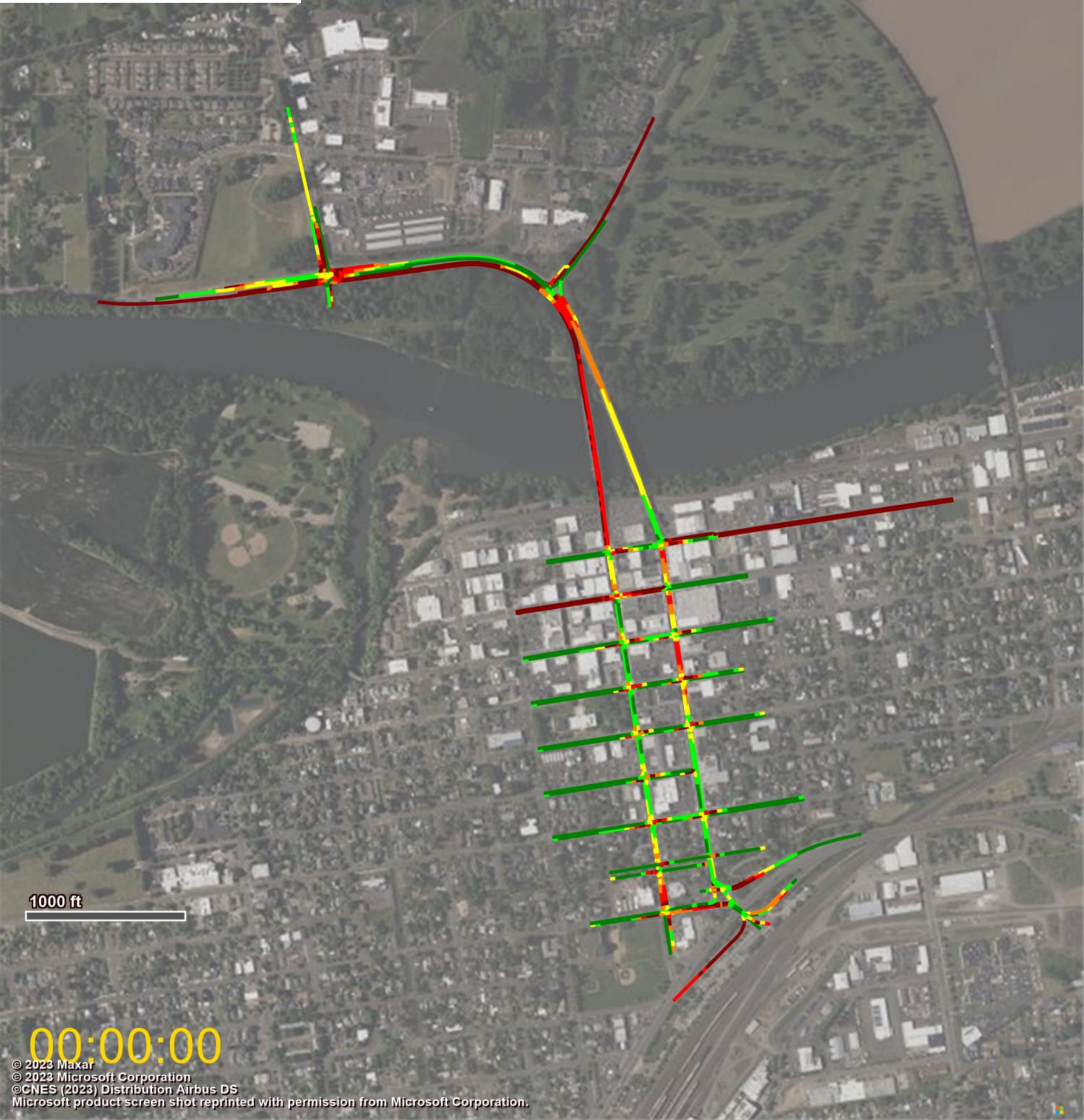
545-600 PM

2043 No Build



APPENDIX F: UNSERVED DEMAND RESULTS

NO-BUILD AND PROJECT BUNDLES

Unserved Demand by Input Location (at 6:00 PM)								
	No-Build		Bundle 1		Bundle 2		Bundle 3	
Input Location	Unserved	% Served	Unserved	% Served	Unserved	% Served	Unserved	% Served
1: 1st Ave - WB	596	67%	0	100%	2	100%	2	100%
7: Pacific Hwy WB off-ramp - WB	0	100%	0	100%	18	99%	0	100%
13: 7th Ave - EB	0	100%	5	98%	7	98%	10	97%
17: 2nd Ave - EB	172	86%	47	96%	46	96%	28	98%
20: US20 w/o North Albany Rd - EB	198	89%	0	100%	0	100%	0	100%
22: Springhill Dr - SB	185	85%	0	100%	6	100%	0	100%
Total	**1153**	**91.2%**	**52**	**99.6%**	**79**	**99.4%**	**40**	**99.7%**

APPENDIX G: PROJECT BUNDLE 1 RESULTS

GEH, DELAY, QUEUING, AND SYSTEM MEASURES

BUNDLE 1 GEH - 4:45 to 5:45 PM					
Intersection Number	**Intersection Name**	**Movement**	**Input Volume**	**VISSIM Output Volume**	**GEH**
1	US 20 & N Albany Rd	NBL	5	4	0.5
		NBT	5	5	0.0
		NBR	10	9	0.3
		SBL	625	639	0.6
		SBT	10	11	0.3
		SBR	125	125	0.0
		EBL	110	103	0.7
		EBT	840	834	0.2
		EBR	0	1	1.4
		WBL	5	5	0.0
		WBT	805	824	0.7
		WBR	855	870	0.5
		Total	3395	3428	0.6
2	US 20 & Springhill Dr	SBL	600	570	1.2
		SBR	20	20	0.0
		EBL	45	45	0.0
		EBT	1430	1442	0.3
		WBT	1645	1683	0.9
		WBR	800	837	1.3
		Total	4540	4596	0.8
3	Lyon & 1st	NBL	85	89	0.4
		NBT	1700	1761	1.5
		WBT	130	133	0.3
		WBR	745	764	0.7
		Total	2660	2747	1.7
4	Lyon & 2nd	NBT	1500	1580	2.0
		NBR	65	70	0.6
		EBL	285	268	1.0
		EBT	665	647	0.7
		Total	2515	2565	1.0
5	Lyon & 3rd	NBL	95	100	0.5
		NBT	1460	1540	2.1
		NBR	40	40	0.0
		EBL	65	66	0.1
		EBT	95	91	0.4
		WBT	85	80	0.6
		WBR	40	42	0.3
		Total	1880	1958	1.8
6	Lyon & 5th	NBL	40	41	0.2
		NBT	1485	1558	1.9
		NBR	35	36	0.2
		EBL	40	41	0.2
		EBT	45	49	0.6
		WBT	20	22	0.4
		WBR	10	9	0.3
		Total	1675	1756	2.0
7	Lyon & 9th	NBL	605	637	1.3
		NBU	5	5	0.0
		SBT	5	6	0.4
		SBR	895	910	0.5
		EBL	1285	1284	0.0
		EBT	5	7	0.8

BUNDLE 1 GEH - 4:45 to 5:45 PM					
Intersection Number	Intersection Name	Movement	Input Volume	VISSIM Output Volume	GEH
		EBR	5	3	1.0
		EBU	55	51	0.5
		WBL	0	0	
		WBT	5	3	1.0
		Total	2865	2904	0.7
8	Ellsworth & 9th	NBL	45	45	0.0
		NBR	10	10	0.0
		SBL	1130	1119	0.3
		SBT	510	505	0.2
		SBR	55	54	0.1
		EBT	210	211	0.1
		EBR	5	6	0.4
		Total	1965	1948	0.4
9	Ellsworth & 5th	SBL	30	30	0.0
		SBT	1500	1488	0.3
		SBR	40	41	0.2
		EBT	55	56	0.1
		EBR	55	53	0.3
		WBL	25	22	0.6
		WBT	35	41	1.0
		Total	1740	1730	0.2
10	Ellsworth & 3rd	SBL	60	57	0.4
		SBT	1480	1468	0.3
		SBR	40	37	0.5
		EBT	100	101	0.1
		EBR	85	81	0.4
		WBL	65	59	0.8
		WBT	115	121	0.6
		Total	1945	1926	0.4
11	Ellsworth & 2nd	SBL	490	486	0.2
		SBT	1440	1426	0.4
		EBT	460	361	4.9
		EBR	140	114	2.3
		Total	2530	2386	2.9
12	Ellsworth & 1st	SBT	1855	1833	0.5
		SBR	175	176	0.1
		WBL	75	79	0.5
		WBT	140	145	0.4
		Total	2245	2233	0.3
13	Ellsworth & 6th	SBL	5	0	3.2
		SBT	1560	1548	0.3
		SBR	15	13	0.5
		EBT	5	6	0.4
		EBR	25	24	0.2
		WBL	10	4	2.3
		WBT	10	13	0.9
		Total	1630	1609	0.5

BUNDLE 1 PM PEAK HOUR (4:45-5:45 PM) DELAY				
Intersection	**Approach**	**Movement**	**Volume**	**Average Delay (s)**
US 20 & N Albany Rd	**NB**	Left	4	58
		Through	5	51
		Right	9	15
		Total	**18**	**35**
	SB	Left	639	33
		Through	11	33
		Right	125	7
		Total	**775**	**29**
	EB	Left	103	53
		Through	834	14
		Right	1	21
		Total	**938**	**18**
	WB	Left	5	58
		Through	824	18
		Right	870	20
		Total	**1699**	**19**
		Total	**3430**	**21**
US 20 & Springhill Dr	**SB**	Left	570	84
		Right	20	74
		Total	**590**	**84**
	EB	Left	45	58
		Through	1442	19
		Total	**1487**	**20**
	WB	Through	1683	35
		Right	837	36
		Total	**2520**	**35**
		Total	**4597**	**36**
Lyon & 1st	**NB**	Left	89	5
		Through	1761	8
		Total	**1850**	**8**
	WB	Through	133	46
		Right	764	93
		Total	**897**	**86**
		Total	**2747**	**33**
Lyon & 2nd	**NB**	Through	1580	12
		Right	70	14
		Total	**1650**	**12**
	EB	Left	268	33
		Through	647	31
		Total	**915**	**32**
		Total	**2565**	**19**

BUNDLE 1 PM PEAK HOUR (4:45-5:45 PM) DELAY				
Intersection	**Approach**	**Movement**	**Volume**	**Average Delay (s)**
Lyon & 3rd	NB	Left	100	18
		Through	1540	19
		Right	40	18
		Total	**1680**	**19**
	EB	Left	66	19
		Through	91	21
		Total	**157**	**20**
	WB	Through	80	25
		Right	42	13
		Total	**122**	**21**
		Total	**1959**	**19**
Lyon & 5th	NB	Left	41	14
		Through	1558	18
		Right	36	15
		Total	**1635**	**18**
	EB	Left	41	237
		Through	49	212
		Total	**90**	**224**
	WB	Through	22	20
		Right	9	26
		Total	**31**	**22**
		Total	**1756**	**28**
Lyon & 9th	NB	Left	637	71
		U-Turn	5	69
		Total	**642**	**70**
	SB	Through	6	54
		Right	910	46
		Total	**916**	**46**
	EB	Left	1284	31
		Through	7	19
		Right	3	5
		U-Turn	51	44
		Total	**1345**	**31**
	WB	Through	3	58
		Total	**3**	**58**
		Total	**2906**	**45**
	NB	Left	45	42
		Right	10	22
		Total	**55**	**39**
	SB	Left	1119	24
		Through	505	10

BUNDLE 1 PM PEAK HOUR (4:45-5:45 PM) DELAY				
Intersection	**Approach**	**Movement**	**Volume**	**Average Delay (s)**
Ellsworth & 9th	SB	Right	54	9
		Total	**1678**	**19**
	EB	Through	211	40
		Right	6	22
		Total	**217**	**40**
		Total	**1950**	**22**
Ellsworth & 5th	SB	Left	30	29
		Through	1488	12
		Right	41	10
		Total	**1559**	**13**
	EB	Through	56	138
		Right	53	127
		Total	**109**	**133**
	WB	Left	22	13
		Through	41	17
		Total	**63**	**15**
		Total	**1731**	**20**
Ellsworth & 3rd	SB	Left	57	3
		Through	1468	7
		Right	37	4
		Total	**1562**	**6**
	EB	Through	101	59
		Right	81	54
		Total	**182**	**57**
	WB	Left	59	12
		Through	121	24
		Total	**180**	**20**
		Total	**1924**	**13**
Ellsworth & 2nd	SB	Left	486	5
		Through	1426	5
		Total	**1912**	**5**
	EB	Through	361	265
		Right	114	199
		Total	**475**	**249**
		Total	**2387**	**54**
Ellsworth & 1st	SB	Through	1833	45
		Right	176	45
		Total	**2009**	**45**
	WB	Left	79	49
		Through	145	31
		Total	**224**	**38**

BUNDLE 1 PM PEAK HOUR (4:45-5:45 PM) DELAY				
Intersection	**Approach**	**Movement**	**Volume**	**Average Delay (s)**
		Total	**2233**	**44**
Ellsworth & 6th	**SB**	Through	1548	18
		Right	13	14
		Total	**1561**	**18**
	EB	Through	6	54
		Right	24	61
		Total	**30**	**60**
	WB	Left	4	76
		Through	13	58
		Total	**17**	**62**
		Total	**1608**	**19**

TABLE: QUEUE COUNTERS (Avg/95th)

1: US 20 & N Albany Rd

Approach	Left	Through	Right
Southbound	205 (350)		20 (65)
Eastbound	75 (155)	155 (270)	
Westbound	305 (635)	175 (360)	5 (20)
Northbound		10 (40)	

2: US 20 & Springhill Dr

Approach	Left	Through	Right
Southbound	470 (1110)		
Eastbound	35 (90)	285 (915)	
Westbound	285 (1630)	1315 (1775)	
Northbound			

3: Lyon & 1st

Approach	Left	Through	Right
Southbound			
Eastbound			
Westbound	425 (1050)	70 (145)	
Northbound		230 (305)	

4: Lyon & 2nd

Approach	Left	Through	Right
Southbound			
Eastbound		355 (950)	
Westbound			
Northbound		240 (310)	

5: Lyon & 3rd

Approach	Left	Through	Right
Southbound			
Eastbound		60 (120)	
Westbound		50 (110)	
Northbound		1240 (1705)	

6: Lyon & 5th

Approach	Left	Through	Right
Southbound			
Eastbound		245 (920)	
Westbound		15 (40)	
Northbound			

TABLE: QUEUE COUNTERS (Avg/95th)

7: Lyon & 9th

Approach	↵ / ↰ / ⮥ (first)	↓ / ↑ / → / ← (through)	↳ / ↱ / ⮧ (last)
Top (southbound)	440 (910)		
Left (eastbound)	380 (420)		
Right (westbound)		5 (40)	
Bottom (northbound)	285 (685)	50 (200)	

8: Ellsworth & 9th

Approach	↵ / ↰ / ⮥ (first)	↓ / ↑ / → / ← (through)	↳ / ↱ / ⮧ (last)
Top (southbound)		590 (875)	765 (885)
Left (eastbound)		130 (250)	
Right (westbound)			
Bottom (northbound)		40 (85)	

9: Ellsworth & 5th

Approach	↵ / ↰ / ⮥ (first)	↓ / ↑ / → / ← (through)	↳ / ↱ / ⮧ (last)
Top (southbound)			
Left (eastbound)		130 (495)	
Right (westbound)		25 (60)	
Bottom (northbound)			

10: Ellsworth & 3rd

Approach	↵ / ↰ / ⮥ (first)	↓ / ↑ / → / ← (through)	↳ / ↱ / ⮧ (last)
Top (southbound)		715 (880)	
Left (eastbound)		135 (400)	
Right (westbound)		75 (160)	
Bottom (northbound)			

11: Ellsworth & 2nd

Approach	↵ / ↰ / ⮥ (first)	↓ / ↑ / → / ← (through)	↳ / ↱ / ⮧ (last)
Top (southbound)		125 (305)	90 (305)
Left (eastbound)		570 (615)	
Right (westbound)			
Bottom (northbound)			

12: Ellsworth & 1st

Approach	↵ / ↰ / ⮥ (first)	↓ / ↑ / → / ← (through)	↳ / ↱ / ⮧ (last)
Top (southbound)		990 (1665)	
Left (eastbound)			
Right (westbound)		85 (135)	
Bottom (northbound)			

TABLE: QUEUE COUNTERS (Avg/95th)

Approach	Queue (ft)
Southbound	540 (895)
Eastbound	20 (75)
Westbound	15 (65)
Northbound	

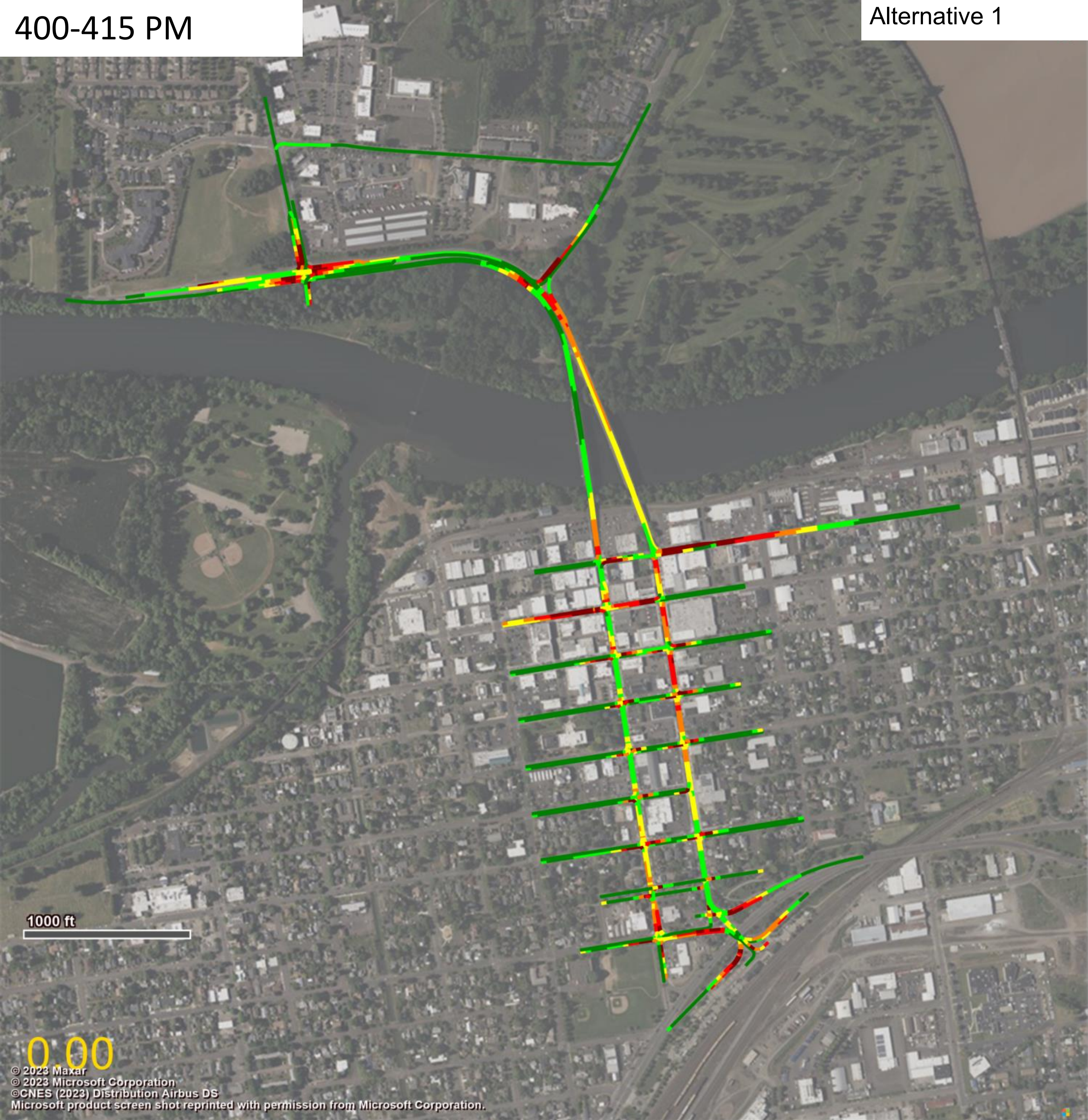
13: Ellsworth & 6th

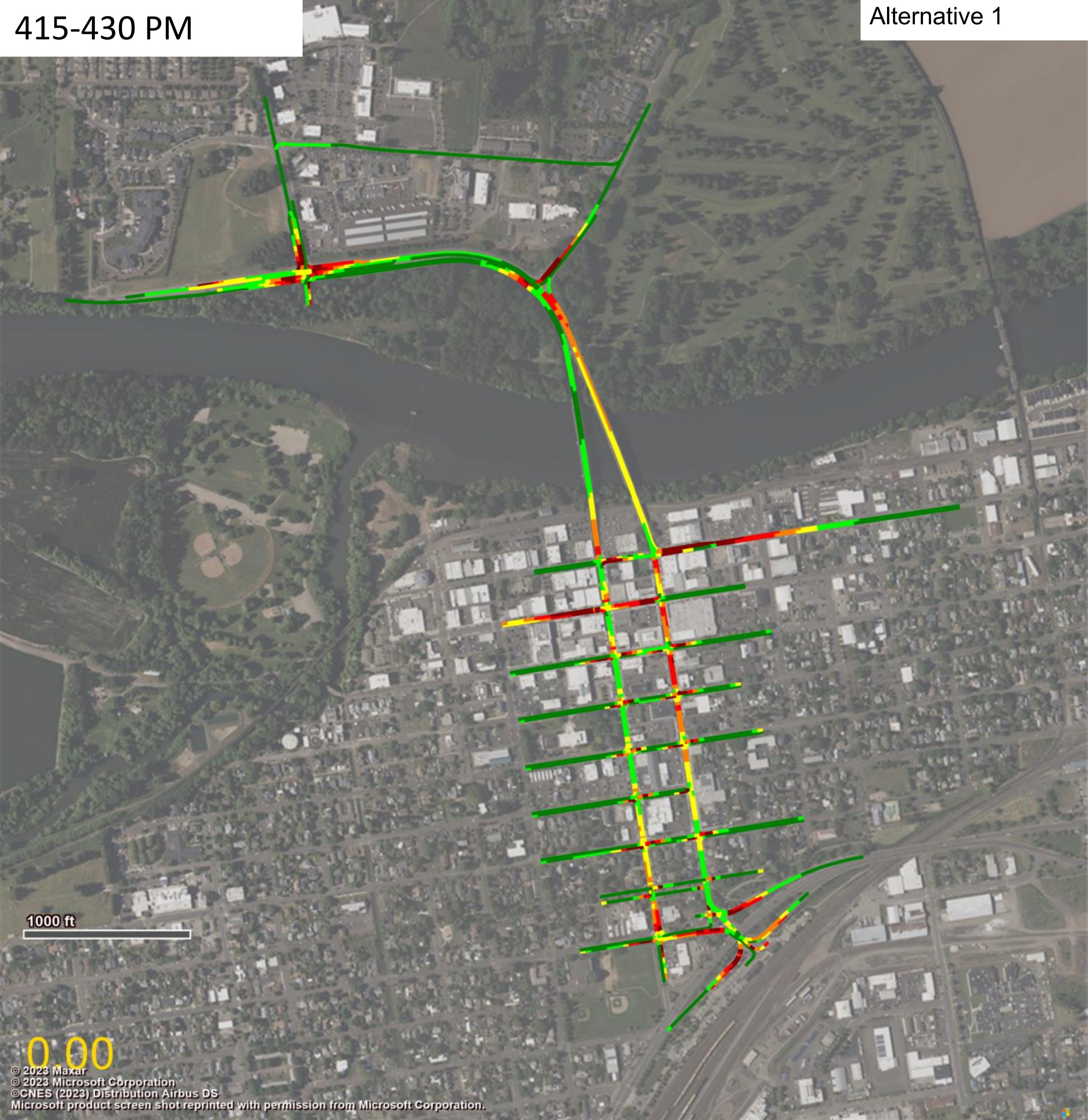
	Average Delay / veh (sec)	Vehicle Hours of Delay (hrs)	Latent Demand (veh)	Latent Delay (veh-hrs)	Vehicle Miles Travelled (mi)	Travel Time (hrs)
Avg	1036.2	627.9	52.5	65.6	11933.2	1071.5
StdDev	160.1	108.0	24.7	42.3	184.2	107.2
Min	739.8	430.4	0.0	0.7	11643.1	875.6
Max	1284.7	795.9	90.0	131.0	12274.9	1234.5

Avg delay/vehicle (min/veh) **3.18**

400-415 PM

Alternative 1

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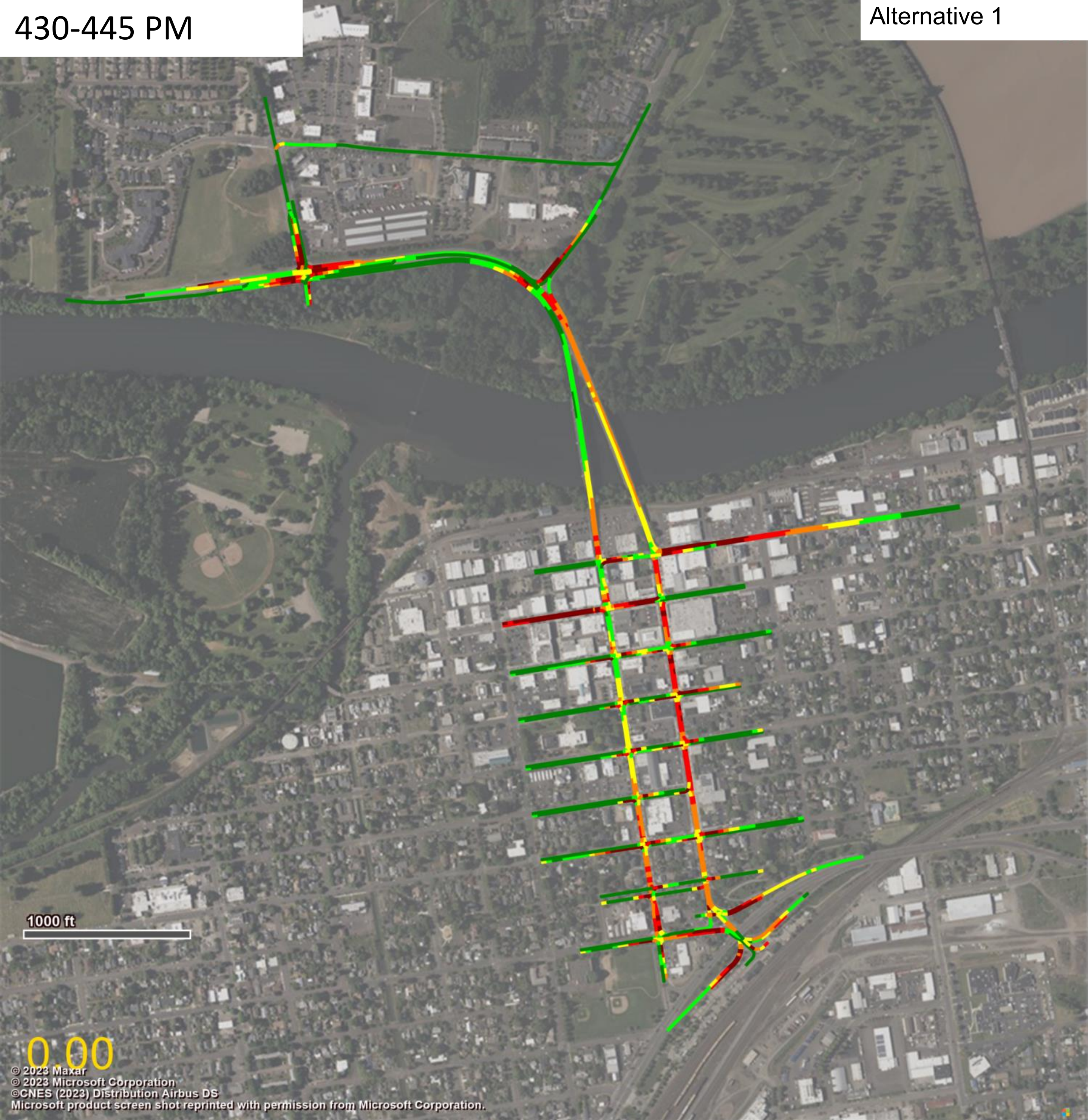
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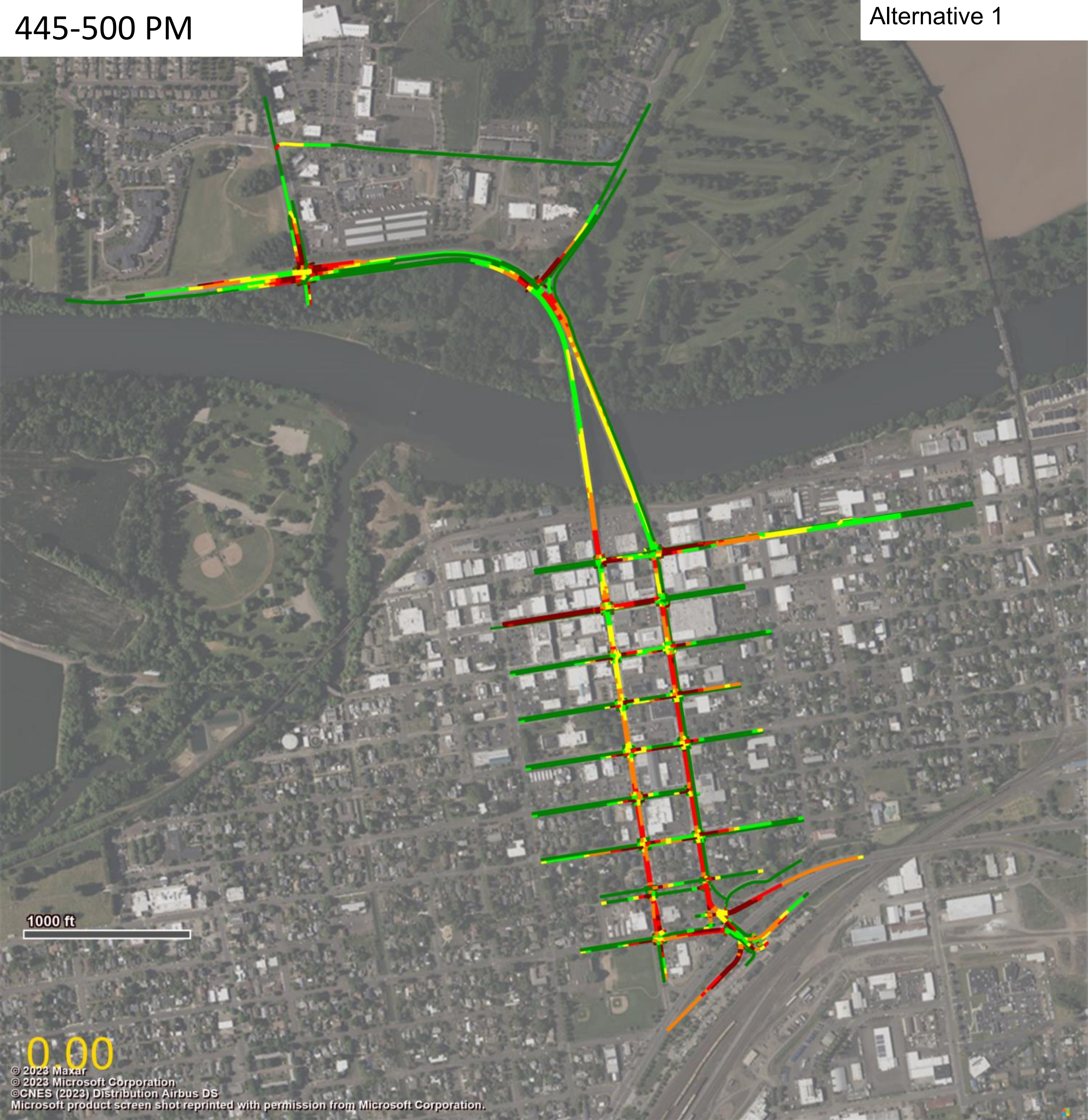

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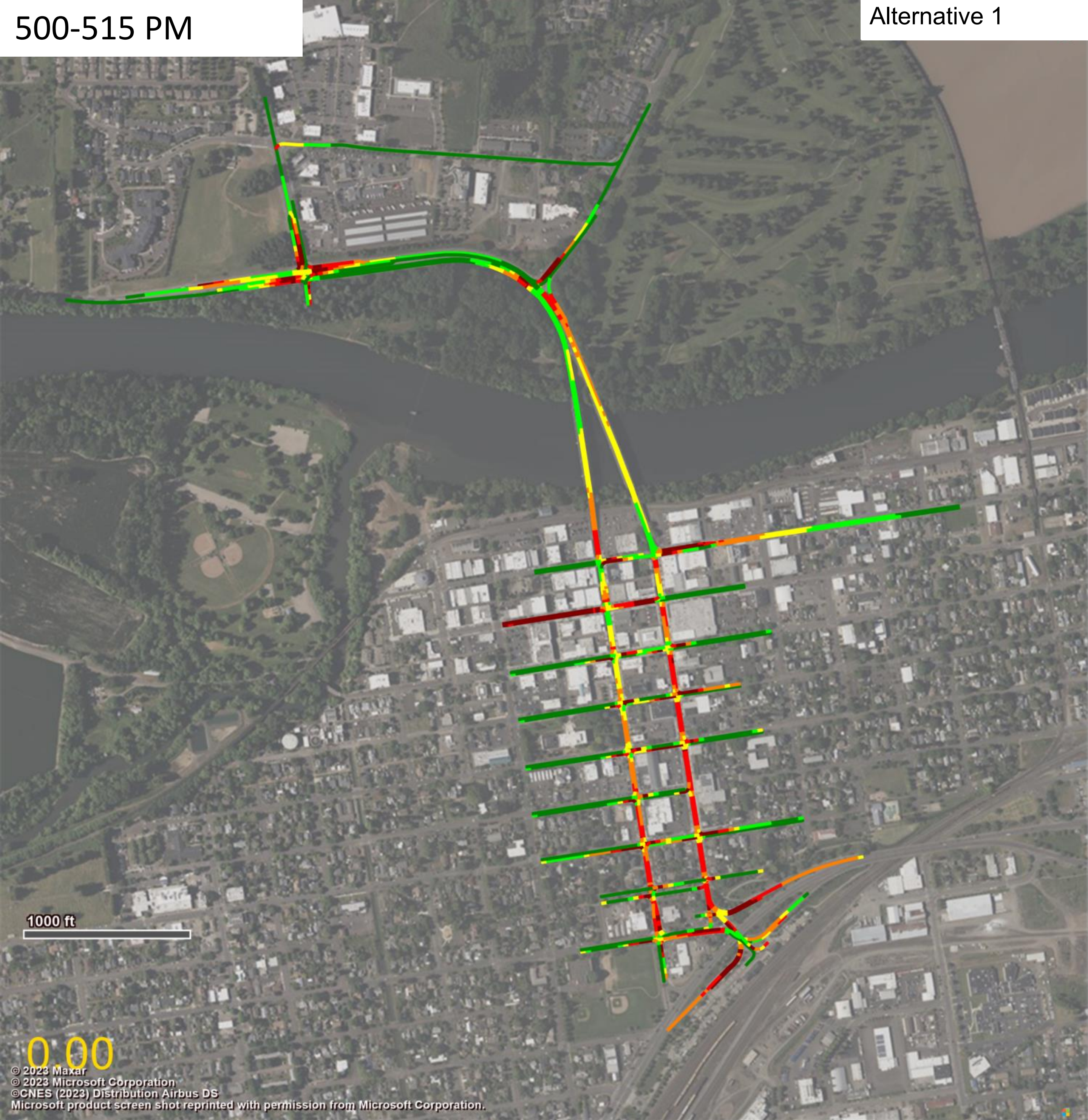
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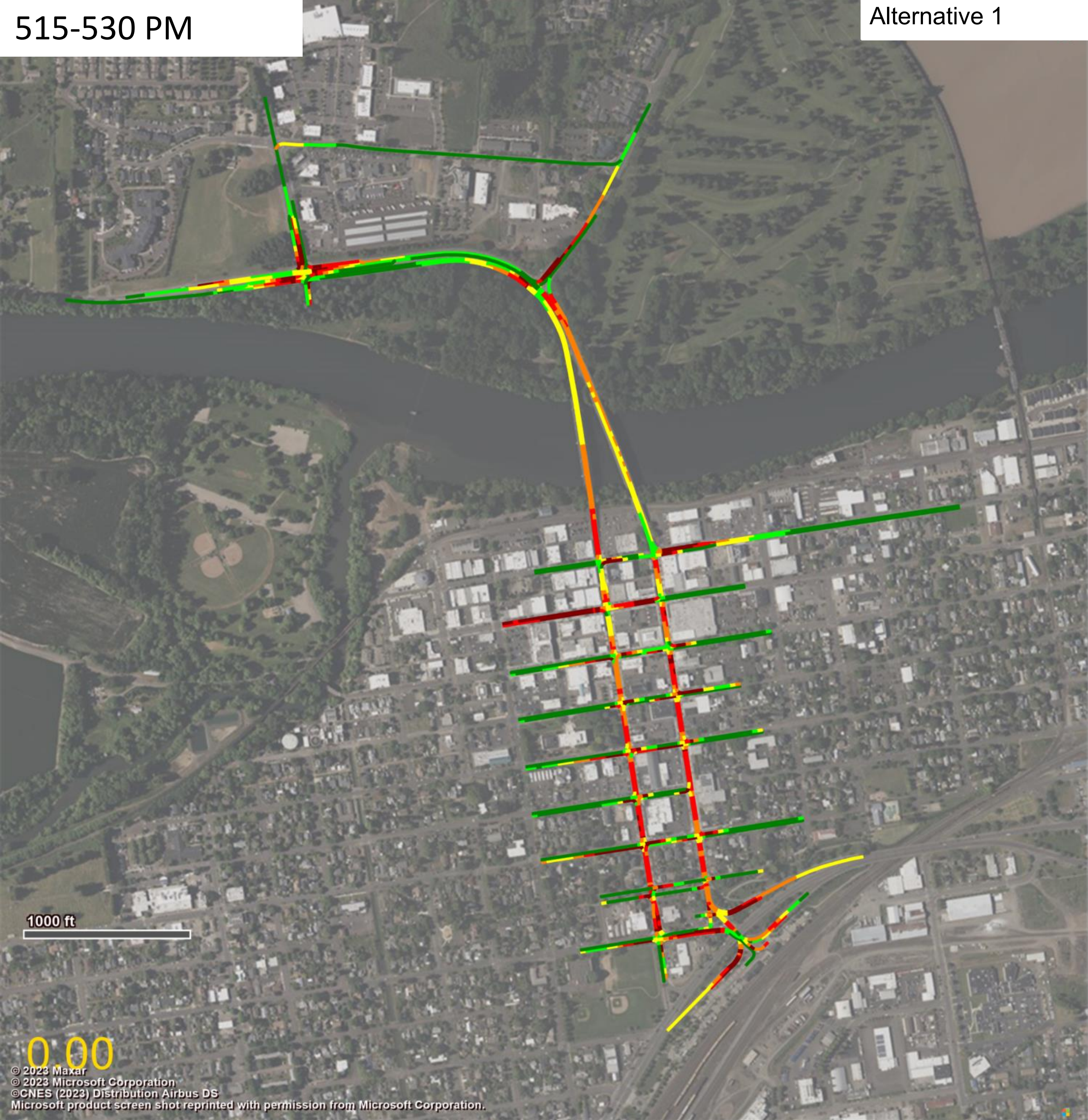
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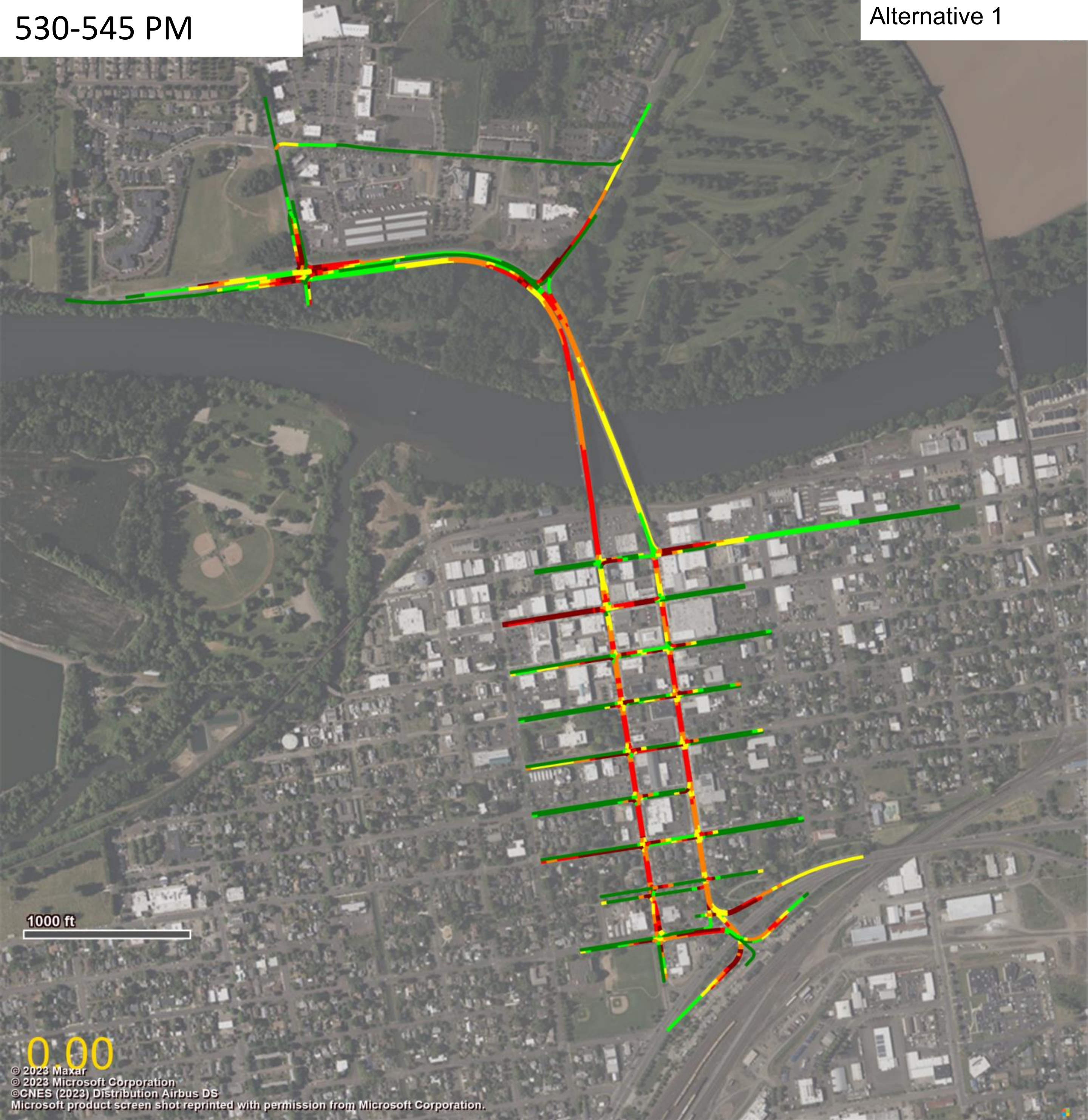
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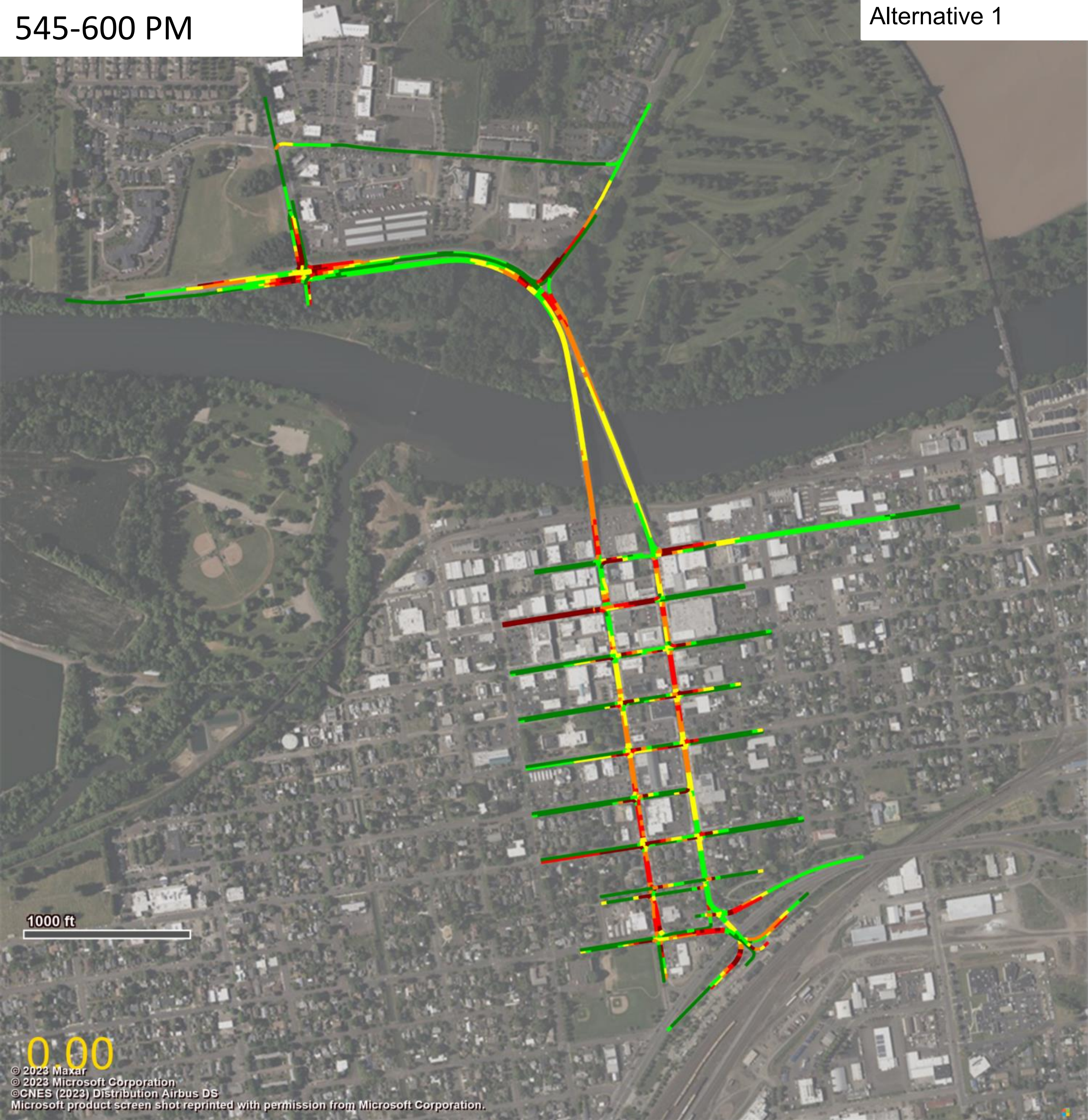
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APPENDIX H: PROJECT BUNDLE 2 RESULTS

GEH, DELAY, QUEUING, AND SYSTEM MEASURES

BUNDLE 2 GEH - 4:45 to 5:45 PM					
Intersection Number	**Intersection Name**	**Movement**	**Input Volume**	**VISSIM Output Volume**	**GEH**
1	US 20 & N Albany Rd	NBL	5	6	0.4
		NBT	5	5	0.0
		NBR	10	9	0.3
		SBL	625	618	0.3
		SBT	10	10	0.0
		SBR	125	127	0.2
		EBL	110	104	0.6
		EBT	840	833	0.2
		EBR	0	1	1.4
		WBL	5	4	0.5
		WBT	805	798	0.2
		WBR	855	850	0.2
		Total	3395	3363	0.6
2	US 20 & Springhill Dr	SBL	600	557	1.8
		SBR	20	17	0.7
		EBL	45	46	0.1
		EBT	1430	1413	0.5
		WBT	1645	1638	0.2
		WBR	800	817	0.6
		Total	4540	4486	0.8
3	Lyon & 1st	NBL	85	85	0.0
		NBT	1700	1707	0.2
		WBT	130	136	0.5
		WBR	745	757	0.4
		Total	2660	2684	0.5
4	Lyon & 2nd	NBT	1500	1524	0.6
		NBR	65	72	0.8
		EBL	285	268	1.0
		EBT	665	639	1.0
		Total	2515	2501	0.3
5	Lyon & 3rd	NBL	95	99	0.4
		NBT	1460	1487	0.7
		NBR	40	40	0.0
		EBL	65	68	0.4
		EBT	95	91	0.4
		WBT	85	79	0.7
		WBR	40	43	0.5
		Total	1880	1906	0.6
6	Lyon & 5th	NBL	40	39	0.2
		NBT	1485	1516	0.8
		NBR	35	37	0.3
		EBL	40	37	0.5
		EBT	45	45	0.0
		WBT	20	22	0.4
		WBR	10	9	0.3
		Total	1675	1705	0.7
7	Lyon & 9th	NBL	605	639	1.4
		NBU	5	5	0.0
		SBT	5	5	0.0
		SBR	895	886	0.3
		EBL	1285	1262	0.6
		EBT	5	7	0.8

BUNDLE 2 GEH - 4:45 to 5:45 PM

Intersection Number	Intersection Name	Movement	Input Volume	VISSIM Output Volume	GEH
		EBR	5	2	1.6
		EBU	55	51	0.5
		WBL	0	0	
		WBT	5	3	1.0
		Total	2865	2859	0.1
8	Ellsworth & 9th	NBL	45	44	0.1
		NBR	10	11	0.3
		SBL	1130	1098	1.0
		SBT	510	495	0.7
		SBR	55	52	0.4
		EBT	210	210	0.0
		EBR	5	6	0.4
		Total	1965	1916	1.1
9	Ellsworth & 5th	SBL	30	30	0.0
		SBT	1500	1452	1.2
		SBR	40	41	0.2
		EBT	55	56	0.1
		EBR	55	52	0.4
		WBL	25	22	0.6
		WBT	35	41	1.0
		Total	1740	1691	1.2
10	Ellsworth & 3rd	SBL	60	56	0.5
		SBT	1480	1436	1.2
		SBR	40	38	0.3
		EBT	100	104	0.4
		EBR	85	81	0.4
		WBL	65	59	0.8
		WBT	115	119	0.4
		Total	1945	1892	1.2
11	Ellsworth & 2nd	SBL	490	481	0.4
		SBT	1440	1391	1.3
		EBT	460	366	4.6
		EBR	140	143	0.3
		Total	2530	2380	3.0
12	Ellsworth & 1st	SBT	1855	1795	1.4
		SBR	175	173	0.2
		WBL	75	78	0.3
		WBT	140	141	0.1
		Total	2245	2186	1.3
13	Ellsworth & 6th	SBL	5	0	3.2
		SBT	1560	1514	1.2
		SBR	15	13	0.5
		EBT	5	6	0.4
		EBR	25	25	0.0
		WBL	10	5	1.8
		WBT	10	14	1.2
		Total	1630	1574	1.4

BUNDLE 2 PM PEAK HOUR (4:45-5:45 PM) DELAY				
Intersection	**Approach**	**Movement**	**Volume**	**Average Delay (s)**
US 20 & N Albany Rd	NB	Left	6	65
		Through	5	57
		Right	9	15
		Total	**20**	**41**
	SB	Left	618	35
		Through	10	34
		Right	127	7
		Total	**755**	**30**
	EB	Left	104	55
		Through	833	25
		Right	1	18
		Total	**938**	**28**
	WB	Left	4	61
		Through	798	17
		Right	850	20
		Total	**1652**	**19**
		Total	**3365**	**24**
US 20 & Springhill Dr	SB	Left	557	160
		Right	17	147
		Total	**574**	**160**
	EB	Left	46	73
		Through	1413	42
		Total	**1459**	**43**
	WB	Through	1638	27
		Right	817	27
		Total	**2455**	**27**
		Total	**4488**	**49**
Lyon & 1st	NB	Left	85	6
		Through	1707	9
		Total	**1792**	**9**
	WB	Through	136	312
		Right	757	352
		Total	**893**	**346**
		Total	**2685**	**121**
Lyon & 2nd	NB	Through	1524	3
		Right	72	2
		Total	**1596**	**3**
	EB	Left	268	32
		Through	639	31
		Total	**907**	**31**
		Total	**2503**	**13**

BUNDLE 2 PM PEAK HOUR (4:45-5:45 PM) DELAY

Intersection	Approach	Movement	Volume	Average Delay (s)
Lyon & 3rd	NB	Left	99	19
		Through	1487	22
		Right	40	23
		Total	**1626**	**21**
	EB	Left	68	21
		Through	91	21
		Total	**159**	**21**
	WB	Through	79	25
		Right	43	12
		Total	**122**	**20**
		Total	**1907**	**21**
Lyon & 5th	NB	Left	39	20
		Through	1516	25
		Right	37	23
		Total	**1592**	**25**
	EB	Left	37	300
		Through	45	258
		Total	**82**	**277**
	WB	Through	22	20
		Right	9	32
		Total	**31**	**23**
		Total	**1705**	**37**
Lyon & 9th	NB	Left	639	125
		U-Turn	5	125
		Total	**644**	**125**
	SB	Through	5	73
		Right	886	92
		Total	**891**	**92**
	EB	Left	1262	33
		Through	7	18
		Right	2	74
		U-Turn	51	139
		Total	**1322**	**37**
	WB	Through	3	67
		Total	**3**	**67**
		Total	**2860**	**74**
	NB	Left	44	43
		Right	11	24
		Total	**55**	**39**
	SB	Left	1098	25
		Through	495	11

BUNDLE 2 PM PEAK HOUR (4:45-5:45 PM) DELAY				
Intersection	**Approach**	**Movement**	**Volume**	**Average Delay (s)**
Ellsworth & 9th	SB	Right	52	9
		Total	**1645**	**20**
	EB	Through	210	39
		Right	6	29
		Total	**216**	**39**
		Total	**1916**	**23**
Ellsworth & 5th	SB	Left	30	31
		Through	1452	15
		Right	41	15
		Total	**1523**	**15**
	EB	Through	56	184
		Right	52	186
		Total	**108**	**185**
	WB	Left	22	15
		Through	41	18
		Total	**63**	**17**
		Total	**1694**	**26**
Ellsworth & 3rd	SB	Left	56	5
		Through	1436	10
		Right	38	7
		Total	**1530**	**9**
	EB	Through	104	68
		Right	81	66
		Total	**185**	**67**
	WB	Left	59	12
		Through	119	24
		Total	**178**	**20**
		Total	**1893**	**16**
Ellsworth & 2nd	SB	Left	481	6
		Through	1391	7
		Total	**1872**	**6**
	EB	Through	366	254
		Right	143	161
		Total	**509**	**228**
		Total	**2381**	**54**
Ellsworth & 1st	SB	Through	1795	63
		Right	173	62
		Total	**1968**	**63**
	WB	Left	78	39
		Through	141	27
		Total	**219**	**32**

BUNDLE 2 PM PEAK HOUR (4:45-5:45 PM) DELAY				
Intersection	**Approach**	**Movement**	**Volume**	**Average Delay (s)**
		Total	**2187**	**60**
Ellsworth & 6th	**SB**	Through	1514	20
		Right	13	20
		Total	**1527**	**20**
	EB	Through	6	46
		Right	25	65
		Total	**31**	**61**
	WB	Left	5	76
		Through	14	57
		Total	**19**	**62**
		Total	**1577**	**21**

TABLE: QUEUE COUNTERS (Avg/95th)

Intersection	Southbound	Eastbound	Westbound	Northbound
1: US 20 & N Albany Rd	20 (65); 205 (450)	75 (160); 260 (1400)	315 (690); 165 (340); 5 (20)	10 (45)
2: US 20 & Springhill Dr	820 (1280)	35 (90); 480 (1350)	235 (1140); 920 (1715)	
3: Lyon & 1st			1380 (1840)	245 (305)
4: Lyon & 2nd		255 (350)		245 (310)
5: Lyon & 3rd		55 (135)	50 (115)	1550 (2015)
6: Lyon & 5th		280 (920)	15 (40)	

TABLE: QUEUE COUNTERS (Avg/95th)

	700 (910)			
365 (445)		**7: Lyon & 9th**		5 (25)
	425 (690)	100 (205)		

		515 (875)	725 (885)	
120 (250)		**8: Ellsworth & 9th**		
		40 (90)		

185 (610)		**9: Ellsworth & 5th**		25 (65)

		140 (310)		
150 (390)		**10: Ellsworth & 3rd**		70 (160)

		140 (305)	95 (295)	
520 (625)		**11: Ellsworth & 2nd**		

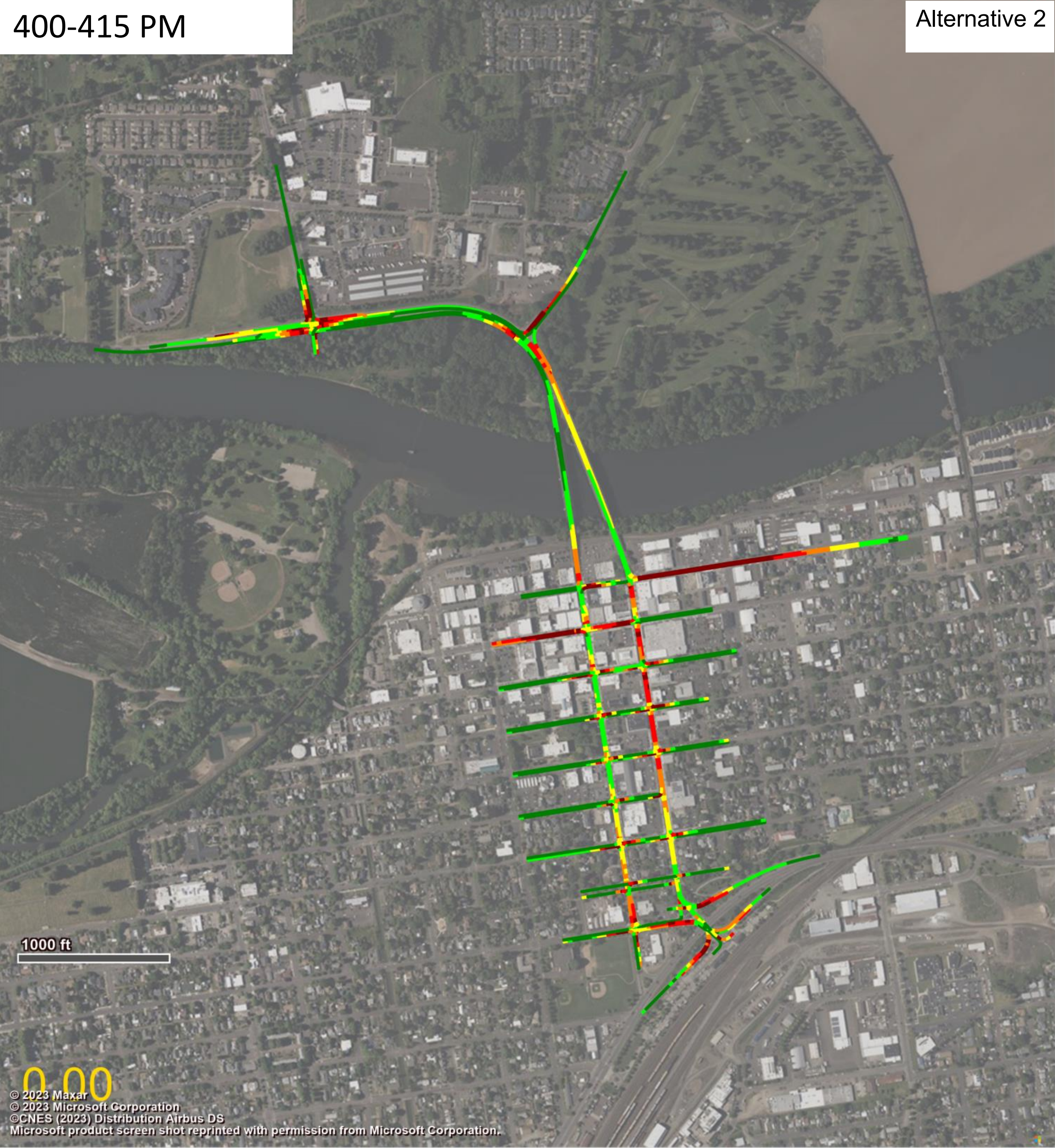
		1135 (1690)		
		12: Ellsworth & 1st		80 (135)

TABLE: QUEUE COUNTERS (Avg/95th)

	565 (890)	
25 (80)	13: Ellsworth & 6th	20 (70)

	Average Delay / veh (sec)	Vehicle Hours of Delay (hrs)	Latent Demand (veh)	Latent Delay (veh-hrs)	Vehicle Miles Travelled (mi)	Travel Time (hrs)
Avg	1357.9	860.1	88.5	121.3	11760.1	1297.1
StdDev	156.8	117.4	45.4	73.7	190.8	113.9
Min	1137.5	697.2	0.0	6.2	11472.6	1139.1
Max	1627.1	1065.9	138.0	227.1	12075.0	1496.6

Avg delay/veh (min/veh) **4.49**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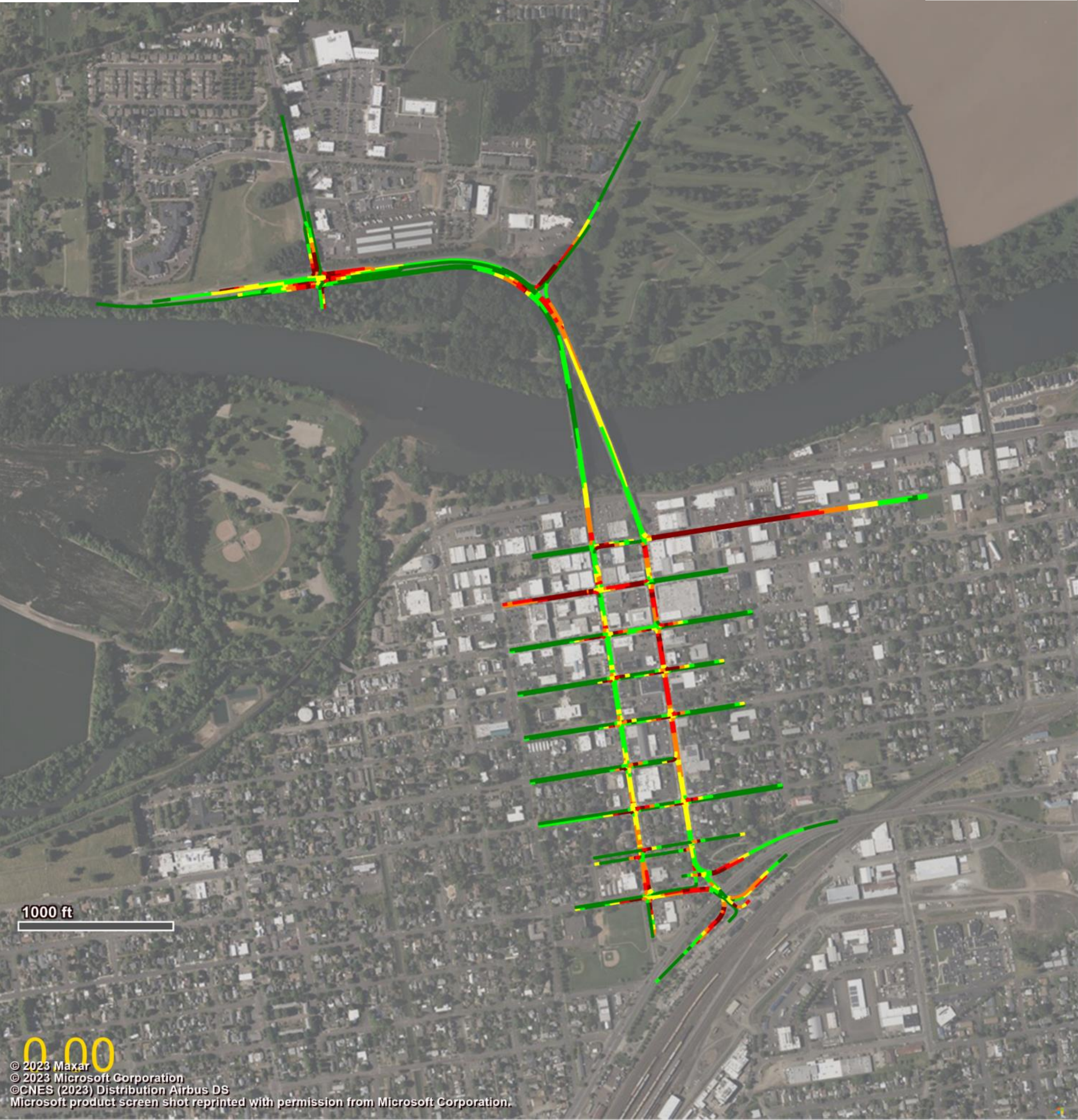
415-430 PM

Alternative 2



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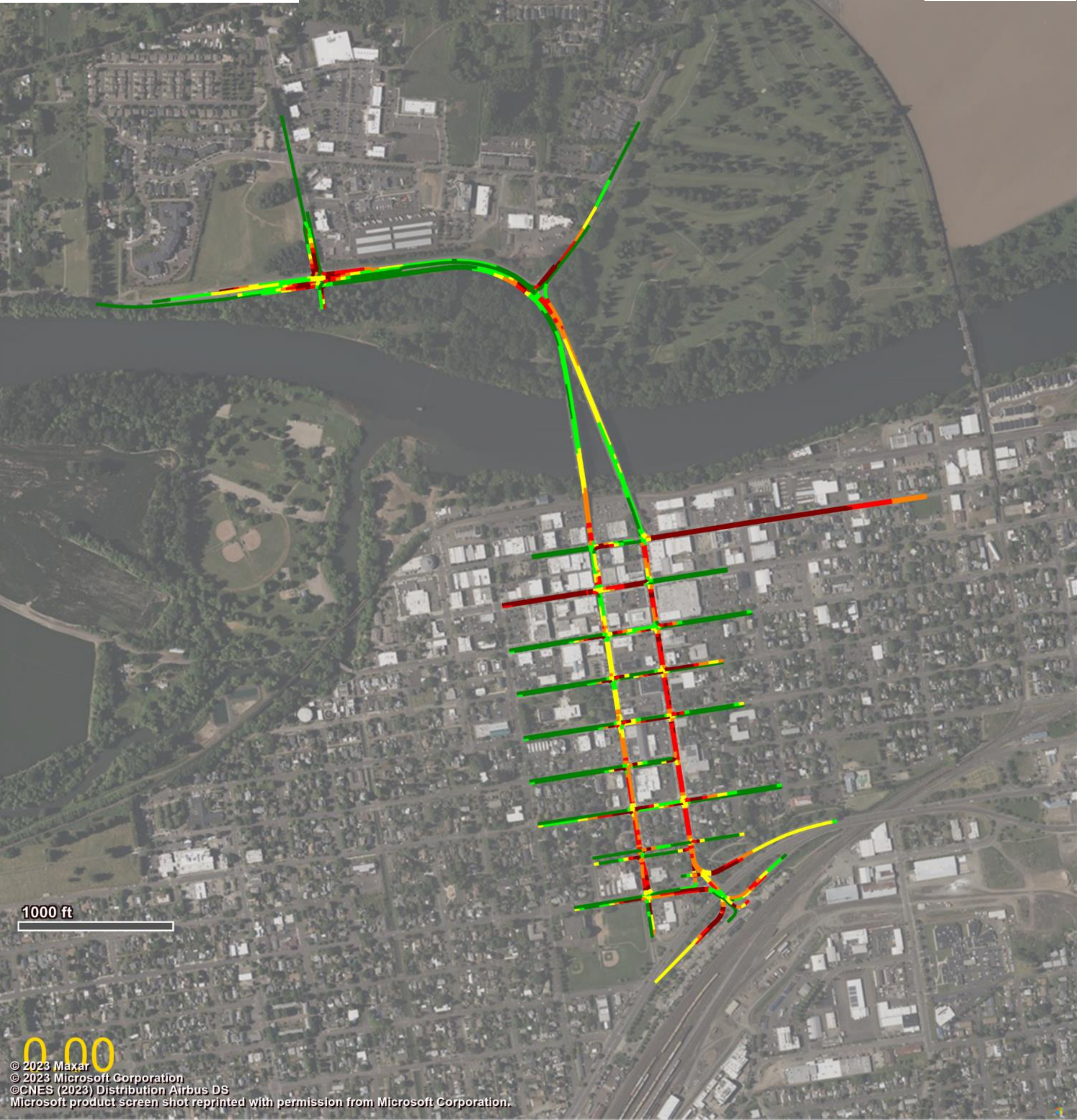

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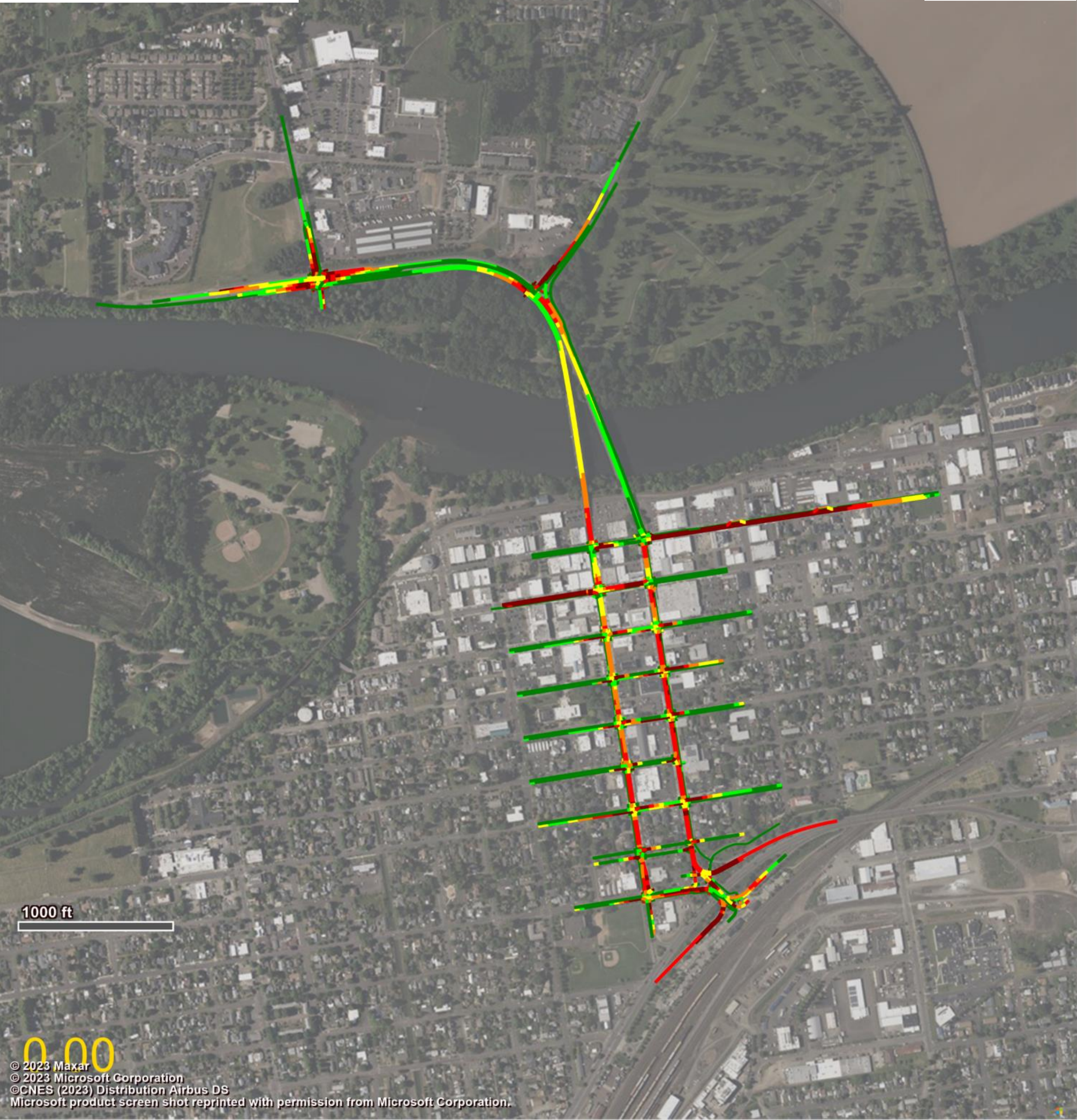

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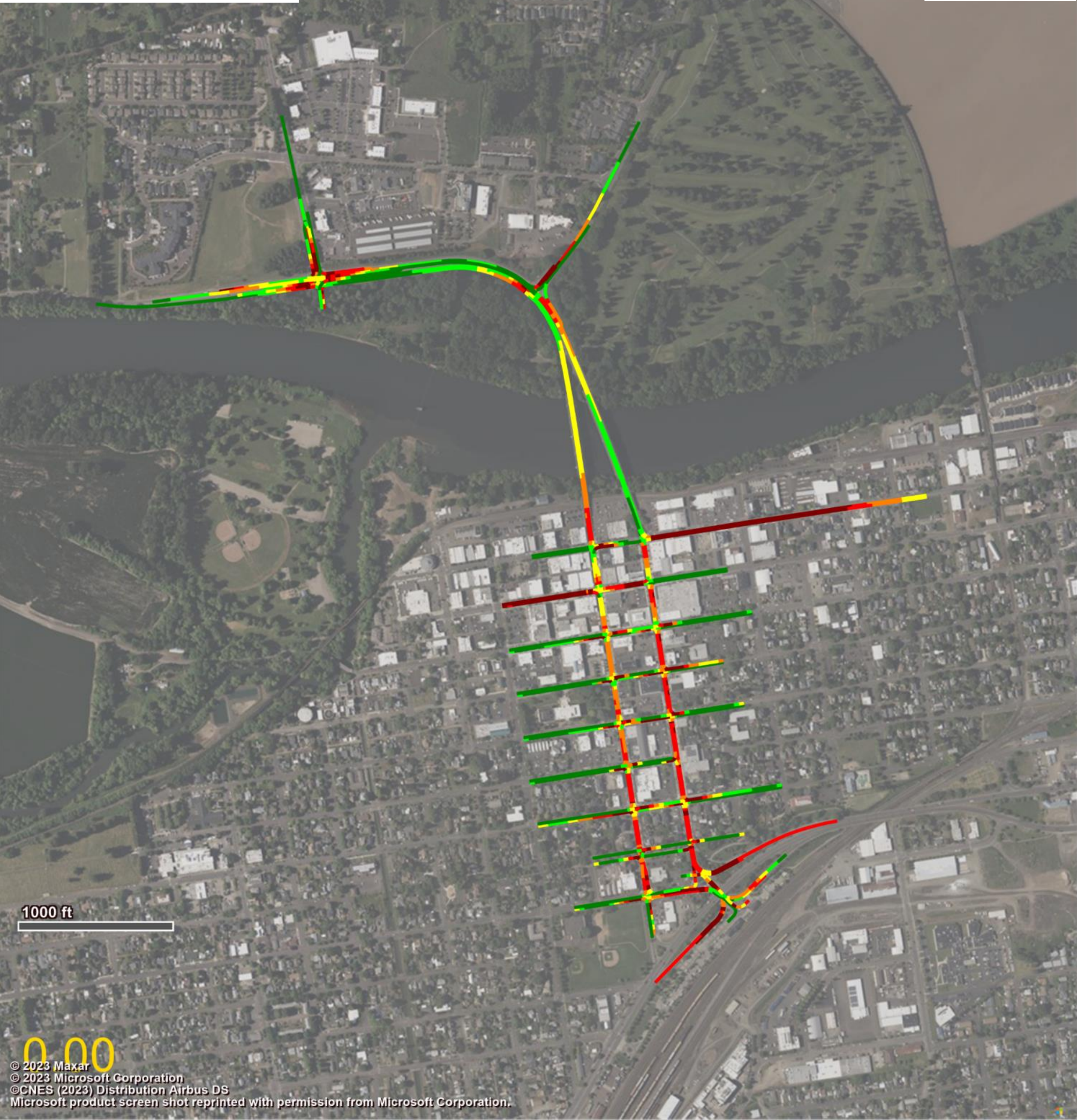

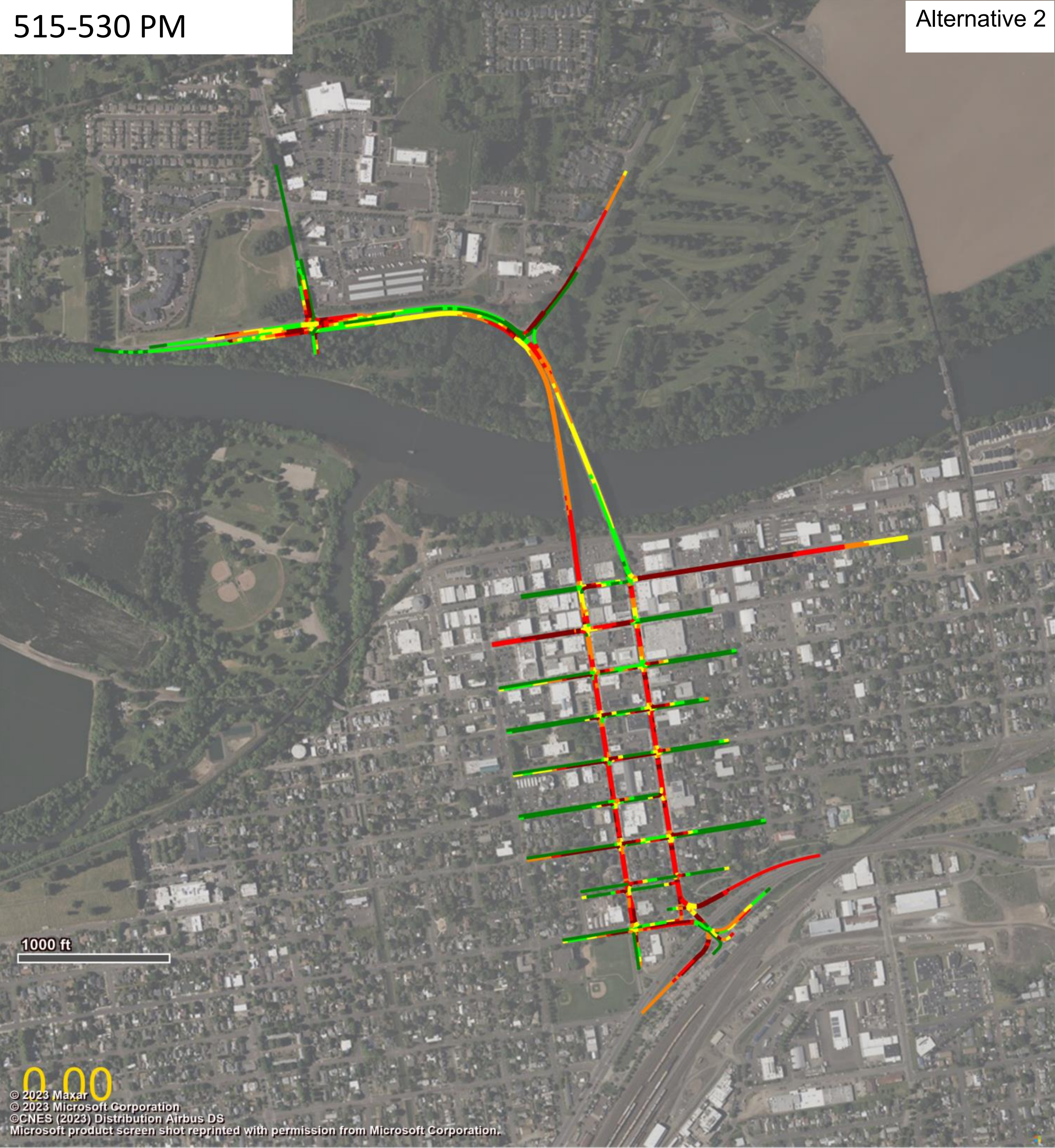
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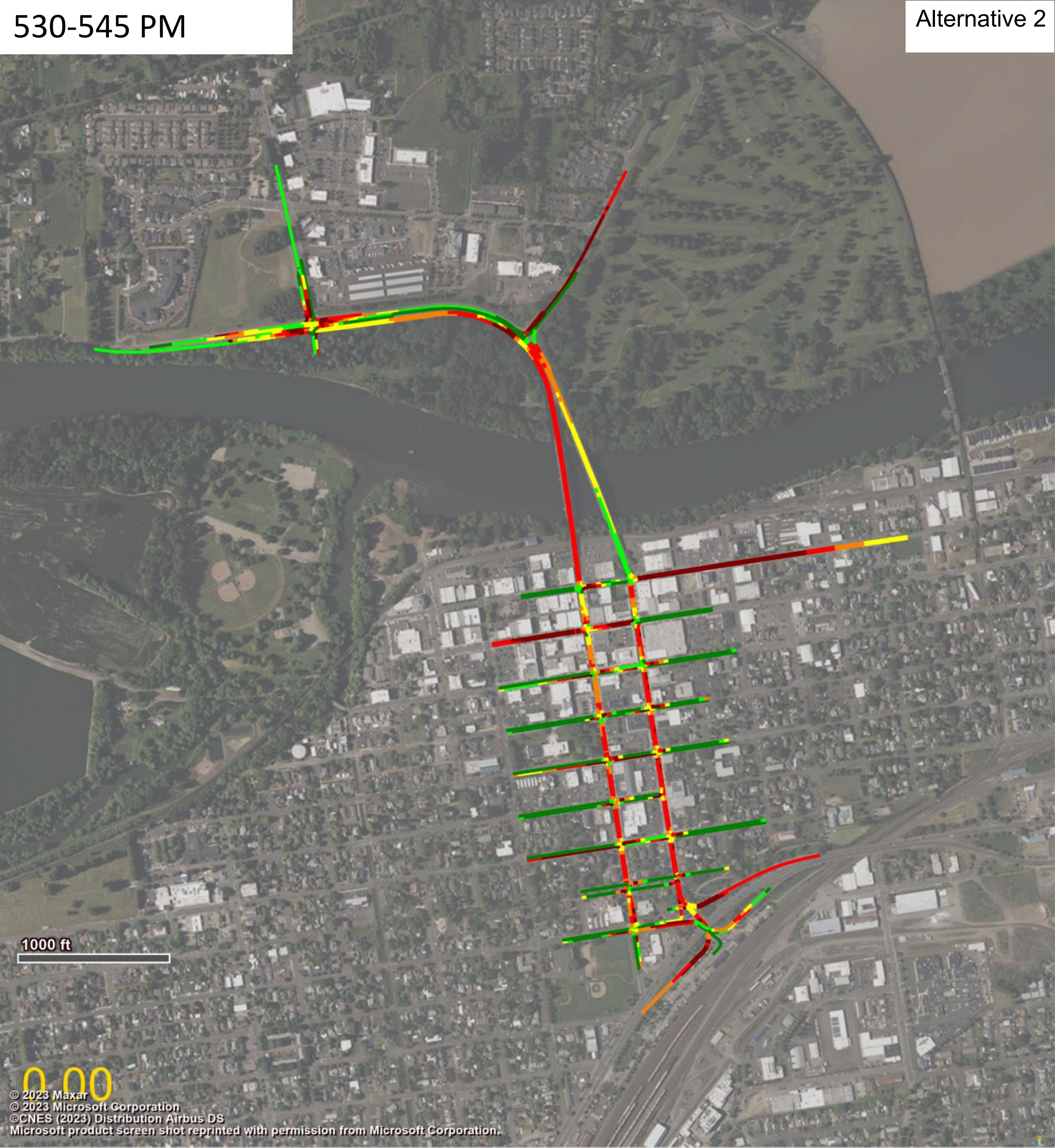
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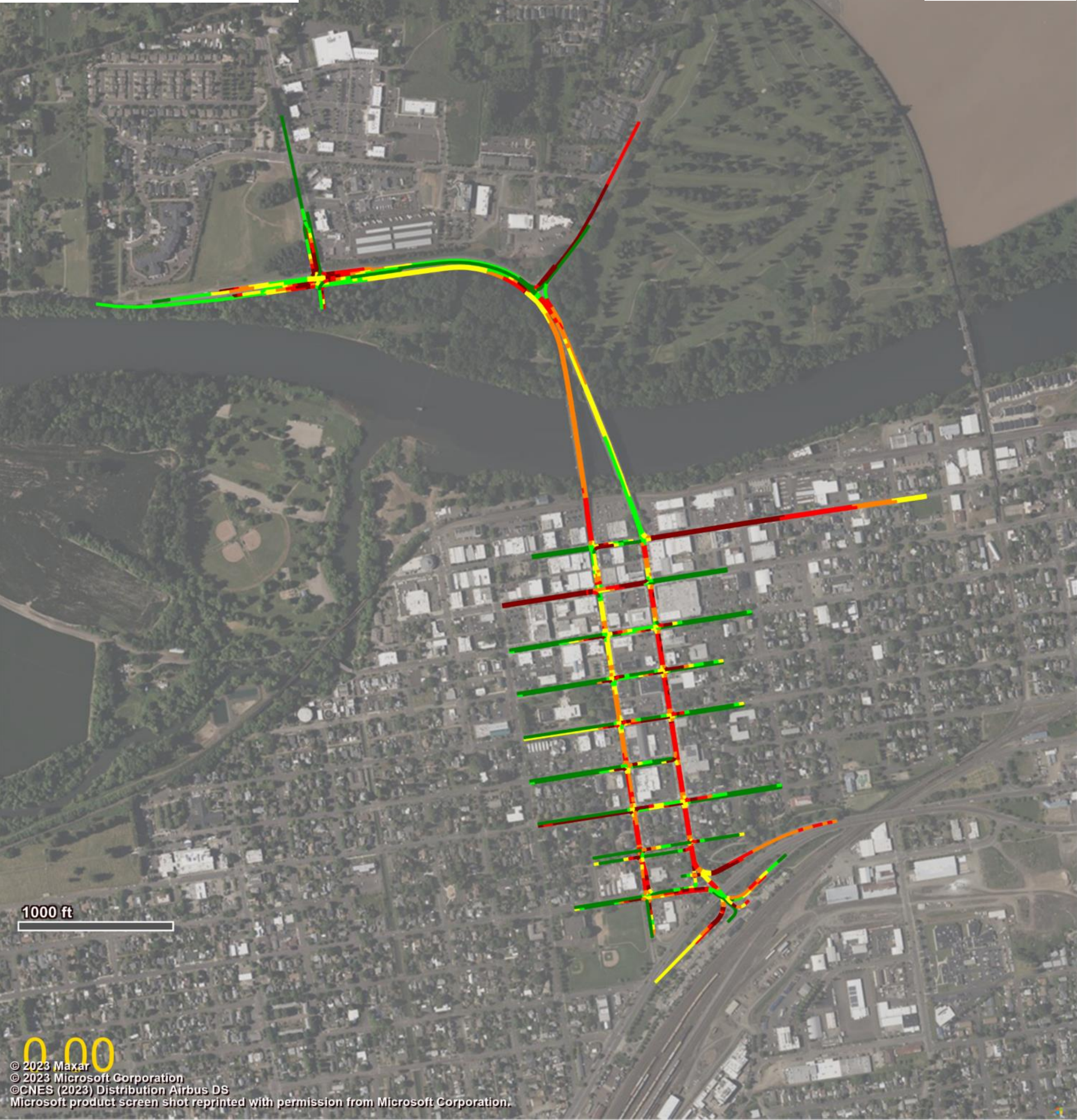
545-600 PM

Alternative 2



APPENDIX I: PROJECT BUNDLE 3 RESULTS

GEH, DELAY, QUEUING, AND SYSTEM MEASURES

BUNDLE 3 GEH - 4:45 to 5:45 PM

Intersection Number	Intersection Name	Movement	Input Volume	VISSIM Output Volume	GEH
1	US 20 & N Albany Rd	NBL	5	5	0.0
		NBT	5	5	0.0
		NBR	10	9	0.3
		SBL	625	619	0.2
		SBT	10	10	0.0
		SBR	125	126	0.1
		EBL	110	105	0.5
		EBT	840	840	0.0
		EBR	0	0	
		WBL	5	4	0.5
		WBT	805	822	0.6
		WBR	855	858	0.1
		Total	3395	3401	0.1
2	US 20 & Springhill Dr	SBL	600	589	0.5
		SBR	20	18	0.5
		EBL	45	46	0.1
		EBT	1430	1418	0.3
		WBT	1645	1663	0.4
		WBR	800	818	0.6
		Total	4540	4552	0.2
3	Lyon & 1st	NBL	85	86	0.1
		NBT	1700	1729	0.7
		WBT	130	135	0.4
		WBR	745	753	0.3
		Total	2660	2704	0.8
4	Lyon & 2nd	NBT	1500	1540	1.0
		NBR	65	75	1.2
		EBL	285	272	0.8
		EBT	665	648	0.7
		Total	2515	2534	0.4
5	Lyon & 3rd	NBL	95	99	0.4
		NBT	1460	1500	1.0
		NBR	40	38	0.3
		EBL	65	68	0.4
		EBT	95	91	0.4
		WBT	85	80	0.6
		WBR	40	42	0.3
		Total	1880	1917	0.8
6	Lyon & 5th	NBL	40	40	0.0
		NBT	1485	1514	0.7
		NBR	35	35	0.0
		EBL	40	40	0.0
		EBT	45	46	0.1
		WBT	20	22	0.4
		WBR	10	9	0.3
		Total	1675	1707	0.8
7	Lyon & 9th	NBL	605	622	0.7
		NBU	5	5	0.0
		SBT	5	5	0.0
		SBR	895	894	0.0
		EBL	1285	1271	0.4
		EBT	5	7	0.8

BUNDLE 3 GEH - 4:45 to 5:45 PM					
Intersection Number	**Intersection Name**	**Movement**	**Input Volume**	**VISSIM Output Volume**	**GEH**
		EBR	5	3	1.0
		EBU	55	52	0.4
		WBL	0	0	
		WBT	5	3	1.0
		Total	2865	2861	0.1
8	Ellsworth & 9th	NBL	45	43	0.3
		NBR	10	10	0.0
		SBL	1130	1107	0.7
		SBT	510	503	0.3
		SBR	55	52	0.4
		EBT	210	212	0.1
		EBR	5	5	0.0
		Total	1965	1933	0.7
9	Ellsworth & 5th	SBL	30	30	0.0
		SBT	1500	1467	0.9
		SBR	40	40	0.0
		EBT	55	54	0.1
		EBR	55	52	0.4
		WBL	25	22	0.6
		WBT	35	41	1.0
		Total	1740	1708	0.8
10	Ellsworth & 3rd	SBL	60	57	0.4
		SBT	1480	1453	0.7
		SBR	40	41	0.2
		EBT	100	102	0.2
		EBR	85	81	0.4
		WBL	65	60	0.6
		WBT	115	118	0.3
		Total	1945	1909	0.8
11	Ellsworth & 2nd	SBL	490	482	0.4
		SBT	1440	1408	0.8
		EBT	460	401	2.8
		EBR	140	126	1.2
		Total	2530	2416	2.3
12	Ellsworth & 1st	SBT	1855	1814	1.0
		SBR	175	178	0.2
		WBL	75	77	0.2
		WBT	140	143	0.3
		Total	2245	2212	0.7
13	Ellsworth & 6th	SBL	5	0	3.2
		SBT	1560	1526	0.9
		SBR	15	14	0.3
		EBT	5	6	0.4
		EBR	25	25	0.0
		WBL	10	5	1.8
		WBT	10	13	0.9
		Total	1630	1589	1.0

BUNDLE 3 PM PEAK HOUR (4:45-5:45 PM) DELAY				
Intersection	**Approach**	**Movement**	**Volume**	**Average Delay (s)**
US 20 & N Albany Rd	NB	Left	5	54
		Through	5	57
		Right	9	13
		Total	**19**	**36**
	SB	Left	619	32
		Through	10	36
		Right	126	7
		Total	**755**	**28**
	EB	Left	105	50
		Through	840	13
		Total	**945**	**17**
	WB	Left	4	57
		Through	822	18
		Right	858	19
		Total	**1684**	**18**
		Total	**3403**	**20**
US 20 & Springhill Dr	SB	Left	589	113
		Right	18	110
		Total	**607**	**113**
	EB	Left	46	55
		Through	1418	13
		Total	**1464**	**15**
	WB	Through	1663	34
		Right	818	36
		Total	**2481**	**35**
		Total	**4552**	**39**
Lyon & 1st	NB	Left	86	5
		Through	1729	7
		Total	**1815**	**7**
	WB	Through	135	328
		Right	753	370
		Total	**888**	**363**
		Total	**2703**	**124**
Lyon & 2nd	NB	Through	1540	3
		Right	75	2
		Total	**1615**	**3**
	EB	Left	272	31
		Through	648	30
		Total	**920**	**30**
		Total	**2535**	**13**
		Left	99	15

BUNDLE 3 PM PEAK HOUR (4:45-5:45 PM) DELAY				
Intersection	**Approach**	**Movement**	**Volume**	**Average Delay (s)**
Lyon & 3rd	NB	Through	1500	16
		Right	38	15
		Total	**1637**	**16**
	EB	Left	68	19
		Through	91	20
		Total	**159**	**20**
	WB	Through	80	24
		Right	42	11
		Total	**122**	**20**
		Total	**1918**	**17**
Lyon & 5th	NB	Left	40	11
		Through	1514	13
		Right	35	12
		Total	**1589**	**12**
	EB	Left	40	142
		Through	46	123
		Total	**86**	**132**
	WB	Through	22	24
		Right	9	34
		Total	**31**	**27**
		Total	**1706**	**19**
Lyon & 9th	NB	Left	622	53
		U-Turn	5	65
		Total	**627**	**53**
	SB	Through	5	29
		Right	894	36
		Total	**899**	**36**
	EB	Left	1271	31
		Through	7	14
		Right	3	2
		U-Turn	52	41
		Total	**1333**	**31**
	WB	Through	3	57
		Total	**3**	**57**
		Total	**2862**	**38**
Ellsworth & 9th	NB	Left	43	41
		Right	10	21
		Total	**53**	**38**
	SB	Left	1107	23
		Through	503	11
		Right	52	9

BUNDLE 3 PM PEAK HOUR (4:45-5:45 PM) DELAY				
Intersection	Approach	Movement	Volume	Average Delay (s)
		Total	1662	19
	EB	Through	212	39
		Right	5	25
		Total	217	39
		Total	1932	22
Ellsworth & 5th	SB	Left	30	15
		Through	1467	10
		Right	40	12
		Total	1537	11
	EB	Through	54	111
		Right	52	108
		Total	106	110
	WB	Left	22	10
		Through	41	16
		Total	63	14
		Total	1706	17
Ellsworth & 3rd	SB	Left	57	2
		Through	1453	6
		Right	41	5
		Total	1551	6
	EB	Through	102	39
		Right	81	36
		Total	183	38
	WB	Left	60	11
		Through	118	25
		Total	178	20
		Total	1912	10
Ellsworth & 2nd	SB	Left	482	5
		Through	1408	5
		Total	1890	5
	EB	Through	401	201
		Right	126	145
		Total	527	187
		Total	2417	45
Ellsworth & 1st	SB	Through	1814	37
		Right	178	36
		Total	1992	37
	WB	Left	77	42
		Through	143	28
		Total	220	33
		Total	2212	36

BUNDLE 3 PM PEAK HOUR (4:45-5:45 PM) DELAY				
Intersection	**Approach**	**Movement**	**Volume**	**Average Delay (s)**
Ellsworth & 6th	**SB**	Through	1526	16
		Right	14	17
		Total	**1540**	**16**
	EB	Through	6	41
		Right	25	53
		Total	**31**	**51**
	WB	Left	5	70
		Through	13	71
		Total	**18**	**71**
		Total	**1589**	**17**

TABLE: QUEUE COUNTERS (Avg/95th)

Intersection	North (top)	West (left)	East (right)	South (bottom)
1: US 20 & N Albany Rd	25 (65); 180 (305)	75 (155); 145 (255)	270 (635); 165 (345); 5 (20)	10 (40)
2: US 20 & Springhill Dr	655 (1280)	35 (85); 240 (685)	295 (1655); 1175 (1775)	
3: Lyon & 1st			1430 (1840)	205 (305)
4: Lyon & 2nd		250 (315)		205 (310)
5: Lyon & 3rd		55 (135)	50 (110)	915 (1940)
6: Lyon & 5th		170 (920)	15 (45)	

TABLE: QUEUE COUNTERS (Avg/95th)

	365 (905)			
	↵	↓	↳	
355 (445)		**7: Lyon & 9th**		5 (35)
	↰	↑	↱	
	230 (685)	45 (200)		

		520 (885)	670 (890)	
	↵	↓	↳	
125 (270)		**8: Ellsworth & 9th**		
	↰	↑	↱	
		35 (85)		

	↵	↓	↳	
125 (520)		**9: Ellsworth & 5th**		25 (60)
	↰	↑	↱	

		115 (310)		
	↵	↓	↳	
110 (290)		**10: Ellsworth & 3rd**		70 (175)
	↰	↑	↱	

		115 (305)	90 (295)	
	↵	↓	↳	
465 (615)		**11: Ellsworth & 2nd**		
	↰	↑	↱	

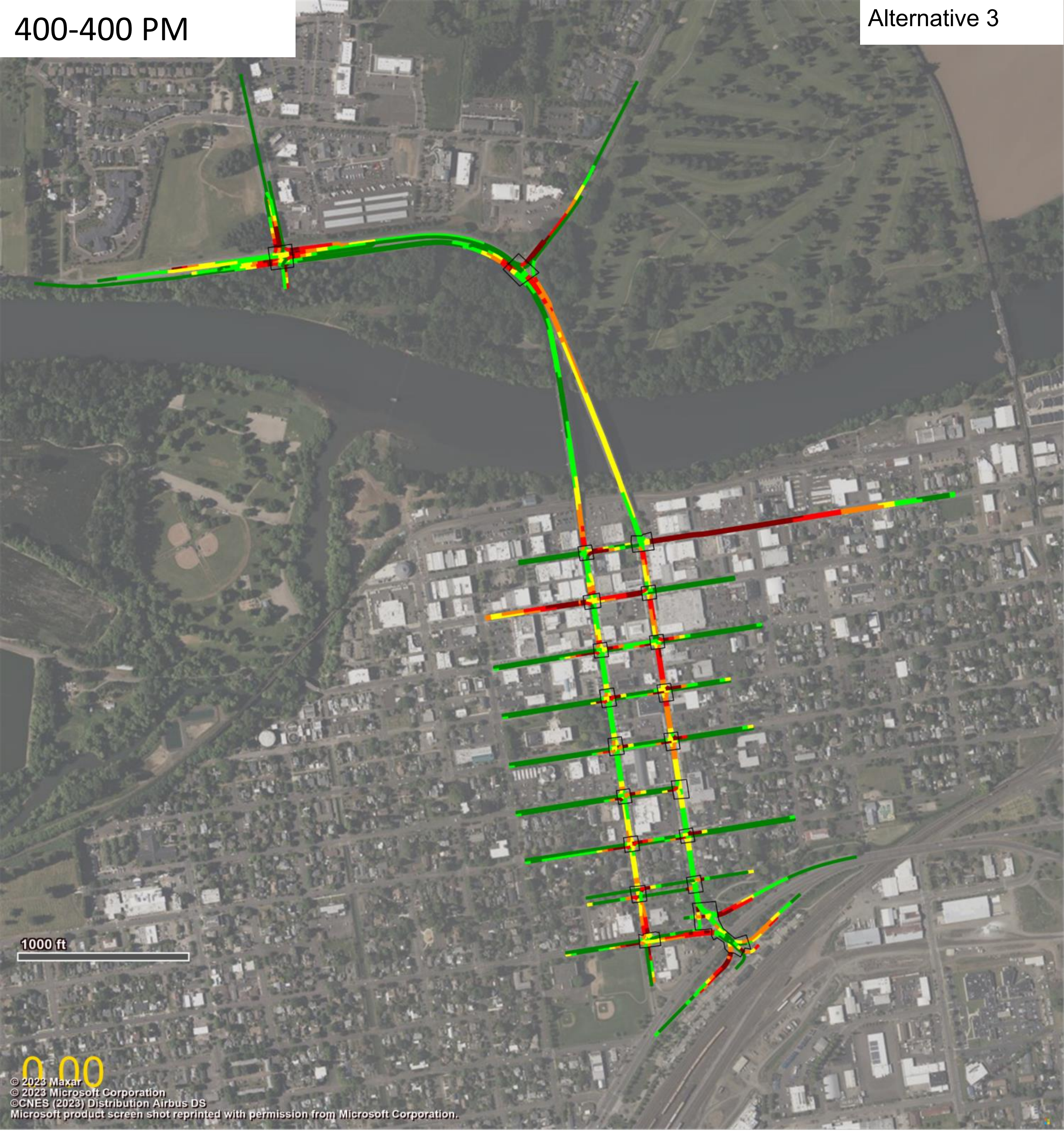
		790 (1665)		
	↵	↓	↳	
		12: Ellsworth & 1st		80 (135)
	↰	↑	↱	

TABLE: QUEUE COUNTERS (Avg/95th)

Intersection	Approach	Direction	Queue (Avg/95th)
13: Ellsworth & 6th	Southbound	↵ ↓ ↳	445 (890)
13: Ellsworth & 6th	Eastbound	→	20 (65)
13: Ellsworth & 6th	Westbound	←	20 (65)

	Average Delay / veh (sec)	Vehicle Hours of Delay (hrs)	Latent Demand (veh)	Latent Delay (veh-hrs)	Vehicle Miles Travelled (mi)	Travel Time (hrs)
Avg	1138.3	698.8	31.8	44.6	11875.8	1140.6
StdDev	195.8	136.6	32.8	41.6	162.1	135.2
Min	788.5	461.2	0.0	0.7	11633.6	905.6
Max	1414.8	898.4	91.0	118.6	12157.5	1338.2

Avg delay/vehicle (min/veh) **3.40**



400-400 PM
Alternative 3
1000 ft
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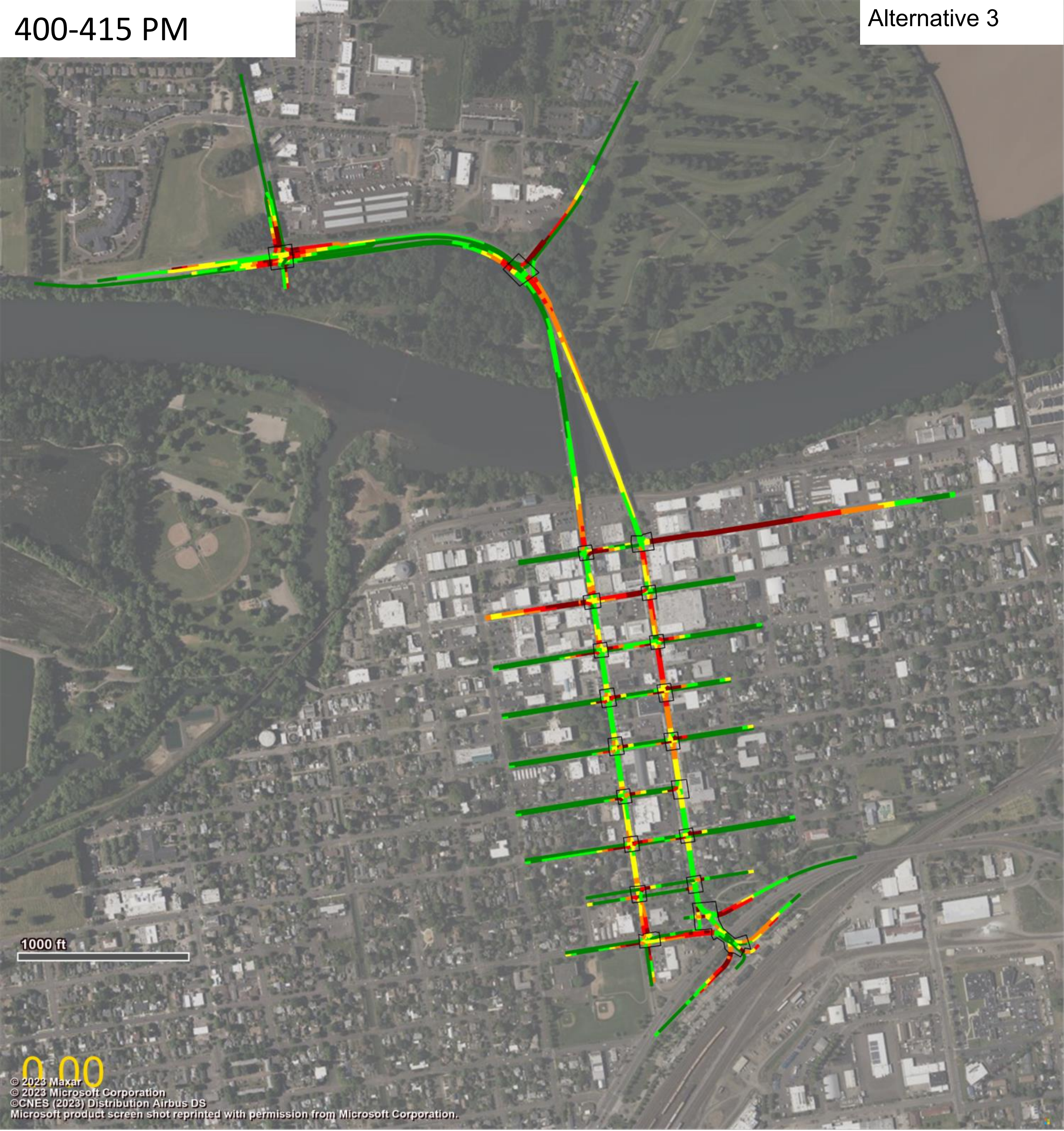
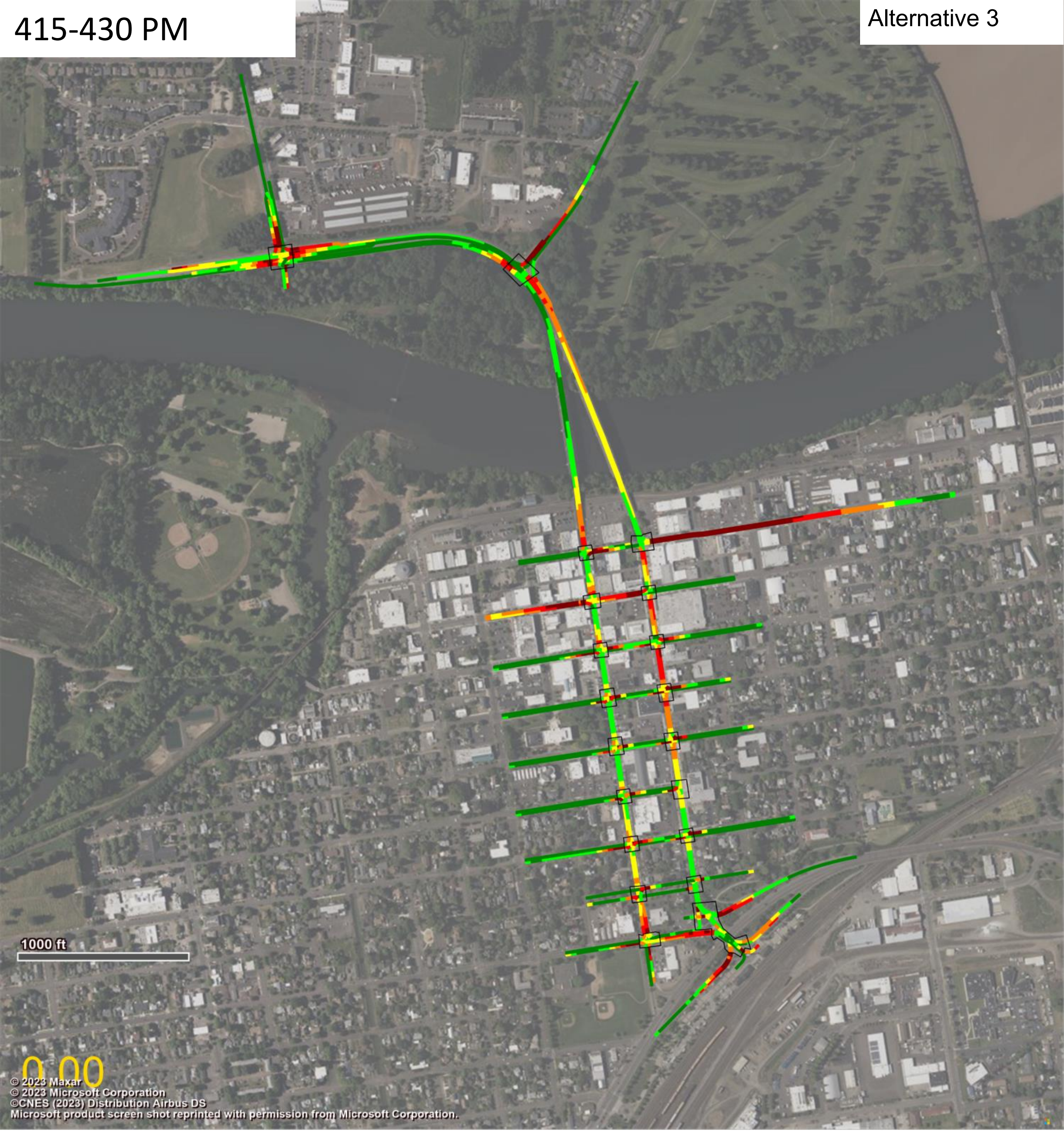
400-415 PM

Alternative 3





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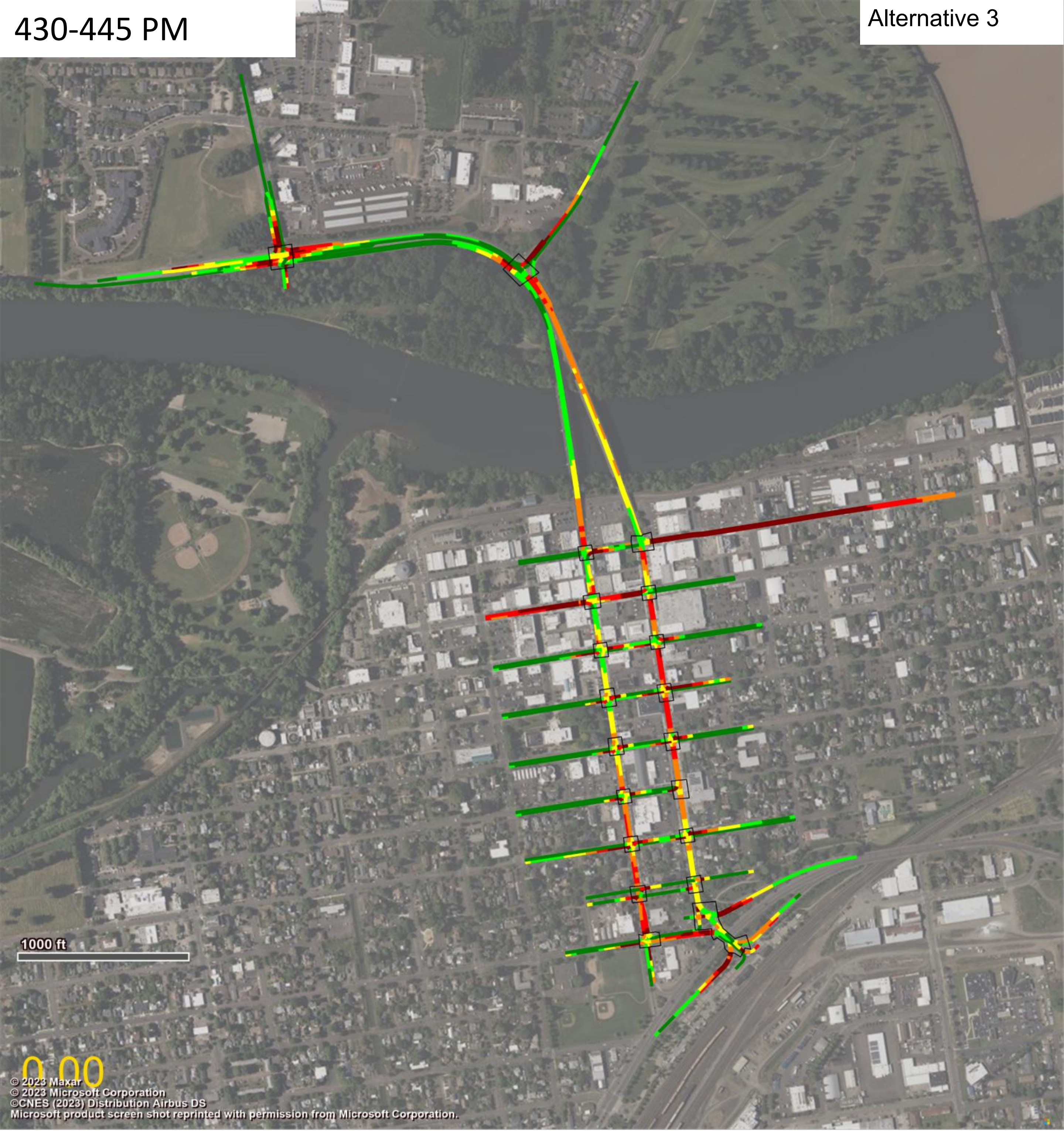

430-445 PM
Alternative 3
1000 ft
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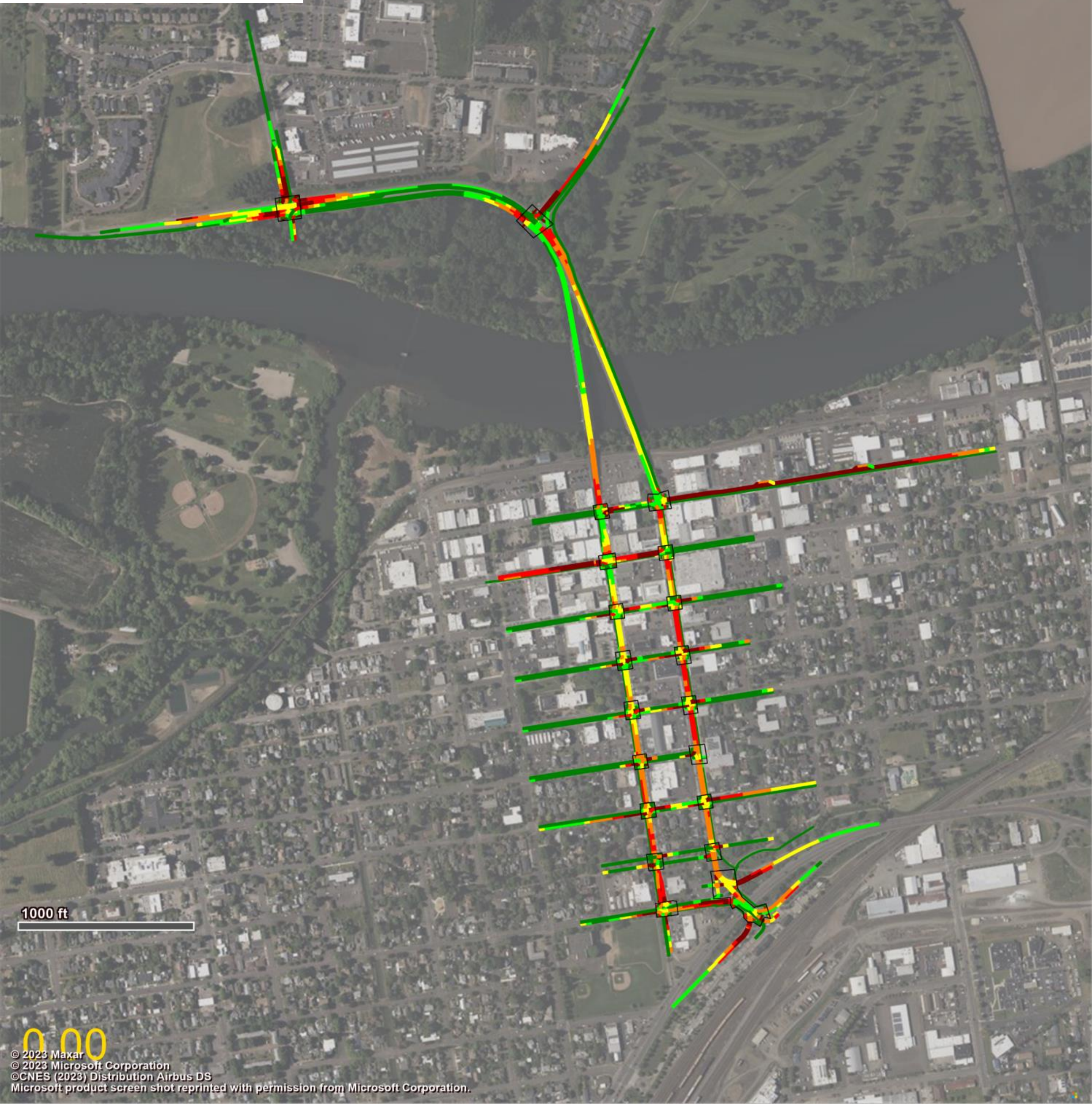
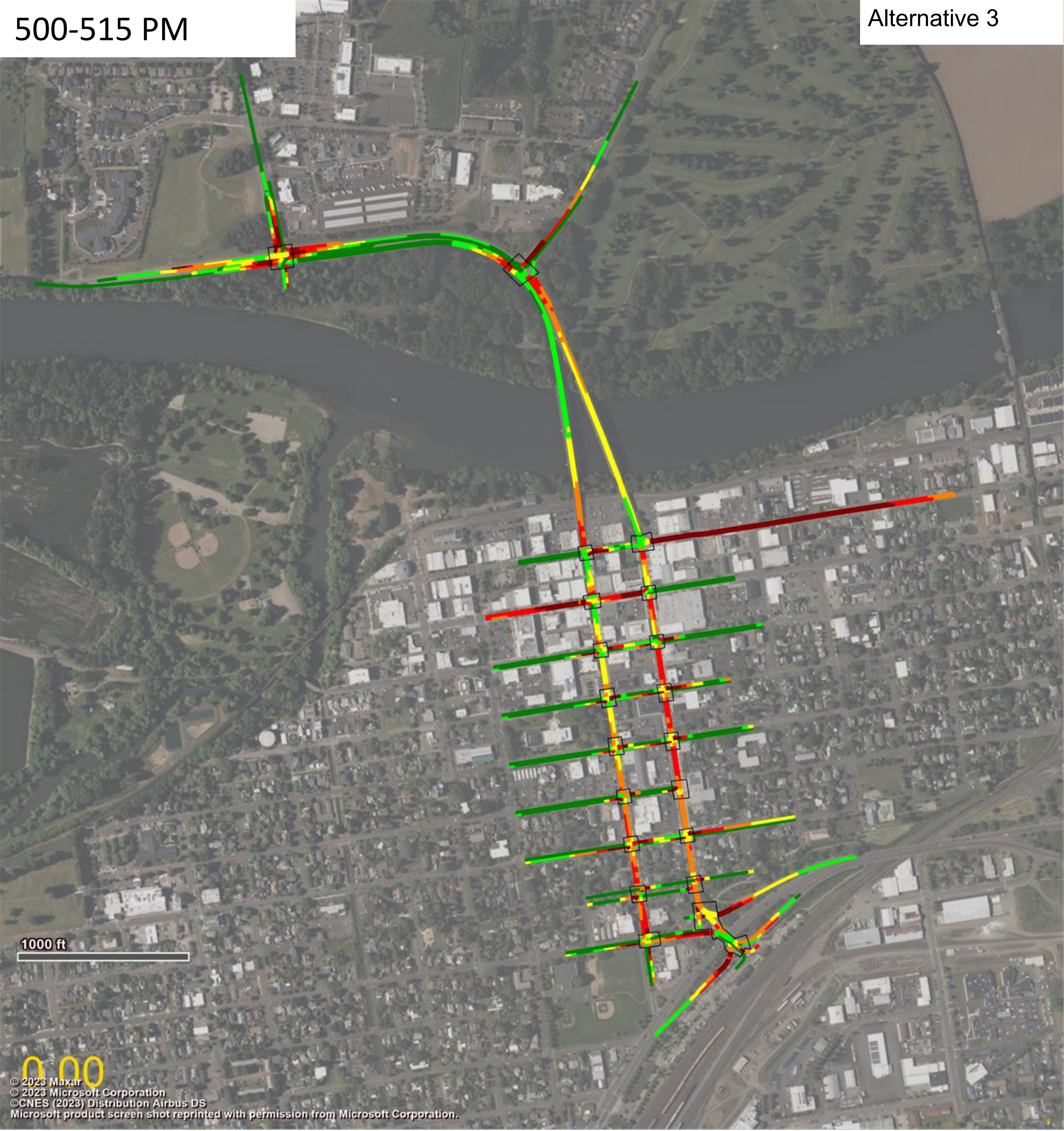
445-500 PM

Alternative 3





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Alternative 3
1000 ft
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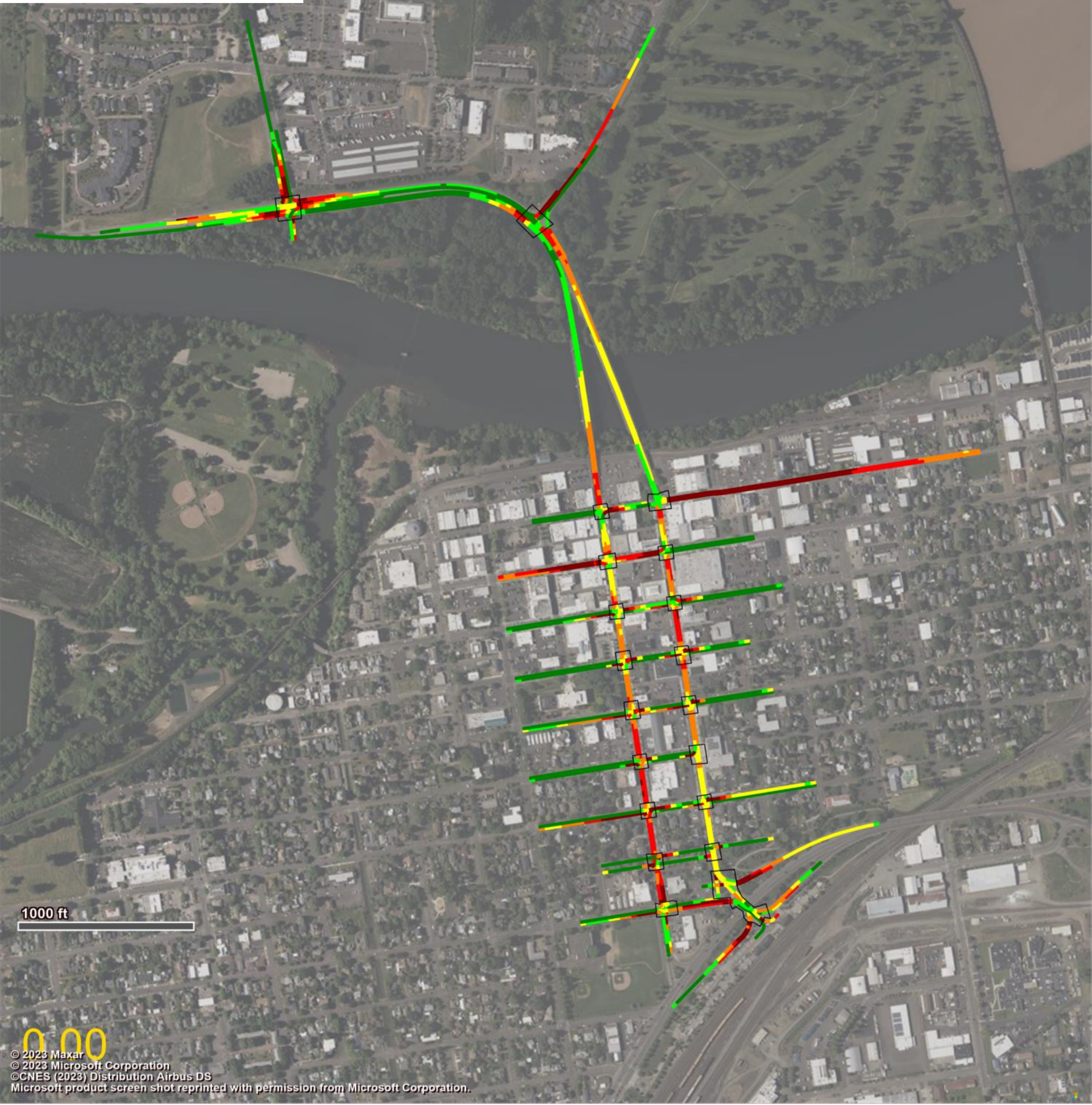
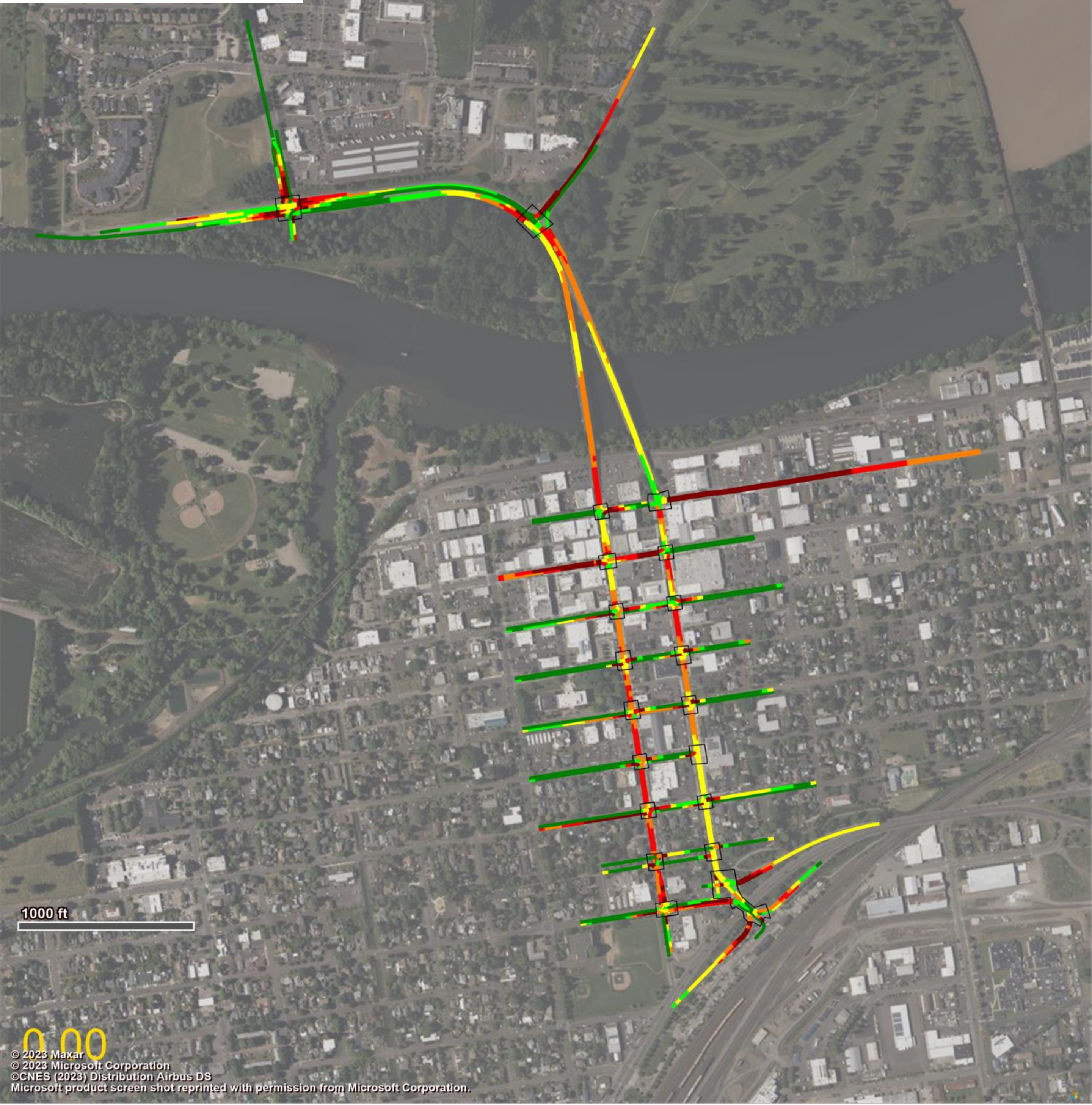
515-530 PM

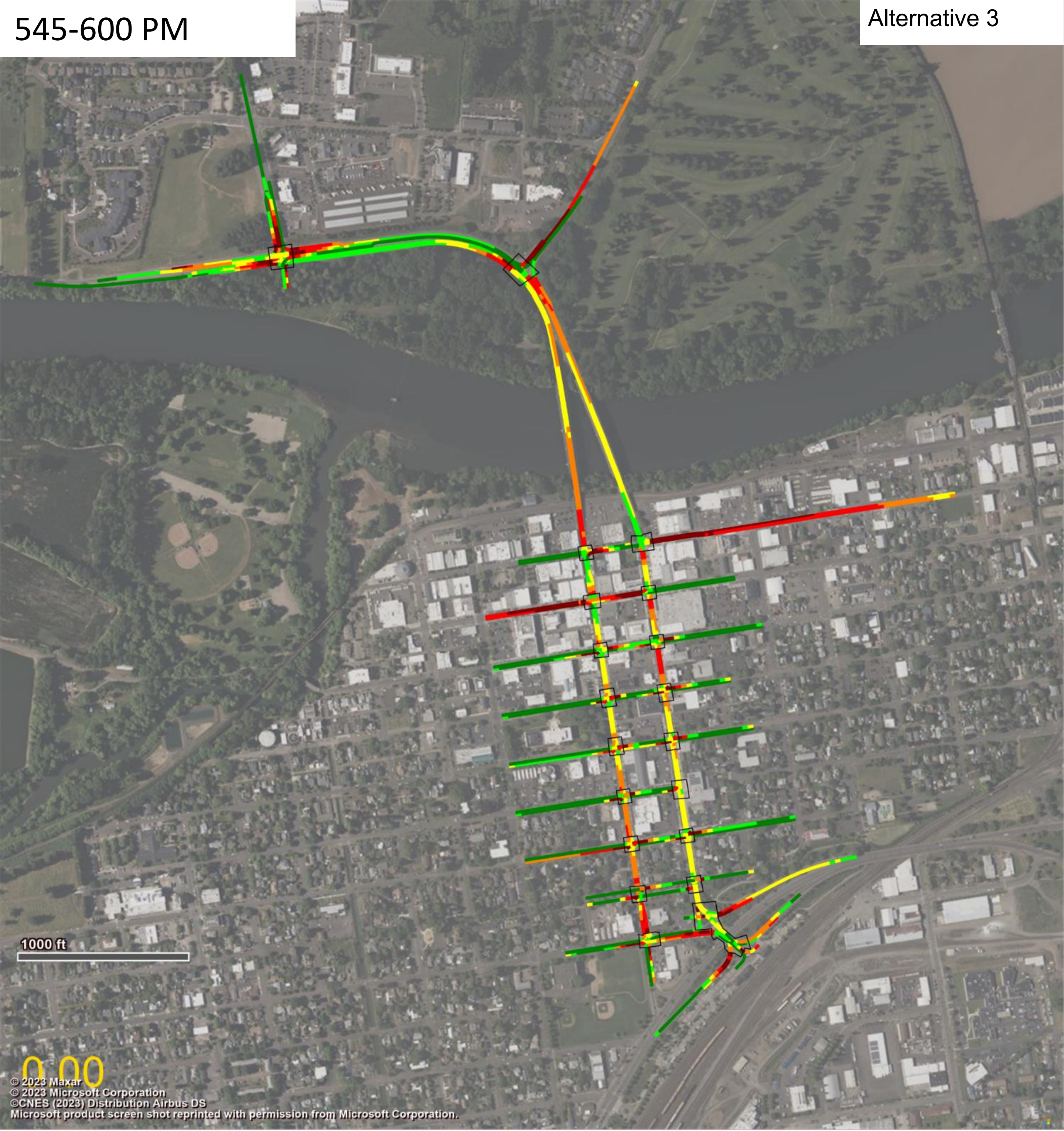
Alternative 3



530-545 PM

Alternative 3





545-600 PM
Alternative 3
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APPENDIX J: PROJECT BUNDLES TRAVEL TIME RESULTS

PROJECT BUNDLES 1, 2, AND 3

Project Bundles Vissim Travel Time Results											
Direction	From/To	Scenario	Travel Time (Seconds)								
			4:00-4:15	4:15-4:30	4:30-4:45	4:45-5:00	5:00-5:15	5:15-5:30	5:30-5:45	5:45-6:00	Peak Hour (4:45-5:45 PM)
Northbound	Lyon Street north of OR 99E SB Off-Ramp/US 20 at N Albany Rd	No-Build	227	243	272	250	245	239	241	216	244
		Bundle 1	250	300	346	332	311	311	266	227	305
		Bundle 2	268	308	354	340	336	337	329	326	335
		Bundle 3	242	269	315	303	270	276	266	233	279
Southbound	US 20 at N Albany Rd/OR 99E NB On-Ramp	No-Build	318	408	489	538	599	602	547	557	571
		Bundle 1	238	273	290	311	351	422	341	316	356
		Bundle 2	243	286	328	352	420	486	385	364	411
		Bundle 3	235	277	302	297	334	372	324	346	331

APPENDIX B – PROPOSED ALTERNATIVES SYNCHRO RESULTS

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	110	660	5	10	865	470	5	0	10	988	5	130
Future Volume (vph)	110	660	5	10	865	470	5	0	10	988	5	130
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Lane Width	12	12	12	12	12	16	12	12	12	12	12	16
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00		0.95	0.95	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.99		1.00		1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00		1.00	1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85		0.91		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.98		0.95	0.95	1.00
Satd. Flow (prot)	1646	3225		1662	3260	1653		1563		1533	1531	1616
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.98		0.95	0.95	1.00
Satd. Flow (perm)	1646	3225		1662	3260	1653		1563		1533	1531	1616
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	120	717	5	11	940	511	5	0	11	1074	5	141
RTOR Reduction (vph)	0	1	0	0	0	121	0	16	0	0	0	78
Lane Group Flow (vph)	120	721	0	11	940	390	0	0	0	591	488	63
Confl. Bikes (#/hr)						1						1
Heavy Vehicles (%)	1%	3%	0%	0%	2%	1%	0%	0%	0%	3%	17%	3%
Turn Type	Prot	NA		Prot	NA	pm+ov	Split	NA		Split	NA	Perm
Protected Phases	5	2		1	6	4	8	8		4	4	
Permitted Phases						6						4
Actuated Green, G (s)	13.0	57.3		1.7	46.0	100.4		1.7		54.4	54.4	54.4
Effective Green, g (s)	13.5	58.5		2.2	47.2	102.4		2.2		55.4	55.4	55.4
Actuated g/C Ratio	0.10	0.44		0.02	0.35	0.76		0.02		0.41	0.41	0.41
Clearance Time (s)	4.5	5.2		4.5	5.2	5.0		4.5		5.0	5.0	5.0
Vehicle Extension (s)	2.5	4.0		2.5	4.0	2.5		2.5		2.5	2.5	2.5
Lane Grp Cap (vph)	165	1404		27	1145	1260		25		632	631	666
v/s Ratio Prot	c0.07	0.22		0.01	c0.29	0.13		c0.00		c0.39	0.32	
v/s Ratio Perm						0.11						0.04
v/c Ratio	0.73	0.51		0.41	0.82	0.31		0.01		0.94	0.77	0.09
Uniform Delay, d1	58.6	27.6		65.4	39.7	5.0		65.0		37.7	34.0	24.1
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00		1.00	1.00	1.00
Incremental Delay, d2	13.9	0.4		7.1	5.1	0.1		0.1		21.1	5.6	0.0
Delay (s)	72.5	28.0		72.5	44.8	5.1		65.1		58.9	39.7	24.2
Level of Service	E	C		E	D	A		E		E	D	C
Approach Delay (s)		34.3			31.1			65.1			47.2	
Approach LOS		C			C			E			D	

Intersection Summary			
HCM 2000 Control Delay	37.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	134.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	79.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	35	1623	1285	575	562	60
Future Volume (vph)	35	1623	1285	575	562	60
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95	0.95	1.00	0.97	
Frpb, ped/bikes	1.00	1.00	1.00	0.98	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	1.00	0.85	0.99	
Flt Protected	0.95	1.00	1.00	1.00	0.96	
Satd. Flow (prot)	1583	3260	3260	1439	3170	
Flt Permitted	0.95	1.00	1.00	1.00	0.96	
Satd. Flow (perm)	1583	3260	3260	1439	3170	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	38	1764	1397	625	611	65
RTOR Reduction (vph)	0	0	0	0	7	0
Lane Group Flow (vph)	38	1764	1397	625	669	0
Confl. Bikes (#/hr)				7		1
Heavy Vehicles (%)	5%	2%	2%	1%	0%	8%
Turn Type	Prot	NA	NA	Free	Prot	
Protected Phases	1	6	2		8	
Permitted Phases		6		Free		
Actuated Green, G (s)	3.1	65.2	58.1	101.5	26.8	
Effective Green, g (s)	3.1	66.2	59.1	101.5	27.3	
Actuated g/C Ratio	0.03	0.65	0.58	1.00	0.27	
Clearance Time (s)	4.0	5.0	5.0		4.5	
Vehicle Extension (s)	2.5	4.7	6.0		2.5	
Lane Grp Cap (vph)	48	2126	1898	1439	852	
v/s Ratio Prot	0.02	c0.54	0.43		c0.21	
v/s Ratio Perm				0.43		
v/c Ratio	0.79	0.83	0.74	0.43	0.78	
Uniform Delay, d1	48.9	13.4	15.5	0.0	34.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	57.1	3.1	2.1	1.0	4.6	
Delay (s)	105.9	16.5	17.6	1.0	39.0	
Level of Service	F	B	B	A	D	
Approach Delay (s)		18.4	12.5		39.0	
Approach LOS		B	B		D	

Intersection Summary			
HCM 2000 Control Delay	18.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	101.5	Sum of lost time (s)	12.0
Intersection Capacity Utilization	74.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	35	115	0	0	0	0	0	2010	185
Future Volume (vph)	0	0	0	35	115	0	0	0	0	0	2010	185
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)					4.0						4.0	
Lane Util. Factor					0.95						0.95	
Frpb, ped/bikes					1.00						1.00	
Flpb, ped/bikes					0.99						1.00	
Frt					1.00						0.99	
Flt Protected					0.99						1.00	
Satd. Flow (prot)					3230						3216	
Flt Permitted					0.99						1.00	
Satd. Flow (perm)					3230						3216	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	38	125	0	0	0	0	0	2185	201
RTOR Reduction (vph)	0	0	0	0	10	0	0	0	0	0	9	0
Lane Group Flow (vph)	0	0	0	0	153	0	0	0	0	0	2377	0
Confl. Peds. (#/hr)	9		18	18		9	10		9	9		10
Confl. Bikes (#/hr)												2
Heavy Vehicles (%)	0%	0%	0%	2%	1%	0%	0%	0%	0%	0%	2%	1%
Turn Type				Perm	NA						NA	
Protected Phases					4						2	
Permitted Phases				4								
Actuated Green, G (s)					21.0						51.0	
Effective Green, g (s)					21.0						51.0	
Actuated g/C Ratio					0.26						0.64	
Clearance Time (s)					4.0						4.0	
Lane Grp Cap (vph)					847						2050	
v/s Ratio Prot											c0.74	
v/s Ratio Perm					0.05							
v/c Ratio					0.18						1.16	
Uniform Delay, d1					22.8						14.5	
Progression Factor					0.61						1.00	
Incremental Delay, d2					0.4						77.7	
Delay (s)					14.3						92.2	
Level of Service					B						F	
Approach Delay (s)		0.0			14.3			0.0			92.2	
Approach LOS		A			B			A			F	

Intersection Summary			
HCM 2000 Control Delay	87.3	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	90.1%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	85	580	65	1280	0	0	0	0
Future Volume (vph)	0	0	0	0	85	580	65	1280	0	0	0	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)					4.0	4.0		5.5				
Lane Util. Factor					1.00	0.88		0.95				
Frpb, ped/bikes					1.00	0.96		1.00				
Flpb, ped/bikes					1.00	1.00		1.00				
Frt					1.00	0.85		1.00				
Flt Protected					1.00	1.00		1.00				
Satd. Flow (prot)					1733	2491		3251				
Flt Permitted					1.00	1.00		1.00				
Satd. Flow (perm)					1733	2491		3251				
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	92	630	71	1391	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	36	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	92	630	0	1426	0	0	0	0
Confl. Peds. (#/hr)	30		2	2		30	4		2	2		4
Confl. Bikes (#/hr)						1			4			
Heavy Vehicles (%)	0%	0%	0%	0%	1%	1%	2%	2%	0%	0%	0%	0%
Turn Type					NA	custom	Perm	NA				
Protected Phases					4	3		6				
Permitted Phases						4	6					
Actuated Green, G (s)					32.6	32.6		37.9				
Effective Green, g (s)					32.6	32.6		37.9				
Actuated g/C Ratio					0.41	0.41		0.47				
Clearance Time (s)					4.0	4.0		5.5				
Vehicle Extension (s)					2.5	2.5		4.0				
Lane Grp Cap (vph)					706	1015		1540				
v/s Ratio Prot					0.05	c0.12						
v/s Ratio Perm						0.13		0.44				
v/c Ratio					0.13	0.62		0.93				
Uniform Delay, d1					14.8	18.8		19.7				
Progression Factor					1.00	1.00		0.69				
Incremental Delay, d2					0.4	2.9		8.5				
Delay (s)					15.2	21.7		22.1				
Level of Service					B	C		C				
Approach Delay (s)		0.0			20.8			22.1			0.0	
Approach LOS		A			C			C			A	

Intersection Summary			
HCM 2000 Control Delay	21.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	73.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	375	105	0	0	0	0	0	0	510	1535	0
Future Volume (vph)	0	375	105	0	0	0	0	0	0	510	1535	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)		4.0								1.0	4.0	
Lane Util. Factor		0.95								1.00	0.95	
Frpb, ped/bikes		1.00								1.00	1.00	
Flpb, ped/bikes		1.00								1.00	1.00	
Frt		0.97								1.00	1.00	
Flt Protected		1.00								0.95	1.00	
Satd. Flow (prot)		3173								1662	3260	
Flt Permitted		1.00								0.95	1.00	
Satd. Flow (perm)		3173								1662	3260	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	408	114	0	0	0	0	0	0	554	1668	0
RTOR Reduction (vph)	0	29	0	0	0	0	0	0	0	159	0	0
Lane Group Flow (vph)	0	493	0	0	0	0	0	0	0	395	1668	0
Confl. Peds. (#/hr)	1		2	2		1	1		1	1		1
Confl. Bikes (#/hr)			1									1
Heavy Vehicles (%)	0%	1%	1%	0%	0%	0%	0%	0%	0%	0%	2%	0%
Turn Type		NA								Prot	NA	
Protected Phases		8								5	2	
Permitted Phases												
Actuated Green, G (s)		11.7								29.7	60.3	
Effective Green, g (s)		11.7								30.7	60.3	
Actuated g/C Ratio		0.15								0.38	0.75	
Clearance Time (s)		4.0								2.0	4.0	
Vehicle Extension (s)		2.5								2.5	4.0	
Lane Grp Cap (vph)		464								637	2457	
v/s Ratio Prot		c0.16								0.24	c0.51	
v/s Ratio Perm												
v/c Ratio		1.06								0.62	0.68	
Uniform Delay, d1		34.1								19.9	5.0	
Progression Factor		1.00								1.43	0.11	
Incremental Delay, d2		59.3								0.1	0.1	
Delay (s)		93.5								28.7	0.7	
Level of Service		F								C	A	
Approach Delay (s)		93.5			0.0			0.0			7.7	
Approach LOS		F			A			A			A	

Intersection Summary			
HCM 2000 Control Delay	24.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	90.1%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	255	630	0	0	0	0	0	1090	30	0	0	0
Future Volume (vph)	255	630	0	0	0	0	0	1090	30	0	0	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)		4.0						4.0				
Lane Util. Factor		0.95						0.95				
Frpb, ped/bikes		1.00						1.00				
Flpb, ped/bikes		1.00						1.00				
Frt		1.00						1.00				
Flt Protected		0.99						1.00				
Satd. Flow (prot)		3244						3247				
Flt Permitted		0.99						1.00				
Satd. Flow (perm)		3244						3247				
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	277	685	0	0	0	0	0	1185	33	0	0	0
RTOR Reduction (vph)	0	55	0	0	0	0	0	3	0	0	0	0
Lane Group Flow (vph)	0	907	0	0	0	0	0	1215	0	0	0	0
Confl. Peds. (#/hr)	1		1	1		1	1		1	1		1
Confl. Bikes (#/hr)			2									1
Heavy Vehicles (%)	1%	1%	0%	0%	0%	0%	0%	2%	0%	0%	0%	0%
Turn Type	Perm	NA						NA				
Protected Phases		8						6				
Permitted Phases	8											
Actuated Green, G (s)		21.0						51.0				
Effective Green, g (s)		21.0						51.0				
Actuated g/C Ratio		0.26						0.64				
Clearance Time (s)		4.0						4.0				
Lane Grp Cap (vph)		851						2069				
v/s Ratio Prot								c0.37				
v/s Ratio Perm		0.28										
v/c Ratio		1.07						0.59				
Uniform Delay, d1		29.5						8.4				
Progression Factor		0.69						0.20				
Incremental Delay, d2		47.4						1.0				
Delay (s)		67.9						2.7				
Level of Service		E						A				
Approach Delay (s)		67.9			0.0			2.7			0.0	
Approach LOS		E			A			A			A	

Intersection Summary			
HCM 2000 Control Delay	31.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	70.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	NBL	NEL
Lane Configurations				
Traffic Volume (vph)	820	5	5	420
Future Volume (vph)	820	5	5	420
Ideal Flow (vphpl)	1750	1750	1750	1750
Total Lost time (s)	6.5		6.5	6.5
Lane Util. Factor	0.95		1.00	0.97
Frt	1.00		1.00	1.00
Flt Protected	1.00		1.00	0.95
Satd. Flow (prot)	3322		1733	3193
Flt Permitted	1.00		1.00	0.95
Satd. Flow (perm)	3322		1733	3193
Peak-hour factor, PHF	0.92	0.92	0.92	0.92
Adj. Flow (vph)	891	5	5	457
RTOR Reduction (vph)	0	0	0	0
Lane Group Flow (vph)	896	0	5	457
Heavy Vehicles (%)	0%	1%	1%	1%
Turn Type	NA		Prot	Prot
Protected Phases	2		3	4
Permitted Phases				
Actuated Green, G (s)	35.3		9.9	19.1
Effective Green, g (s)	35.3		9.9	19.1
Actuated g/C Ratio	0.42		0.12	0.23
Clearance Time (s)	6.5		6.5	6.5
Vehicle Extension (s)	6.0		2.5	2.5
Lane Grp Cap (vph)	1399		204	727
v/s Ratio Prot	c0.27		c0.00	c0.14
v/s Ratio Perm				
v/c Ratio	0.64		0.02	0.63
Uniform Delay, d1	19.2		32.7	29.2
Progression Factor	1.00		1.00	1.00
Incremental Delay, d2	1.7		0.0	1.5
Delay (s)	20.9		32.7	30.6
Level of Service	C		C	C
Approach Delay (s)	20.9		32.7	30.6
Approach LOS	C		C	C

Intersection Summary			
HCM 2000 Control Delay	24.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	83.8	Sum of lost time (s)	21.0
Intersection Capacity Utilization	57.4%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	SEL	SER
Lane Configurations										
Traffic Volume (vph)	0	0	0	0	5	850	425	0	0	0
Future Volume (vph)	0	0	0	0	5	850	425	0	0	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)					4.0	4.0	6.5			
Lane Util. Factor					0.95	0.95	0.97			
Frt					0.85	0.85	1.00			
Flt Protected					1.00	1.00	1.00			
Satd. Flow (prot)					1402	1399	3361			
Flt Permitted					1.00	1.00	1.00			
Satd. Flow (perm)					1402	1399	3361			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	5	924	462	0	0	0
RTOR Reduction (vph)	0	0	0	0	228	228	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	239	234	462	0	0	0
Heavy Vehicles (%)	0%	0%	0%	0%	1%	1%	1%	0%	2%	2%
Turn Type					NA	Prot	Prot			
Protected Phases					6	6	3 8 5			
Permitted Phases										
Actuated Green, G (s)					28.4	28.4	47.4			
Effective Green, g (s)					28.4	28.4	44.4			
Actuated g/C Ratio					0.34	0.34	0.53			
Clearance Time (s)					4.0	4.0				
Vehicle Extension (s)					4.0	4.0				
Lane Grp Cap (vph)					475	474	1780			
v/s Ratio Prot					c0.17	0.17	c0.14			
v/s Ratio Perm										
v/c Ratio					0.50	0.49	0.26			
Uniform Delay, d1					22.1	22.0	10.7			
Progression Factor					1.00	1.00	0.00			
Incremental Delay, d2					1.1	1.1	0.1			
Delay (s)					23.2	23.1	0.1			
Level of Service					C	C	A			
Approach Delay (s)		0.0			23.2		0.1		0.0	
Approach LOS		A			C		A		A	

Intersection Summary			
HCM 2000 Control Delay	15.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	83.8	Sum of lost time (s)	21.0
Intersection Capacity Utilization	41.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	110	840	0	5	803	855	5	5	10	643	10	127
Future Volume (vph)	110	840	0	5	803	855	5	5	10	643	10	127
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Lane Width	12	12	12	12	12	16	12	12	12	12	12	16
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00		0.95	0.95	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.99		1.00		1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00		1.00	1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85		0.93		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.99		0.95	1.00	1.00
Satd. Flow (prot)	1646	3228		1662	3260	1655		1612		1519	1421	1616
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.99		0.95	1.00	1.00
Satd. Flow (perm)	1646	3228		1662	3260	1655		1612		1519	1421	1616
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	113	866	0	5	828	881	5	5	10	663	10	131
RTOR Reduction (vph)	0	0	0	0	0	111	0	10	0	0	0	72
Lane Group Flow (vph)	113	866	0	5	828	770	0	10	0	663	10	59
Confl. Bikes (#/hr)						1						1
Heavy Vehicles (%)	1%	3%	0%	0%	2%	1%	0%	0%	0%	4%	17%	3%
Turn Type	Prot	NA		Prot	NA	pm+ov	Split	NA		Split	NA	Perm
Protected Phases	5	2		1	6	4	8	8		4	4	
Permitted Phases						6						4
Actuated Green, G (s)	12.4	53.7		0.9	42.2	103.5		2.7		61.3	61.3	61.3
Effective Green, g (s)	12.9	54.9		1.4	43.4	105.5		3.2		62.3	62.3	62.3
Actuated g/C Ratio	0.09	0.40		0.01	0.31	0.77		0.02		0.45	0.45	0.45
Clearance Time (s)	4.5	5.2		4.5	5.2	5.0		4.5		5.0	5.0	5.0
Vehicle Extension (s)	2.5	4.0		2.5	4.0	2.5		2.5		2.5	2.5	2.5
Lane Grp Cap (vph)	154	1286		16	1026	1267		37		686	642	730
v/s Ratio Prot	c0.07	0.27		0.00	c0.25	0.27		c0.01		c0.44	0.01	
v/s Ratio Perm						0.19						0.04
v/c Ratio	0.73	0.67		0.31	0.81	0.61		0.28		0.97	0.02	0.08
Uniform Delay, d1	60.8	34.1		67.7	43.4	7.1		66.2		36.7	20.8	21.5
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00		1.00	1.00	1.00
Incremental Delay, d2	15.6	1.5		8.0	5.0	0.7		2.9		26.0	0.0	0.0
Delay (s)	76.4	35.6		75.7	48.3	7.8		69.1		62.7	20.8	21.5
Level of Service	E	D		E	D	A		E		E	C	C
Approach Delay (s)		40.3			27.6			69.1			55.5	
Approach LOS		D			C			E			E	

Intersection Summary			
HCM 2000 Control Delay	37.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	137.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	78.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	45	1448	1645	800	582	18
Future Volume (vph)	45	1448	1645	800	582	18
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95	0.95	1.00	0.97	
Frpb, ped/bikes	1.00	1.00	1.00	0.98	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	1.00	0.85	1.00	
Flt Protected	0.95	1.00	1.00	1.00	0.95	
Satd. Flow (prot)	1583	3228	3260	1439	3213	
Flt Permitted	0.95	1.00	1.00	1.00	0.95	
Satd. Flow (perm)	1583	3228	3260	1439	3213	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	46	1493	1696	825	600	19
RTOR Reduction (vph)	0	0	0	0	2	0
Lane Group Flow (vph)	46	1493	1696	825	617	0
Confl. Bikes (#/hr)				7		1
Heavy Vehicles (%)	5%	3%	2%	1%	0%	8%
Turn Type	Prot	NA	NA	Free	Prot	
Protected Phases	1	6	2		8	
Permitted Phases		6		Free		
Actuated Green, G (s)	4.4	76.7	68.3	111.6	25.4	
Effective Green, g (s)	4.4	77.7	69.3	111.6	25.9	
Actuated g/C Ratio	0.04	0.70	0.62	1.00	0.23	
Clearance Time (s)	4.0	5.0	5.0		4.5	
Vehicle Extension (s)	2.5	4.7	6.0		2.5	
Lane Grp Cap (vph)	62	2247	2024	1439	745	
v/s Ratio Prot	0.03	0.46	c0.52		c0.19	
v/s Ratio Perm				c0.57		
v/c Ratio	0.74	0.66	0.84	0.57	0.83	
Uniform Delay, d1	53.0	9.6	16.7	0.0	40.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	35.9	0.9	3.7	1.7	7.4	
Delay (s)	89.0	10.5	20.5	1.7	48.2	
Level of Service	F	B	C	A	D	
Approach Delay (s)		12.9	14.3		48.2	
Approach LOS		B	B		D	

Intersection Summary			
HCM 2000 Control Delay	18.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	111.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	74.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	75	140	0	0	0	0	0	1855	175
Future Volume (vph)	0	0	0	75	140	0	0	0	0	0	1855	175
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)					4.0						4.0	
Lane Util. Factor					0.95						0.95	
Frpb, ped/bikes					1.00						1.00	
Flpb, ped/bikes					0.99						1.00	
Frt					1.00						0.99	
Flt Protected					0.98						1.00	
Satd. Flow (prot)					3196						3215	
Flt Permitted					0.98						1.00	
Satd. Flow (perm)					3196						3215	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	0	0	0	77	144	0	0	0	0	0	1912	180
RTOR Reduction (vph)	0	0	0	0	19	0	0	0	0	0	9	0
Lane Group Flow (vph)	0	0	0	0	202	0	0	0	0	0	2083	0
Confl. Peds. (#/hr)	9		18	18		9	10		9	9		10
Confl. Bikes (#/hr)												2
Heavy Vehicles (%)	0%	0%	0%	2%	1%	0%	0%	0%	0%	0%	2%	1%
Turn Type				Perm	NA						NA	
Protected Phases					4						2	
Permitted Phases				4								
Actuated Green, G (s)					17.0						55.0	
Effective Green, g (s)					17.0						55.0	
Actuated g/C Ratio					0.21						0.69	
Clearance Time (s)					4.0						4.0	
Lane Grp Cap (vph)					679						2210	
v/s Ratio Prot											c0.65	
v/s Ratio Perm					0.06							
v/c Ratio					0.30						0.94	
Uniform Delay, d1					26.5						11.1	
Progression Factor					1.14						1.00	
Incremental Delay, d2					0.9						9.7	
Delay (s)					31.0						20.8	
Level of Service					C						C	
Approach Delay (s)		0.0			31.0			0.0			20.8	
Approach LOS		A			C			A			C	

Intersection Summary			
HCM 2000 Control Delay	21.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	82.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	130	745	85	1700	0	0	0	0
Future Volume (vph)	0	0	0	0	130	745	85	1700	0	0	0	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)					4.0	4.0		7.0				
Lane Util. Factor					1.00	0.88		0.95				
Frpb, ped/bikes					1.00	1.00		1.00				
Flpb, ped/bikes					1.00	1.00		1.00				
Frt					1.00	0.85		1.00				
Flt Protected					1.00	1.00		1.00				
Satd. Flow (prot)					1559	2592		3252				
Flt Permitted					1.00	1.00		1.00				
Satd. Flow (perm)					1559	2592		3252				
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	0	0	0	137	784	89	1789	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	37	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	137	784	0	1841	0	0	0	0
Confl. Peds. (#/hr)	30		2	2		30	4		2	2		4
Confl. Bikes (#/hr)						1			4			
Heavy Vehicles (%)	0%	0%	0%	0%	1%	1%	2%	2%	0%	0%	0%	0%
Parking (#/hr)					0							
Turn Type					NA	custom	Perm	NA				
Protected Phases					4	3		6				
Permitted Phases							6					
Actuated Green, G (s)					32.2	24.0		36.8				
Effective Green, g (s)					32.2	24.0		36.8				
Actuated g/C Ratio					0.40	0.30		0.46				
Clearance Time (s)					4.0	4.0		7.0				
Vehicle Extension (s)					2.5	2.5		4.0				
Lane Grp Cap (vph)					627	777		1495				
v/s Ratio Prot					c0.09	c0.30						
v/s Ratio Perm								0.57				
v/c Ratio					0.22	1.01		1.23				
Uniform Delay, d1					15.7	28.0		21.6				
Progression Factor					1.00	1.00		0.61				
Incremental Delay, d2					0.8	34.5		106.9				
Delay (s)					16.5	62.5		120.0				
Level of Service					B	E		F				
Approach Delay (s)		0.0			55.7			120.0			0.0	
Approach LOS		A			E			F			A	

Intersection Summary			
HCM 2000 Control Delay	98.9	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.09		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	93.9%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	460	140	0	0	0	0	0	0	490	1440	0
Future Volume (vph)	0	460	140	0	0	0	0	0	0	490	1440	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)		4.0								4.0	4.0	
Lane Util. Factor		0.95								1.00	0.95	
Frpb, ped/bikes		1.00								1.00	1.00	
Flpb, ped/bikes		1.00								1.00	1.00	
Frt		0.96								1.00	1.00	
Flt Protected		1.00								0.95	1.00	
Satd. Flow (prot)		3165								1662	3260	
Flt Permitted		1.00								0.95	1.00	
Satd. Flow (perm)		3165								1662	3260	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	479	146	0	0	0	0	0	0	510	1500	0
RTOR Reduction (vph)	0	31	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	594	0	0	0	0	0	0	0	510	1500	0
Confl. Peds. (#/hr)	1		2	2		1	1		1	1		1
Confl. Bikes (#/hr)			1									1
Heavy Vehicles (%)	0%	1%	1%	0%	0%	0%	0%	0%	0%	0%	2%	0%
Turn Type		NA								Prot	NA	
Protected Phases		8								5	2	
Permitted Phases												
Actuated Green, G (s)		22.0								58.0	50.0	
Effective Green, g (s)		22.0								58.0	50.0	
Actuated g/C Ratio		0.28								0.72	0.62	
Clearance Time (s)		4.0								4.0	4.0	
Vehicle Extension (s)		2.5								2.5	4.0	
Lane Grp Cap (vph)		870								1204	2037	
v/s Ratio Prot		c0.19								0.31	c0.46	
v/s Ratio Perm												
v/c Ratio		0.68								0.42	0.74	
Uniform Delay, d1		25.9								4.4	10.4	
Progression Factor		1.00								0.68	0.40	
Incremental Delay, d2		4.3								0.4	1.0	
Delay (s)		30.2								3.4	5.1	
Level of Service		C								A	A	
Approach Delay (s)		30.2			0.0			0.0			4.7	
Approach LOS		C			A			A			A	

Intersection Summary			
HCM 2000 Control Delay	10.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	82.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	285	665	0	0	0	0	0	1500	65	0	0	0
Future Volume (vph)	285	665	0	0	0	0	0	1500	65	0	0	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)		7.0						4.0				
Lane Util. Factor		0.95						0.95				
Frpb, ped/bikes		1.00						1.00				
Flpb, ped/bikes		1.00						1.00				
Frt		1.00						0.99				
Flt Protected		0.99						1.00				
Satd. Flow (prot)		3242						3240				
Flt Permitted		0.99						1.00				
Satd. Flow (perm)		3242						3240				
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	297	693	0	0	0	0	0	1562	68	0	0	0
RTOR Reduction (vph)	0	19	0	0	0	0	0	4	0	0	0	0
Lane Group Flow (vph)	0	971	0	0	0	0	0	1627	0	0	0	0
Confl. Peds. (#/hr)	1		1	1		1	1		1	1		1
Confl. Bikes (#/hr)			2									1
Heavy Vehicles (%)	1%	1%	0%	0%	0%	0%	0%	2%	0%	0%	0%	0%
Turn Type	Perm	NA						NA				
Protected Phases		8						6				
Permitted Phases	8											
Actuated Green, G (s)		23.0						46.0				
Effective Green, g (s)		23.0						46.0				
Actuated g/C Ratio		0.29						0.58				
Clearance Time (s)		7.0						4.0				
Lane Grp Cap (vph)		932						1863				
v/s Ratio Prot								c0.50				
v/s Ratio Perm		0.30										
v/c Ratio		1.04						0.87				
Uniform Delay, d1		28.5						14.5				
Progression Factor		1.09						0.39				
Incremental Delay, d2		38.6						3.7				
Delay (s)		69.8						9.4				
Level of Service		E						A				
Approach Delay (s)		69.8			0.0			9.4			0.0	
Approach LOS		E			A			A			A	

Intersection Summary			
HCM 2000 Control Delay	32.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	88.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	NBL	NEL
Lane Configurations				
Traffic Volume (vph)	0	1285	0	605
Future Volume (vph)	0	1285	0	605
Ideal Flow (vphpl)	1750	1750	1750	1750
Total Lost time (s)	6.5			6.5
Lane Util. Factor	0.95			0.97
Frt	0.85			1.00
Flt Protected	1.00			0.95
Satd. Flow (prot)	2798			3072
Flt Permitted	1.00			0.95
Satd. Flow (perm)	2798			3072
Peak-hour factor, PHF	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1397	0	658
RTOR Reduction (vph)	0	0	0	0
Lane Group Flow (vph)	1397	0	0	658
Heavy Vehicles (%)	0%	1%	1%	5%
Turn Type	NA		Prot	Prot
Protected Phases	2		3	4
Permitted Phases				
Actuated Green, G (s)	62.9			26.5
Effective Green, g (s)	62.9			26.5
Actuated g/C Ratio	0.50			0.21
Clearance Time (s)	6.5			6.5
Vehicle Extension (s)	6.0			2.5
Lane Grp Cap (vph)	1396			646
v/s Ratio Prot	c0.50			c0.21
v/s Ratio Perm				
v/c Ratio	1.87dr			1.02
Uniform Delay, d1	31.6			49.8
Progression Factor	1.00			1.00
Incremental Delay, d2	24.3			40.2
Delay (s)	55.8			89.9
Level of Service	E			F
Approach Delay (s)	55.8		0.0	89.9
Approach LOS	E		A	F

Intersection Summary			
HCM 2000 Control Delay	66.7	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	126.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	74.9%	ICU Level of Service	D
Analysis Period (min)	15		
dr Defacto Right Lane. Recode with 1 though lane as a right lane.			
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL2	NBL	NBR	SEL	SER
Lane Configurations											
Traffic Volume (vph)	0	0	0	0	5	895	5	600	0	0	0
Future Volume (vph)	0	0	0	0	5	895	5	600	0	0	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)					4.0	4.0		6.5			
Lane Util. Factor					0.95	0.95		1.00			
Frt					0.85	0.85		1.00			
Flt Protected					1.00	1.00		1.00			
Satd. Flow (prot)					1402	1399		1733			
Flt Permitted					1.00	1.00		1.00			
Satd. Flow (perm)					1402	1399		1733			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	5	973	5	652	0	0	0
RTOR Reduction (vph)	0	0	0	0	89	89	0	36	0	0	0
Lane Group Flow (vph)	0	0	0	0	403	397	0	621	0	0	0
Heavy Vehicles (%)	0%	0%	0%	0%	1%	1%	0%	1%	0%	2%	2%
Turn Type					NA	Prot	Perm	Prot			
Protected Phases					6	6		3 8 5			
Permitted Phases							3 8 5				
Actuated Green, G (s)					59.4	59.4		58.6			
Effective Green, g (s)					59.4	59.4		55.6			
Actuated g/C Ratio					0.47	0.47		0.44			
Clearance Time (s)					4.0	4.0					
Vehicle Extension (s)					4.0	4.0					
Lane Grp Cap (vph)					660	659		764			
v/s Ratio Prot					c0.29	0.28					
v/s Ratio Perm								0.36			
v/c Ratio					0.61	0.60		0.81			
Uniform Delay, d1					24.7	24.6		30.7			
Progression Factor					1.00	1.00		1.38			
Incremental Delay, d2					1.9	1.8		0.6			
Delay (s)					26.6	26.4		42.9			
Level of Service					C	C		D			
Approach Delay (s)		0.0			26.5			42.9		0.0	
Approach LOS		A			C			D		A	

Intersection Summary			
HCM 2000 Control Delay	33.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	126.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	65.5%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	110	840	0	5	805	855	5	5	10	625	10	125
Future Volume (vph)	110	840	0	5	805	855	5	5	10	625	10	125
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Lane Width	12	12	12	12	12	16	12	12	12	12	12	16
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00		0.95	0.95	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.99		1.00		1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00		1.00	1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85		0.93		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.99		0.95	1.00	1.00
Satd. Flow (prot)	1646	3228		1662	3260	1655		1612		1564	1421	1616
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.99		0.95	1.00	1.00
Satd. Flow (perm)	1646	3228		1662	3260	1655		1612		1564	1421	1616
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	113	866	0	5	830	881	5	5	10	644	10	129
RTOR Reduction (vph)	0	0	0	0	0	114	0	10	0	0	0	72
Lane Group Flow (vph)	113	866	0	5	830	767	0	10	0	644	10	57
Confl. Bikes (#/hr)						1						1
Heavy Vehicles (%)	1%	3%	0%	0%	2%	1%	0%	0%	0%	1%	17%	3%
Turn Type	Prot	NA		Prot	NA	pm+ov	Split	NA		Split	NA	Perm
Protected Phases	5	2		1	6	4	8	8		4	4	
Permitted Phases						6						4
Actuated Green, G (s)	12.3	52.9		0.9	41.5	98.9		2.6		57.4	57.4	57.4
Effective Green, g (s)	12.8	54.1		1.4	42.7	100.9		3.1		58.4	58.4	58.4
Actuated g/C Ratio	0.10	0.41		0.01	0.32	0.76		0.02		0.44	0.44	0.44
Clearance Time (s)	4.5	5.2		4.5	5.2	5.0		4.5		5.0	5.0	5.0
Vehicle Extension (s)	2.5	4.0		2.5	4.0	2.5		2.5		2.5	2.5	2.5
Lane Grp Cap (vph)	158	1313		17	1046	1255		37		686	623	709
v/s Ratio Prot	c0.07	0.27		0.00	c0.25	0.27		c0.01		c0.41	0.01	
v/s Ratio Perm						0.20						0.04
v/c Ratio	0.72	0.66		0.29	0.79	0.61		0.28		0.94	0.02	0.08
Uniform Delay, d1	58.3	32.0		65.3	41.1	7.2		63.8		35.6	21.1	21.7
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00		1.00	1.00	1.00
Incremental Delay, d2	13.4	1.3		6.9	4.5	0.8		2.9		20.5	0.0	0.0
Delay (s)	71.7	33.3		72.2	45.6	8.0		66.8		56.1	21.1	21.7
Level of Service	E	C		E	D	A		E		E	C	C
Approach Delay (s)		37.8			26.4			66.8			50.0	
Approach LOS		D			C			E			D	

Intersection Summary			
HCM 2000 Control Delay	35.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	133.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	78.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	35	1605	1285	575	590	60
Future Volume (vph)	35	1605	1285	575	590	60
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95	0.95	1.00	0.97	
Frpb, ped/bikes	1.00	1.00	1.00	0.98	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	1.00	0.85	0.99	
Flt Protected	0.95	1.00	1.00	1.00	0.96	
Satd. Flow (prot)	1583	3260	3260	1439	3090	
Flt Permitted	0.95	1.00	1.00	1.00	0.96	
Satd. Flow (perm)	1583	3260	3260	1439	3090	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	38	1745	1397	625	641	65
RTOR Reduction (vph)	0	0	0	0	7	0
Lane Group Flow (vph)	38	1745	1397	625	699	0
Confl. Bikes (#/hr)				7		1
Heavy Vehicles (%)	5%	2%	2%	1%	3%	8%
Turn Type	Prot	NA	NA	Free	Prot	
Protected Phases	1	6	2		8	
Permitted Phases		6		Free		
Actuated Green, G (s)	3.1	65.7	58.6	103.4	28.2	
Effective Green, g (s)	3.1	66.7	59.6	103.4	28.7	
Actuated g/C Ratio	0.03	0.65	0.58	1.00	0.28	
Clearance Time (s)	4.0	5.0	5.0		4.5	
Vehicle Extension (s)	2.5	4.7	6.0		2.5	
Lane Grp Cap (vph)	47	2102	1879	1439	857	
v/s Ratio Prot	0.02	c0.54	0.43		c0.23	
v/s Ratio Perm				0.43		
v/c Ratio	0.81	0.83	0.74	0.43	0.82	
Uniform Delay, d1	49.9	14.0	16.2	0.0	34.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	62.0	3.2	2.2	1.0	5.9	
Delay (s)	111.9	17.3	18.4	1.0	40.8	
Level of Service	F	B	B	A	D	
Approach Delay (s)		19.3	13.0		40.8	
Approach LOS		B	B		D	

Intersection Summary			
HCM 2000 Control Delay	19.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	103.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	75.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	85	580	65	1280	0	0	0	0
Future Volume (vph)	0	0	0	0	85	580	65	1280	0	0	0	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)					4.0	4.0		5.5				
Lane Util. Factor					0.95	0.95		0.95				
Frpb, ped/bikes					0.96	0.98		1.00				
Flpb, ped/bikes					1.00	1.00		1.00				
Frt					0.88	0.85		1.00				
Flt Protected					1.00	1.00		1.00				
Satd. Flow (prot)					1403	1365		3251				
Flt Permitted					1.00	1.00		1.00				
Satd. Flow (perm)					1403	1365		3251				
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	92	630	71	1391	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	35	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	407	315	0	1427	0	0	0	0
Confl. Peds. (#/hr)	30		2	2		30	4		2	2		4
Confl. Bikes (#/hr)						1			4			
Heavy Vehicles (%)	0%	0%	0%	0%	1%	1%	2%	2%	0%	0%	0%	0%
Turn Type					NA	custom	Perm	NA				
Protected Phases					4	3		6				
Permitted Phases						4	6					
Actuated Green, G (s)					31.6	31.6		38.9				
Effective Green, g (s)					31.6	31.6		38.9				
Actuated g/C Ratio					0.40	0.40		0.49				
Clearance Time (s)					4.0	4.0		5.5				
Vehicle Extension (s)					2.5	2.5		4.0				
Lane Grp Cap (vph)					554	539		1580				
v/s Ratio Prot					c0.29	0.11						
v/s Ratio Perm						0.12		0.44				
v/c Ratio					0.73	0.58		0.90				
Uniform Delay, d1					20.6	19.0		18.8				
Progression Factor					1.00	1.00		0.70				
Incremental Delay, d2					8.4	4.6		6.7				
Delay (s)					29.0	23.6		19.8				
Level of Service					C	C		B				
Approach Delay (s)		0.0			26.7			19.8			0.0	
Approach LOS		A			C			B			A	

Intersection Summary			
HCM 2000 Control Delay	22.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	77.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	110	840	0	5	805	855	5	5	10	625	10	125
Future Volume (vph)	110	840	0	5	805	855	5	5	10	625	10	125
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Lane Width	12	12	12	12	12	16	12	12	12	12	12	16
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00		0.95	0.95	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.99		1.00		1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00		1.00	1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85		0.93		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.99		0.95	1.00	1.00
Satd. Flow (prot)	1646	3228		1662	3260	1653		1612		1564	1421	1616
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.99		0.95	1.00	1.00
Satd. Flow (perm)	1646	3228		1662	3260	1653		1612		1564	1421	1616
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	113	866	0	5	830	881	5	5	10	644	10	129
RTOR Reduction (vph)	0	0	0	0	0	159	0	10	0	0	0	79
Lane Group Flow (vph)	113	866	0	5	830	722	0	10	0	644	10	50
Confl. Bikes (#/hr)						1						1
Heavy Vehicles (%)	1%	3%	0%	0%	2%	1%	0%	0%	0%	1%	17%	3%
Turn Type	Prot	NA		Prot	NA	pm+ov	Split	NA		Split	NA	Perm
Protected Phases	5	2		1	6	4	8	8		4	4	
Permitted Phases						6						4
Actuated Green, G (s)	6.1	33.6		0.9	28.4	61.6		1.8		33.2	33.2	33.2
Effective Green, g (s)	6.6	34.8		1.4	29.6	63.6		2.3		34.2	34.2	34.2
Actuated g/C Ratio	0.07	0.39		0.02	0.33	0.72		0.03		0.39	0.39	0.39
Clearance Time (s)	4.5	5.2		4.5	5.2	5.0		4.5		5.0	5.0	5.0
Vehicle Extension (s)	2.5	4.0		2.5	4.0	2.5		2.5		2.5	2.5	2.5
Lane Grp Cap (vph)	122	1266		26	1087	1185		41		603	547	623
v/s Ratio Prot	c0.07	0.27		0.00	c0.25	0.23		c0.01		c0.41	0.01	
v/s Ratio Perm						0.20						0.03
v/c Ratio	0.93	0.68		0.19	0.76	0.61		0.25		1.07	0.02	0.08
Uniform Delay, d1	40.8	22.4		43.1	26.4	6.3		42.4		27.2	16.9	17.3
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00		1.00	1.00	1.00
Incremental Delay, d2	58.5	1.7		2.6	3.4	0.8		2.3		56.1	0.0	0.0
Delay (s)	99.3	24.1		45.7	29.9	7.1		44.7		83.4	16.9	17.3
Level of Service	F	C		D	C	A		D		F	B	B
Approach Delay (s)		32.7			18.2			44.7			71.7	
Approach LOS		C			B			D			E	

Intersection Summary			
HCM 2000 Control Delay	34.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	88.7	Sum of lost time (s)	16.0
Intersection Capacity Utilization	78.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	45	1430	1645	800	600	20
Future Volume (vph)	45	1430	1645	800	600	20
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95	0.95	1.00	0.97	
Frpb, ped/bikes	1.00	1.00	1.00	0.98	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	1.00	0.85	1.00	
Flt Protected	0.95	1.00	1.00	1.00	0.95	
Satd. Flow (prot)	1583	3228	3260	1439	3121	
Flt Permitted	0.95	1.00	1.00	1.00	0.95	
Satd. Flow (perm)	1583	3228	3260	1439	3121	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	46	1474	1696	825	619	21
RTOR Reduction (vph)	0	0	0	0	2	0
Lane Group Flow (vph)	46	1474	1696	825	638	0
Confl. Bikes (#/hr)				7		1
Heavy Vehicles (%)	5%	3%	2%	1%	3%	8%
Turn Type	Prot	NA	NA	Free	Prot	
Protected Phases	1	6	2		8	
Permitted Phases		6		Free		
Actuated Green, G (s)	3.8	71.5	63.7	108.0	27.0	
Effective Green, g (s)	3.8	72.5	64.7	108.0	27.5	
Actuated g/C Ratio	0.04	0.67	0.60	1.00	0.25	
Clearance Time (s)	4.0	5.0	5.0		4.5	
Vehicle Extension (s)	2.5	4.7	6.0		2.5	
Lane Grp Cap (vph)	55	2166	1952	1439	794	
v/s Ratio Prot	0.03	0.46	c0.52		c0.20	
v/s Ratio Perm				c0.57		
v/c Ratio	0.84	0.68	0.87	0.57	0.80	
Uniform Delay, d1	51.8	10.7	18.1	0.0	37.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	63.9	1.1	5.0	1.7	5.7	
Delay (s)	115.7	11.8	23.1	1.7	43.5	
Level of Service	F	B	C	A	D	
Approach Delay (s)		15.0	16.1		43.5	
Approach LOS		B	B		D	

Intersection Summary			
HCM 2000 Control Delay	19.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	108.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	75.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	130	745	85	1700	0	0	0	0
Future Volume (vph)	0	0	0	0	130	745	85	1700	0	0	0	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)					4.0	4.0		5.5				
Lane Util. Factor					0.95	0.95		0.95				
Frpb, ped/bikes					0.97	1.00		1.00				
Flpb, ped/bikes					1.00	1.00		1.00				
Frt					0.89	0.85		1.00				
Flt Protected					1.00	1.00		1.00				
Satd. Flow (prot)					1272	1399		3252				
Flt Permitted					1.00	1.00		1.00				
Satd. Flow (perm)					1272	1399		3252				
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	0	0	0	137	784	89	1789	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	36	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	529	392	0	1842	0	0	0	0
Confl. Peds. (#/hr)	30		2	2		30	4		2	2		4
Confl. Bikes (#/hr)						1			4			
Heavy Vehicles (%)	0%	0%	0%	0%	1%	1%	2%	2%	0%	0%	0%	0%
Parking (#/hr)					0							
Turn Type					NA	custom	Perm	NA				
Protected Phases					4	3		6				
Permitted Phases							6					
Actuated Green, G (s)					32.6	16.0		37.9				
Effective Green, g (s)					32.6	16.0		37.9				
Actuated g/C Ratio					0.41	0.20		0.47				
Clearance Time (s)					4.0	4.0		5.5				
Vehicle Extension (s)					2.5	2.0		4.0				
Lane Grp Cap (vph)					518	279		1540				
v/s Ratio Prot					c0.42	c0.28						
v/s Ratio Perm								0.57				
v/c Ratio					1.02	1.41		1.20				
Uniform Delay, d1					23.7	32.0		21.1				
Progression Factor					1.00	1.00		0.57				
Incremental Delay, d2					45.0	202.4		91.3				
Delay (s)					68.7	234.4		103.3				
Level of Service					E	F		F				
Approach Delay (s)		0.0			139.2			103.3			0.0	
Approach LOS		A			F			F			A	

Intersection Summary			
HCM 2000 Control Delay	115.1	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.23		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	97.7%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	85	580	65	1280	0	0	0	0
Future Volume (vph)	0	0	0	0	85	580	65	1280	0	0	0	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)					4.0	4.0		5.5				
Lane Util. Factor					0.95	0.95		0.95				
Frpb, ped/bikes					0.98	0.99		1.00				
Flpb, ped/bikes					1.00	1.00		1.00				
Frt					0.88	0.85		1.00				
Flt Protected					1.00	1.00		1.00				
Satd. Flow (prot)					1428	1391		3251				
Flt Permitted					1.00	1.00		1.00				
Satd. Flow (perm)					1428	1391		3251				
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	92	630	71	1391	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	36	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	407	315	0	1426	0	0	0	0
Confl. Peds. (#/hr)	10		2	2		10	4		2	2		4
Confl. Bikes (#/hr)						1			4			
Heavy Vehicles (%)	0%	0%	0%	0%	1%	1%	2%	2%	0%	0%	0%	0%
Turn Type					NA	custom	Perm	NA				
Protected Phases					4	3		6				
Permitted Phases						4	6					
Actuated Green, G (s)					33.2	33.2		37.3				
Effective Green, g (s)					33.2	33.2		37.3				
Actuated g/C Ratio					0.42	0.42		0.47				
Clearance Time (s)					4.0	4.0		5.5				
Vehicle Extension (s)					2.5	2.5		4.0				
Lane Grp Cap (vph)					592	577		1515				
v/s Ratio Prot					c0.28	0.17						
v/s Ratio Perm						0.06		0.44				
v/c Ratio					0.69	0.55		0.94				
Uniform Delay, d1					19.2	17.7		20.3				
Progression Factor					1.00	1.00		0.70				
Incremental Delay, d2					6.4	3.7		10.0				
Delay (s)					25.6	21.4		24.1				
Level of Service					C	C		C				
Approach Delay (s)		0.0			23.7			24.1			0.0	
Approach LOS		A			C			C			A	

Intersection Summary			
HCM 2000 Control Delay	24.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	75.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	130	745	85	1700	0	0	0	0
Future Volume (vph)	0	0	0	0	130	745	85	1700	0	0	0	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)					4.0	4.0		5.5				
Lane Util. Factor					0.95	0.95		0.95				
Frpb, ped/bikes					0.98	1.00		1.00				
Flpb, ped/bikes					1.00	1.00		1.00				
Frt					0.89	0.85		1.00				
Flt Protected					1.00	1.00		1.00				
Satd. Flow (prot)					1294	1399		3252				
Flt Permitted					1.00	1.00		1.00				
Satd. Flow (perm)					1294	1399		3252				
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	0	0	0	137	784	89	1789	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	35	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	529	392	0	1843	0	0	0	0
Confl. Peds. (#/hr)	10		2	2		10	4		2	2		4
Confl. Bikes (#/hr)						1			4			
Heavy Vehicles (%)	0%	0%	0%	0%	1%	1%	2%	2%	0%	0%	0%	0%
Parking (#/hr)					0							
Turn Type					NA	custom	Perm	NA				
Protected Phases					4	3		6				
Permitted Phases							6					
Actuated Green, G (s)					32.2	24.0		38.3				
Effective Green, g (s)					32.2	24.0		38.3				
Actuated g/C Ratio					0.40	0.30		0.48				
Clearance Time (s)					4.0	4.0		5.5				
Vehicle Extension (s)					2.5	2.0		4.0				
Lane Grp Cap (vph)					520	419		1556				
v/s Ratio Prot					c0.41	0.28						
v/s Ratio Perm								0.57				
v/c Ratio					1.02	0.94		1.18				
Uniform Delay, d1					23.9	27.2		20.9				
Progression Factor					1.00	1.00		0.55				
Incremental Delay, d2					43.9	30.4		85.9				
Delay (s)					67.8	57.7		97.3				
Level of Service					E	E		F				
Approach Delay (s)		0.0			63.5			97.3			0.0	
Approach LOS		A			E			F			A	

Intersection Summary			
HCM 2000 Control Delay	86.2	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.17		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	96.0%	ICU Level of Service	F
Analysis Period (min)	15		

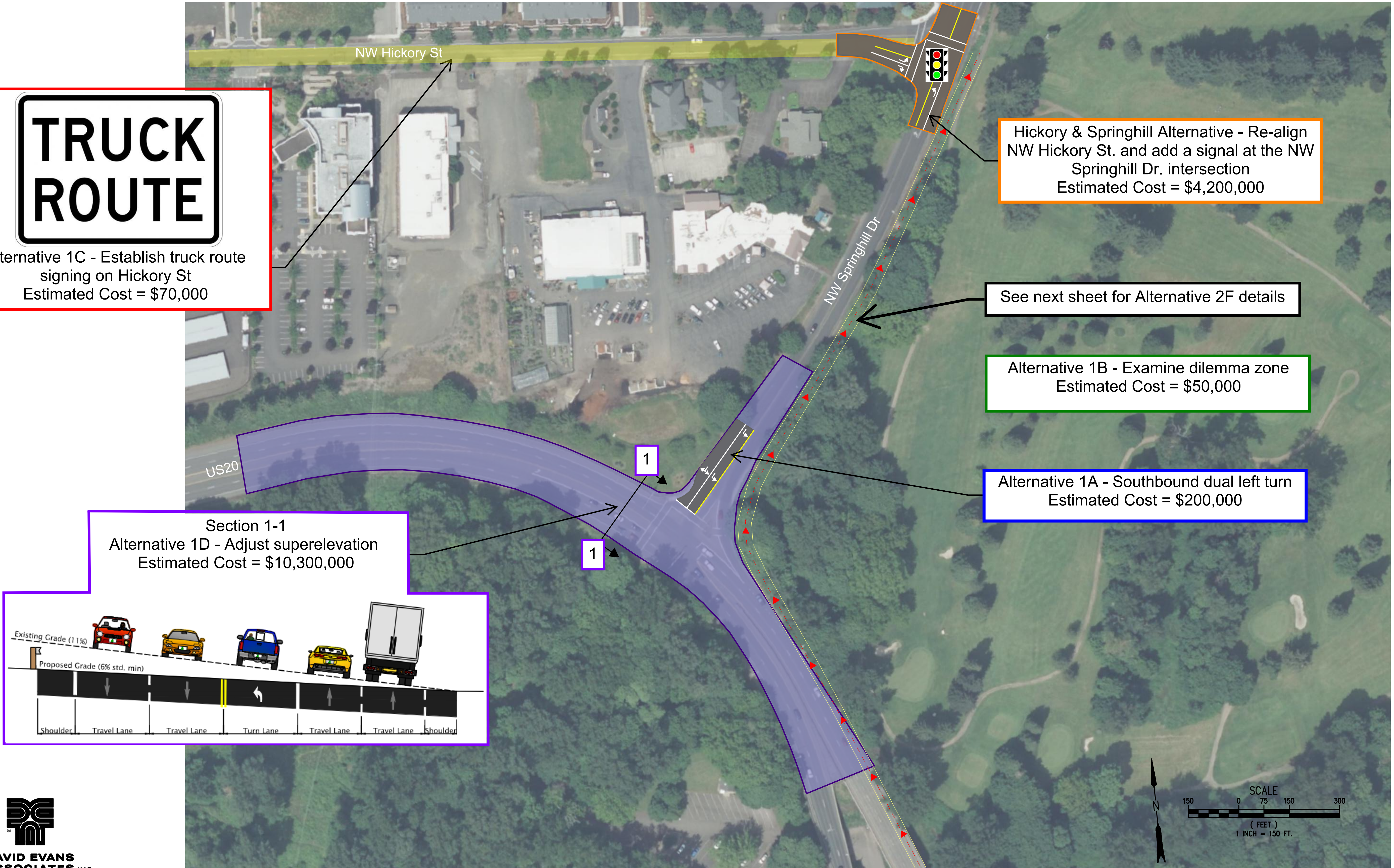
c Critical Lane Group

APPENDIX C – ALTERNATIVES SCHEMATICS

SPRINGHILL DRIVE / US 20 ALTERNATIVES

TRUCK ROUTE

Alternative 1C - Establish truck route signing on Hickory St
Estimated Cost = $70,000



Hickory & Springhill Alternative - Re-align NW Hickory St. and add a signal at the NW Springhill Dr. intersection
Estimated Cost = $4,200,000

See next sheet for Alternative 2F details

Alternative 1B - Examine dilemma zone
Estimated Cost = $50,000

Alternative 1A - Southbound dual left turn
Estimated Cost = $200,000

Section 1-1
Alternative 1D - Adjust superelevation
Estimated Cost = $10,300,000

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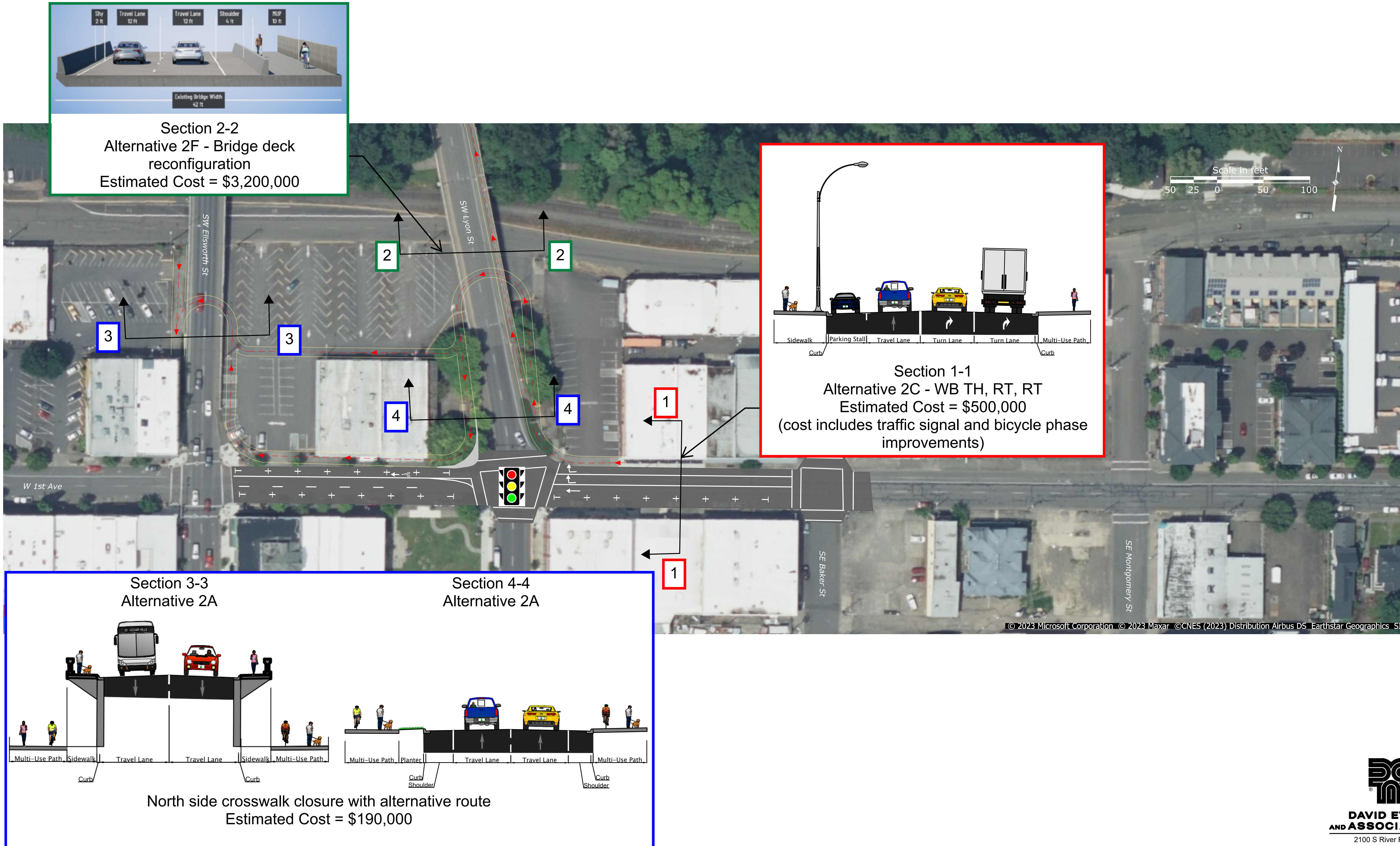
1ST / LYON ST ALTERNATIVES



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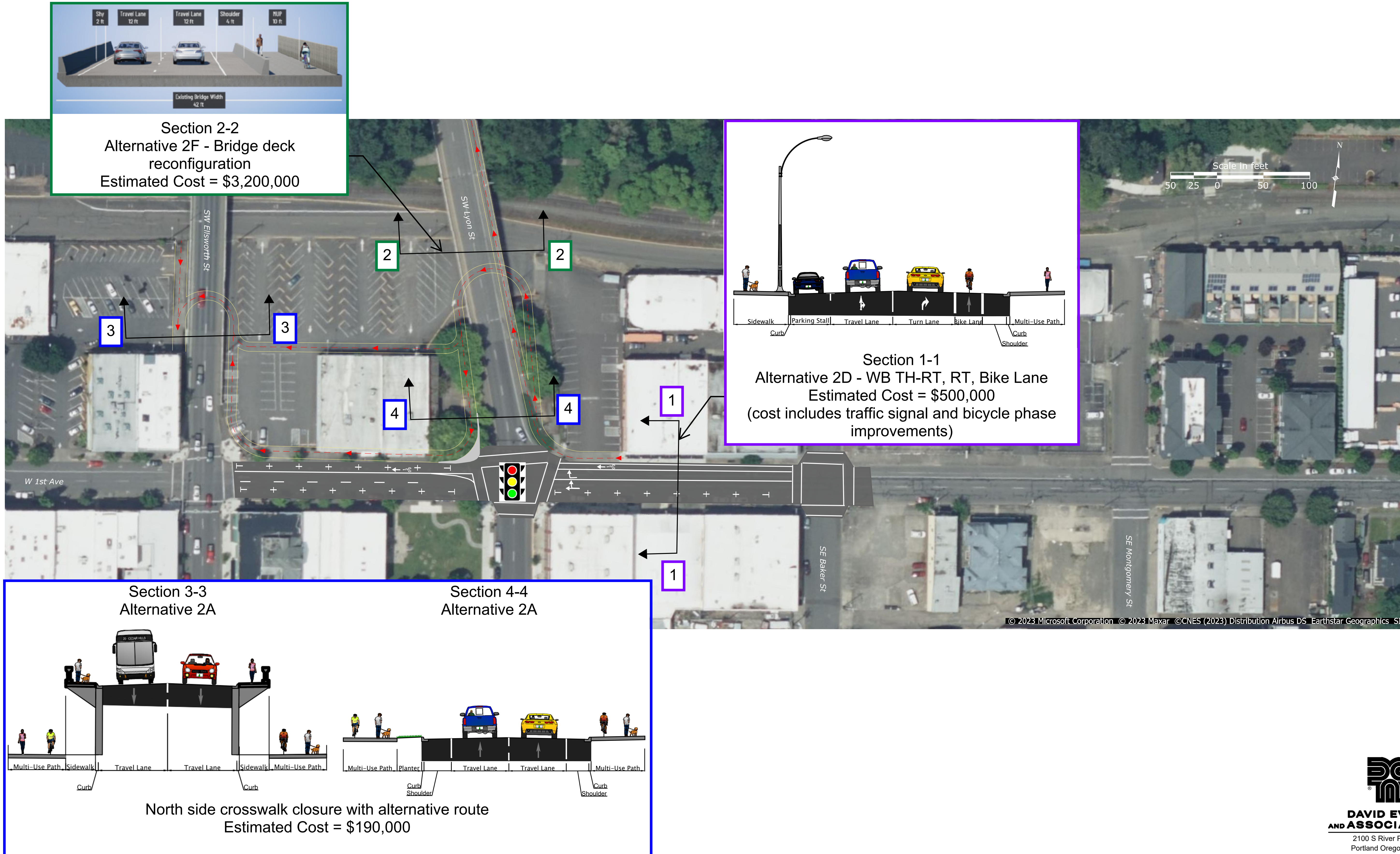
1ST / LYON ST ALTERNATIVES



Section 2-2
Alternative 2F - Bridge deck reconfiguration
Estimated Cost = $3,200,000

Section 1-1
Alternative 2D - WB TH-RT, RT, Bike Lane
Estimated Cost = $500,000
(cost includes traffic signal and bicycle phase improvements)

Section 3-3
Alternative 2A

Section 4-4
Alternative 2A

North side crosswalk closure with alternative route
Estimated Cost = $190,000

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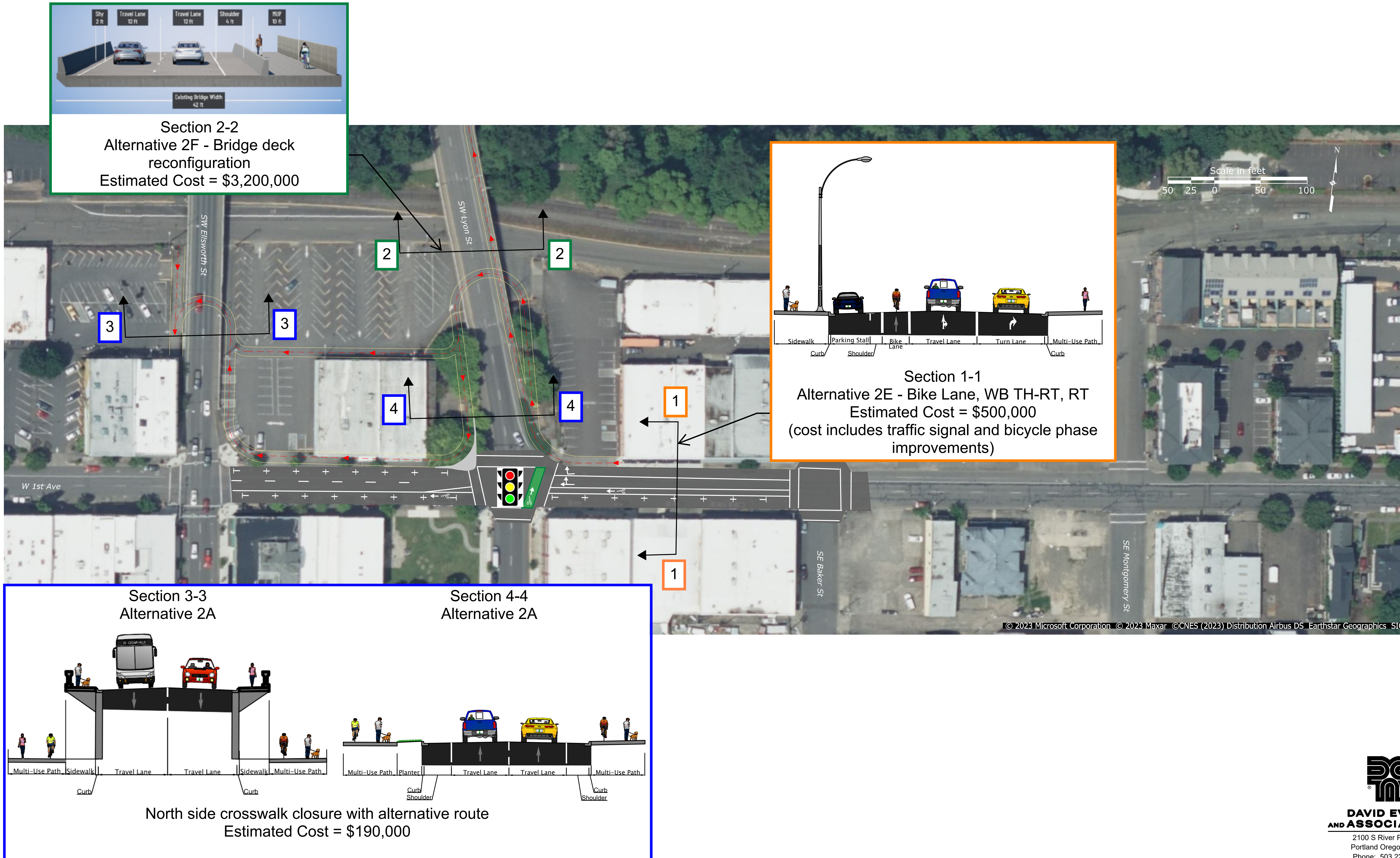
1ST / LYON ST ALTERNATIVES



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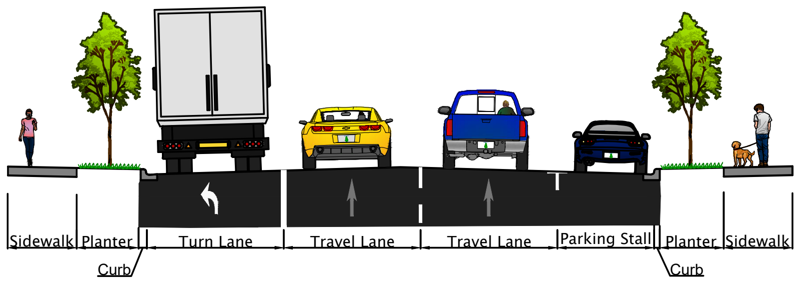
1ST & 2ND / ELLSWORTH ST ALTERNATIVES



Section 1-1
Alternative 4C - Add SBL turn lane
Total Parking Spaces Removed = 6
Estimated Cost = $250,000

Alternative 4B - Upgrade signal timing
Estimated Cost = $20,000

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DOWNTOWN UNSIGNALIZED INTERSECTIONS ALTERNATIVES

Alternative 5B - Add RRFB on upstream crosswalks
Estimated Cost = $500,000

Example RRFB crossing

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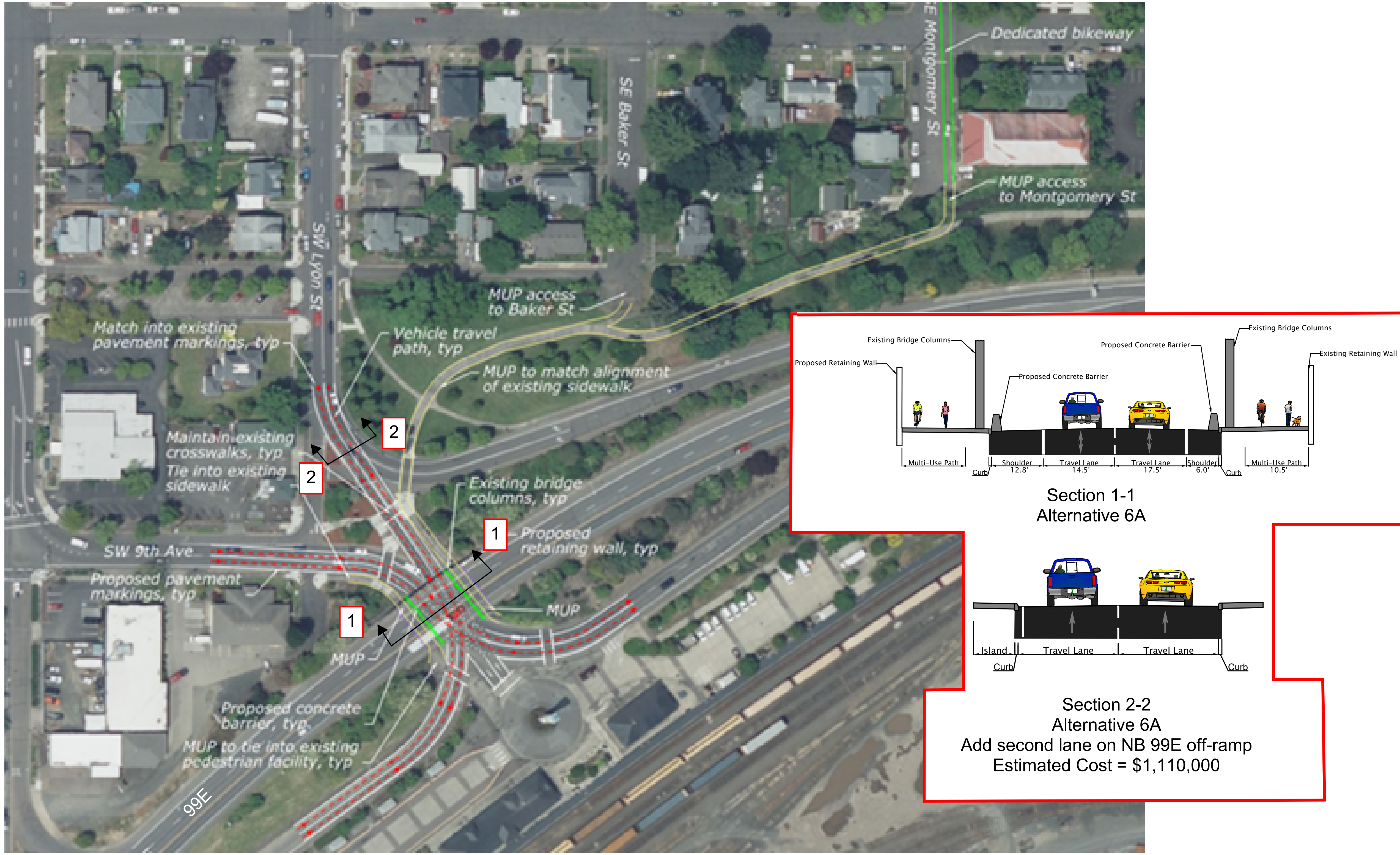
9TH / LYON ST / OR 99E ALTERNATIVES



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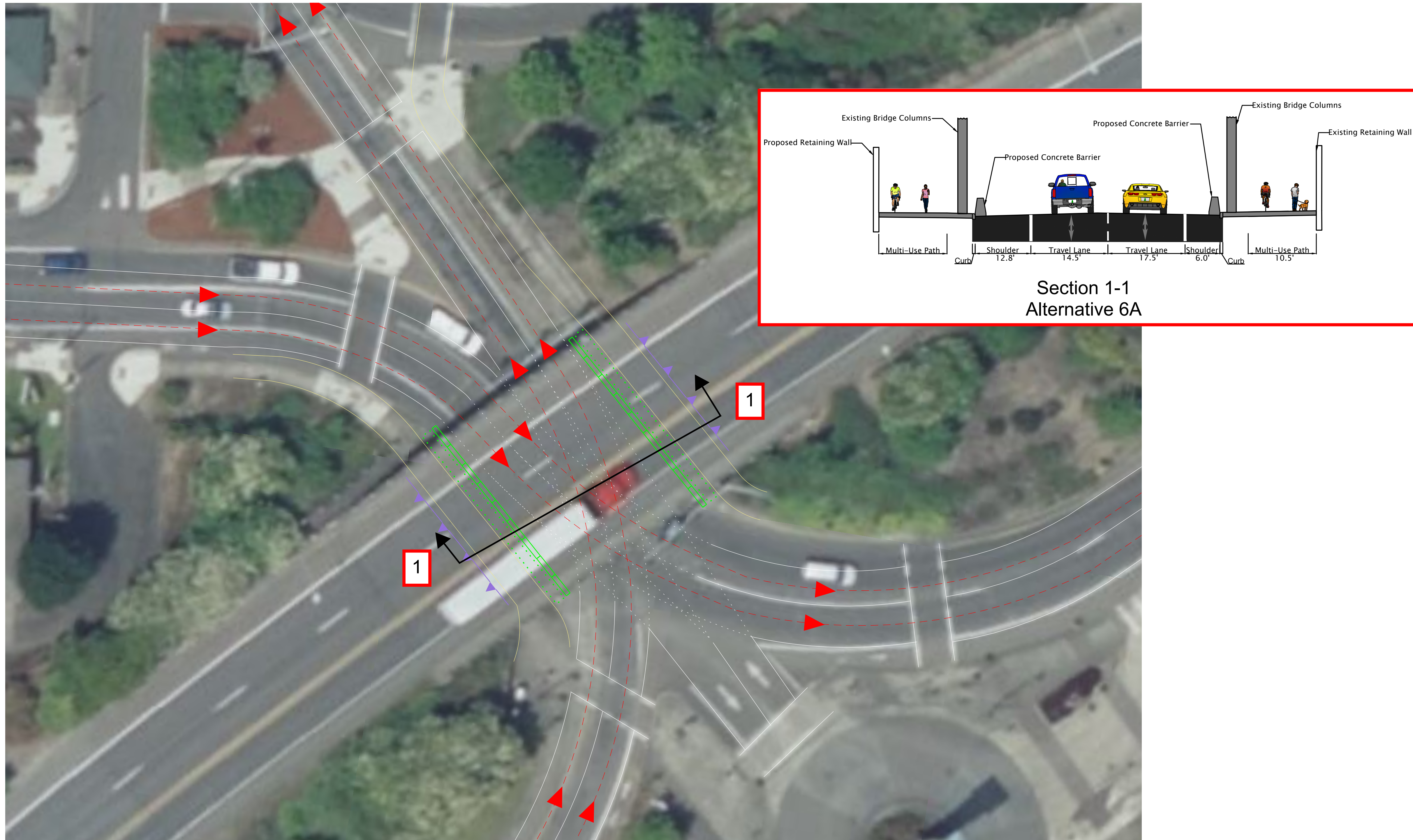
9TH / LYON ST / OR 99E ALTERNATIVES



Section 1-1
Alternative 6A

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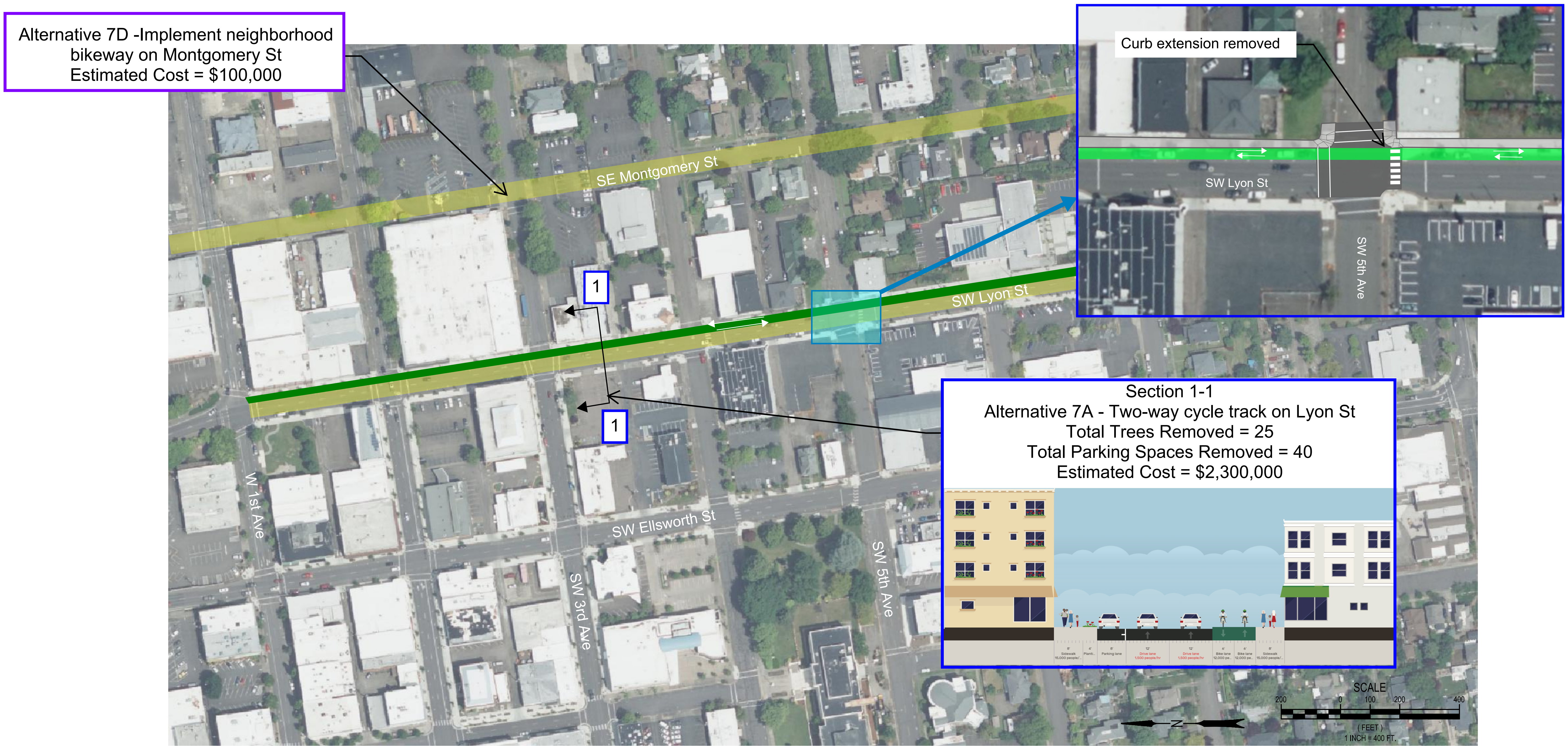
LYON / ELLSWORTH
BIKE FACILITIES ALTERNATIVES



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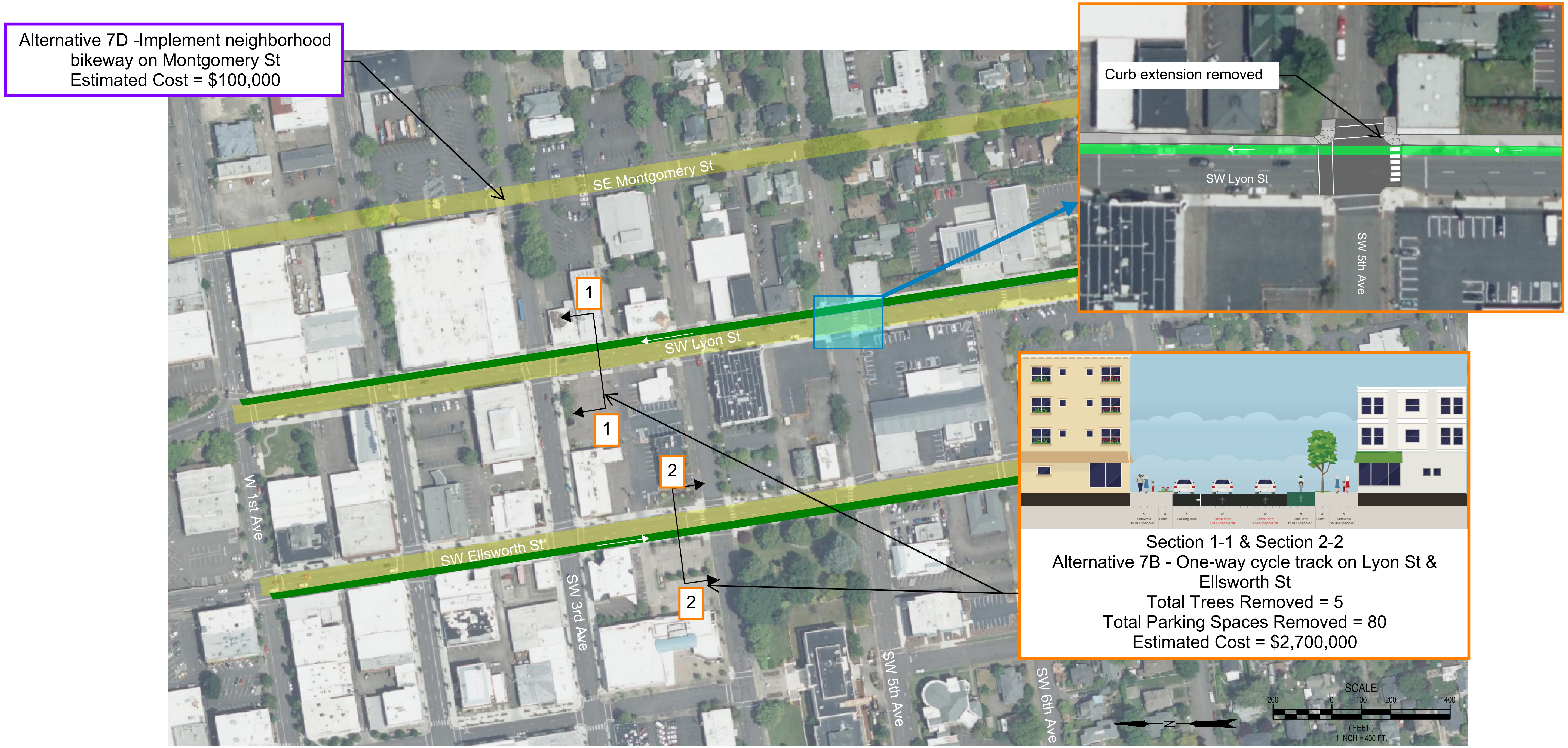

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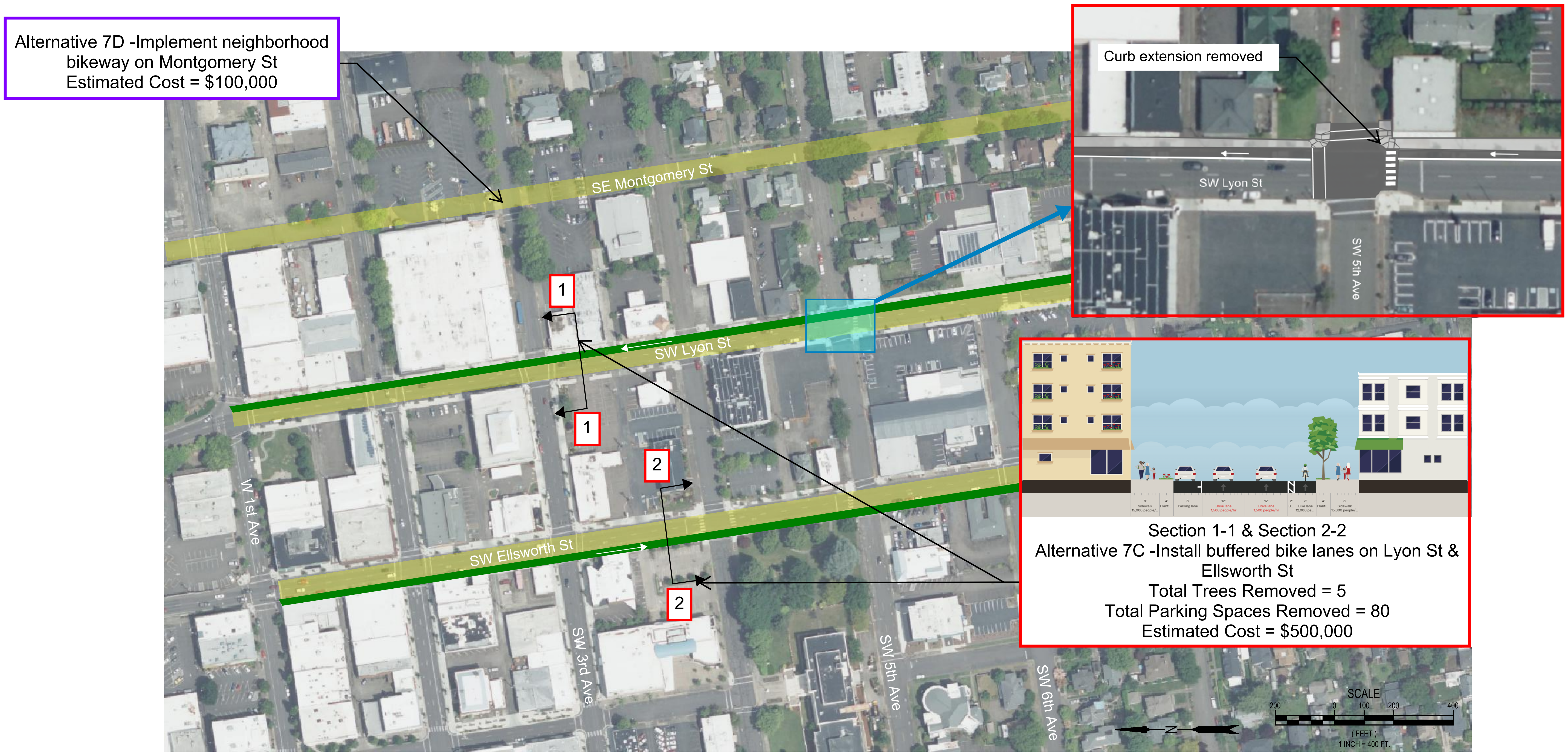
BIKE FACILITIES ALTERNATIVES



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APPENDIX D – ADDITIONAL ALTERNATIVES ADDENDUM

ADDITIONAL ALTERNATIVES ADDENDUM

DATE: April 30, 2024

TO: Rob Emmons, PE | City of Albany

Ron Irish, PE | City of Albany

FROM: Aaron Berger, PE | DKS Associates

Scott Mansur, PE, PTOE, RSP_1 | DKS Associates

SUBJECT: US 20 Albany Study – Additional Alternatives Addendum DKS P#23072-000

ADDITIONAL TRAFFIC NEEDS

After completing the US 20 corridor system evaluation with the Vissim model for Project Bundles 1, 2, and 3, some additional needs with viable solutions were highlighted that were not exposed in the No-Build Vissim model or within the HCM analysis. These needs are summarized as follows:

- Signal Progression at 9th Avenue – The additional southbound traffic demand released from the 1st and 2nd Avenue/Ellsworth Street bottleneck by the proposed improvements creates more southbound queuing on Ellsworth Street due to poor progression at the Ellsworth Street/9th Avenue and Lyon Street/OR 99E/9th Avenue signals. The widening of the OR 99E northbound off-ramp to a dual lane approach provides additional signal timing flexibility to these two signals, which currently operate as free-running under peak hour conditions
- Queuing on 2nd Avenue between Ellsworth Street and Lyon Street – these queues become a new bottleneck in the system with the improvements to the 1st Avenue/Lyon Street intersection and the 2nd Avenue/Ellsworth Street intersection. The eastbound left turn at 2nd Avenue and Lyon Street is held up by northbound Lyon Street queues and propagates into the eastbound through traffic on 2nd Avenue.

ADDITIONAL ALTERNATIVES EVALUATION

Based on the additional identified traffic needs, the following alternatives were developed and evaluated:

- **Alternative 8: Signal Coordination at 9th Avenue/Ellsworth Street and 9th Avenue/Lyon Street/OR 99E** – This alternative involved coordinating these two intersections during at least the PM peak period using a 120 second cycle length and a 10 second offset, progressing the southbound/eastbound movement. The estimated cost of this alternative is **$50,000**.
- **Alternative 9: New Exclusive Eastbound Left Turn Lane at 2nd Avenue/Lyon Street** – This alternative involves removing parking for half a block on both sides of 2nd Avenue between Ellsworth Street and Lyon Street, re-striping the approach to include an exclusive

eastbound left turn lane, and re-timing the signal to include both an eastbound left turn phase and a corresponding protected pedestrian phase. The estimated cost of this alternative is **$250,000**.

Both these alternatives were evaluated using the Vissim model for Project Bundle 3, and the model results were compared against Project Bundle 3 to determine the potential project benefits.

From a corridor perspective, the signal coordination of the two 9th Avenue signals decreased queuing on southbound Ellsworth Street and improved average southbound travel times on US 20 by 1.1 minutes (20%) during the PM peak period. The southbound travel time profiles are shown in Figure 1.

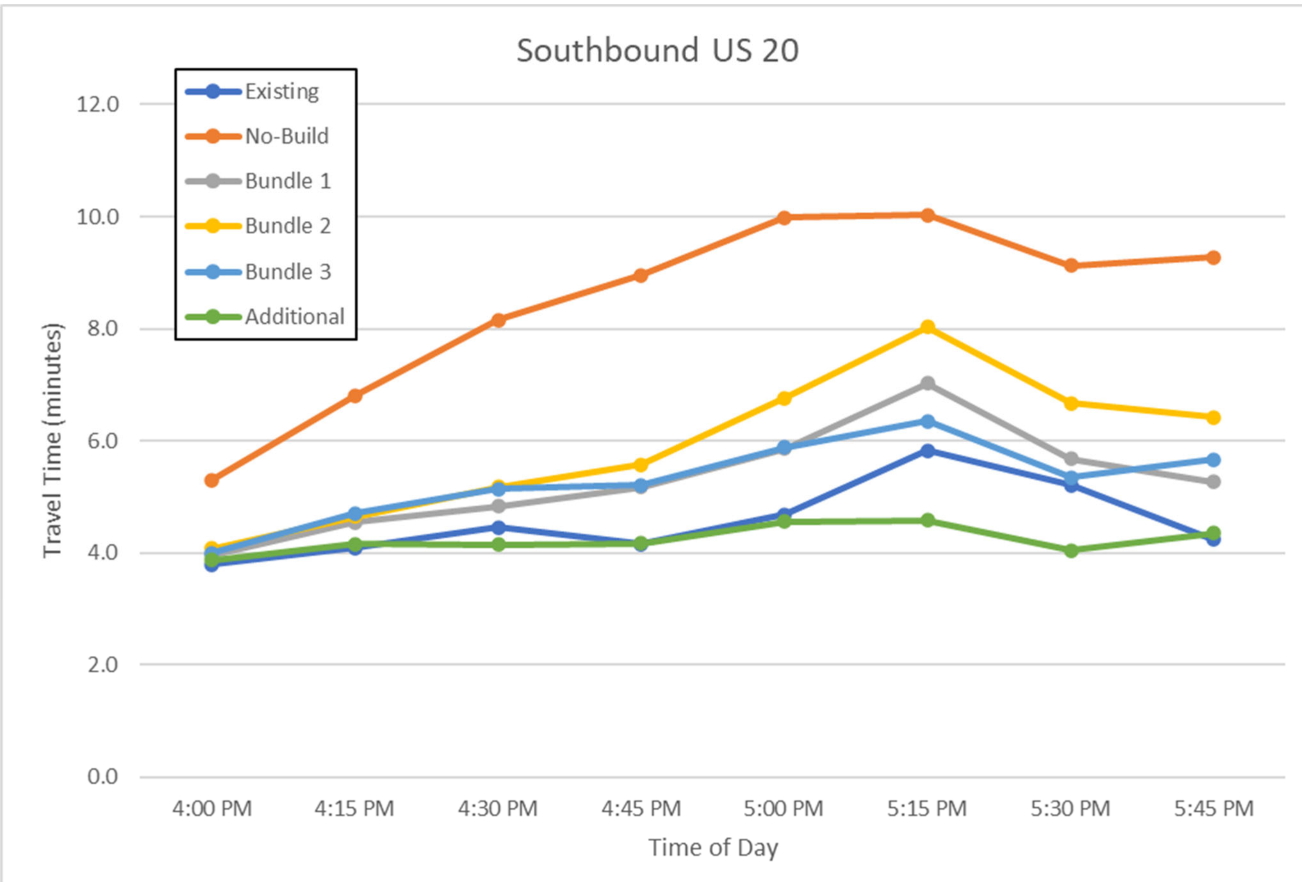


FIGURE 1: SOUTHBOUND US 20 TRAVEL TIME

The exclusive eastbound left turn lane at 2nd Avenue/Lyon Street improved the unserved demand on 2nd Avenue from 2% to 0%. Net, the two proposed improvements reduced the system delay by 13% over Project Bundle 3 conditions, from 3.4 to 2.9 minutes of delay per vehicle. The improvements also result in a net unserved demand of only one vehicle by 6 PM, compared to 41 vehicles under No-Build conditions. The full queue plots by 15-minute PM peak period time interval are included as Appendix A to this document. These results indicate that both **Alternative 8** and **Alternative 9** provide substantial operational benefits to the US 20 corridor and the local system, reducing travel delays and queuing.

RECOMMENDATIONS

Based on the findings from this evaluation, **Alternative 8** and **Alternative 9** are recommended for inclusion in the US 20 corridor plan and for adoption into the upcoming Albany TSP project list. **Alternative 8** (9th Avenue signal coordination) is recommended to be implemented as a two-phase project:

- **Phase 1** would be a Short-Term project and would involve a review and update of the entire US 20 corridor timing on Lyon Street and Ellsworth Street, including consideration of different cycle lengths. This alternative is recommended for simultaneous implementation with the other short-term alternatives along the couplet portion of the corridor that affect signal timing and/or lane configurations.
- **Phase 2** would be a Long-Term project and would be implemented with **Alternative 6A** (OR 99E northbound off-ramp second lane), coordinating the two signals on 9th Avenue to better progress southbound to eastbound traffic.

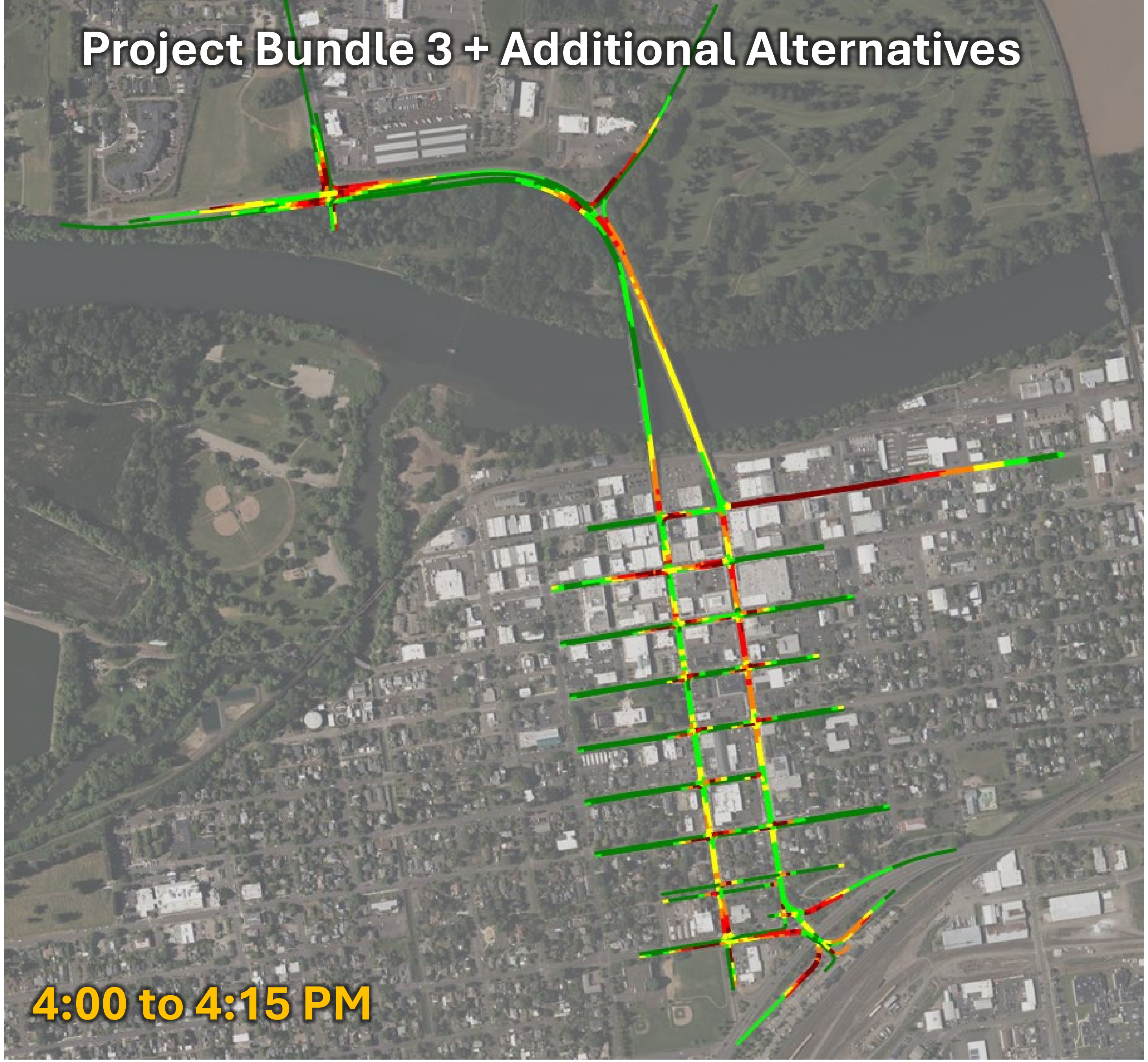
Alternative 9 (eastbound left turn lane and phasing at 2nd Avenue/Lyon Street) is recommended for Short-Term implementation, ideally as a simultaneous project with Alternative 4C (southbound left turn at 2nd Avenue/Ellsworth St).

APPENDICES

APPENDIX A – ADDITIONAL ALTERNATIVES 2043 CONDITIONS QUEUE PLOTS

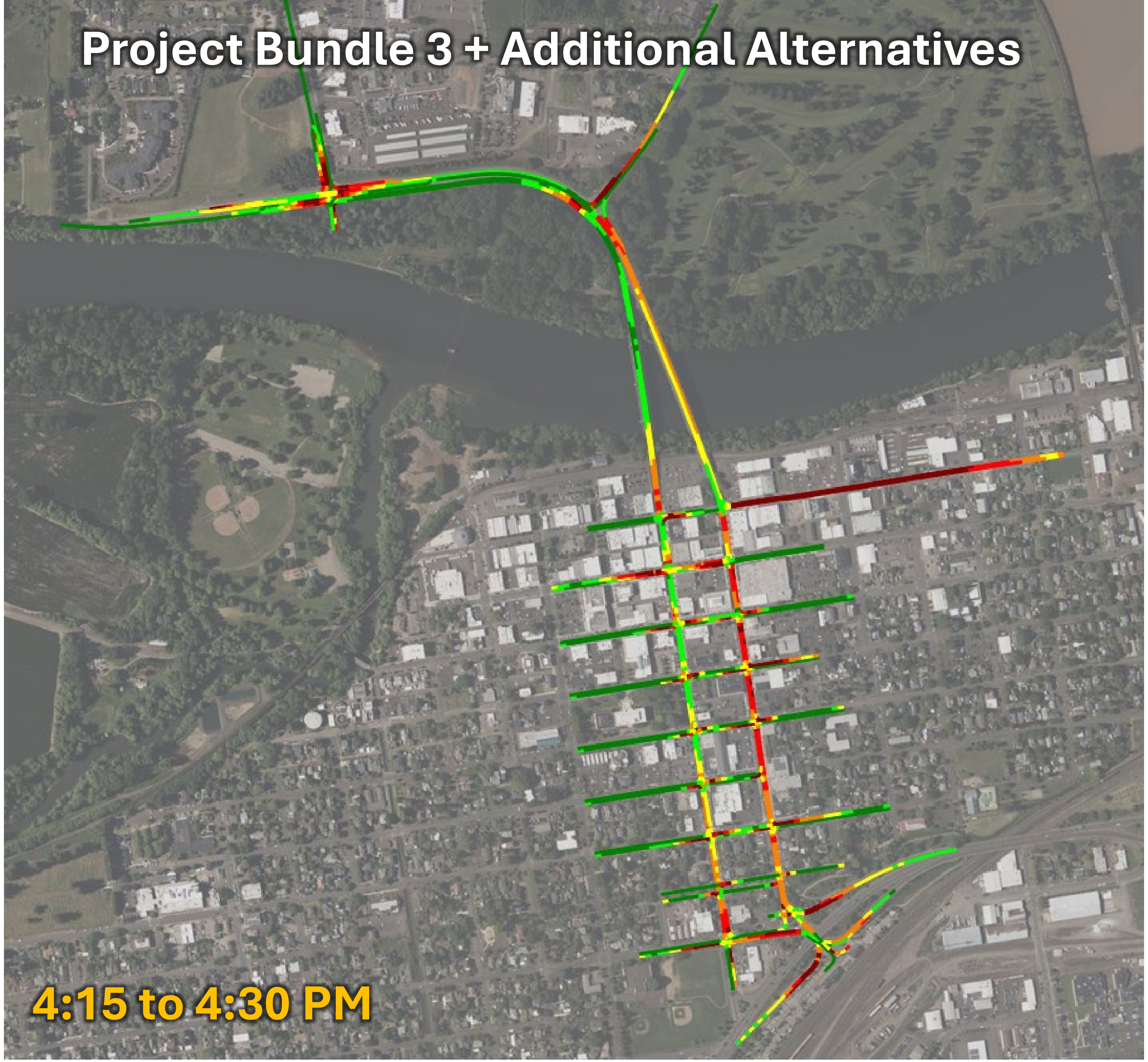
APPENDIX A: ADDITIONAL ALTERNATIVES

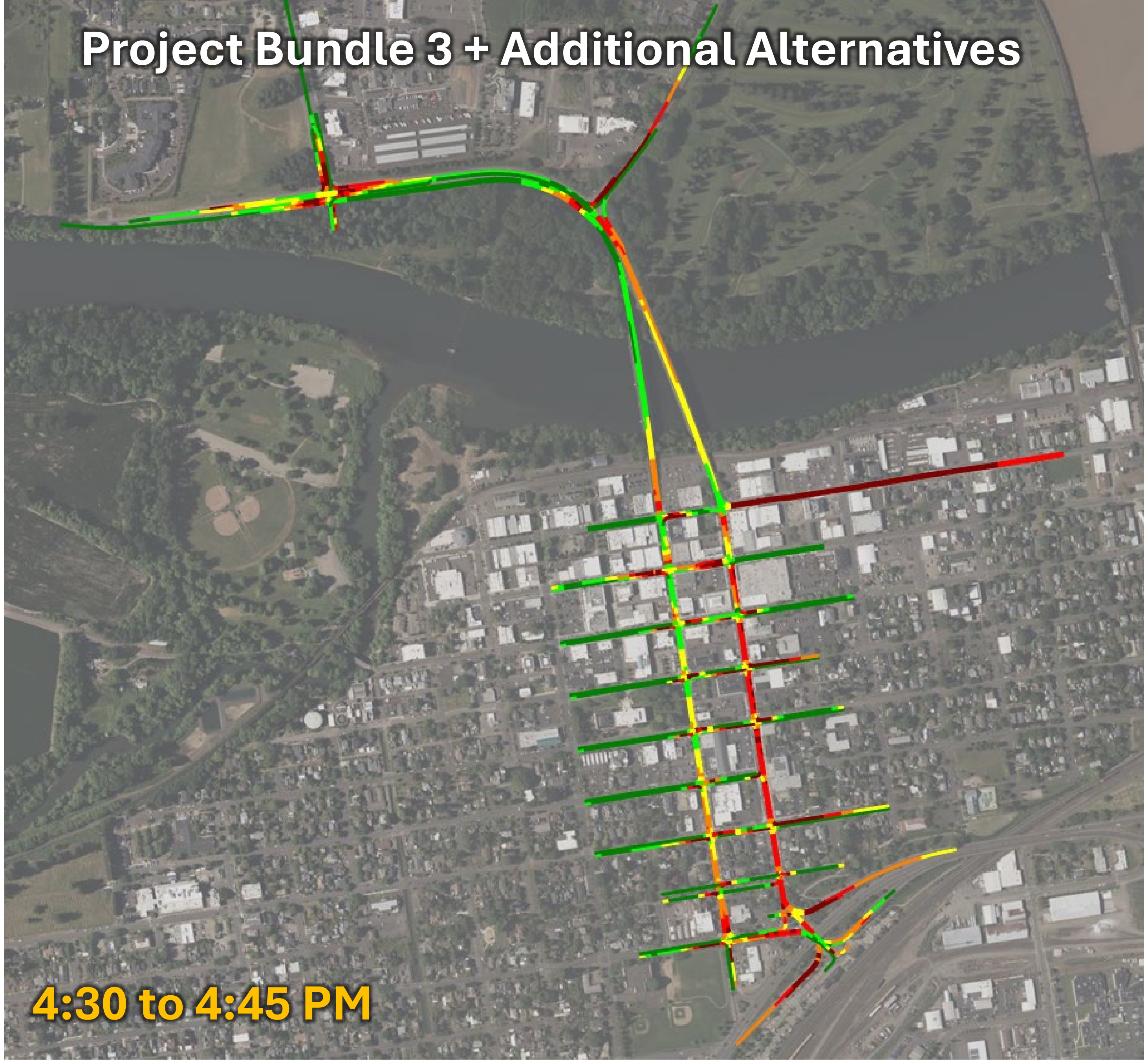
2043 PM CONDITIONS QUEUE PLOTS



Project Bundle 3 + Additional Alternatives
4:00 to 4:15 PM

Project Bundle 3 + Additional Alternatives

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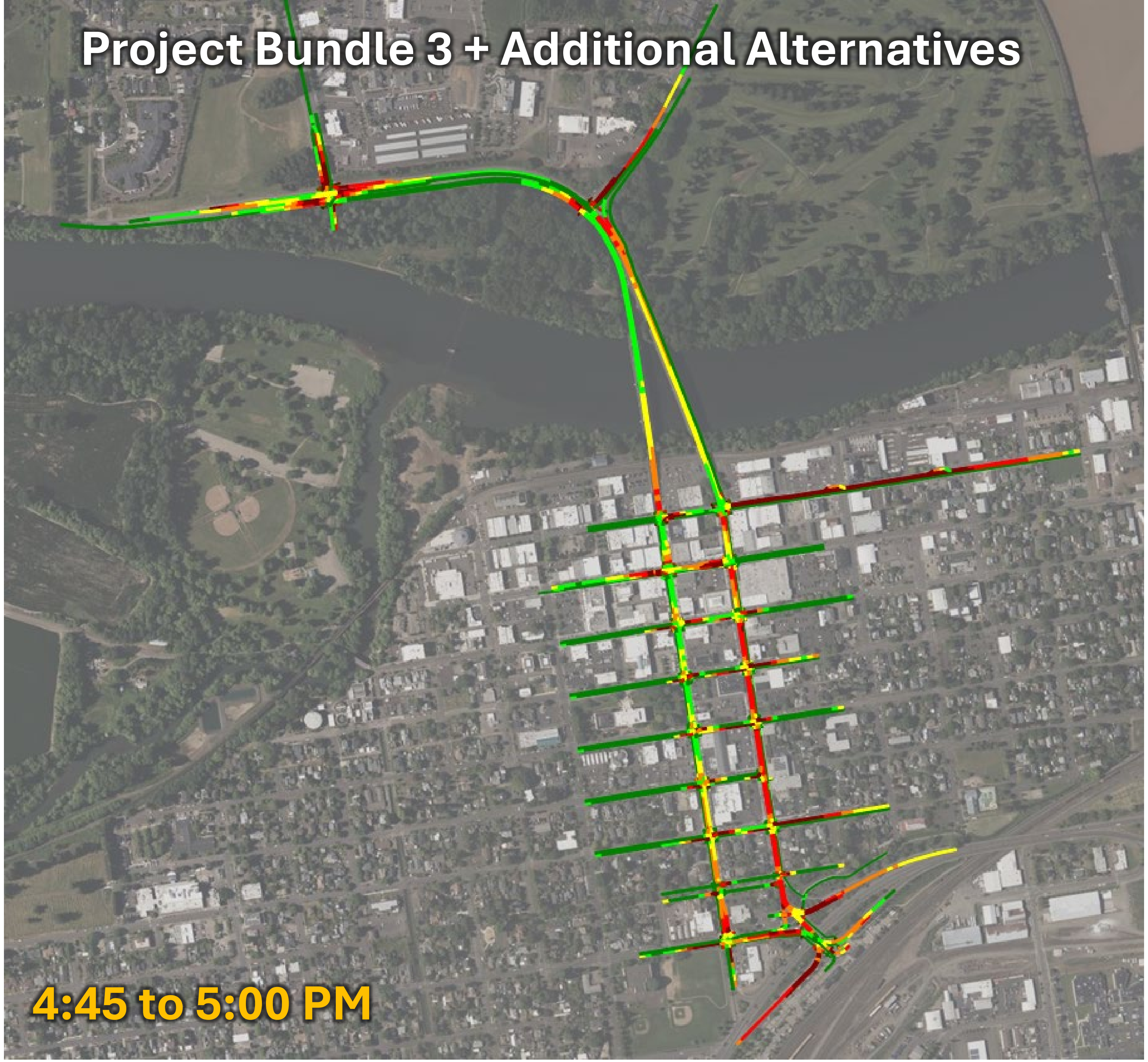
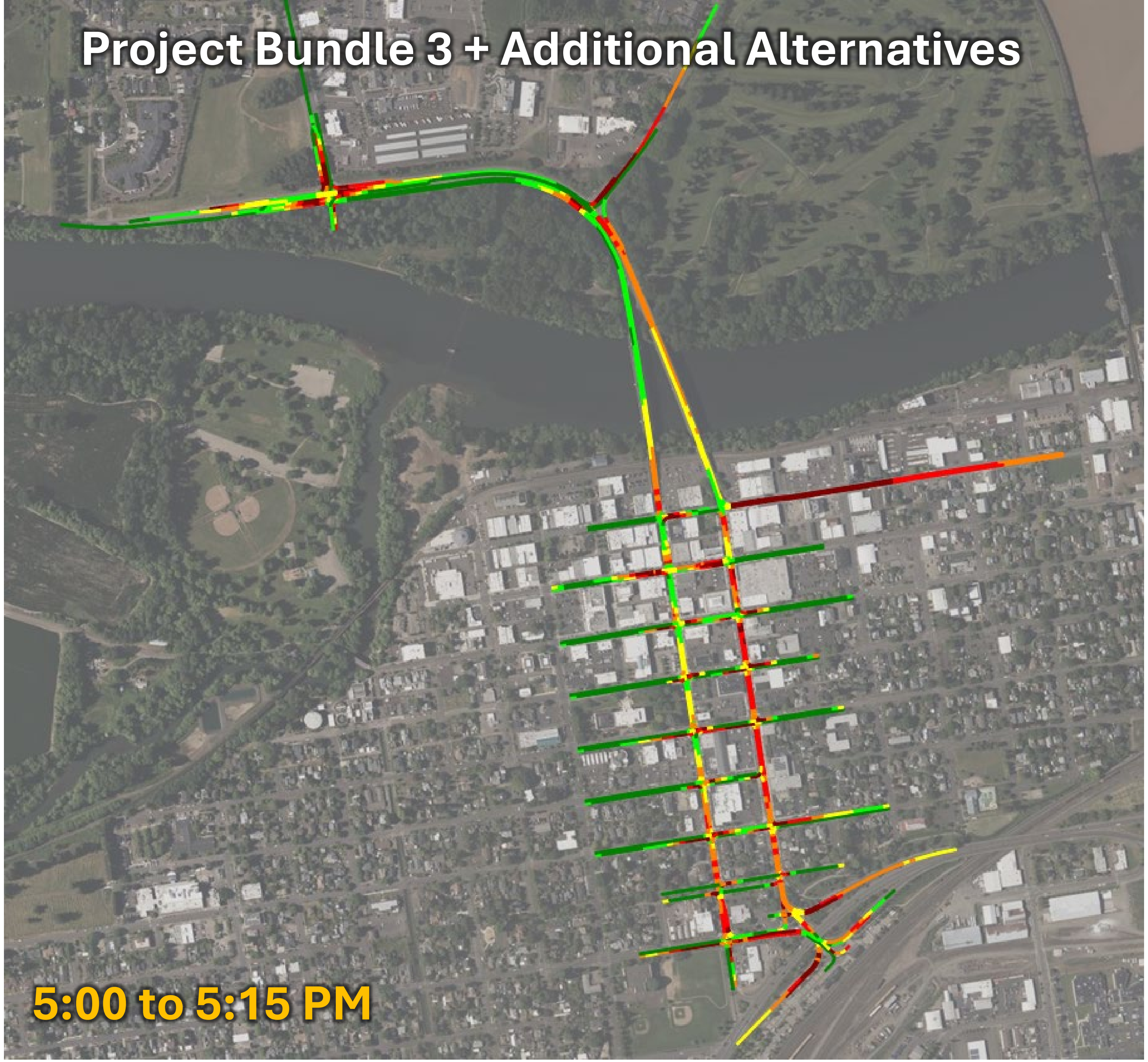
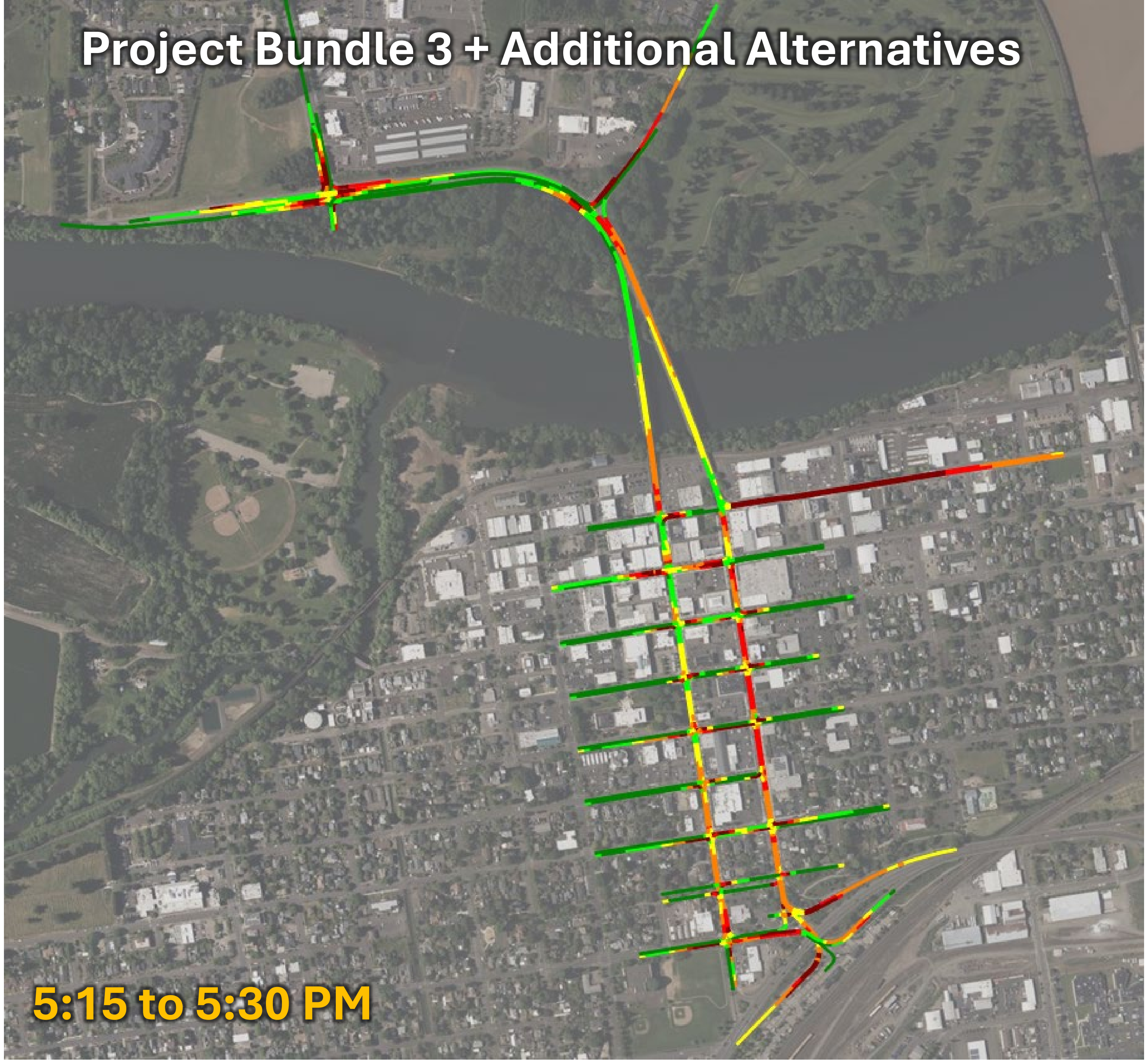
4:30 to 4:45 PM


Project Bundle 3 + Additional Alternatives
4:45 to 5:00 PM


Project Bundle 3 + Additional Alternatives
5:00 to 5:15 PM


Project Bundle 3 + Additional Alternatives
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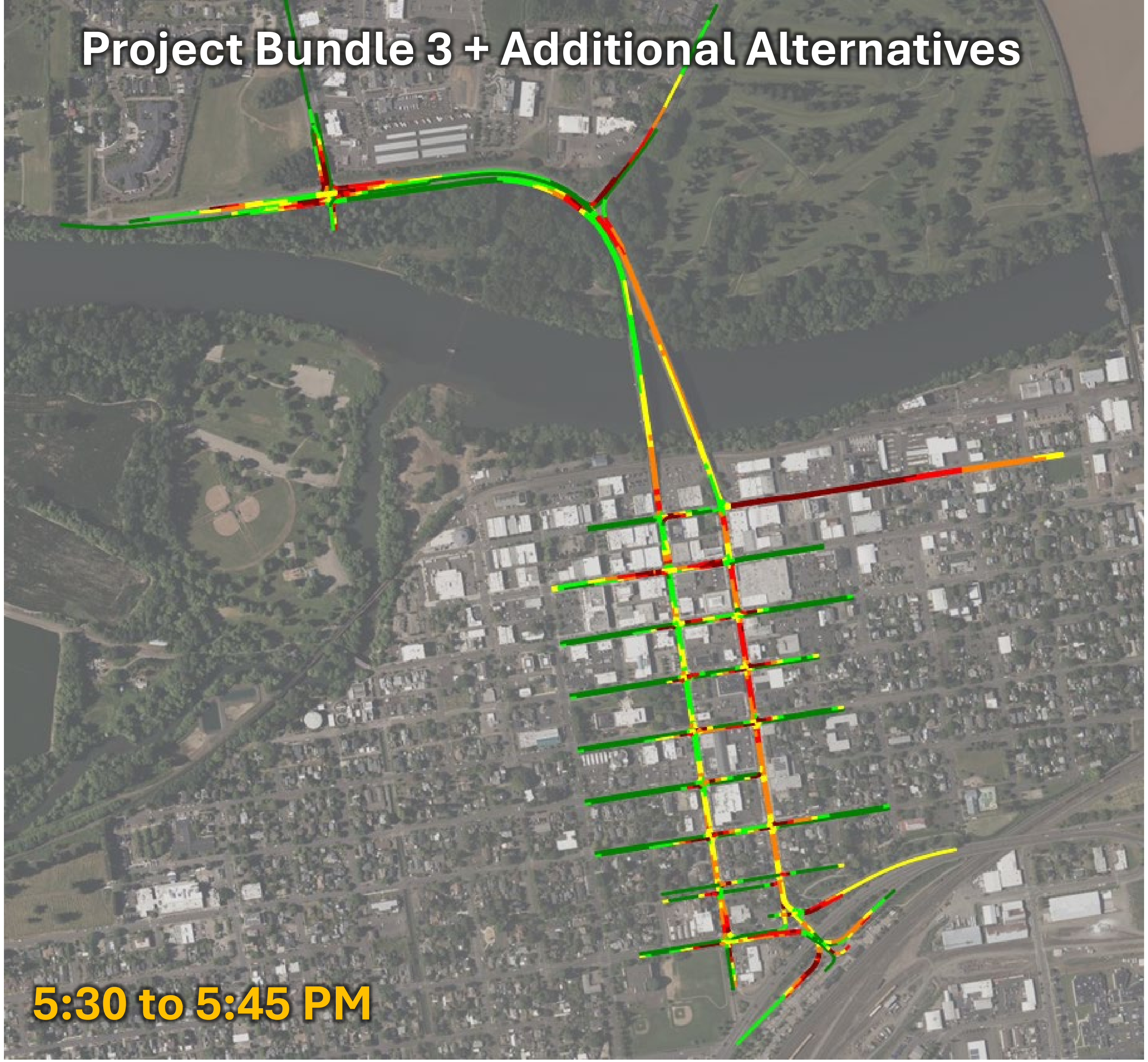
Project Bundle 3 + Additional Alternatives
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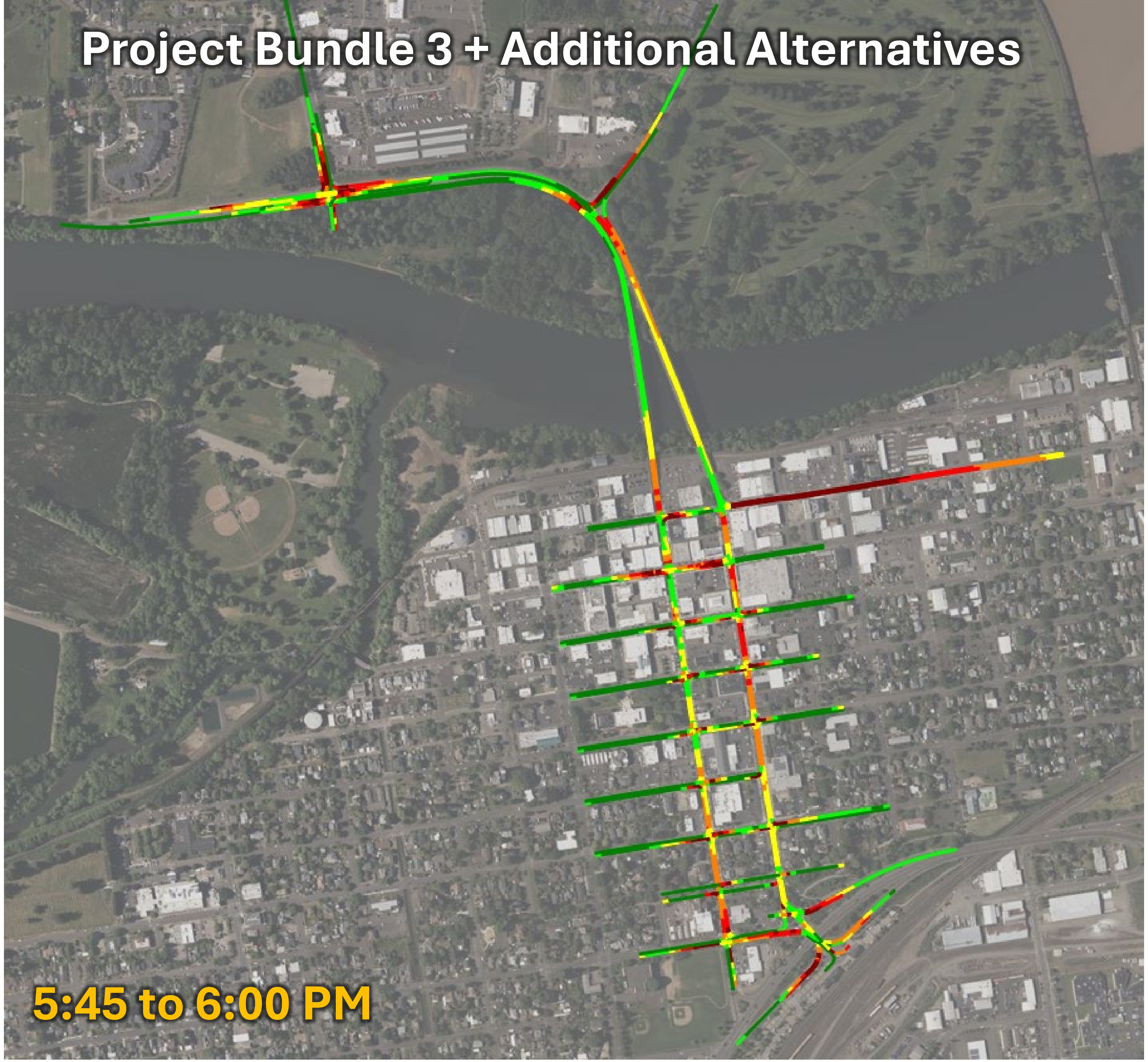
Project Bundle 3 + Additional Alternatives
5:45 to 6:00 PM