Appendix K: Segment A – No-Build Vissim Analysis

MEMORANDUM

DATE: April 18, 2018

TO: Metro
Portland, Oregon

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SUBJECT: Metro SW Corridor DEIS- Segment A– PM Model Future No Build Vissim Model Results Memorandum P# 17017-000

This memorandum documents the development of the future No-Build year 2035 weekday PM peak period Vissim microsimulation model for the Metro SW Corridor DEIS project- Segment A. This memorandum also documents the performance measures reported by the future No-Build year Vissim model.

The Methods and Assumptions memorandum[1] documented the details of model development that were assumed going into this task. This memorandum documents additional assumptions made and parameters that were changed during modeling.

Project Description

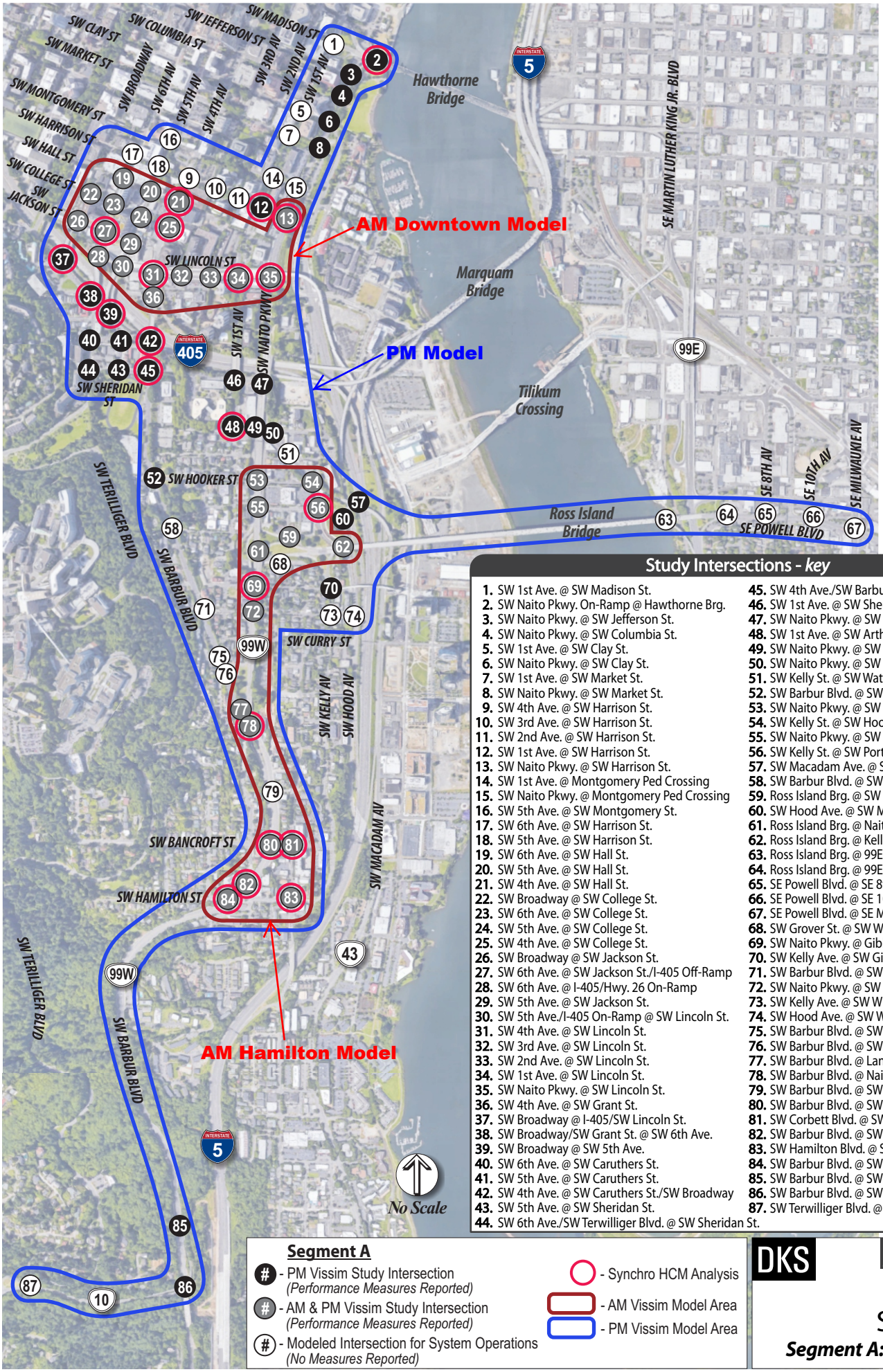
The project evaluates the transportation impacts (and other environmental issues) associated with the Future No-Build and Future Build Light Rail alternatives for 2035. Because the study area is so large and sometimes spans between different jurisdictions, this project was divided into the following three segments for evaluation of alignment alternatives, station access projects, and other segment-related options:

- Segment A: Inner Portland
- Segment B: Outer Portland
- Segment C: Tigard and Tualatin

The transit alternatives address the impacts of various options for track alignment and station locations as well as related station access projects, bridgehead reconfigurations, and O&M facility sites within each of these three segments. This memo is focusing on the No-Build year 2035 of Segment A - the PM peak period.

The No-Build model assumes that the project will not be built in any capacity. The purpose of this alternative is to have a direct comparison between future scenarios, instead of comparing a future LRT Alternative with the existing conditions.

[1] SWC Transportation Analysis Methods, June 2017, DKS Associates.



Study Intersections - *key*

1. SW 1st Ave. @ SW Madison St.
2. SW Naito Pkwy. On-Ramp @ Hawthorne Brg.
3. SW Naito Pkwy. @ SW Jefferson St.
4. SW Naito Pkwy. @ SW Columbia St.
5. SW 1st Ave. @ SW Clay St.
6. SW Naito Pkwy. @ SW Clay St.
7. SW 1st Ave. @ SW Market St.
8. SW Naito Pkwy. @ SW Market St.
9. SW 4th Ave. @ SW Harrison St.
10. SW 3rd Ave. @ SW Harrison St.
11. SW 2nd Ave. @ SW Harrison St.
12. SW 1st Ave. @ SW Harrison St.
13. SW Naito Pkwy. @ SW Harrison St.
14. SW 1st Ave. @ Montgomery Ped Crossing
15. SW Naito Pkwy. @ Montgomery Ped Crossing
16. SW 5th Ave. @ SW Montgomery St.
17. SW 6th Ave. @ SW Harrison St.
18. SW 5th Ave. @ SW Harrison St.
19. SW 6th Ave. @ SW Hall St.
20. SW 5th Ave. @ SW Hall St.
21. SW 4th Ave. @ SW Hall St.
22. SW Broadway @ SW College St.
23. SW 6th Ave. @ SW College St.
24. SW 5th Ave. @ SW College St.
25. SW 4th Ave. @ SW College St.
26. SW Broadway @ SW Jackson St.
27. SW 6th Ave. @ SW Jackson St./I-405 Off-Ramp
28. SW 6th Ave. @ I-405/Hwy. 26 On-Ramp
29. SW 5th Ave. @ SW Jackson St.
30. SW 5th Ave./I-405 On-Ramp @ SW Lincoln St.
31. SW 4th Ave. @ SW Lincoln St.
32. SW 3rd Ave. @ SW Lincoln St.
33. SW 2nd Ave. @ SW Lincoln St.
34. SW 1st Ave. @ SW Lincoln St.
35. SW Naito Pkwy. @ SW Lincoln St.
36. SW 4th Ave. @ SW Grant St.
37. SW Broadway @ I-405/SW Lincoln St.
38. SW Broadway/SW Grant St. @ SW 6th Ave.
39. SW Broadway @ SW 5th Ave.
40. SW 6th Ave. @ SW Caruthers St.
41. SW 5th Ave. @ SW Caruthers St.
42. SW 4th Ave. @ SW Caruthers St./SW Broadway
43. SW 5th Ave. @ SW Sheridan St.
44. SW 6th Ave./SW Terwilliger Blvd. @ SW Sheridan St.
45. SW 4th Ave./SW Barbur Blvd. @ SW Sheridan St.
46. SW 1st Ave. @ SW Sheridan St.
47. SW Naito Pkwy. @ SW Sheridan St.
48. SW 1st Ave. @ SW Arthur St.
49. SW Naito Pkwy. @ SW Arthur St.
50. SW Naito Pkwy. @ SW Kelly St.
51. SW Kelly St. @ SW Water St.
52. SW Barbur Blvd. @ SW Hooker St.
53. SW Naito Pkwy. @ SW Hooker St.
54. SW Kelly St. @ SW Hooker St./SW Macadam Ave.
55. SW Naito Pkwy. @ SW Porter St.
56. SW Kelly St. @ SW Porter St./SW Hood Ave.
57. SW Macadam Ave. @ SW Hood Ave.
58. SW Barbur Blvd. @ SW Woods St.
59. Ross Island Brg. @ SW Woods St./SW Water Ave.
60. SW Hood Ave. @ SW Macadam Ave.
61. Ross Island Brg. @ Naito Pkwy.
62. Ross Island Brg. @ Kelly Ramps
63. Ross Island Brg. @ 99E SB
64. Ross Island Brg. @ 99E NB
65. SE Powell Blvd. @ SE 8th Ave.
66. SE Powell Blvd. @ SE 10th Ave.
67. SE Powell Blvd. @ SE Milwaukie Ave.
68. SW Grover St. @ SW Water Ave.
69. SW Naito Pkwy. @ Gibbs/Naito Ramps
70. SW Kelly Ave. @ SW Gibbs St.
71. SW Barbur Blvd. @ SW Whitaker St.
72. SW Naito Pkwy. @ SW Whitaker St.
73. SW Kelly Ave. @ SW Whitaker St.
74. SW Hood Ave. @ SW Whitaker St.
75. SW Barbur Blvd. @ SW Pennoyer St.
76. SW Barbur Blvd. @ SW Condor Ave.
77. SW Barbur Blvd. @ Lane/Ped Crossing
78. SW Barbur Blvd. @ Naito/Ped Crossing
79. SW Barbur Blvd. @ SW Lowell St.
80. SW Barbur Blvd. @ SW Bancroft St.
81. SW Corbett Blvd. @ SW Bancroft St.
82. SW Barbur Blvd. @ SW Hamilton St. *(East)*
83. SW Hamilton Blvd. @ SW Corbett Ave.
84. SW Barbur Blvd. @ SW Hamilton St. *(West)*
85. SW Barbur Blvd. @ SW Capitol Hwy. EB
86. SW Barbur Blvd. @ SW Capitol Hwy. WB
87. SW Terwilliger Blvd. @ SW Capitol Hwy.

Segment A

- # - PM Vissim Study Intersection *(Performance Measures Reported)*
- # - AM & PM Vissim Study Intersection *(Performance Measures Reported)*
- # - Modeled Intersection for System Operations *(No Measures Reported)*
- Synchro HCM Analysis
- AM Vissim Model Area
- PM Vissim Model Area

DKS

figure 1

Study Area

Segment A: Inner Portland

Segment A Study Area and Model Area

Segment A includes a total of 87 signalized and unsignalized intersections. Performance measures were reported for major signalized and un-signalized intersections. Intersections with no reported performance measures were included in the model due to their influence on arrival patters, lane utilization, and queuing at study intersections with reported performance measures. PM No-Build Study intersections are shown in Figure 1.

Model Development Summary

The Vissim model development process used the following two documents as guidelines - The Federal Highway Administration's (FHWA's) Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software[2] and the Oregon Department of Transportation (ODOT), Protocol for Vissim Simulation[3].This section describes the steps completed in the future no-build year 2035 PM peak period (4:30 PM to 5:30 PM) model development process.

Network Coding

The geometry of the PM Existing Condition model was used as a baseline to develop the PM Future No Build model. Two future projects were added to the model, per Metro's directions:

- Green Loop on SW 4th Avenue – This project added a new mixed-use path along the east side of SW 4th Avenue from SW Lincoln Street to SW College Street. The project also included a new signal at SW 4th Avenue and SW College Street, with signalized bicycle crossings.
- Division Transit Project – The yet to be constructed Division Transit Line was added to the model.
- Signal at the eastbound Hawthorne Bridge and the SW Naito Parkway northbound on-ramp.

Additional edits included keep clear zones at intersections impacted by queue spillback under future No-Build volume conditions, and updated signal timings to accommodate changes in turn volumes as well. The remainder of the model retained existing conditions coding.

Traffic Demand and Routing

Vissim's Dynamic Traffic Assignment (DTA) feature was used in combination with the O-D matrix (based on Metro's Financially Constrained 2035 travel demand model and post-processed future turn movement forecasts) to generate motor vehicle inputs and routing through the network. The DTA assignment was then converted to static vehicle inputs and complete O-D routes. The roadway network extents in the Vissim model were such that there was only one possible route for each O-D pair.

Based on the Financially Constrained 2035 Metro model, vehicle trip growth within the model area projects to be about 14% higher than under existing conditions by the year 2035. In the absence of more mode specific growth projections,

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[2] Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software, Federal Highway Administration, June 2004.
[3] Protocol for Vissim Simulation, ODOT, June 2011

pedestrian and bicycle volumes within the model were also grown by 15%, representing the additional trip activity for all modes within the model area.

Traffic Volume Peaking Profile

As most peaking profiles within the existing model did not show substantial peaking behavior under existing conditions, these profiles were also applied to the future No-Build model.

Vehicle Compositions

Heavy vehicle percentage from the existing model were also applied to the future No-Build model.

Simulation Period and Seeding Period

The future No-Build model used the same simulation period (4-6 PM) and same seeding period (30 minutes) as the existing conditions model.

Error Checking

A review of the animation was conducted to determine locations where conflict areas or priority rules were needed to increased queue spillback and locations where signal timing could change to operate more efficiently under future conditions.

Validation

Upon the completion of the error checking, DKS validated the model results. The model validation was based on 15 simulation runs to account for variation.

The following calibration targets were used for the future year No-Build Vissim model:

- A quantitative comparison between forecasted two-hour balanced volumes and model output results for traffic volumes.

The GEH statistic was calculated for all study intersections. The traffic volume calibration results are documented in Appendix A to this document. HCM intersection analysis performed under a separate task of this project indicated multiple over capacity locations within the model. Therefore, the volume throughput measure (GEH) was not expected to meet calibration standards, as over-capacity intersections were not expected to serve the full assigned demand.

Future No-Build Model Measures of Effectiveness

The following measures of effectiveness were collected from the future No-Build model and summarized in the Appendices:

- Appendix B - Overall intersection delay and individual turn movement delay at study intersections for motor vehicles
- Appendix C - 95th percentile motor vehicle queue lengths
- Appendix D – Vissim Model Queue Plots (same format as used for Existing Conditions)
- Appendix E - Corridor travel times for motor vehicles

The delay measurements were calculated over the entire peak hour interval (excluding the seeding time) for each simulation run. Delay reported for a study intersection is measured upstream to the next intersection and not through. 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 travel times were measured over segments within the study area based on the entering and exiting time stamp of each vehicle traversing the selected segment.

Table 1 shows some network performance measures generated by Vissim. The key measure is latent demand, vehicles unable to enter the network due to queue spillback during the analysis period (4-6 PM). As shown in Table 1, the roadway network modeled for No-Build conditions does not have sufficient capacity to serve all the future two-hour demand. In reality, most of the latent demand would shift either to other regional routes or to a different time of day.

Table 1: Future No-Build Network System Performance

Total Vehicles Arrived (4-6 PM)	Latent Demand (4-6 PM)	Percent Demand Unserved (4-6 PM)	Total Delay (vehicle-hours, 4-6 PM)
47,200	4,090	8.7%	7,520

APPENDIX

Appendix A: Vissim Model Two-Hour GEH Statistic

Appendix B: Vissim Model Delay

Appendix C: Vissim Model Queue Data

Appendix D: Vissim Model Queue Plots

Appendix E: Vissim Model Travel Time Data

Appendix A

Vissim Model Two-Hour GEH Statistic

Metro SW Corridor DEIS- Segment A - PM model

Future No-Build Vissim Model Results Memorandum

Intersection Number	Intersection Name	Movement	Input Volume	VISSIM Output Volume	GEH
2	SW Naito Pkwy On-Ramp @ Hawthorne Bridge	NBR	615	515	3.0
		Total	615	515	3.0
3	SW Naito Pkwy @ SW Jefferson St	NBL	140	139	0.1
		NBT	2420	2083	5.0
		SBT	2770	2798	0.4
		SBR	230	198	1.5
		Total	5560	5218	3.3
4	SW Naito Pkwy @ SW Columbia St	NBT	2745	2399	4.8
		SBT	2770	2813	0.6
		EBL	430	336	3.4
		EBR	640	487	4.6
		Total	6585	6035	4.9
6	SW Naito Pkwy @ SW Clay St	NBL	95	77	1.4
		NBT	1705	1496	3.7
		SBT	3235	2556	8.9
		SBR	175	171	0.2
		WBL	90	67	1.8
		WBT	715	604	3.1
		WBR	1040	892	3.4
		Total	7055	6630	3.6
8	SW Naito Pkwy @ SW Market St	NBT	1080	887	4.4
		NBR	30	27	0.4
		SBL	1665	1596	1.2
		SBT	1660	1601	1.0
		EBL	720	694	0.7
		EBT	1145	1033	2.4
		EBR	535	514	0.6
		Total	6835	6352	4.2
12	SW 1st Ave @ SW Harrison St	NBL	190	106	4.9
		NBR	255	141	5.7
		SBL	420	452	1.1
		SBT	1060	1014	1.0
		SBR	200	213	0.6
		EBT	510	458	1.7
		EBR	205	177	1.4
		WBL	60	85	2.1
		WBT	545	599	1.6
		Total	3445	3245	2.4
13	SW Naito Pkwy @ SW Harrison St	NBL	380	449	2.4
		NBT	645	556	2.6
		NBR	65	47	1.7
		SBT	2135	1963	2.7
		SBR	100	139	2.5
		EBL	240	162	3.9
		EBT	375	369	0.2
		EBR	570	524	1.4
		WBL	305	293	0.5
		WBT	125	114	0.7
		WBR	20	21	0.2
		Total	4960	4637	3.3
		NBL	60	26	3.7
		NBT	1210	1117	1.9

Intersection Number	Intersection Name	Movement	Input Volume	VISSIM Output Volume	GEH
19	SW 6th Ave @ SW Hall St	EBL	90	81	0.7
		EBT	145	144	0.1
		WBT	60	96	2.9
		WBR	140	78	4.2
		Total	1705	1542	2.9
20	SW 5th Ave @ SW Hall St	SBL	70	0	8.4
		SBT	645	610	1.0
		EBT	90	85	0.4
		EBR	65	55	0.9
		WBL	60	110	3.8
		WBT	205	184	1.1
		Total	1135	1044	1.9
21	SW 4th Ave @ SW Hall St	NBL	265	297	1.3
		NBT	1790	1548	4.2
		EBL	160	85	4.8
		Total	2215	1930	4.4
22	SW Broadway @ SW College St	SBL	150	139	0.6
		SBT	1485	1496	0.2
		SBR	20	16	0.7
		EBT	30	32	0.3
		EBR	30	25	0.7
		WBL	345	254	3.7
		WBT	20	29	1.3
23	SW 6th Ave @ SW College St	NBL	215	114	5.6
		NBT	1110	1024	1.9
		EBL	80	65	1.2
		EBT	100	101	0.1
		WBT	150	168	1.0
		WBR	80	57	2.0
		Total	1735	1529	3.6
24	SW 5th Ave @ SW College St	SBL	55	57	0.2
		SBT	715	713	0.1
		EBT	40	69	2.8
		EBR	60	23	4.1
		WBL	225	193	1.6
		WBT	230	222	0.4
		Total	1325	1277	0.9
25	SW 4th Ave @ SW College St	NBL	455	421	1.1
		NBT	1960	1724	3.9
		EBL	95	128	2.2
		Total	2510	2273	3.4
26	SW Broadway @ SW Jackson St	SBL	90	82	0.6
		SBT	1680	1630	0.9
		SBR	90	92	0.1
		EBT	75	82	0.6
		EBR	100	88	0.9
		WBL	380	404	0.9
		WBT	20	27	1.0
		Total	2435	2405	0.4
27	SW 6th Ave @ SW Jackson St	NBL	400	432	1.1
		NBT	790	615	4.7
		EBL	165	167	0.1

Intersection Number	Intersection Name	Movement	Input Volume	VISSIM Output Volume	GEH
		WBR	370	366	0.1
		Total	1725	1580	2.5
28	SW 6th Ave @ I-405/Hwy 26 On-Ramp	NBL	2805	2283	7.3
		Total	2805	2283	7.3
29	SW 5th Ave @ SW Jackson St	SBL	345	222	5.2
		SBT	655	675	0.5
		SBR	20	26	0.9
		EBT	0	14	3.7
		EBR	20	0	4.5
		Total	1040	937	2.3
30	SW 5th Ave @ SW Lincoln St	SBL	165	164	0.1
		SBT	55	11	5.4
		WBL	15	0	3.9
		WBU	60	95	2.8
		Total	295	270	1.1
31	SW 4th Ave @ SW Lincoln St	NBL	40	26	1.7
		NBT	1340	1179	3.2
		EBL	45	57	1.2
		EBT	180	196	0.8
		WBT	35	79	4.1
		WBR	360	373	0.5
		Total	2705	2446	3.6
33	SW 2nd Ave @ SW Lincoln St	NBL	15	12	0.6
		NBR	20	19	0.2
		SBL	20	0	4.5
		SBR	15	40	3.4
		EBL	10	20	1.8
		EBT	330	290	1.6
		EBR	10	5	1.3
		WBL	20	19	0.2
		WBT	305	340	1.4
		WBR	25	24	0.1
		Total	770	769	0.0
34	SW 1st Ave @ SW Lincoln St	NBL	215	249	1.6
		NBT	560	320	8.1
		SBT	1250	1188	1.3
		SBR	135	145	0.6
		EBL	40	62	2.2
		EBR	330	243	3.6
		Total	2530	2212	4.6
35	SW Naito Pkwy @ SW Lincoln St	NBT	1115	1078	0.8
		SBT	3050	2822	3.0
		Total	4165	3905	2.9
36	SW 4th Ave @ SW Grant St	SBU	70	12	6.4
		Total	70	12	6.4
37	SW Broadway @ I-405 SB Off-Ramp/SW Lincoln St	NBR	325	634	10.0
		SBL	1055	1091	0.8
		SBT	415	390	0.9
		SBR	15	21	1.0
		EBT	1890	1885	0.1
		EBR	150	116	2.1

Intersection Number	Intersection Name	Movement	Input Volume	VISSIM Output Volume	GEH
		EBU	20	25	0.7
		Total	3870	4162	3.3
38	SW Broadway @ SW Grant St/SW 6th Ave	NBT	1070	1085	0.3
		EBL	385	310	2.8
		EBT	2405	2368	0.5
		EBR	885	948	1.5
		WBR	2540	1926	9.2
		Total	7285	6637	5.5
39	SW Broadway @ SW 5th Ave	SBT	435	503	2.2
		EBR	2405	2367	0.6
		WBT	2540	1914	9.4
		Total	5380	4784	5.9
40	SW 4th Ave @ SW Caruthers St	NBL	5	7	0.6
		NBT	870	902	0.8
		SBT	860	922	1.5
		SBR	25	33	1.1
		EBL	55	58	0.3
		EBR	15	10	1.0
		WBL	215	90	7.2
		WBT	5	6	0.3
		WBR	145	120	1.5
		Total	2195	2148	0.7
41	SW 5th Ave @ SW Caruthers St	SBT	2730	2709	0.3
		SBR	110	161	3.1
		WBL	50	138	6.4
		WBT	255	55	11.4
		Total	3145	3063	1.0
42	SW 4th Ave @ SW Caruthers St/SW Broadway	NBL	550	622	2.1
		NBT	1125	1019	2.3
		WBT	2295	1481	13.2
		WBR	185	189	0.2
		Total	4155	3311	9.8
43	SW 5th Ave @ SW Sheridan St	SBL	2780	2842	0.8
		EBT	605	437	5.2
		Total	3385	3279	1.3
44	SW 6th Ave/SW Terwilliger Blvd @ SW Sheridan St	NBT	875	907	0.8
		NBR	445	435	0.3
		SBL	160	0	12.6
		SBT	905	1005	2.3
		SBR	25	18	1.1
		Total	2410	2365	0.7
45	SW 4th Ave/SW Barbur Blvd @ SW Sheridan St	NBT	1470	1322	2.8
		NBR	120	146	1.6
		EBL	205	323	5.1
		EBT	1735	1662	1.3
		EBR	1445	1294	2.9
		Total	4975	4747	2.3
		NBL	5	2	1.1
		NBT	340	306	1.3
		NBR	290	268	0.9
		SBL	745	639	2.8

Intersection Number	Intersection Name	Movement	Input Volume	VISSIM Output Volume	GEH
46	SW 1st Ave @ SW Sheridan St	SBT	830	777	1.3
		SBR	5	11	1.5
		EBL	10	24	2.4
		EBT	10	29	3.0
		EBR	25	0	5.0
		WBL	55	80	2.2
		WBT	0	20	4.5
		WBR	60	11	5.8
		Total	2375	2167	3.1
47	SW Naito Pkwy @ SW Sheridan St	EBT	1045	937	2.4
		WBT	115	110	0.3
		Total	1160	1047	2.4
48	SW 1st Ave @ SW Arthur St	NBL	50	59	0.9
		NBT	190	183	0.4
		NBR	165	148	1.0
		SBL	260	271	0.5
		SBT	715	667	1.3
		SBR	135	74	4.2
		EBL	60	94	2.7
		EBT	1900	1788	1.8
		EBR	195	159	1.9
		WBT	2125	1337	13.4
		WBR	385	299	3.3
		Total	6180	5079	10.4
52	SW Barbur Blvd @ SW Hooker St	NBL	20	16	0.7
		NBT	1505	1390	2.1
		NBR	90	93	0.2
		SBL	135	112	1.5
		SBT	1295	1173	2.5
		SBR	15	14	0.2
		EBL	5	4	0.3
		EBT	5	1	1.6
		EBR	5	3	0.7
		WBL	55	47	0.8
		WBT	5	3	0.7
		WBR	90	99	0.7
		Total	3225	2955	3.4
56	SW Kelly St/SW Corbett Ave @ SW Porter St/SW Hood Ave	NBT	1820	725	21.7
		NBR	1595	599	21.3
		SBL	205	226	1.0
		SBT	60	31	3.0
		SBR	60	44	1.6
		EBR	25	23	0.3
		Total	3765	1648	28.8
58	SW Barbur Blvd @ SW Woods St	NBL	0	6	2.4
		NBT	1585	1462	2.2
		NBR	400	401	0.0
		SBL	260	224	1.6
		SBT	1095	992	2.3
		SBR	0	8	2.8
		EBL	0	6	2.4
		EBR	0	2	1.4

Intersection Number	Intersection Name	Movement	Input Volume	VISSIM Output Volume	GEH
		WBL	25	20	0.7
		WBR	30	29	0.1
		Total	3395	3150	3.0
59	SW Water Ave @ Ross Island Bridge	SBR	105	100	0.3
		WBT	1585	697	18.6
		WBR	30	14	2.4
60	SW Hood Ave @ SW Macadam Ave	Total	2690	1620	16.3
61	SW Naito Pkwy @ Ross Island Bridge	NBR	1550	1280	5.1
		EBT	3345	3039	3.8
		Total	4895	4319	6.0
62	Kelly Ramps @ Ross Island Bridge	NBR	1420	1301	2.3
		EBT	4895	4317	6.0
		Total	6315	5618	6.4
69	SW Naito Pkwy @ SW Gibbs St/Naito Ramps	NBT	1610	1392	4.0
		NBR	10	3	1.9
		WBR	605	531	2.2
		Total	2225	1926	4.6
70	SW Kelly Ave @ SW Gibbs St	NBL	5	4	0.3
		NBT	1420	1301	2.3
		NBR	15	0	3.9
		SBL	70	88	1.4
		SBT	310	191	5.3
		SBR	10	81	7.4
		EBT	40	47	0.8
		EBR	395	433	1.3
		Total	2265	2145	1.8
77	SW Barbur Blvd @ SW Lane St	NBL	75	68	0.6
		NBT	1780	1674	1.8
		SBT	1100	991	2.4
		SBR	15	10	1.0
		EBL	75	43	2.9
		EBR	320	193	5.6
		Total	3365	2979	4.8
78	SW Barbur Blvd @ SW Abernathy St	NBL	25	17	1.2
		SBT	1390	1221	3.3
		SBR	30	25	0.7
		EBL	30	32	0.3
		EBR	20	15	0.8
		Total	1495	4276	36.6
80	SW Barbur Blvd @ SW Bancroft St	NBR	615	509	3.2
		WBR	160	140	1.2
		Total	775	649	3.3
81	SW Corbett Ave @ SW Bancroft St	NBL	105	93	0.9
		NBT	665	500	4.8
		NBR	35	31	0.5
		SBL	25	22	0.4
		SBT	615	616	0.0
		SBR	20	18	0.3
		EBL	500	416	2.8
		EBT	80	81	0.1
		EBR	35	14	3.0

Intersection Number	Intersection Name	Movement	Input Volume	VISSIM Output Volume	GEH
		WBL	50	51	0.1
		WBT	35	31	0.5
		WBR	30	27	0.4
		Total	2195	1900	4.6
82	SW Barbur Blvd @ SW Hamilton St	NBT	3780	3723	0.7
		NBR	390	363	1.0
		SBL	785	768	0.4
		SBT	4330	3311	11.7
		SBR	95	57	3.1
		EBL	175	53	8.1
		EBT	135	46	6.6
		EBR	25	2	4.4
		WBL	660	631	0.8
		WBT	105	98	0.5
		WBR	310	220	3.9
		Total	10790	9272	10.7
83	SW Hamilton Blvd @ SW Corbett Ave	NBL	670	505	4.8
		NBT	530	450	2.6
		NBR	85	68	1.4
		SBL	5	2	1.1
		SBT	380	367	0.5
		SBR	315	319	0.2
		EBL	265	127	7.0
		EBT	100	90	0.7
		EBR	945	966	0.5
		WBL	30	29	0.1
		WBT	90	86	0.3
		WBR	10	12	0.4
		Total	3425	3021	5.0

Appendix B

Vissim Model Delay

Metro SW Corridor DEIS- Segment A - PM model

Future No-Build Vissim Model Results Memorandum

Delay Results for PM Peak Hour
No-Build Delay (Sec)

Study Intersection No.		2	3	4	6	8	12	13
Approach	**Movement**	**Naito/Hawthorne**	**Naito/Jefferson**	**Naito/Columbia**	**Naito/Clay**	**Naito/Market**	**1st/Harrison**	**Naito/Harrison**
NB	Left		39		67		28	92
	Thru		1	5	11	49		11
	Right	27				63	13	23
SB	Left					7	76	
	Thru		21	5	8	1	80	23
	Right		17		3		96	26
EB	Left			31		811		53
	Thru			34		448	48	13
	Right	14				568	51	35
WB	Left				34		26	76
	Thru				30		18	33
	Right				27			20
Intersection Total		**16**	**13**	**10**	**15**	**202**	**57**	**33**

Delay Results for PM Peak Hour
No-Build Delay (Sec)

Study Intersection No.		19	20	21	22	23	24	25	26
Approach	**Movement**	**6th/Hall St**	**5th/Hall**	**4th/Hall**	**Broadway/College**	**6th/College**	**5th/College**	**4th/College**	**Broadway/Jackson**
NB	Left	15		14		11		16	
	Thru	11		7		8		11	
	Right								
SB	Left		0		56		20		11
	Thru		73		63		18		21
	Right				80				33
EB	Left	9		15		24		21	
	Thru		20		37		30		32
	Right	7	14		21	15	22		41
WB	Left		29		42		33		40
	Thru	8	25		36	10	31		39
	Right	10				13			
Intersection Total		**10**	**53**	**8**	**59**	**10**	**23**	**12**	**27**

Delay Results for PM Peak Hour
No-Build Delay (Sec)

Study Intersection No.		27	28	29	30	31	33	34	35
Approach	**Movement**	**6th/Jackson**	**6th/I-405 On-Ramp**	**5th/Jackson**	**5th/Lincoln**	**4th/Lincoln**	**2nd/Lincoln**	**1st/Lincoln**	**Naito/Lincoln**
NB	Left	22	10			19	15	38	
	Thru	3				16		19	11
	Right					6	5		
SB	Left				5		0		
	Thru			17	3			22	8
	Right			84			5	31	
EB	Left	32				44	29	27	
	Thru			46			18	18	
	Right					13	21		
WB	Left				0		30		
	Thru					28	16		
	Right	0				21	12		
Intersection Total		**12**	**10**	**20**	**11**	**17**	**18**	**23**	**9**

Delay Results for PM Peak Hour
No-Build Delay (Sec)

Study Intersection No.		36	37	38	39	40	41
Approach	**Movement**	**4th/Grant**	**Broadway/I-405 SB Off-Ramp**	**Broadway/6th**	**Broadway/5th**	**4th/Caruthers**	**5th/Caruthers**
NB	Left					19	
	Thru			100		11	
	Right		105				
SB	Left		62				
	Thru		65		60	4	25
	Right		54			4	41
EB	Left			92		55	
	Thru		115	27	12	22	
	Right		134	39			
WB	Left					28	29
	Thru				126	30	41
	Right			24		16	
Intersection Total		**5**	**103**	**46**	**65**	**11**	**27**

Delay Results for PM Peak Hour
No-Build Delay (Sec)

Study Intersection No.		42	43	44	45	46
Approach	**Movement**	**4th/Caruthers/Broadway**	**5th/Sheridan**	**6th/Terwillige/Sheridan**	**4th/Barbur/Sheridan St**	**1st/Sheridan**
NB	Left	90		0		2
	Thru	15		24	249	0
	Right			23	139	1
SB	Left		22	0		8
	Thru			2		18
	Right			2		22
EB	Left			0	21	12
	Thru			0	16	0
	Right		27	0	11	17
WB	Left					19
	Thru	29				18
	Right	1				6
Intersection Total		**35**	**23**	**15**	**82**	**10**

Delay Results for PM Peak Hour
No-Build Delay (Sec)

Study Intersection No.		47	48	52	56	58
Approach	**Movement**	**Naito/Sheridan**	**1st/Arthur**	**Barbur/Hooker**	**Kelly/Corbett/Porter/Hood**	**Barbur/Woods**
NB	Left		90	83		117
	Thru		76	111	1188	135
	Right		80	78	1867	122
SB	Left		168	144	73	42
	Thru		81	99	27	72
	Right		35	104	24	74
EB	Left		102	42		48
	Thru		107	31	6	27
	Right	2	116	16		0
WB	Left			87		66
	Thru	3	68	72		0
	Right		80	81		32
Intersection Total		**2**	**95**	**104**	**1202**	**105**

Delay Results for PM Peak Hour
No-Build Delay (Sec)

Study Intersection No.		59	60	61	62	69
Approach	**Movement**	**Water/Ross Island Bridge**	**Hood/Macadam**	**Naito/Ross Island Bridge**	**Kelly/Ross Island Bridge**	**Naito/Gibbs**
NB	Left					
	Thru					229
	Right			127	57	382
SB	Left					
	Thru					
	Right	7				
EB	Left					
	Thru					
	Right			188	13	
WB	Left					
	Thru	1054				
	Right	1144				210
Intersection Total		**886**	**#DIV/0!**	**168**	**23**	**224**

Delay Results for PM Peak Hour
No-Build Delay (Sec)

Study Intersection No.		70	77	78	80	81	82
Approach	**Movement**	**Kelly/Gibbs**	**Barbur/Lane**	**Barbur/Abernathy**	**Barbur/Bancroft**	**Corbett/Bancroft**	**Barbur/Hamilton**
NB	Left	276	23	26		5	
	Thru	287	5			3	109
	Right	0			22	3	152
SB	Left	97				3	275
	Thru	97	265	12		1	66
	Right	106	242	4		4	53
EB	Left	0	168	54		23	2171
	Thru	30	179	63		21	2095
	Right	38				24	2258
WB	Left					13	74
	Thru					13	74
	Right				19	8	30
Intersection Total		**195**	**107**	**14**	**21**	**8**	**126**

Delay Results for PM Peak Hour No-Build Delay (Sec)		
Study Intersection No.		83
Approach	**Movement**	**Hamilton/Corbett**
NB	Left	248
	Thru	247
	Right	246
SB	Left	39
	Thru	30
	Right	32
EB	Left	41
	Thru	32
	Right	47
WB	Left	29
	Thru	19
	Right	12
Intersection Total		**110**

Appendix C

Vissim Model Queue Data

Metro SW Corridor DEIS- Segment A - PM model

Future No-Build Vissim Model Results Memorandum

Queuing Results for PM Peak Hour
No-Build 95th Percentile Queue

Study Intersection No.		2	3	4	6	8	12	13
Approach	**Movement**	**Naito/Hawthorne**	**Naito/Jefferson**	**Naito/Columbia**	**Naito/Clay**	**Naito/Market**	**1st/Harrison**	**Naito/Harrison**
NB	Left	-	116	69	67	48	112	502
	Thru	-	-	288	274	289	-	129
	Right	239	-	-	-	-	81	-
SB	Left	-	-	-	177	287	-	-
	Thru	-	623	281	265	47	-	510
	Right	-	-	-	-	-	-	-
EB	Left	-	-	-	-	2153	-	201
	Thru	-	-	216	-	2147	261	270
	BAT	-	-	-	-	2125	-	240
WB	Left	-	-	-	-	-	-	346
	Thru	-	-	-	355	-	184	120
	Right	-	-	-	82	-	-	-

Queuing Results for PM Peak Hour
No-Build 95th Percentile Queue

Study Intersection No.		19	20	21	22	23	24	25	26
Approach	**Movement**	**6th/Hall St**	**5th/Hall**	**4th/Hall**	**Broadway/College**	**6th/College**	**5th/College**	**4th/College**	**Broadway/Jackson**
NB	Left	-	-	-	-	-	-	-	-
	Thru	159	-	236	-	127	-	267	-
	Right	-	-	-	-	-	-	-	-
SB	Left	-	-	-	-	-	-	-	-
	Thru	-	836	-	985	-	274	-	277
	Right	-	-	-	-	-	-	-	-
EB	Left	-	-	-	-	-	-	-	-
	Thru	74	66	67	61	106	90	-	199
	BAT	-	-	-	-	-	-	69	-
WB	Left	-	-	-	-	-	-	-	-
	Thru	133	265	-	182	127	263	-	592
	Right	-	-	-	-	-	-	-	-

Queuing Results for PM Peak Hour
No-Build 95th Percentile Queue

Study Intersection No.		27	28	29	30	31	33	34	35
Approach	**Movement**	**6th/Jackson**	**6th/I-405 On-Ramp**	**5th/Jackson**	**5th/Lincoln**	**4th/Lincoln**	**2nd/Lincoln**	**1st/Lincoln**	**Naito/Lincoln**
NB	Left	-	679	-	-	-	-	134	-
	Thru	368	-	-	-	299	20	94	223
	Right	-	-	-	-	160	-	-	-
SB	Left	-	-	-	-	-	-	-	-
	Thru	-	-	273	174	-	21	343	428
	Right	-	-	-	-	-	-	-	-
EB	Left	174	-	-	-	69	23	68	-
	Thru	-	-	-	-	140	251	-	-
	BAT	-	-	23	-	-	-	202	-
WB	Left	-	-	-	-	-	43	-	-
	Thru	-	-	-	-	260	204	-	-
	Right	0	-	-	68	-	-	-	-

Queuing Results for PM Peak Hour
No-Build 95th Percentile Queue

Study Intersection No.		36	37	38	39	40	41
Approach	**Movement**	**4th/Grant**	**Broadway/I-405 SB Off-Ramp**	**Broadway/6th**	**Broadway/5th**	**4th/Caruthers**	**5th/Caruthers**
NB	Left	-	-	-	-	-	-
	Thru	-	-	404	-	198	-
	Right	-	359	-	-	-	-
SB	Left	-	-	-	-	-	-
	Thru	-	523	-	-	272	365
	Right	-	-	-	566	-	-
EB	Left	0	-	440	-	80	-
	Thru	-	1100	449	239	-	-
	BAT	-	-	-	-	-	-
WB	Left	-	-	-	-	-	-
	Thru	-	-	-	-	110	284
	Right	-	-	198	618	-	-

Queuing Results for PM Peak Hour
No-Build 95th Percentile Queue

Study Intersection No.		42	43	44	45	46
Approach	**Movement**	**4th/Caruthers/Broadway**	**5th/Sheridan**	**6th/Terwillige/Sheridan**	**4th/Barbur/Sheridan St**	**1st/Sheridan**
NB	Left	260	-	-	1097	-
	Thru	208	-	1200	1071	-
	Right	-	-	-	-	-
SB	Left	-	306	0	-	169
	Thru	-	-	158	-	-
	Right	-	-	-	-	-
EB	Left	-	-	-	-	-
	Thru	-	150	0	266	41
	BAT	-	-	-	290	-
WB	Left	-	-	-	-	-
	Thru	1402	-	-	-	46
	Right	-	-	-	-	-

Queuing Results for PM Peak Hour
No-Build 95th Percentile Queue

Study Intersection No.		47	48	52	56	58
Approach	**Movement**	**Naito/Sheridan**	**1st/Arthur**	**Barbur/Hooker**	**Kelly/Corbett/Porter/Hood**	**Barbur/Woods**
NB	Left	-	49	23	-	0
	Thru	-	229	2515	-	-
	Right	-	-	-	-	-
SB	Left	-	823	1043	74	144
	Thru	-	823	1046	-	-
	Right	-	39	-	-	-
EB	Left	-	1253	-	-	-
	Thru	-	1273	19	-	20
	BAT	-	-	-	21	-
WB	Left	-	-	-	-	-
	Thru	-	8468	155	-	44
	Right	-	-	-	-	-

Queuing Results for PM Peak Hour
No-Build 95th Percentile Queue

Study Intersection No.		59	60	61	62	69
Approach	**Movement**	**Water/Ross Island Bridge**	**Hood/Macadam**	**Naito/Ross Island Bridge**	**Kelly/Ross Island Bridge**	**Naito/Gibbs**
NB	Left	-	-	-	-	-
	Thru	-	-	-	-	-
	Right	-	-	-	490	-
SB	Left	-	-	4216	-	-
	Thru	-	-	-	-	-
	Right	42	-	-	-	-
EB	Left	-	-	-	-	-
	Thru	-	-	-	2498	-
	BAT	-	-	-	-	-
WB	Left	-	-	-	-	-
	Thru	-	-	-	-	-
	Right	-	-	-	-	2195

Queuing Results for PM Peak Hour
No-Build 95th Percentile Queue

Study Intersection No.		70	77	78	80	81	82
Approach	**Movement**	**Kelly/Gibbs**	**Barbur/Lane**	**Barbur/Abernathy**	**Barbur/Bancroft**	**Corbett/Bancroft**	**Barbur/Hamilton**
NB	Left	-	30	1728	-	-	-
	Thru	1528	1359	-	-	75	2330
	Right	-	-	-	-	-	-
SB	Left	-	2519	-	-	-	4434
	Thru	15	-	-	-	66	4429
	Right	-	-	-	-	-	-
EB	Left	-	207	-	-	-	-
	Thru	-	-	52	-	895	959
	BAT	2470	-	-	-	-	-
WB	Left	-	-	-	-	-	-
	Thru	-	-	-	-	44	312
	Right	-	-	-	84	-	148

Queuing Results for PM Peak Hour No-Build 95th Percentile Queue		
Study Intersection No.		83
Approach	**Movement**	**Hamilton/Corbett**
NB	Left	-
	Thru	1598
	Right	-
SB	Left	-
	Thru	334
	Right	-
EB	Left	-
	Thru	706
	BAT	-
WB	Left	-
	Thru	60
	Right	-

Appendix D

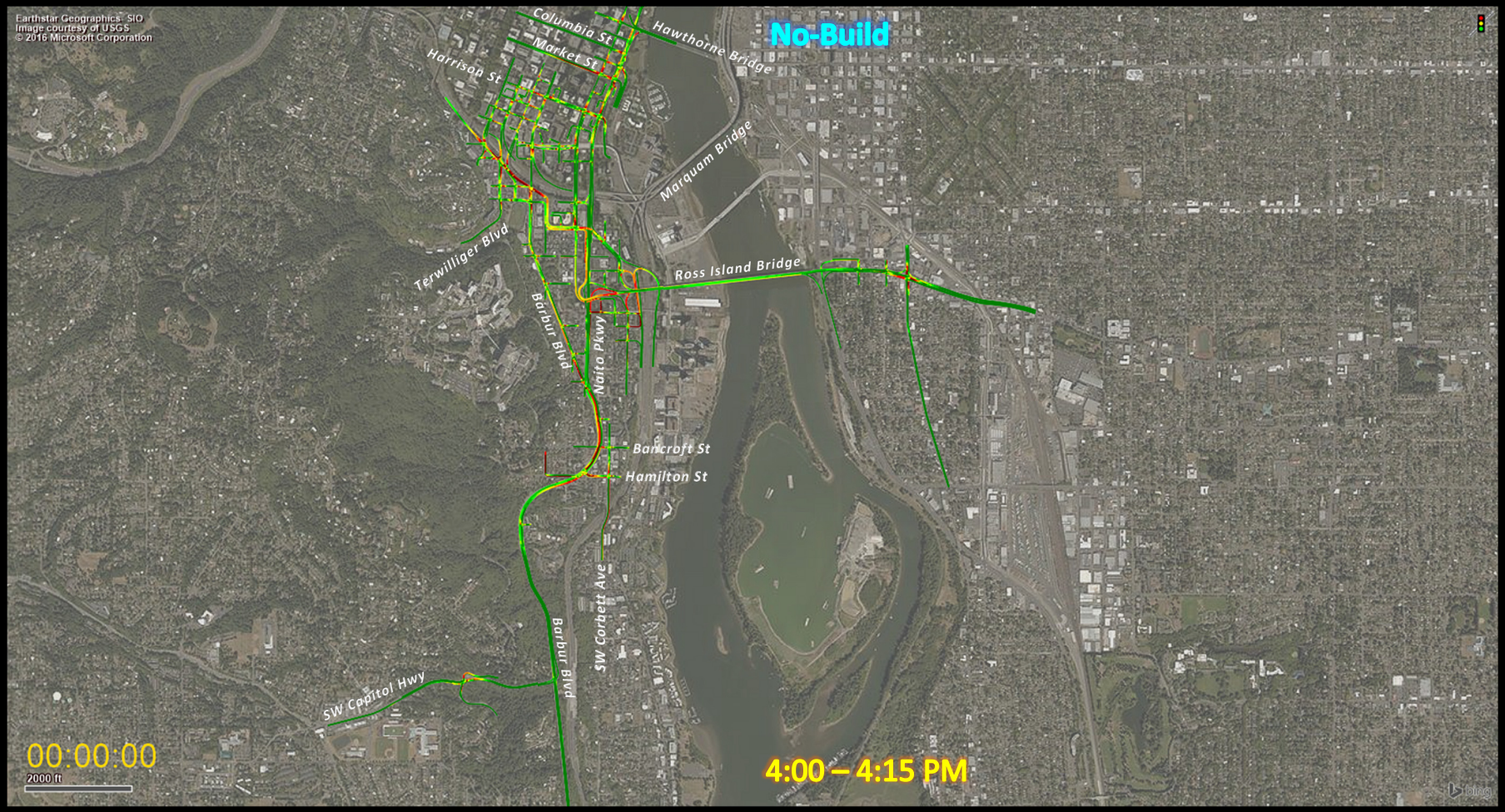
Vissim Model Queue Plots

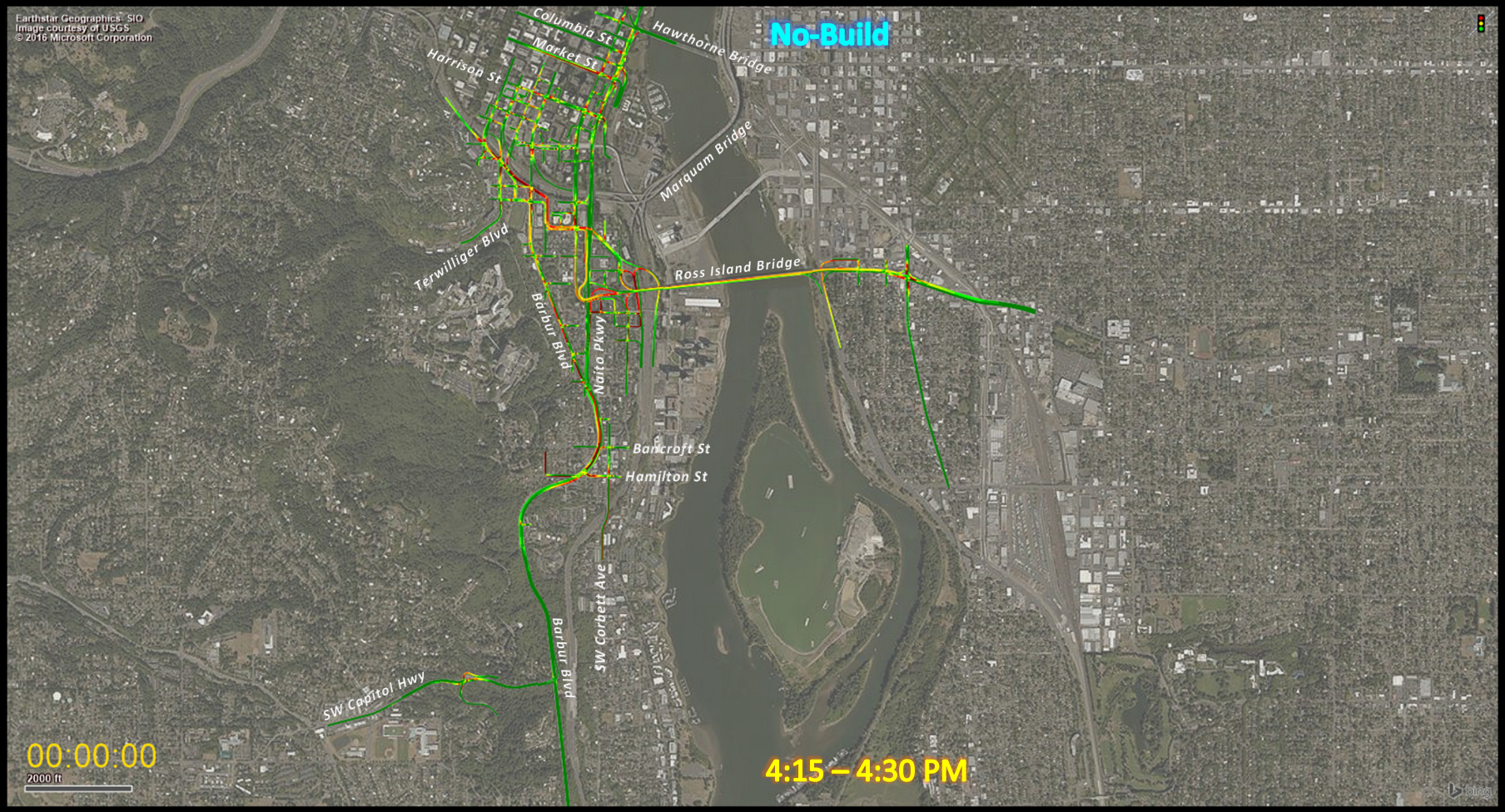
Metro SW Corridor DEIS- Segment A - PM model

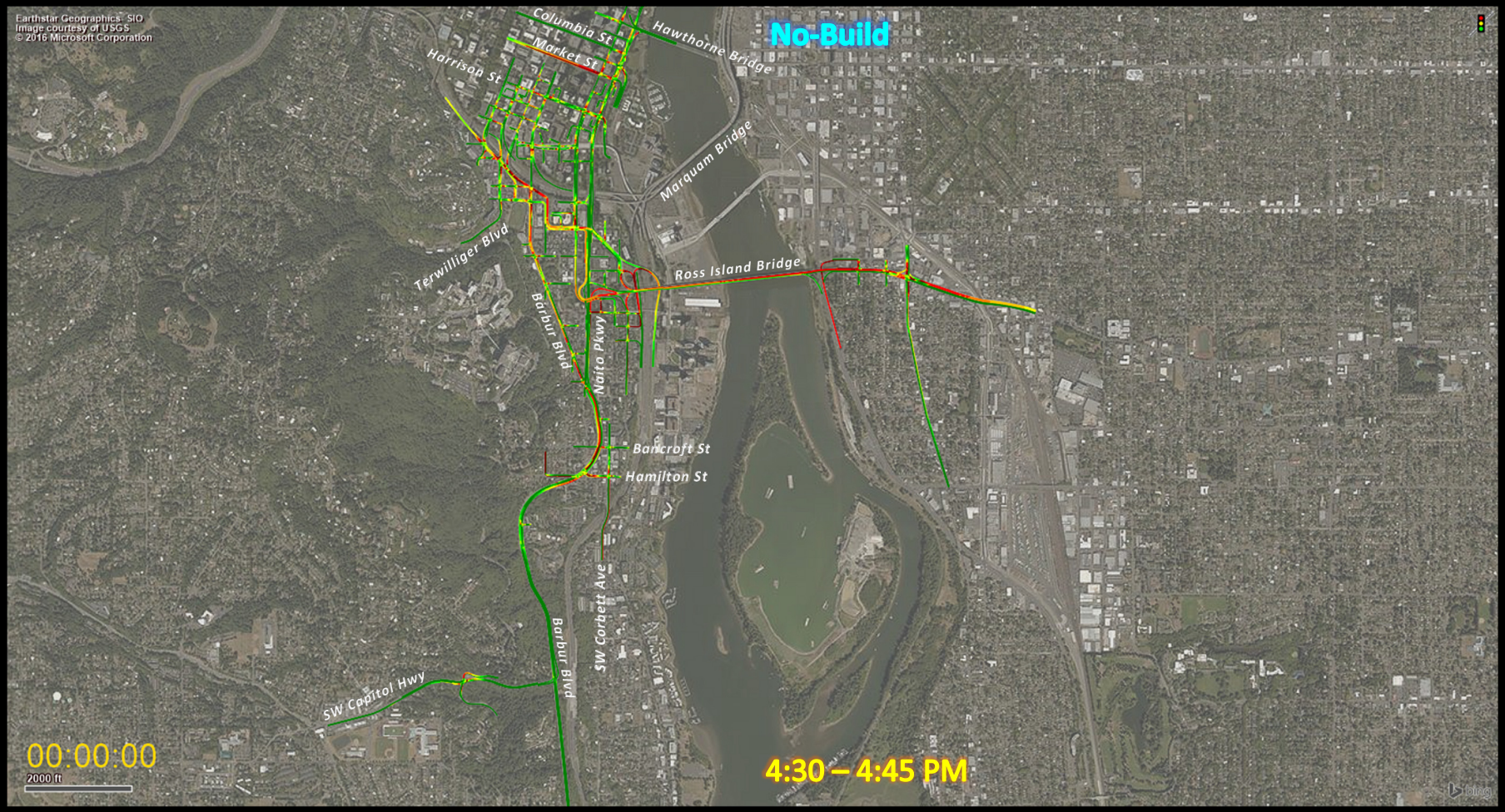
Future No-Build Vissim Model Results Memorandum

No-Build: Full Study Area

No LRT Alignment


Earthstar Geographics, SIO
Image courtesy of USGS
© 2016 Microsoft Corporation
No-Build
Columbia St
Market St
Harrison St
Hawthorne Bridge
Marquam Bridge
Terwilliger Blvd
Ross Island Bridge
Barbur Blvd
Naito Pkwy
Bancroft St
Hamilton St
SW Corbett Ave
Barbur Blvd
SW Capitol Hwy
00:00:00
2000 ft
4:00 – 4:15 PM


Earthstar Geographics, SIO
Image courtesy of USGS
© 2016 Microsoft Corporation
No-Build
Columbia St
Market St
Harrison St
Hawthorne Bridge
Marquam Bridge
Terwilliger Blvd
Ross Island Bridge
Barbur Blvd
Naito Pkwy
Bancroft St
Hamilton St
SW Corbett Ave
Barbur Blvd
SW Capitol Hwy
00:00:00
2000 ft
4:15 – 4:30 PM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Earthstar Geographics, SIO
Image courtesy of USGS
© 2016 Microsoft Corporation
Columbia St
Market St
Harrison St
Hawthorne Bridge
Marquam Bridge
Terwilliger Blvd
Ross Island Bridge
Barbur Blvd
Naito Pkwy
Bancroft St
Hamilton St
SW Corbett Ave
Barbur Blvd
SW Capitol Hwy
00:00:00
2000 ft
4:30 – 4:45 PM

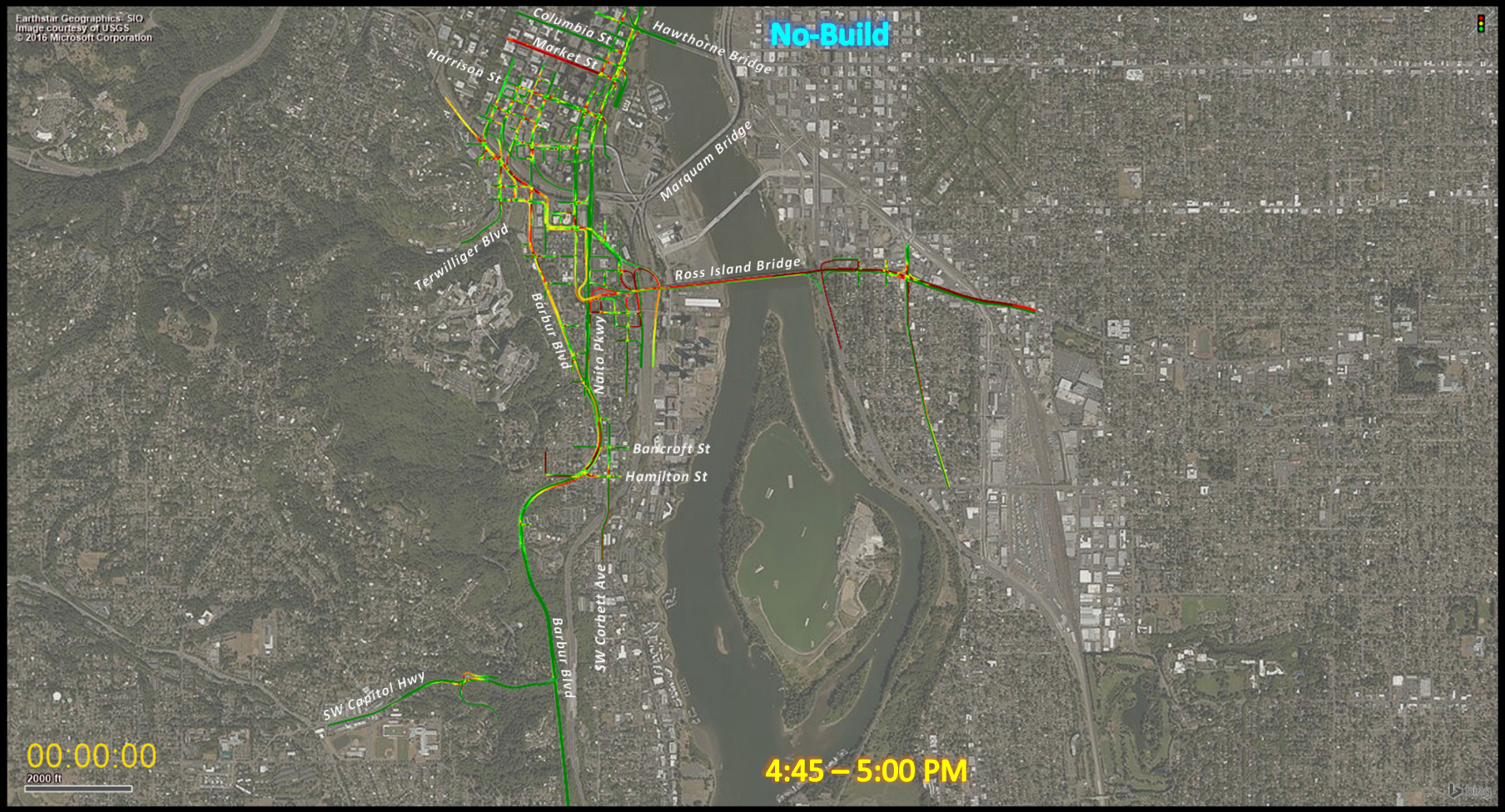
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Image courtesy of USGS
© 2016 Microsoft Corporation
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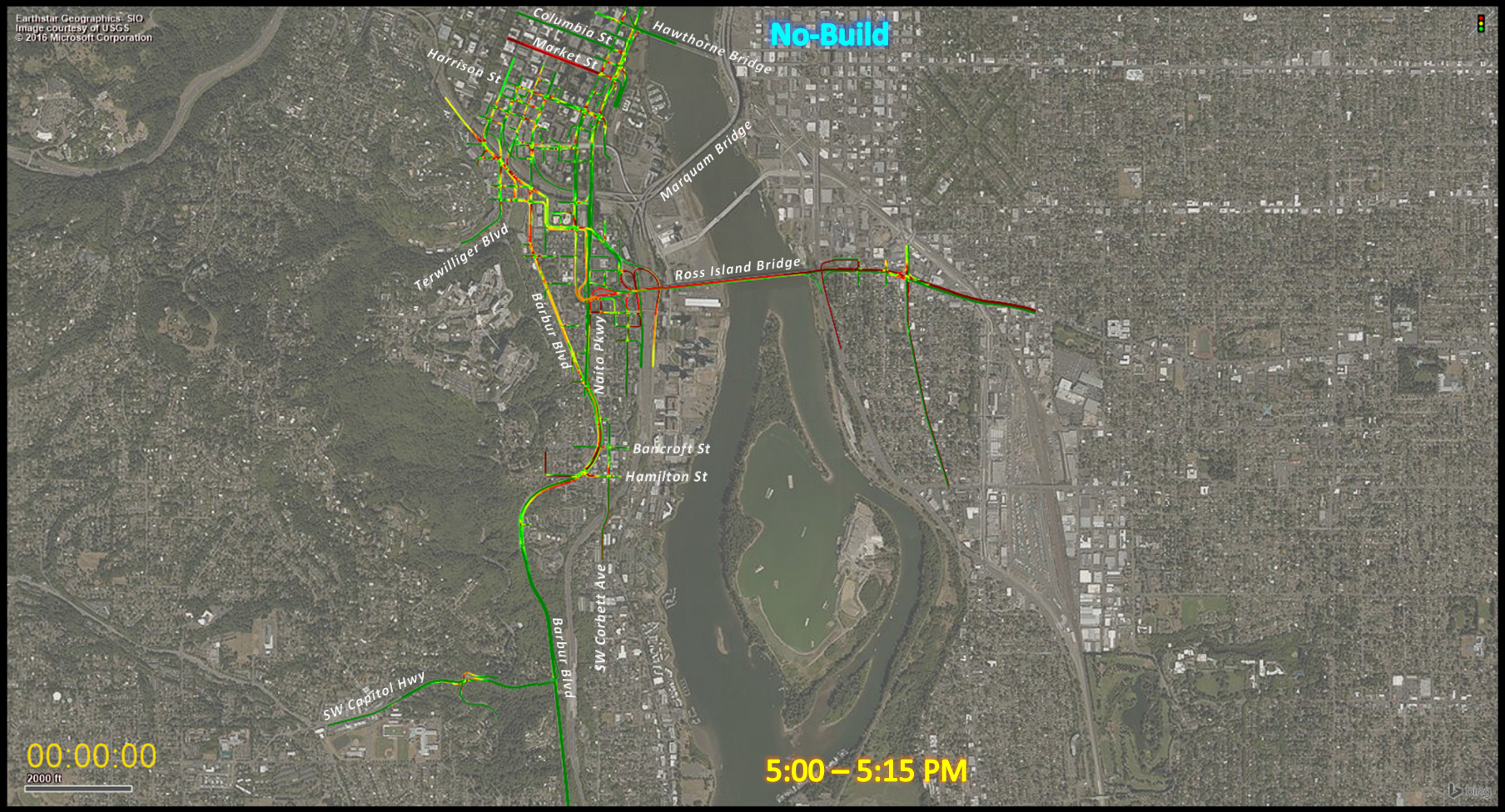
Columbia St
Market St
Harrison St
Hawthorne Bridge
Marquam Bridge
Terwilliger Blvd
Ross Island Bridge
Barbur Blvd
Naito Pkwy
Bancroft St
Hamilton St
SW Corbett Ave
Barbur Blvd
SW Capitol Hwy
00:00:00
2000 ft
4:45 – 5:00 PM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Earthstar Geographics, SIO
Image courtesy of USGS
© 2016 Microsoft Corporation
Columbia St
Market St
Harrison St
Hawthorne Bridge
Marquam Bridge
Terwilliger Blvd
Ross Island Bridge
Barbur Blvd
Naito Pkwy
Bancroft St
Hamilton St
SW Corbett Ave
Barbur Blvd
SW Capitol Hwy
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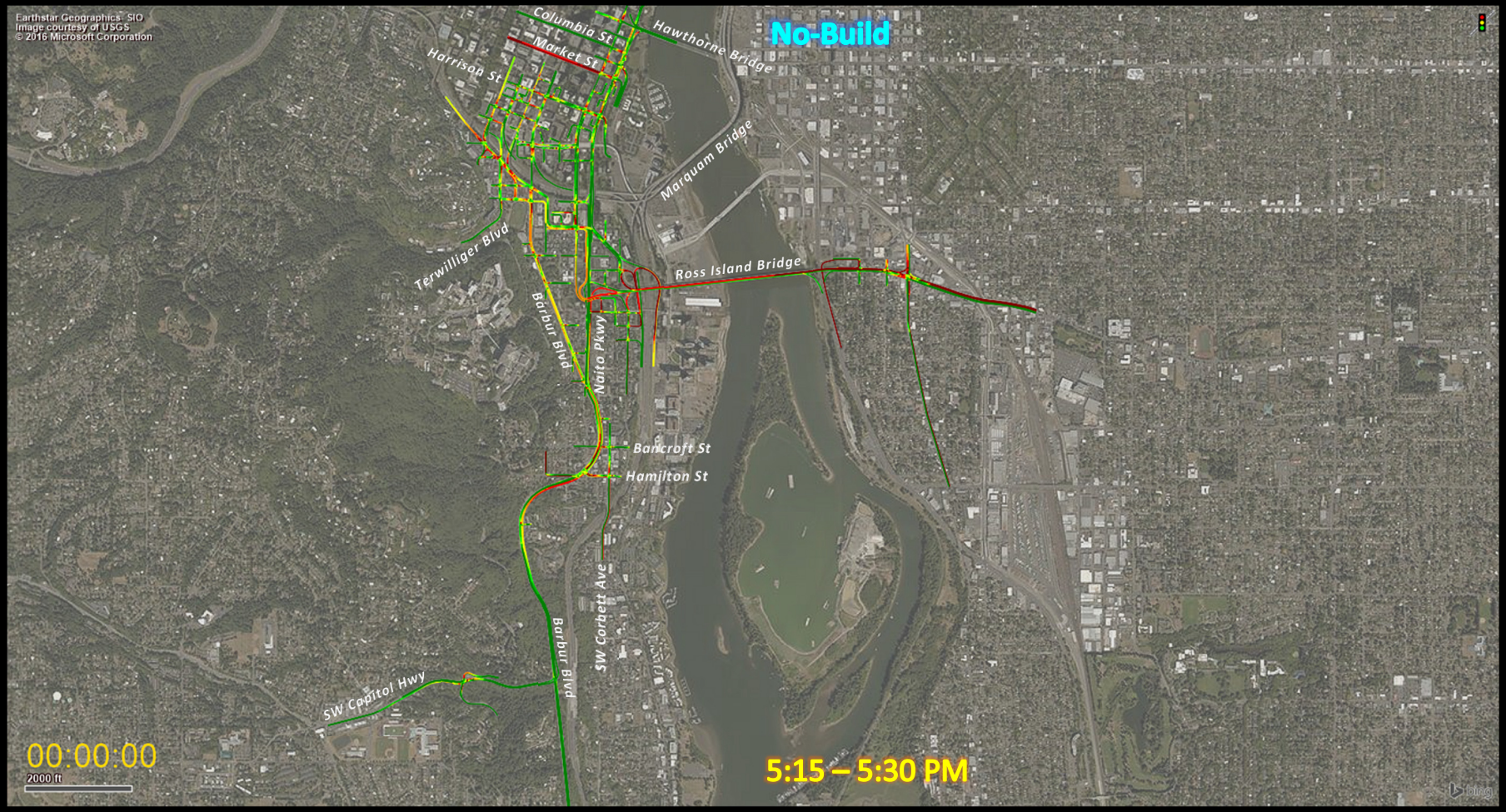
2000 ft
5:00 – 5:15 PM


Earthstar Geographics, SIO
Image courtesy of USGS
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No-Build
Columbia St
Market St
Hawthorne Bridge
Harrison St
Marquam Bridge
Terwilliger Blvd
Ross Island Bridge
Barbur Blvd
Naito Pkwy
Bancroft St
Hamilton St
SW Corbett Ave
Barbur Blvd
SW Capitol Hwy
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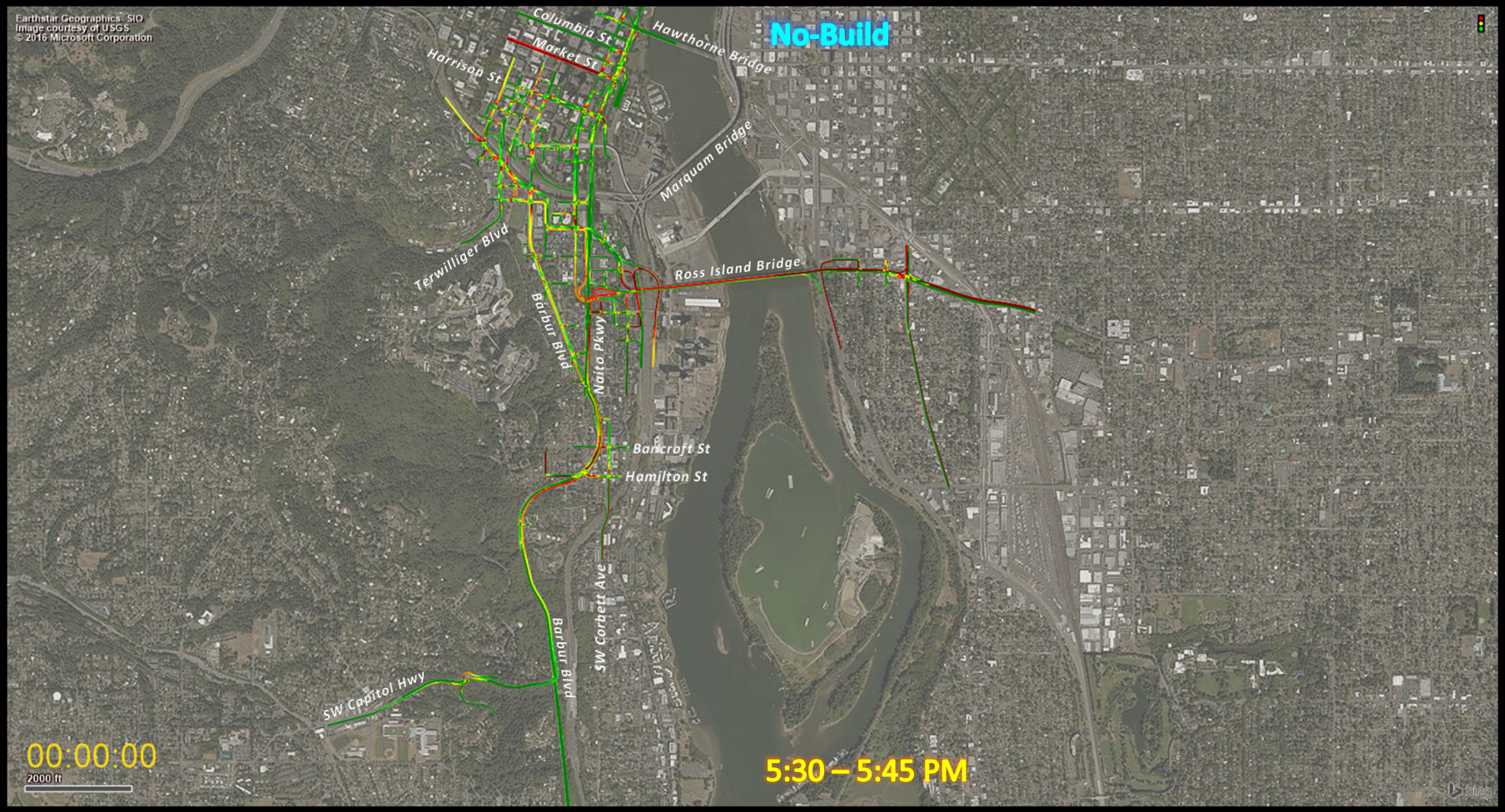
2000 ft
5:15 – 5:30 PM


No-Build
Earthstar Geographics, SIO
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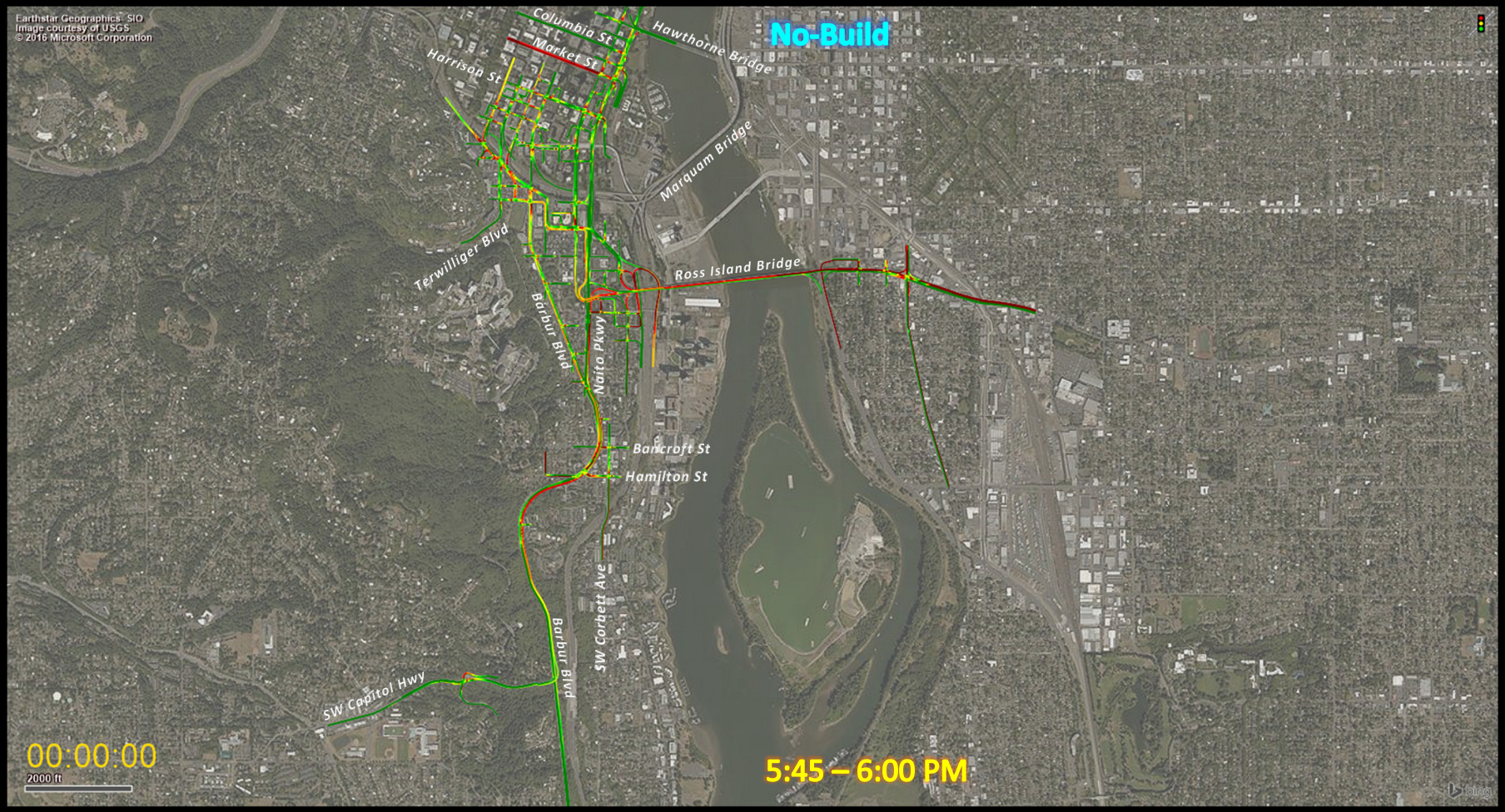
Columbia St
Market St
Harrison St
Hawthorne Bridge
Marquam Bridge
Terwilliger Blvd
Ross Island Bridge
Barbur Blvd
Naito Pkwy
Bancroft St
Hamilton St
SW Corbett Ave
Barbur Blvd
SW Capitol Hwy
00:00:00
2000 ft
5:30 – 5:45 PM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No-Build
Columbia St
Market St
Hawthorne Bridge
Harrison St
Marquam Bridge
Terwilliger Blvd
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Naito Pkwy
Bancroft St
Hamilton St
SW Corbett Ave
Barbur Blvd
SW Capitol Hwy
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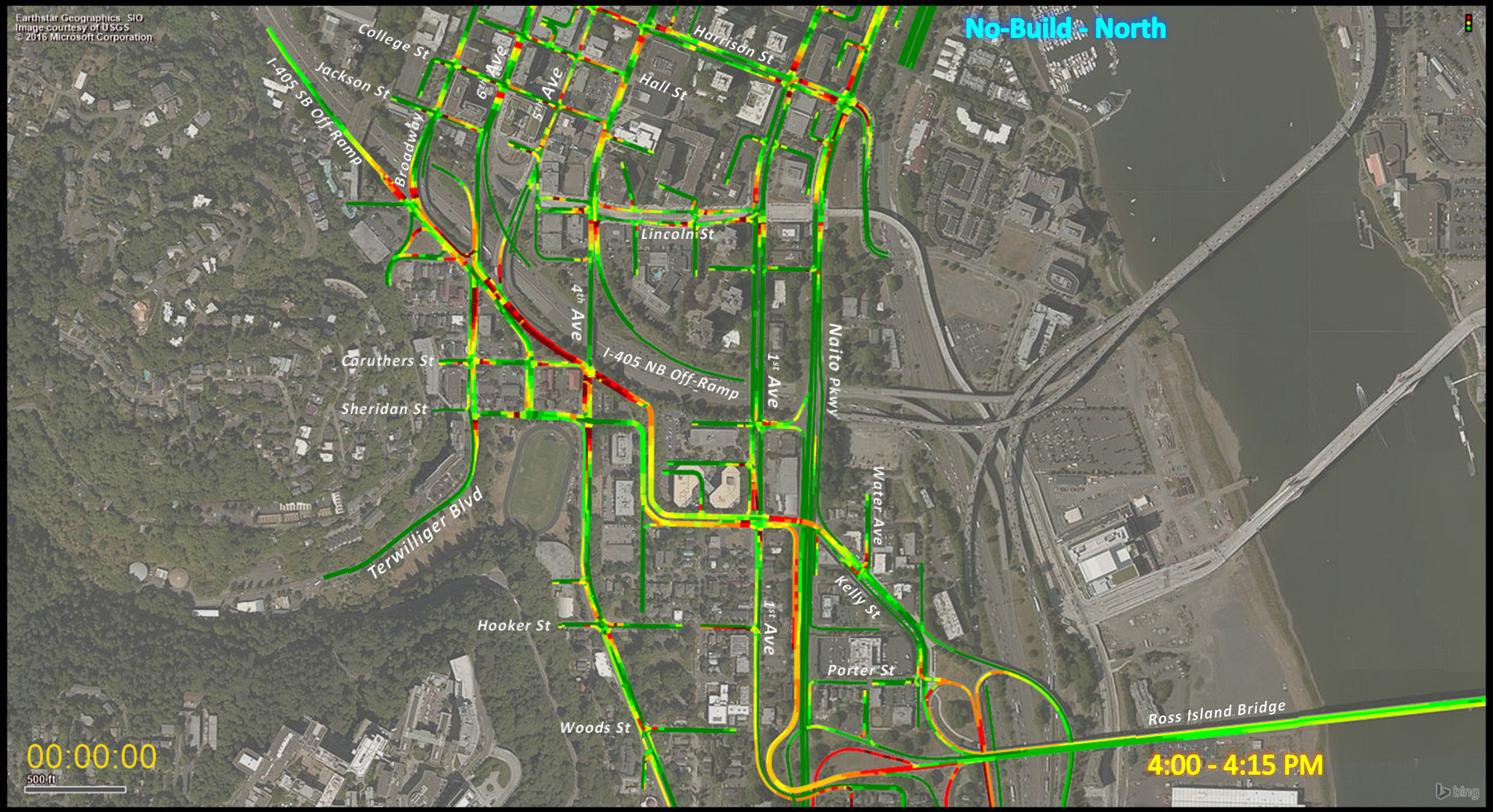
2000 ft
5:45 – 6:00 PM

No – Build: North

No LRT Alignment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Earthstar Geographics, SIO
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College St
Jackson St
I-405 SB Off-Ramp
Broadway
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Harrison St
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4th Ave
I-405 NB Off-Ramp
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Caruthers St
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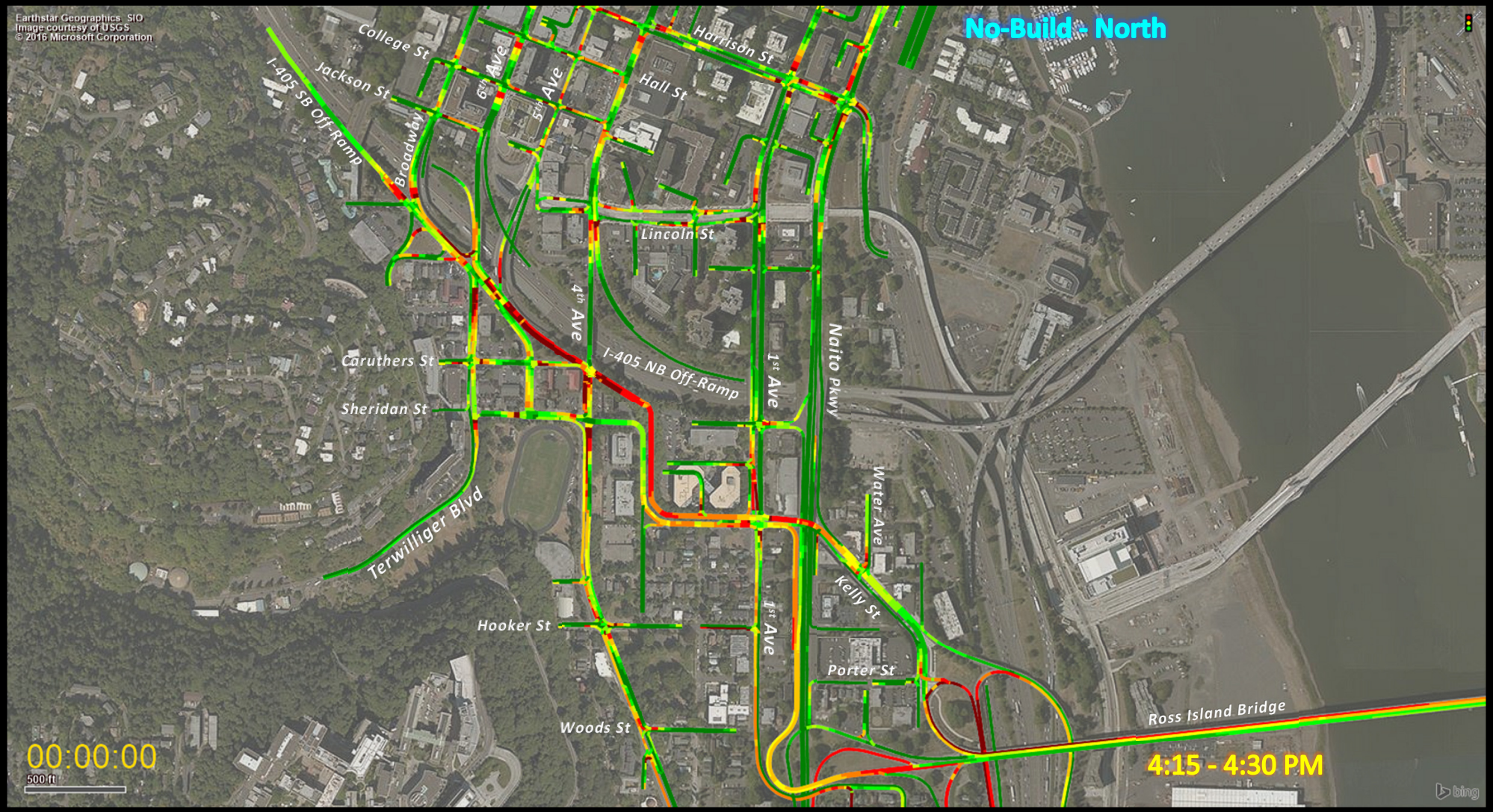
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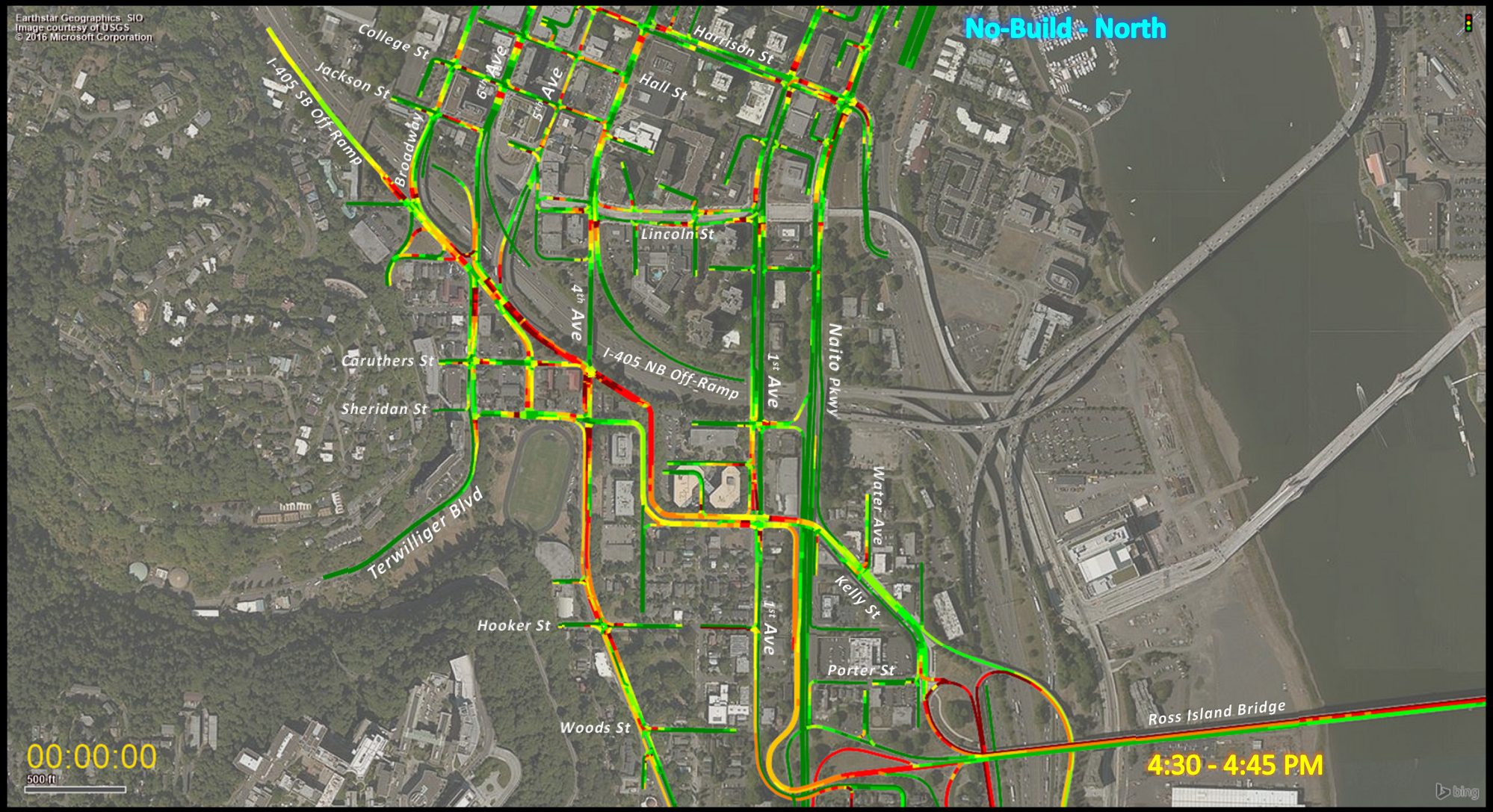
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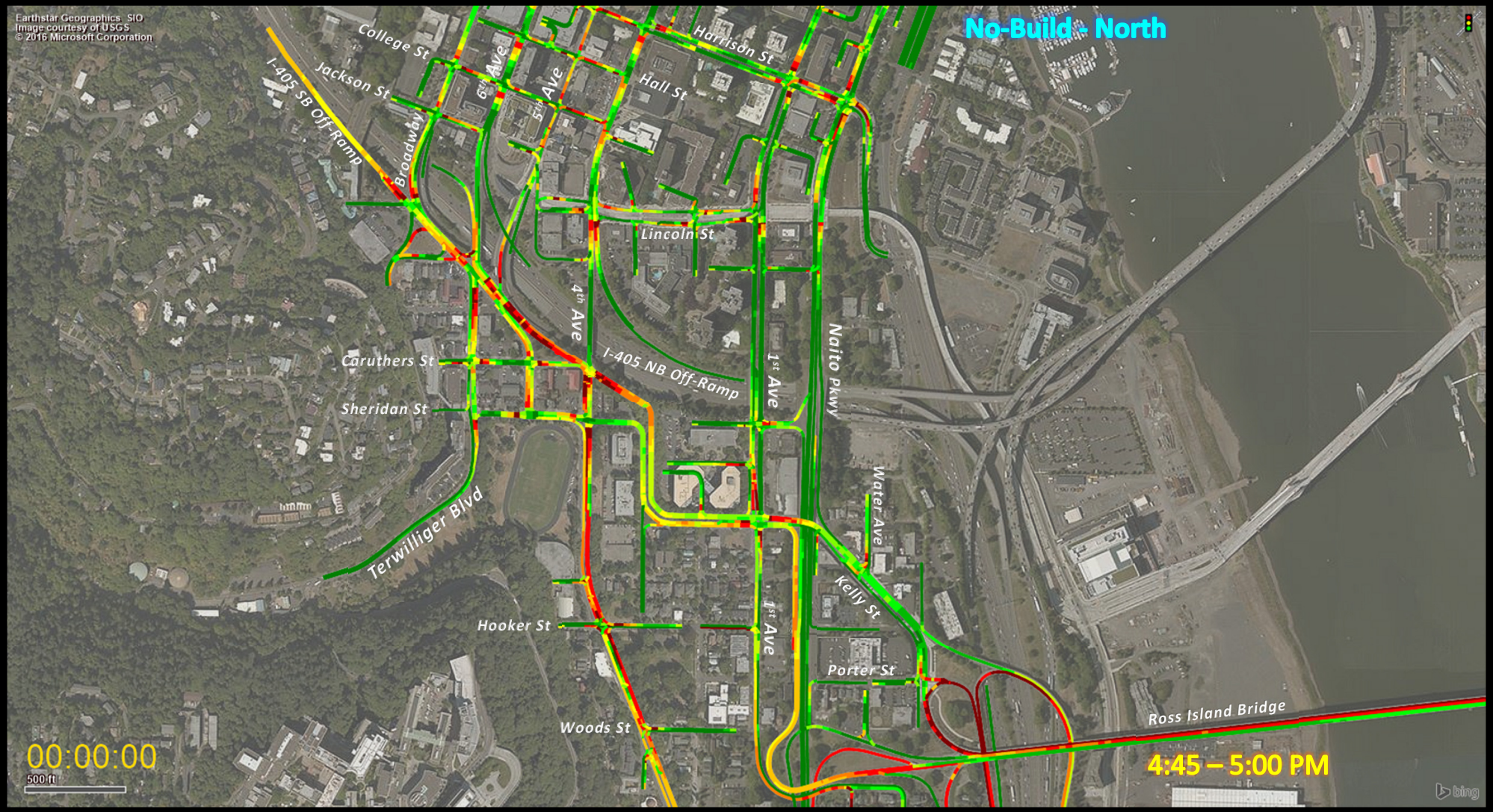
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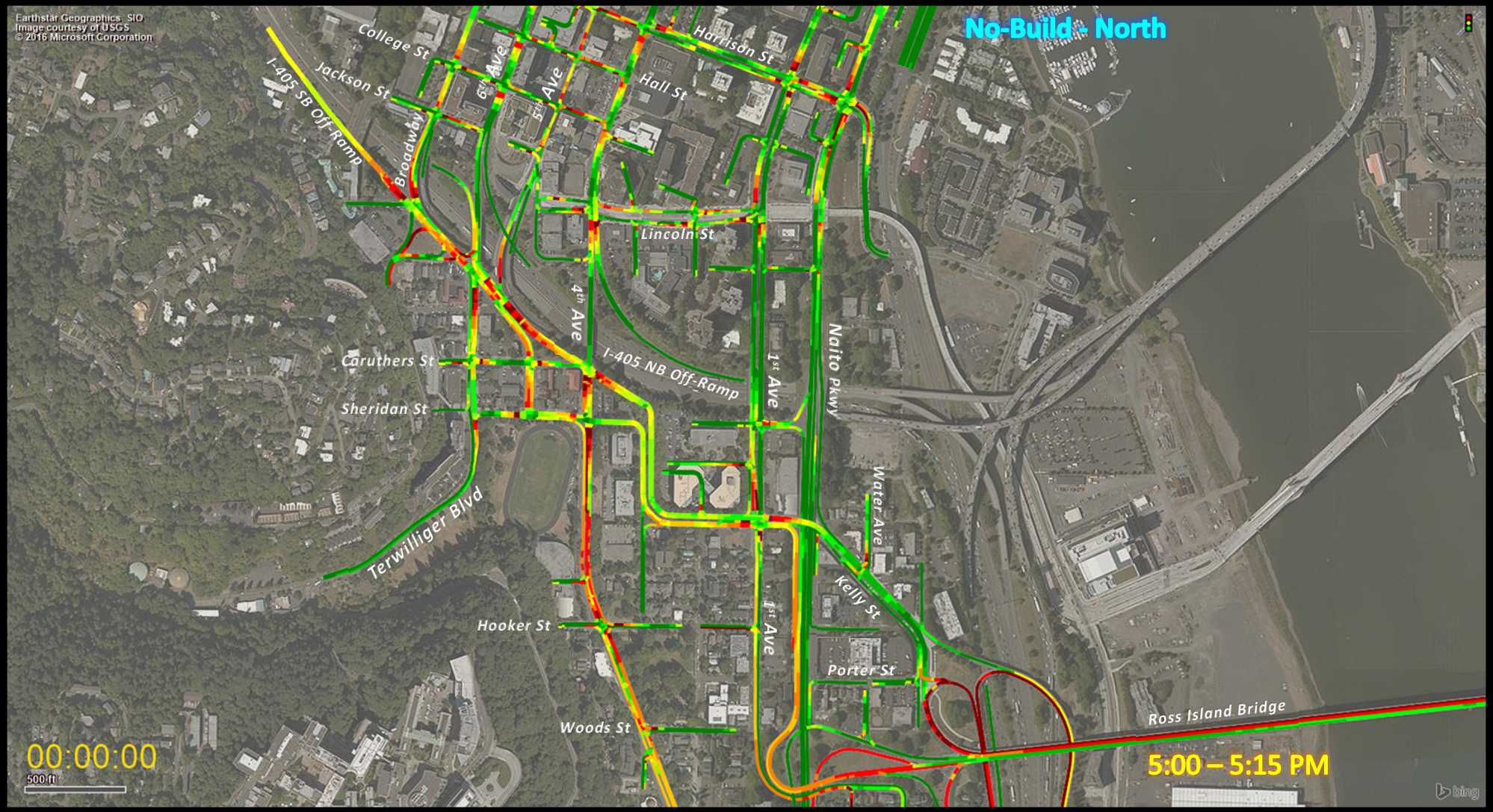
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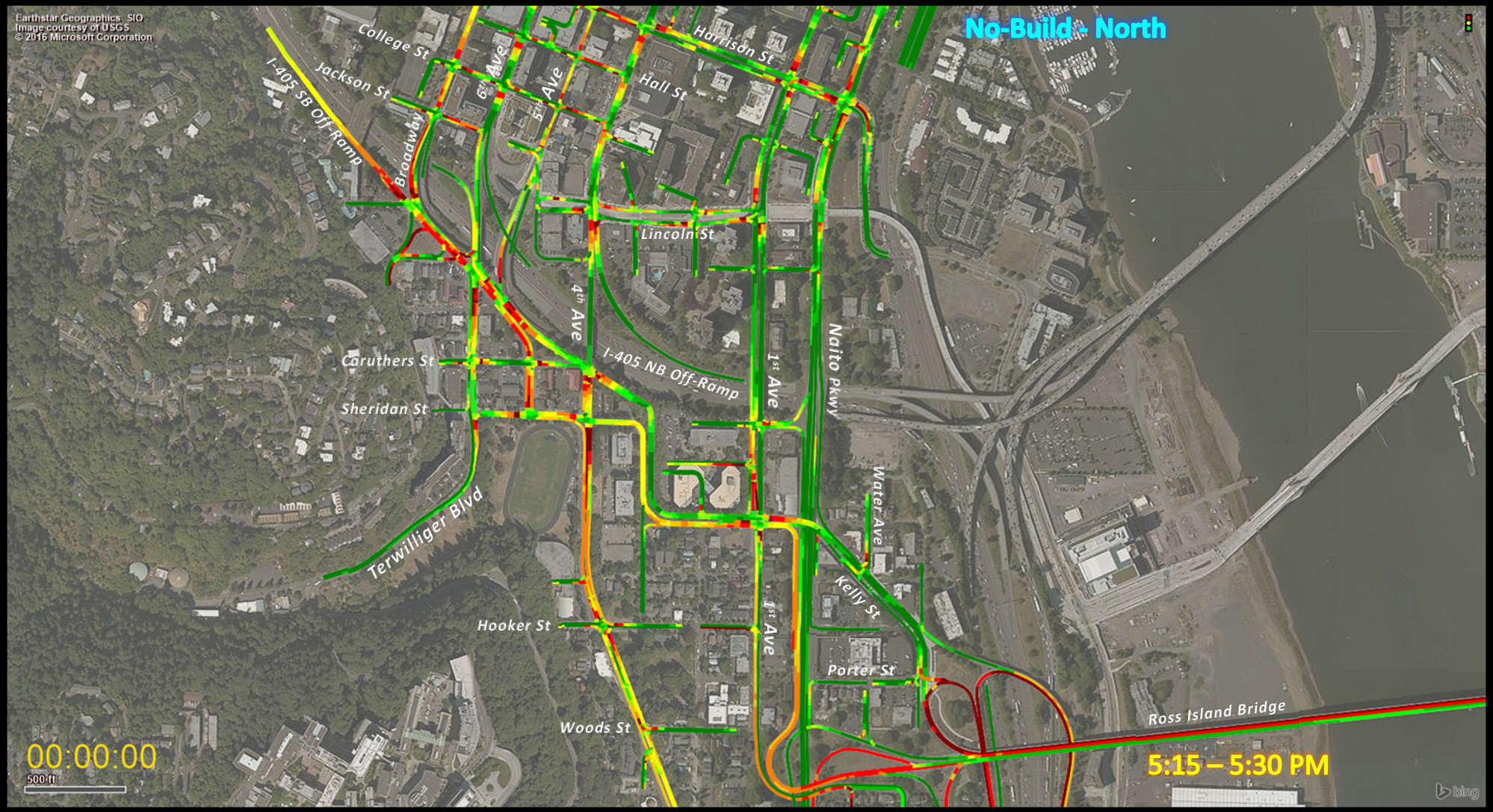
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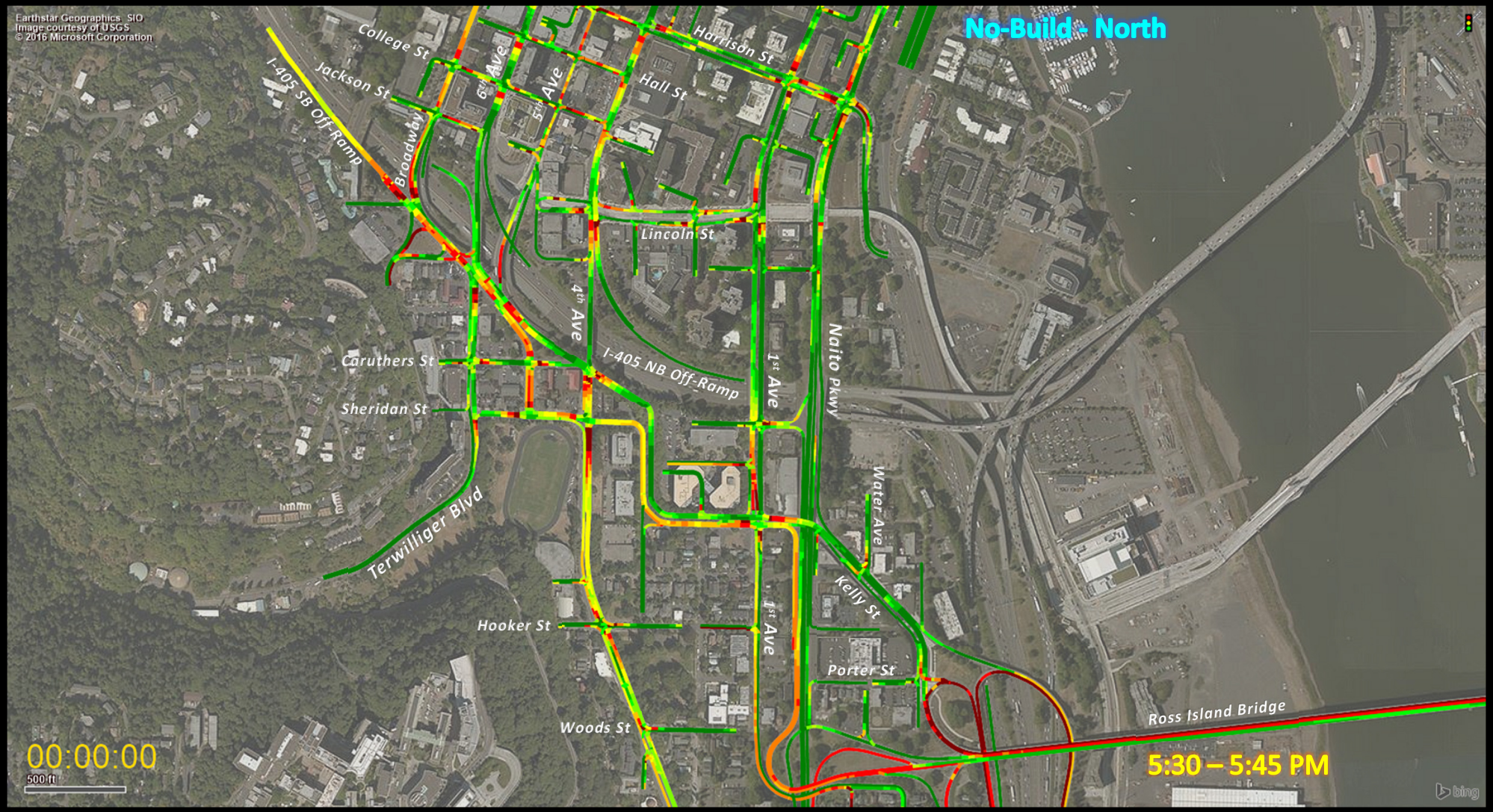
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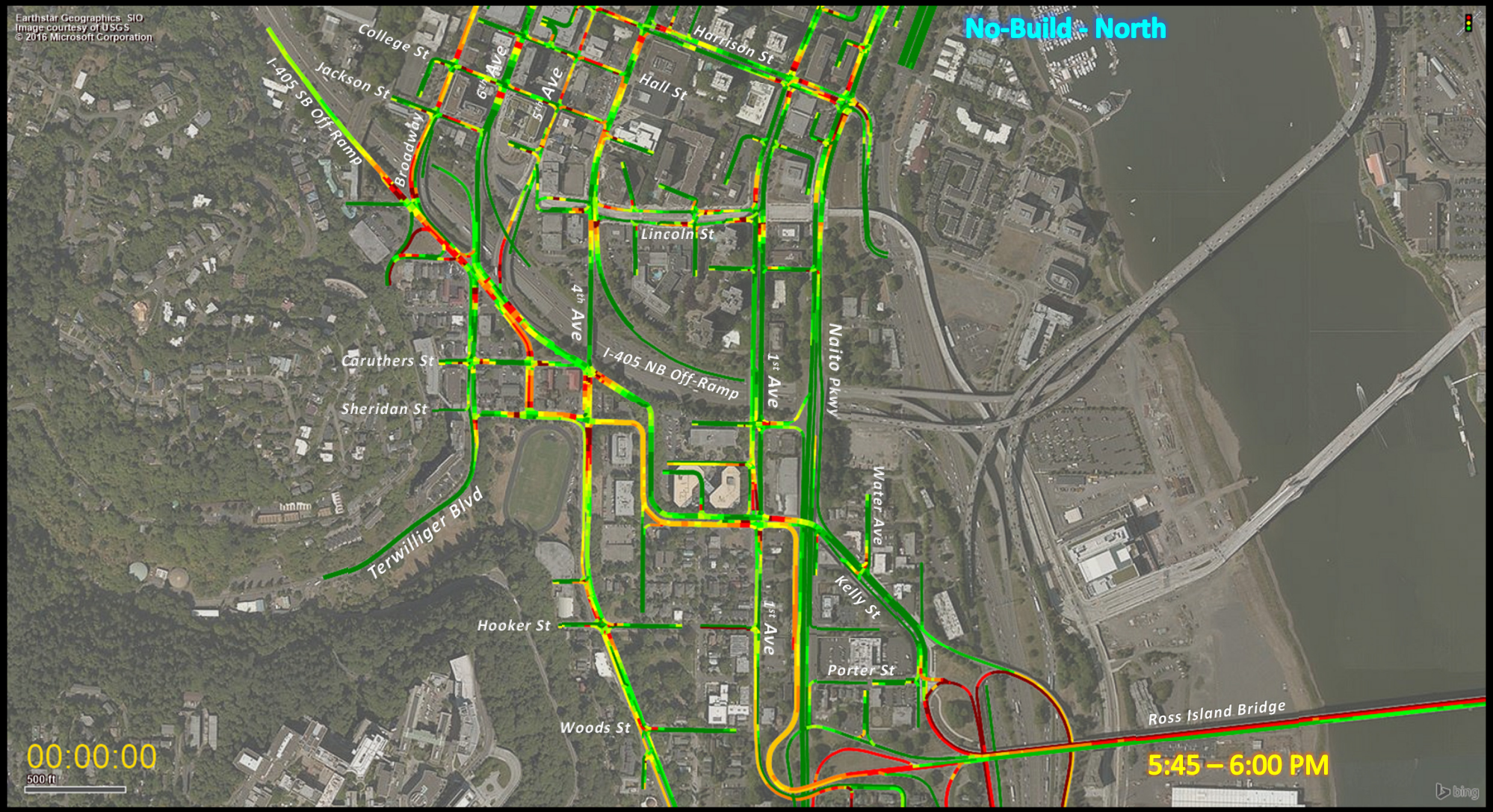
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Water Ave
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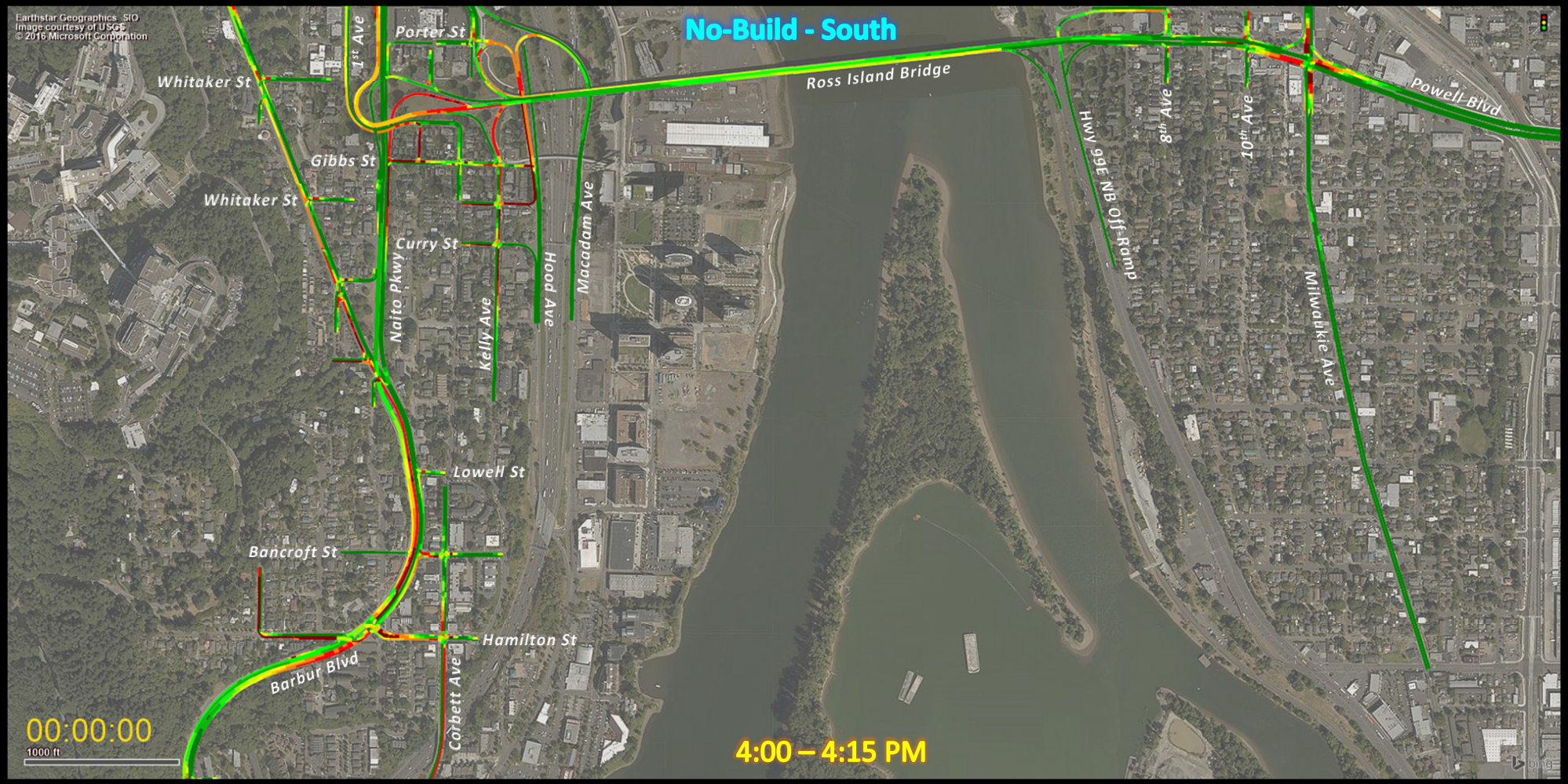
No – Build: South

No LRT Alignment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Earthstar Geographics SIO
Image courtesy of USGS
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Powell Blvd
Gibbs St
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Curry St
Naito Pkwy
Kelly Ave
Hood Ave
Macadam Ave
Hwy 99E NB Off-Ramp
8th Ave
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Bancroft St
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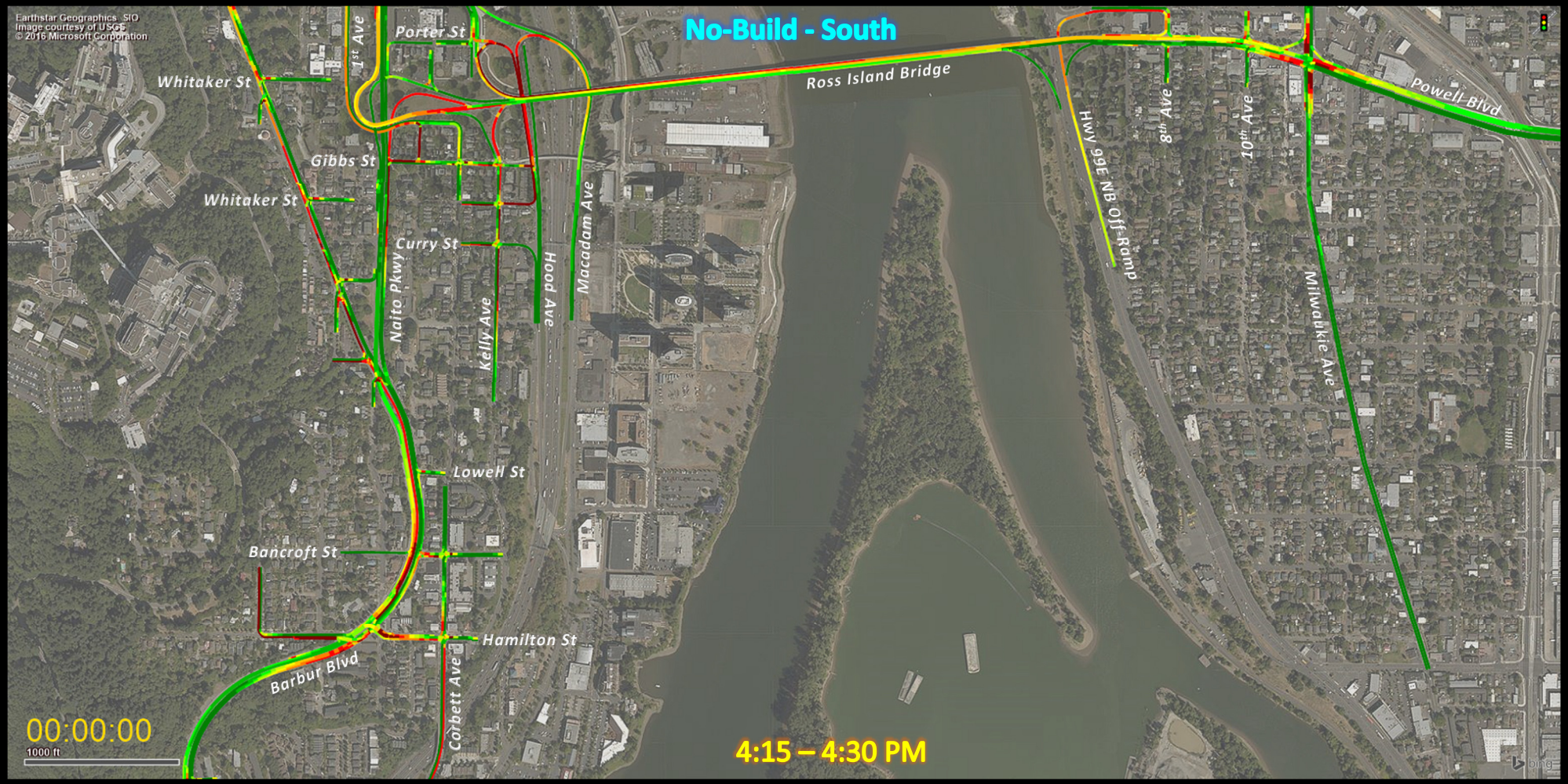
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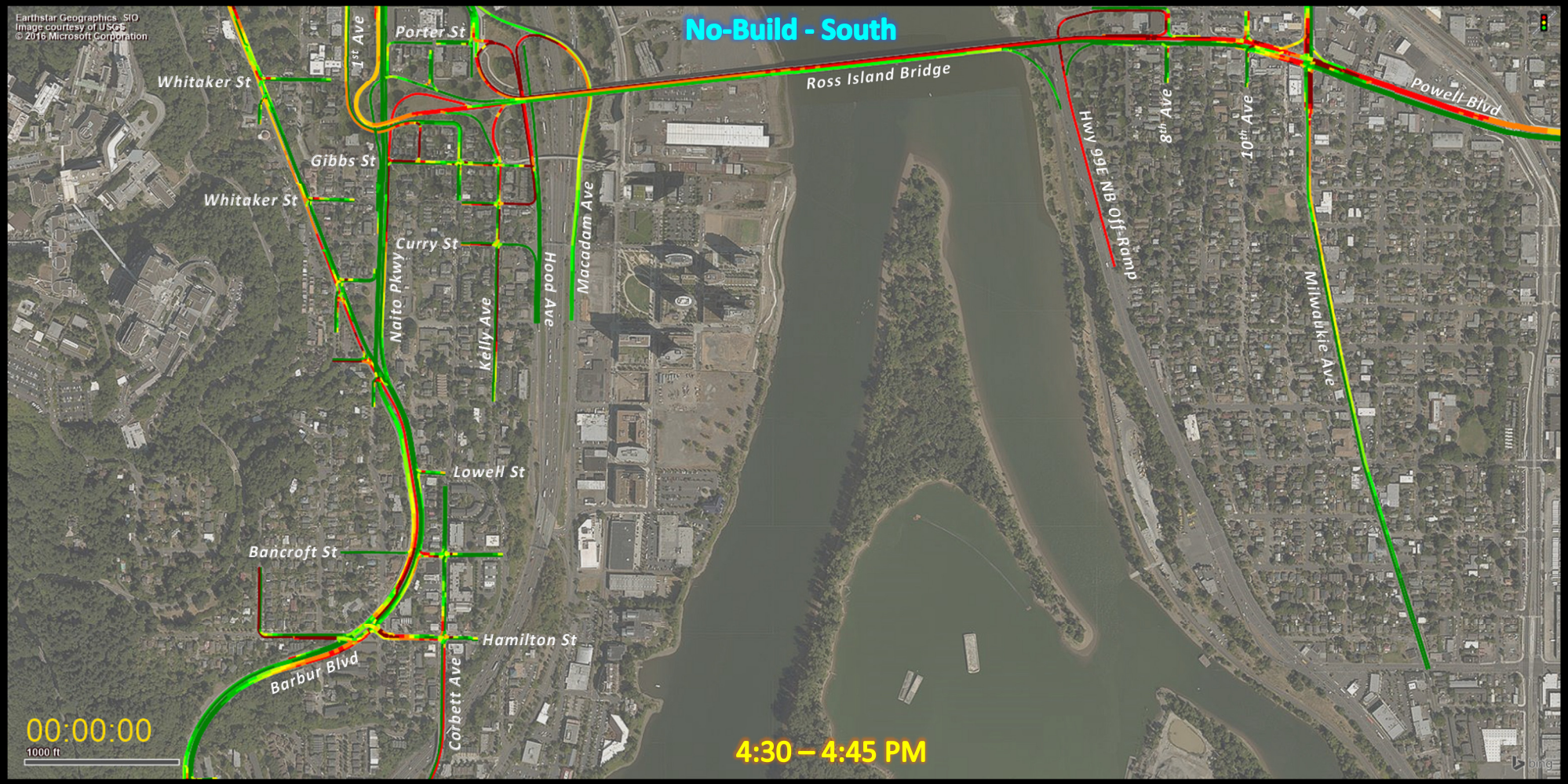
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Image courtesy of USGS
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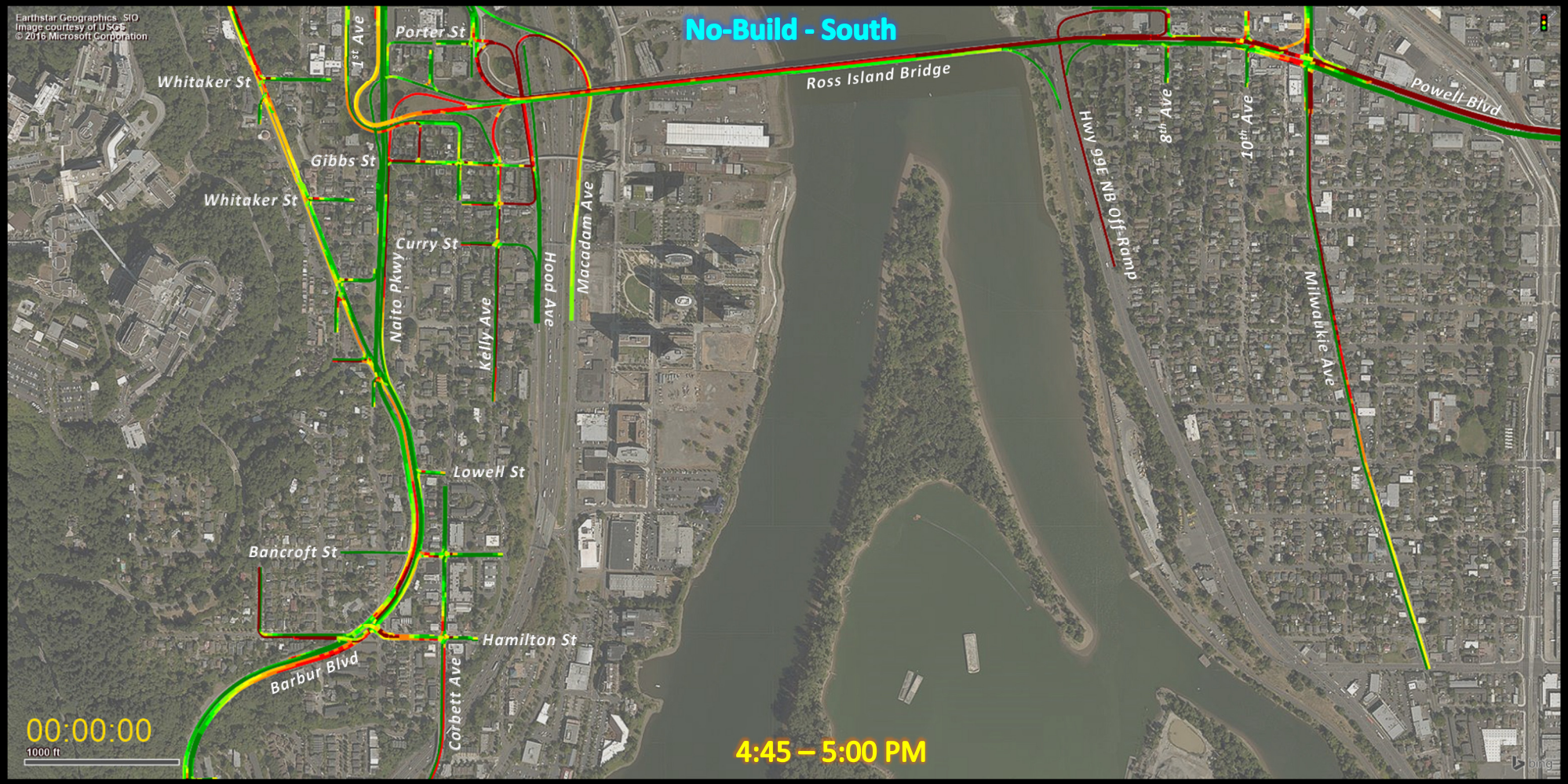
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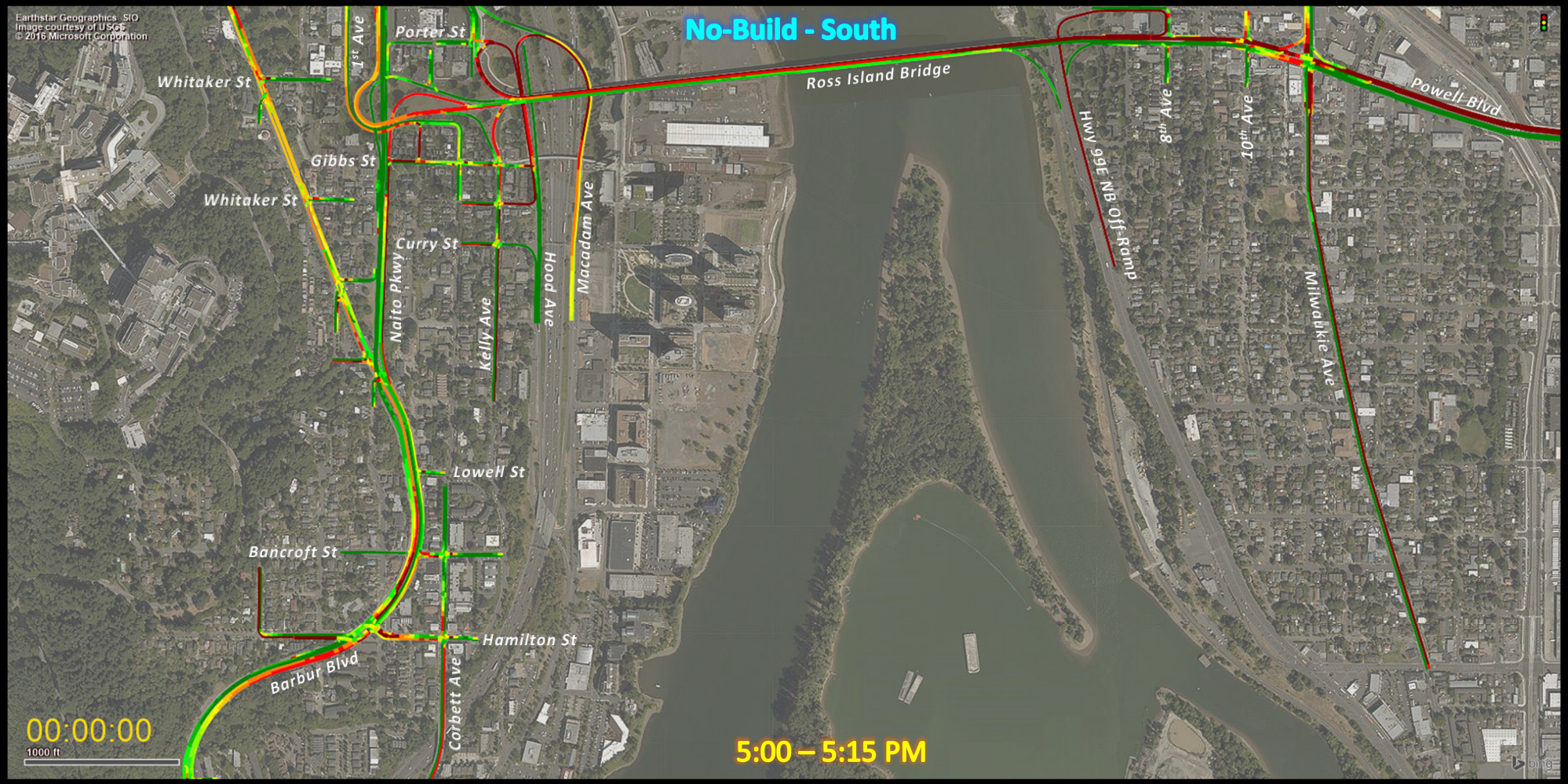
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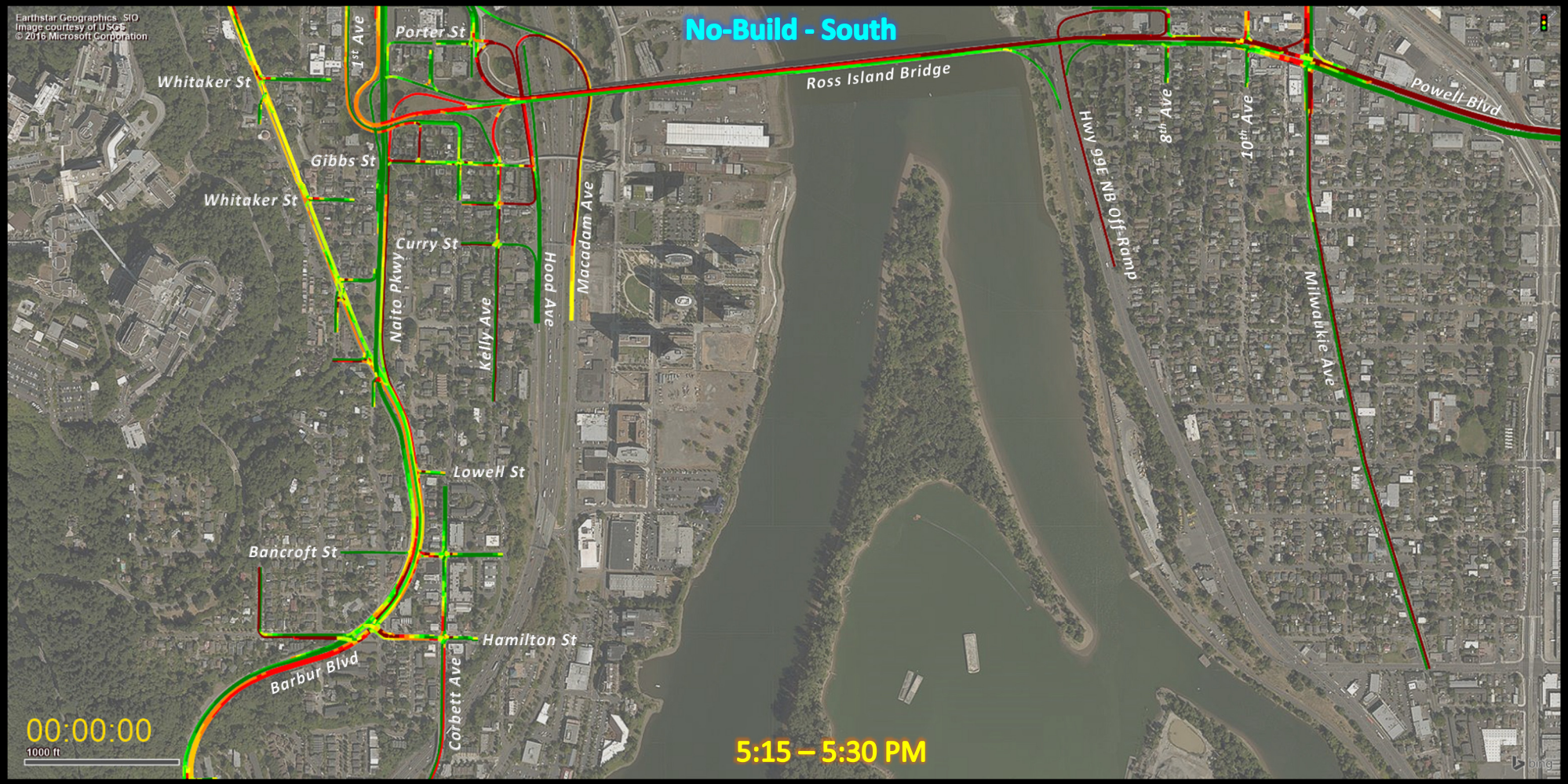
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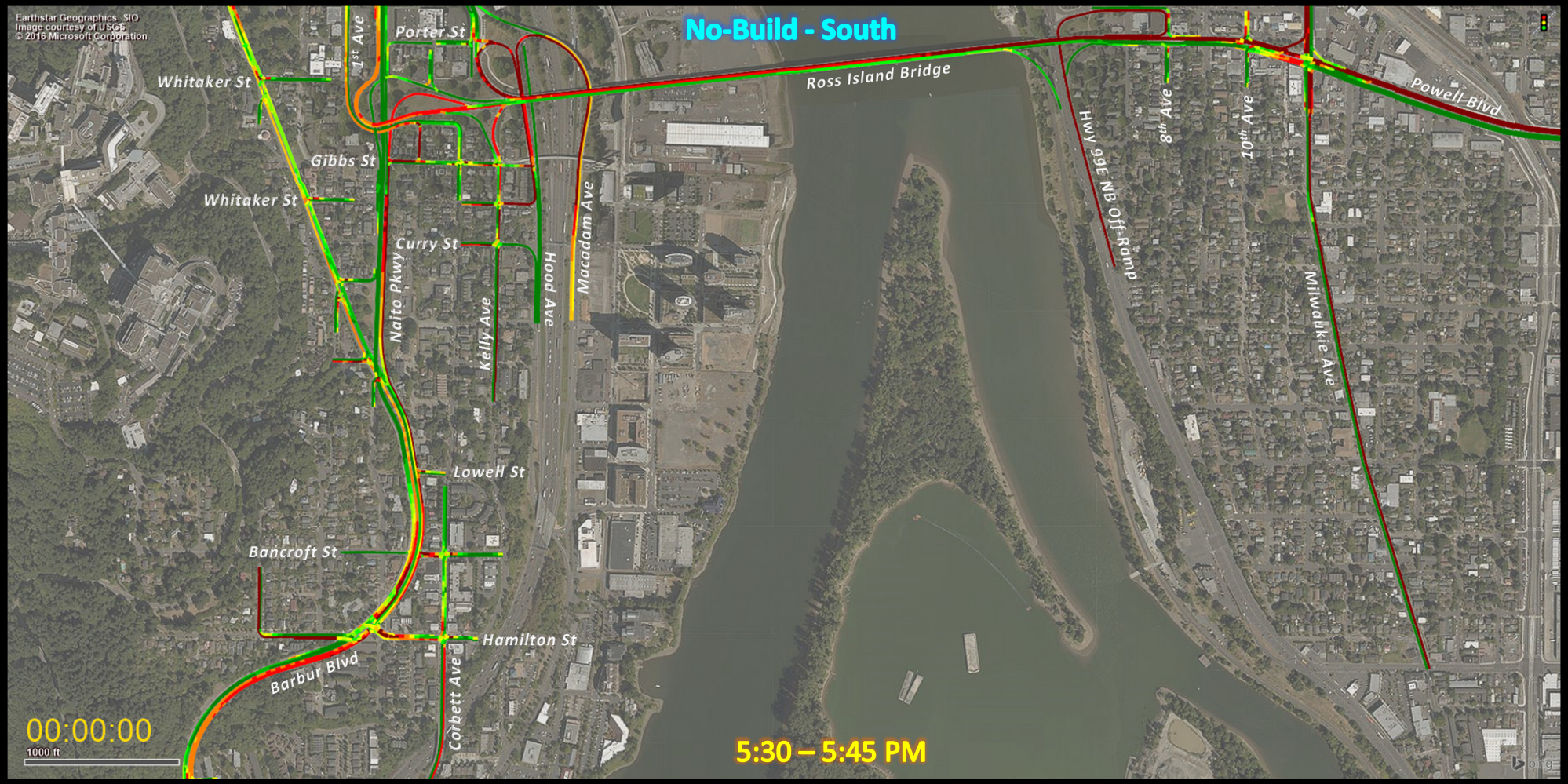
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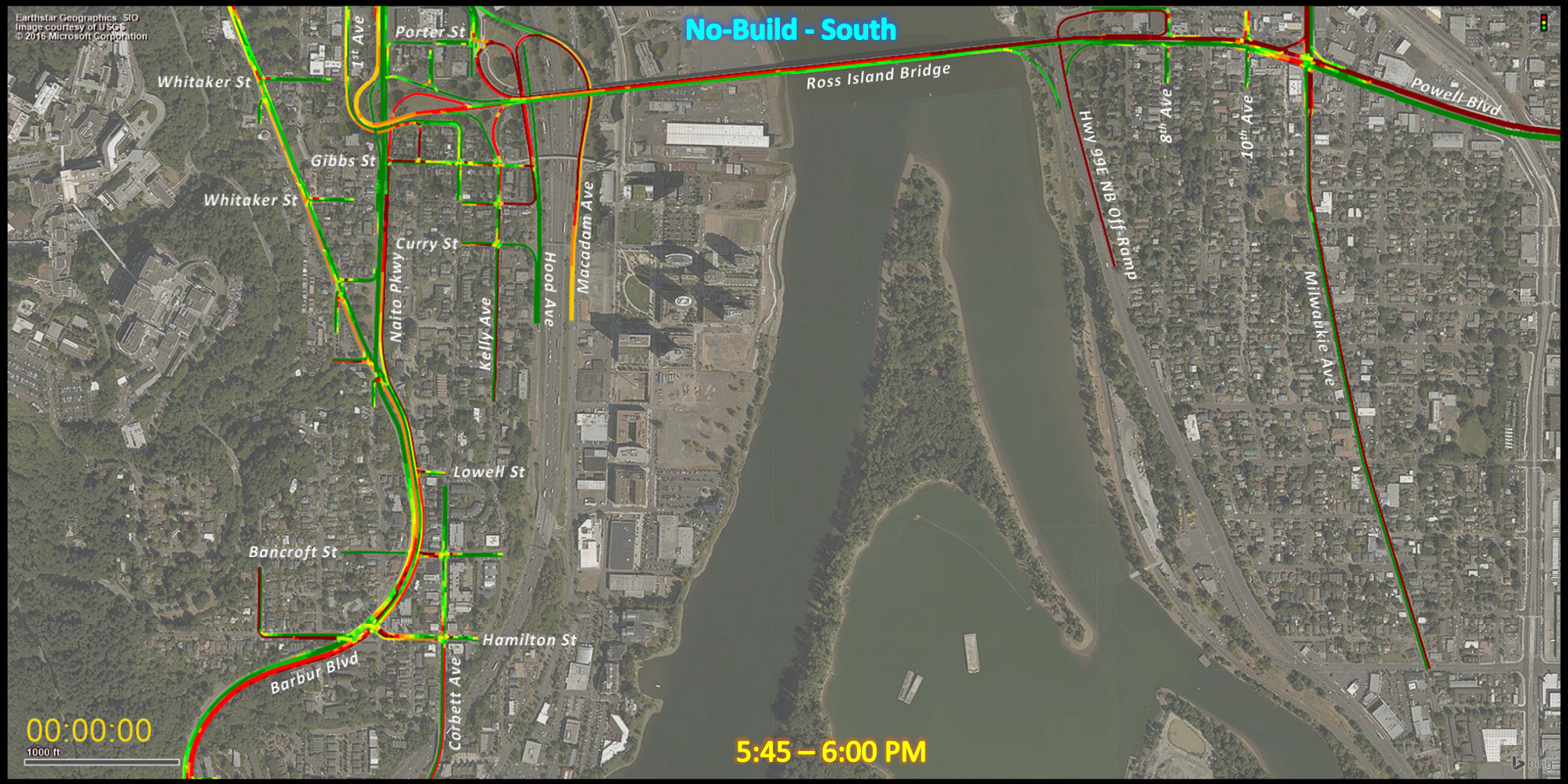
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10th Ave
Milwaukie Ave
Lowell St
Bancroft St
Hamilton St
Barbur Blvd
Corbett Ave
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5:45 – 6:00 PM

Appendix E

Vissim Model Travel Time Data

Metro SW Corridor DEIS- Segment A - PM model

Future No-Build Vissim Model Results Memorandum

No-Build PM Peak Hour (4:30 - 5:30 PM)			Travel Time (Sec)				Model Average Speed (mph)	Model 85th Percentile (mph)	Model Average Delay (min)
From	To	Distance (ft)	10-Run Average	Standard Deviation	Min	Max			
I-405 SB Exit Ramp @ Broadway	Hwy 99E on Powell Blvd	8810	11:01	3:02	4:43	21:03	9	12	7:36
Powell Blvd/Milwaukie Ave	I-405 NB Entrance Ramp @ SW 6th	9673	22:41	5:11	13:13	43:55	5	6	19:17
Barbur Blvd/Hamilton Street	Hwy 99E on Powell Blvd	8018	12:15	3:37	6:18	34:27	7	9	8:58
Powell Blvd/Milwaukie Ave	Barbur Blvd/Hamilton Street	9969	16:31	6:40	4:05	40:11	7	12	13:24
Macadam Ave/Curry St	Hwy 99E on Powell Blvd	7214	20:29	5:33	4:19	36:35	4	6	17:16
Naito Pkwy/Harrison St	Hwy 99E on Powell Blvd	8027	5:54	0:53	3:27	7:07	15	19	3:10
Barbur Blvd/Capitol Hwy	6th Ave/College St	11421	16:49	6:05	4:12	36:25	8	12	12:42
5th Ave/College St	Barbur Blvd/Capitol Hwy	11335	17:10	6:30	4:54	28:59	8	13	13:04
5th Ave/College St	Lincoln St east of Naito Pkwy	2024	3:03	0:20	2:43	4:03	8	8	0:53
Lincoln St east of Naito Pkwy	6th Ave/College St	2548	3:13	0:20	2:51	4:06	9	10	0:44
Powell Blvd/Milwaukie Ave	Kelly Ave/Porter St	5682	15:57	6:49	2:36	47:29	4	8	14:14
Kelly Ave/Porter St	I-405 NB Entrance Ramp @ SW 6th	3991	10:41	5:09	2:09	23:39	4	8	8:59
Powell Blvd/Milwaukie Ave	Hood Ave/Curry St	7155	31:54	13:16	6:16	6:40	3	4	29:40

MEMORANDUM

DATE: November 22, 2017

TO: Metro
Portland, Oregon

FROM: Randy Johnson, PE, PTOE
DKS Associates
Aaron Berger, PE (WA)
DKS Associates

SUBJECT: Metro SW Corridor DEIS- Segment A– AM Models P# 17017-000

Future No Build Vissim Model Results Memorandum

This memorandum documents the development of the future No-Build year 2035 weekday AM peak period Vissim microsimulation models for the Metro SW Corridor DEIS project- Segment A. This memorandum also documents the performance measures reported by the future No-Build year Vissim model.

The Methods and Assumptions memorandum[1] documented the details of model development that were assumed going into this task. This memorandum documents additional assumptions made and parameters that were changed during modeling.

Project Description

The project evaluates the transportation impacts (and other environmental issues) associated with the Future No-Build and Future Build Light Rail alternatives for 2035. Because the study area is so large and sometimes spans between different jurisdictions, this project was divided into the following three segments for evaluation of alignment alternatives, station access projects, and other segment-related options:

- Segment A: Inner Portland
- Segment B: Outer Portland
- Segment C: Tigard and Tualatin

The transit alternatives address the impacts of various options for track alignment and station locations as well as related station access projects, bridgehead reconfigurations, and O&M facility sites within each of these three segments. This memo is focusing on the AM peak period of the No-Build year 2035 of Segment A subareas.

The No-Build model assumes that the project will not be built in any capacity. The purpose of this alternative is to have a direct comparison between future scenarios, instead of comparing a future LRT Alternative with the existing conditions.

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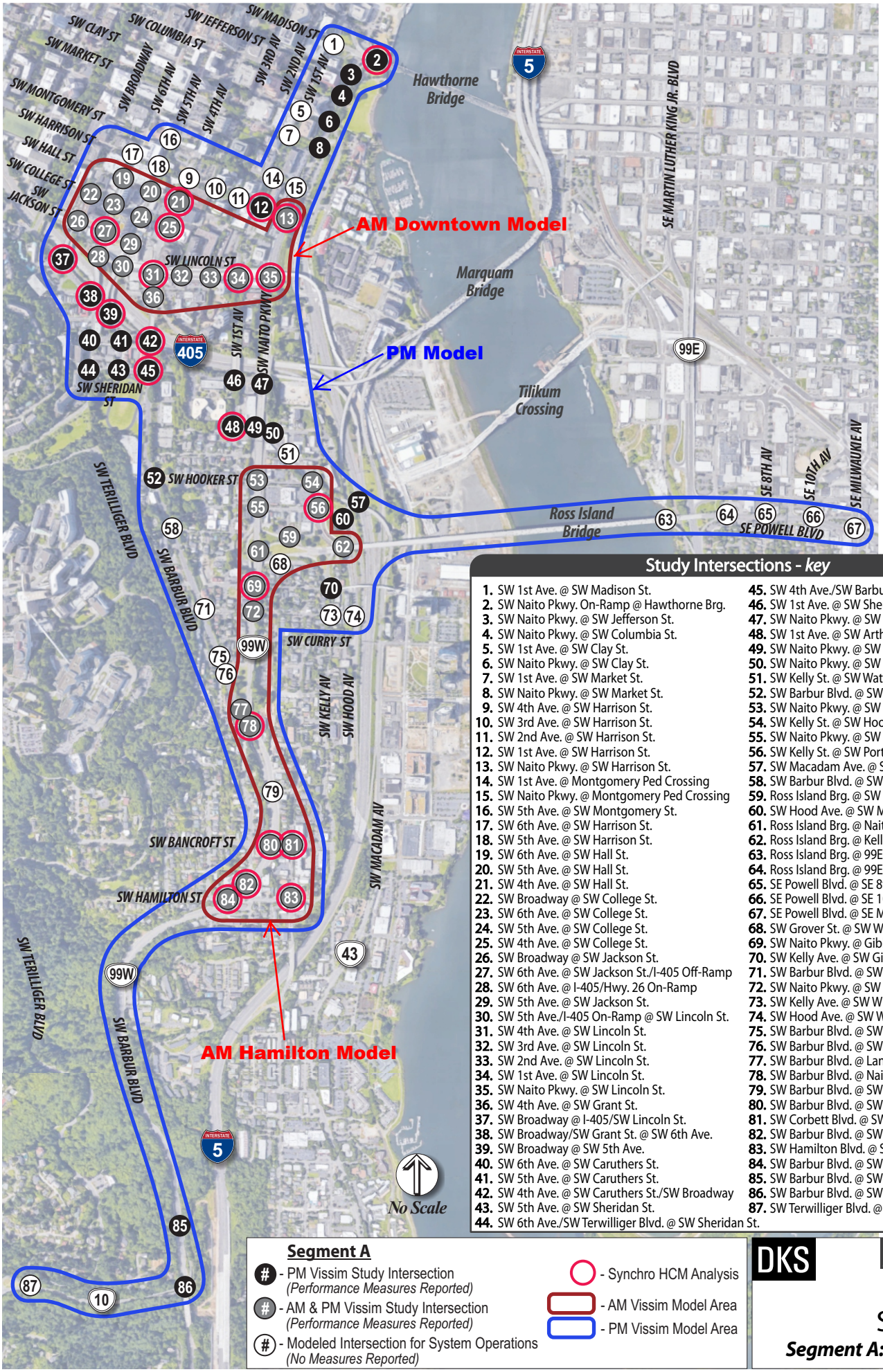
[1] SWC Transportation Analysis Methods, June 2017, DKS Associates.



Study Intersections - *key*

1. SW 1st Ave. @ SW Madison St.
2. SW Naito Pkwy. On-Ramp @ Hawthorne Brg.
3. SW Naito Pkwy. @ SW Jefferson St.
4. SW Naito Pkwy. @ SW Columbia St.
5. SW 1st Ave. @ SW Clay St.
6. SW Naito Pkwy. @ SW Clay St.
7. SW 1st Ave. @ SW Market St.
8. SW Naito Pkwy. @ SW Market St.
9. SW 4th Ave. @ SW Harrison St.
10. SW 3rd Ave. @ SW Harrison St.
11. SW 2nd Ave. @ SW Harrison St.
12. SW 1st Ave. @ SW Harrison St.
13. SW Naito Pkwy. @ SW Harrison St.
14. SW 1st Ave. @ Montgomery Ped Crossing
15. SW Naito Pkwy. @ Montgomery Ped Crossing
16. SW 5th Ave. @ SW Montgomery St.
17. SW 6th Ave. @ SW Harrison St.
18. SW 5th Ave. @ SW Harrison St.
19. SW 6th Ave. @ SW Hall St.
20. SW 5th Ave. @ SW Hall St.
21. SW 4th Ave. @ SW Hall St.
22. SW Broadway @ SW College St.
23. SW 6th Ave. @ SW College St.
24. SW 5th Ave. @ SW College St.
25. SW 4th Ave. @ SW College St.
26. SW Broadway @ SW Jackson St.
27. SW 6th Ave. @ SW Jackson St./I-405 Off-Ramp
28. SW 6th Ave. @ I-405/Hwy. 26 On-Ramp
29. SW 5th Ave. @ SW Jackson St.
30. SW 5th Ave./I-405 On-Ramp @ SW Lincoln St.
31. SW 4th Ave. @ SW Lincoln St.
32. SW 3rd Ave. @ SW Lincoln St.
33. SW 2nd Ave. @ SW Lincoln St.
34. SW 1st Ave. @ SW Lincoln St.
35. SW Naito Pkwy. @ SW Lincoln St.
36. SW 4th Ave. @ SW Grant St.
37. SW Broadway @ I-405/SW Lincoln St.
38. SW Broadway/SW Grant St. @ SW 6th Ave.
39. SW Broadway @ SW 5th Ave.
40. SW 6th Ave. @ SW Caruthers St.
41. SW 5th Ave. @ SW Caruthers St.
42. SW 4th Ave. @ SW Caruthers St./SW Broadway
43. SW 5th Ave. @ SW Sheridan St.
44. SW 6th Ave./SW Terwilliger Blvd. @ SW Sheridan St.
45. SW 4th Ave./SW Barbur Blvd. @ SW Sheridan St.
46. SW 1st Ave. @ SW Sheridan St.
47. SW Naito Pkwy. @ SW Sheridan St.
48. SW 1st Ave. @ SW Arthur St.
49. SW Naito Pkwy. @ SW Arthur St.
50. SW Naito Pkwy. @ SW Kelly St.
51. SW Kelly St. @ SW Water St.
52. SW Barbur Blvd. @ SW Hooker St.
53. SW Naito Pkwy. @ SW Hooker St.
54. SW Kelly St. @ SW Hooker St./SW Macadam Ave.
55. SW Naito Pkwy. @ SW Porter St.
56. SW Kelly St. @ SW Porter St./SW Hood Ave.
57. SW Macadam Ave. @ SW Hood Ave.
58. SW Barbur Blvd. @ SW Woods St.
59. Ross Island Brg. @ SW Woods St./SW Water Ave.
60. SW Hood Ave. @ SW Macadam Ave.
61. Ross Island Brg. @ Naito Pkwy.
62. Ross Island Brg. @ Kelly Ramps
63. Ross Island Brg. @ 99E SB
64. Ross Island Brg. @ 99E NB
65. SE Powell Blvd. @ SE 8th Ave.
66. SE Powell Blvd. @ SE 10th Ave.
67. SE Powell Blvd. @ SE Milwaukie Ave.
68. SW Grover St. @ SW Water Ave.
69. SW Naito Pkwy. @ Gibbs/Naito Ramps
70. SW Kelly Ave. @ SW Gibbs St.
71. SW Barbur Blvd. @ SW Whitaker St.
72. SW Naito Pkwy. @ SW Whitaker St.
73. SW Kelly Ave. @ SW Whitaker St.
74. SW Hood Ave. @ SW Whitaker St.
75. SW Barbur Blvd. @ SW Pennoyer St.
76. SW Barbur Blvd. @ SW Condor Ave.
77. SW Barbur Blvd. @ Lane/Ped Crossing
78. SW Barbur Blvd. @ Naito/Ped Crossing
79. SW Barbur Blvd. @ SW Lowell St.
80. SW Barbur Blvd. @ SW Bancroft St.
81. SW Corbett Blvd. @ SW Bancroft St.
82. SW Barbur Blvd. @ SW Hamilton St. *(East)*
83. SW Hamilton Blvd. @ SW Corbett Ave.
84. SW Barbur Blvd. @ SW Hamilton St. *(West)*
85. SW Barbur Blvd. @ SW Capitol Hwy. EB
86. SW Barbur Blvd. @ SW Capitol Hwy. WB
87. SW Terwilliger Blvd. @ SW Capitol Hwy.

Segment A

- # - PM Vissim Study Intersection *(Performance Measures Reported)*
- # - AM & PM Vissim Study Intersection *(Performance Measures Reported)*
- # - Modeled Intersection for System Operations *(No Measures Reported)*
- Synchro HCM Analysis
- AM Vissim Model Area
- PM Vissim Model Area

DKS

figure 1

Study Area

Segment A: Inner Portland

Segment A Study Area and Model Area

Segment A AM analysis includes the Hamilton and Downtown subareas. Performance measures were reported for major signalized and un-signalized intersections. Intersections with no reported performance measures were included in the model due to their influence on arrival patters, lane utilization, and queuing at study intersections with reported performance measures. AM No-Build Study intersections are shown in Figure 1.

Model Development Summary

The Vissim model development process used the following two documents as guidelines - The Federal Highway Administration's (FHWA's) Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software[2] and the Oregon Department of Transportation (ODOT), Protocol for Vissim Simulation[3].This section describes the steps completed in the future no-build year 2035 AM peak period (7:45 AM to 8:45 AM) model development process.

Network Coding

The geometry of the AM Existing Condition model was used as a baseline to develop the AM Future No Build model. Two future projects were added to the model, per Metro's directions:

- Green Loop on SW 4th Avenue – This project added a new mixed-use path along the east side of SW 4th Avenue from SW Lincoln Street to SW College Street. The project also included a new signal at SW 4th Avenue and SW College Street, with signalized bicycle crossings that time with the College Street approach.
- Division Transit Project – The yet to be constructed Division Transit Line was added to the model and replaced the Line 4.

Additional edits included keep clear zones at intersections impacted by queue spillback under future No-Build volume conditions, and updated signal timings to accommodate changes in turn volumes as well. The remainder of the model retained existing conditions coding.

Traffic Demand and Routing

Vissim's Dynamic Traffic Assignment (DTA) feature was used in combination with the O-D matrix (based on Metro's Financially Constrained 2035 travel demand model and post-processed future turn movement forecasts) to generate motor vehicle inputs and routing through the network. The DTA assignment was then converted to static vehicle inputs and complete O-D routes. The roadway network extents in the Vissim model were such that there was only one possible route for each O-D pair.

Based on the Financially Constrained 2035 Metro model, vehicle trip growth within the Downtown model is 10% higher than under existing conditions by the year 2035 and 13% higher for the Hamilton model. In the absence of more mode specific growth projections, pedestrian and bicycle volumes within the model were also grown by 15%, representing the additional trip activity for all modes within the model area. In the downtown core, the zones near Portland State

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[2] Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software, Federal Highway Administration, June 2004.
[3] Protocol for Vissim Simulation, ODOT, June 2011

University were had negative growth in the Metro model due to mode shift. For analysis purposes the growth was held at zero for these zones.

Traffic Volume Peaking Profile

As most peaking profiles within the existing model did not show substantial peaking behavior under existing conditions, these profiles were also applied to the future No-Build model.

Vehicle Compositions

Heavy vehicle percentage from the existing model were also applied to the future No-Build model.

Simulation Period and Seeding Period

The future No-Build model used the same simulation period (7-9 AM) and same seeding period (30 minutes) as the existing conditions model.

Error Checking

A review of the animation was conducted to determine locations where conflict areas or priority rules were needed to increased queue spillback and locations where signal timing could change to operate more efficiently under future conditions.

Validation

Upon the completion of the error checking, DKS validated the model results. The model validation was based on 15 simulation runs to account for variation.

The following calibration targets were used for the future year No-Build Vissim model:

- A quantitative comparison between forecasted two-hour balanced volumes and model output results for traffic volumes.

The GEH statistic was calculated for all study intersections. The traffic volume calibration results are documented in Appendices A and B to this document. HCM intersection analysis performed under a separate task of this project indicated multiple over capacity locations within the model. Therefore, the volume throughput measure (GEH) was not expected to meet calibration standards, as over-capacity intersections were not expected to serve the full assigned demand.

Future No-Build Model Measures of Effectiveness

The following measures of effectiveness were collected from the future No-Build model and summarized in the Appendices:

- Appendices C and D - Overall intersection delay and individual turn movement delay at study intersections for motor vehicles
- Appendices E and F - 95th percentile motor vehicle queue lengths
- Appendices G and H – Vissim Model Queue Plots (same format as used for Existing Conditions)

The delay measurements were calculated over the entire peak hour interval (excluding the seeding time) for each simulation run. Delay reported for a study intersection is measured upstream to the next intersection and not through. 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.

Table 1 shows the Downtown model network performance measures generated by Vissim and Table 2 shows the measures for the Hamilton model. The key measure is latent demand, vehicles unable to enter the network due to queue spillback during the analysis period (7-9 AM). As shown in Table 1 for the Downtown model, there is no latent demand during the AM 2-hour peak period indicating there is adequate capacity to serve all demand. Nearly 5% of the demand in the Hamilton model area during the AM 2-hour peak is unserved. This demand is a combination of latent demand from northbound Barbur, eastbound Capitol Highway, northbound Corbett Avenue, and northbound Macadam Avenue. The traffic bottlenecks that result in these congestion hot spots are lack of available capacity at Barbur/Hamilton, Corbett/Hamilton and queue spillback from Arthur Street impacting the Macadam Avenue ramp.

Table 1: No Build Network System Performance

Model/scenario	Total Vehicles Arrived (7-9 AM)	Latent Demand (7-9 AM)	Percent Demand Unserved (7-9 AM)	Total Delay (vehicle-hours, 7-9 AM)
Downtown / No-Build	14,510	0	0%	130
Hamilton / No Build	21,430	1080	4.8%	980

APPENDIX

Appendix A: Vissim Downtown AM Model Two-Hour GEH Statistic

Appendix B: Vissim Hamilton AM Model Two-Hour GEH Statistic

Appendix C: Vissim Downtown AM Model Delay

Appendix D: Vissim Hamilton AM Model Delay

Appendix E: Vissim Downtown AM Model Queue Data

Appendix F: Vissim Hamilton AM Model Queue Data

Appendix G: Vissim Downtown AM Model Queue Plots

Appendix H: Vissim Hamilton AM Model Queue Plots

Appendix A

Vissim Downtown AM Model Two-Hour GEH Statistic

Metro SW Corridor DEIS- Segment A - AM model

Future No-Build Vissim Model Methodology and Results Memorandum

Intersection Number	Intersection Name	Movement	Input Volume	VISSIM Output Volume	GEH
13	Harrison/Naito	NBL	275	304	1.2
		NBT	2620	2674	0.7
		NBR	165	130	2.0
		SBT	855	819	0.9
		SBR	60	53	0.7
		EBL	200	197	0.2
		EBT	215	221	0.3
		EBR	145	130	0.9
		WBL	105	111	0.4
		WBT	90	79	0.8
		WBR	35	37	0.2
		Total	4765	4755	0.1
19	Hall/6th	NBL	55	71	1.4
		NBT	1520	1513	0.1
		EBL	35	37	0.2
		EBT	45	45	0.0
		WBT	25	18	1.1
		WBR	60	57	0.3
		Total	1740	1741	0.0
20	Hall/5th	SBL	25	23	0.3
		SBT	470	501	1.0
		EBT	25	27	0.3
		EBR	20	18	0.3
		WBL	35	38	0.4
		WBT	95	92	0.2
		Total	670	699	0.8
21	Hall/4th	NBL	130	125	0.3
		NBT	2570	2512	0.8
		EBL	50	50	0.0
		Total	2750	2687	0.9
22	Broadway/College	SBL	70	59	1.0
		SBT	625	647	0.6
		SBR	15	17	0.4
		EBT	5	4	0.3
		EBR	5	6	0.3
		WBL	375	314	2.3
		WBT	25	30	0.7
		Total	1120	1077	0.9
23	6th/College	NBL	325	254	3.0
		NBT	1485	1483	0.0
		EBL	25	22	0.4
		EBT	50	42	0.8
		WBT	75	89	1.1
		WBR	65	77	1.0

Intersection Number	Intersection Name	Movement	Input Volume	VISSIM Output Volume	GEH
		Total	2035	1967	1.1
24	College/5th	SBL	35	77	4.0
		SBT	490	480	0.3
		EBT	25	11	2.3
		EBR	35	31	0.5
		WBL	315	336	0.8
		WBT	140	166	1.5
		Total	1040	1101	1.3
25	4th/College	NBL	455	505	1.6
		NBT	2640	2553	1.2
		EBL	60	88	2.3
		Total	3155	3146	0.1
26	Broadway/Jackson	SBL	30	0	5.5
		SBT	925	903	0.5
		SBR	50	65	1.4
		EBT	30	41	1.3
		WBL	0	77	8.8
		WBT	25	30	0.7
		Total	1060	1116	1.2
27	6th/Jackson	NBL	25	107	7.1
		NBT	1130	1058	1.5
		EBL	60	41	1.9
		WBR	630	641	0.3
		Total	1845	1847	0.0
29	5th/Jackson	SBT	830	830	0.0
		SBR	10	14	0.8
		EBR	10	10	0.0
30	5th Ave Rail Crossing	SBT	305	306	0.0
		EBT	395	416	0.7
		Total	700	722	0.6
31	Lincoln/4th	NBL	40	31	1.1
		NBT	2050	2098	0.7
		EBL	125	36	7.0
		EBT	65	57	0.7
		WBT	10	0	3.2
		WBR	195	236	2.0
		Total	3565	3503	0.7
32	3rd/Lincoln	NBR	20	19	0.2
		SBR	5	5	0.0
		EBT	270	236	1.5
		EBR	40	50	1.1
		WBT	200	231	1.5
		WBR	105	93	0.9
		Total	640	634	0.2

Intersection Number	Intersection Name	Movement	Input Volume	VISSIM Output Volume	GEH
33	Lincoln/3rd	NBL	20	15	0.8
		NBR	15	17	0.4
		SBL	5	4	0.3
		SBR	35	35	0.0
		EBL	10	6	1.0
		EBT	270	239	1.4
		EBR	10	10	0.0
		WBL	30	17	1.9
		WBT	250	274	1.0
		WBR	25	32	0.9
		Total	670	649	0.6
34	Lincoln/1st	NBL	160	170	0.6
		NBT	290	296	0.2
		SBT	300	293	0.3
		SBR	145	153	0.5
		EBL	50	59	0.9
		EBR	240	202	1.8
		Total	1185	1173	0.2
35	Lincoln/Naito	NBT	3060	3098	0.5
		SBT	1105	1055	1.1
		Total	4165	4153	0.1
36	4th/Grant	NBT	2090	2072	0.3
		SBU	0	54	7.3
		Total	2090	2126	0.6

Appendix B

Vissim Hamilton AM Model Two-Hour GEH Statistic

Metro SW Corridor DEIS- Segment A - AM model

Future No-Build Vissim Model Methodology and Results Memorandum

Intersection Number	Intersection Name	Movement	2 hrs Balanced Volume	VISSIM Output Volume	GEH
56	Kelly @ Porter	NBT	2735	2725	0.1
		EBR	25	22	0.4
		EBT	1980	1977	0.0
		SBT	40	39	0.1
		SBL	265	259	0.3
		SBR	85	80	0.4
		Total	5215	5102	1.1
62	Ross Island Brg.@ Kelly Ramps	NBR	494	631	4.1
		SBL	1590	1183	7.7
80	SW Barbur Blvd.@ SW Bancroft St.	WBR	385	301	3.2
		NBR	65	5	7.2
81	SWCorbett Blvd. @SWBancroft St.	WBR	20	17	0.5
		WBT	30	27	0.4
		WBL	35	36	0.1
		EBL	15	0	3.9
		EBT	20	5	3.0
		EBR	30	0	5.5
		SBL	15	15	0.0
		SBR	10	12	0.4
		SBT	170	163	0.4
		NBT	400	380	0.7
		NBR	95	87	0.6
		NBL	345	266	3.2
		Total	1185	1007	3.8
82	SW Barbur Blvd.@ SW Hamilton St.	SBR	150	143	0.4
		SBT	1935	1941	0.1
		WBR	570	468	3.2
		WBT	250	211	1.8
		WBL	200	190	0.5
		EBL	100	84	1.2
		EBT	70	56	1.2
		EBR	0	13	3.6
		SBL	435	446	0.4
		NBT	5795	4718	10.5
		NBR	480	393	2.9
83	SW Hamilton Blvd. @SW Corbett Blvd.	SBL	5	5	0.0
		SBT	105	82	1.7
		SBR	125	112	0.8
		WBR	5	26	3.8
		WBL	15	15	0.0
		WBT	50	29	2.4
		NBT	635	498	4.1
		NBR	70	53	1.5
		NBL	845	696	3.8
		EBL	200	191	0.5
		EBT	125	98	1.8
		EBR	660	602	1.6

Appendix C

Vissim Downtown AM Model Delay

Metro SW Corridor DEIS- Segment A - AM model

Future No-Build Vissim Model Methodology and Results Memorandum

Delay Results for AM Peak Hour																			
Delay (Sec)																			
Study Intersection No.		13	19	20	21	22	23	24	25	26	27	29	30	31	32	33	34	35	36
Approach	**Movement**	**Harrison/ Naito**	**Hall/ 6th**	**Hall/ 5th**	**Hall/ 4th**	**Broadway/ College**	**6th/ College**	**College/ 5th**	**4th/ College**	**Broadway/ Jackson**	**6th/ Jackson**	**5th/ Jackson**	**5th Ave Rail Crossing**	**Lincoln/ 4th**	**3rd/ Lincoln**	**Lincoln/ 3rd**	**Lincoln/ 1st**	**Lincoln/ Naito**	**4th/ Grant**
NB	Left	49	11		9		16		11		0			0		13	26		
	Thru	14	8		3		12		9		0			11			10	9	3
	Right	18													7	6			
SB	Left			12		7		6		0						10			
	Thru	16		11		6		7		6		9	2				15	6	
	Right	17				5				8		59			6	6	17		
EB	Left	46	19		20		8		7		8			42		0	28		
	Thru	4		14		18		30		0		42			1	0	12		
	Right	25	18	13		21	7	0		16			2	17	0	7			
WB	Left	38		21		30		18		15						17			
	Thru	28	19	25		0	5	16		15				0	2	8			
	Right	26	6				5				0			6	3	7			
Intersection Total		**19**	**9**	**13**	**4**	**12**	**12**	**12**	**9**	**7**	**0**	**10**	**2**	**11**	**2**	**8**	**15**	**8**	**3**

Appendix D

Vissim Hamilton AM Model Delay

Metro SW Corridor DEIS- Segment A - AM model

Future No-Build Vissim Model Methodology and Results Memorandum

Hamilton Delay Results for AM Peak Hour								
Approach	Movement	Delay (Sec)						
		56	62	80	81	82	83	629
		SW Kelly St. @ SW Porter St	Ross Island Bridge @ Kelly Ramps	SW Barbur Blvd.@ SW Bancroft St.	SW Corbett Blvd. @ SW Bancroft St.	SW Barbur Blvd.@ SW Hamilton St.	SW Hamilton Blvd. @ SW Corbett Blvd.	Ross Island Brg.@ Kelly Ramps
NB	Left				27		224	
	Thru	4			23	180	224	
	Right		90	14	23	333	224	415
SB	Left	227			2	74	13	
	Thru	93			1	9	10	
	Right	83			8	13	10	
EB	Left				0	286	17	
	Thru	10			11	388	13	
	Right	5			0	368	19	
WB	Left				12	62	21	
	Thru				26	66	13	
	Right			35	10	31	13	
Intersection Total		19	90	35	19	130	119	415

Appendix E

Vissim Downtown AM Model Queue Data

Metro SW Corridor DEIS- Segment A - AM model

Future No-Build Vissim Model Methodology and Results Memorandum

Queuing Results for AM Peak Hour																			
95th Percentile Queue																			
Study Intersection No.		13	19	20	21	22	23	24	25	26	27	29	30	31	32	33	34	35	36
Approach	**Movement**	**Harrison/ Naito**	**Hall/ 6th**	**Hall/ 5th**	**Hall/ 4th**	**Broadway/ College**	**6th/ College**	**College/ 5th**	**4th/ College**	**Broadway/ Jackson**	**6th/ Jackson**	**5th/ Jackson**	**5th Ave Rail Crossing**	**Lincoln/ 4th**	**3rd/ Lincoln**	**Lincoln/ 3rd**	**Lincoln/ 1st**	**Lincoln/ Naito**	**4th/ Grant**
NB	Left	250	-	-	-	-	-	-	-	-	-	-	-	439	-	-	866	-	-
	Thru	568	176	-	123	-	229	-	-	-	-	-	-	339	-	225	870	687	-
	Right	-	-	-	-	-	-	-	-	-	-	-	-	-	43	-	-	-	-
SB	Left	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Thru	176	-	165	-	108	-	181	-	154	-	205	192	-	-	106	580	180	-
	Right	-	-	-	-	-	-	-	-	-	-	-	202	-	19	-	-	-	-
EB	Left	222	-	-	120	-	-	-	25	-	22	-	-	44	-	0	425	-	42
	Thru	156	62	44	-	22	46	49	-	23	-	-	-	70	-	184	131	-	-
	BAT	64	-	-	-	-	-	-	-	-	-	22	-	-	-	-	-	-	-
WB	Left	72	-	-	-	-	-	-	-	-	-	-	-	-	-	66	-	-	-
	Thru	83	63	97	-	138	64	162	-	62	-	-	-	84	-	142	45	-	-
	Right	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Appendix F

Vissim Hamilton AM Model Queue Data

Metro SW Corridor DEIS- Segment A - AM model

Future No-Build Vissim Model Methodology and Results Memorandum

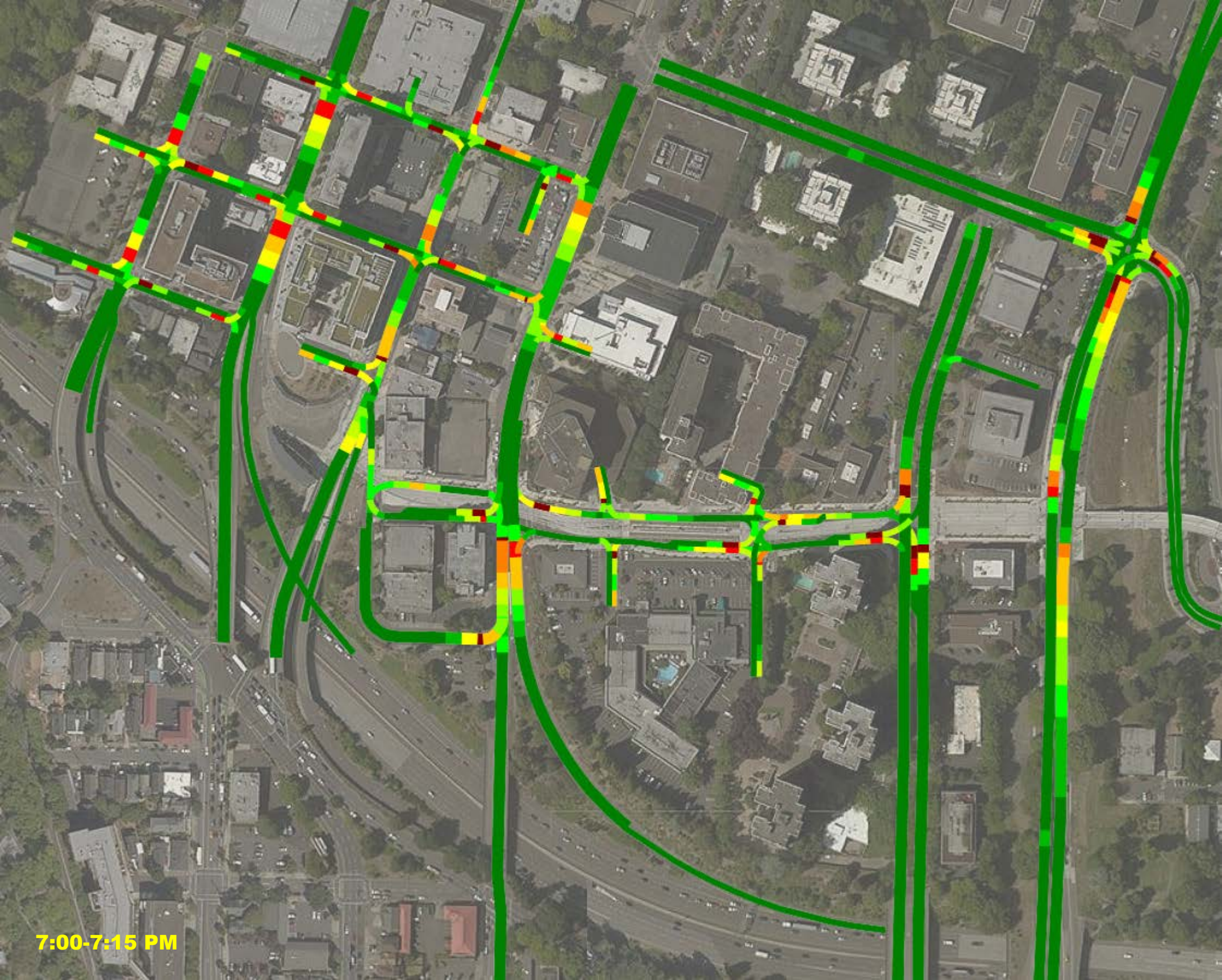
Hamilton 95th Percentile Queuing Results for AM Peak Hour								
Study Intersection Number		56	62	80	81	82	83	629
Approach	Movement	Kelly @ Porter	Ross Island Brg.@ Kelly Ramps	SW Barbur Blvd.@ SW Bancroft St.	SWCorbett Blvd. @SWBancroft St.	SW Barbur Blvd.@ SW Hamilton St.	SW Hamilton Blvd. @SW Corbett Blvd.	Ross Island Brg.@ Kelly Ramps
NB	Left	-	-	-	-	-	-	-
	Thru	217	-	-	-	8991	1596	-
	Right	-	396	-	-	-	-	-
SB	Left	892	-	-	-	391	-	4230
	Thru	-	-	-	-	176	77	-
	Right	-	-	-	-	-	-	-
EB	Left	-	-	-	-	-	-	-
	Thru	-	-	-	19	788	541	-
	Right	-	-	-	-	-	-	-
WB	Left	-	-	-	-	393	-	-
	Thru	-	-	-	-	-	43	-
	Right	-	-	695	-	283	-	-

Appendix G

Vissim Downtown AM Model Queue Plots

Metro SW Corridor DEIS- Segment A - AM model

Future No-Build Vissim Model Methodology and Results Memorandum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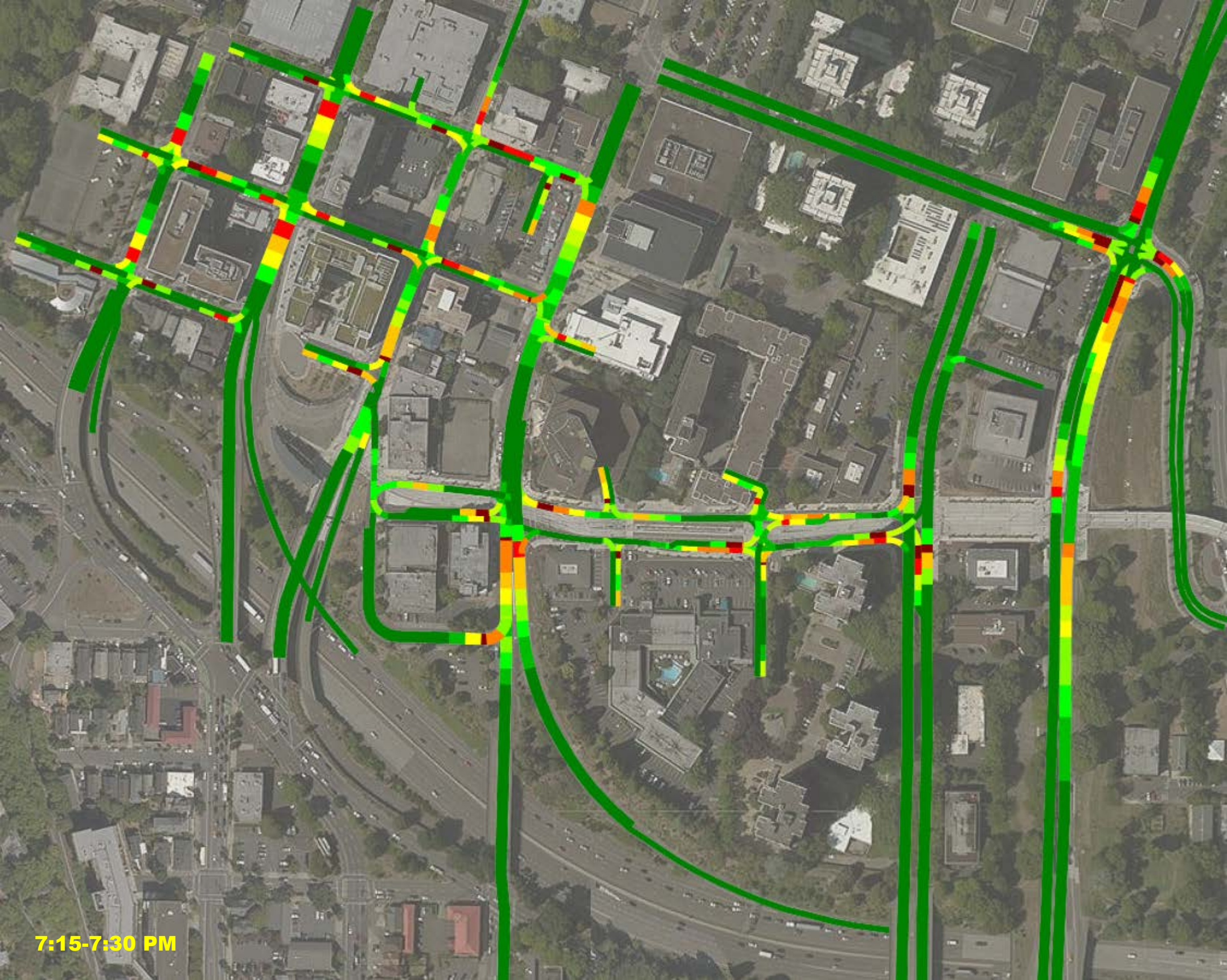
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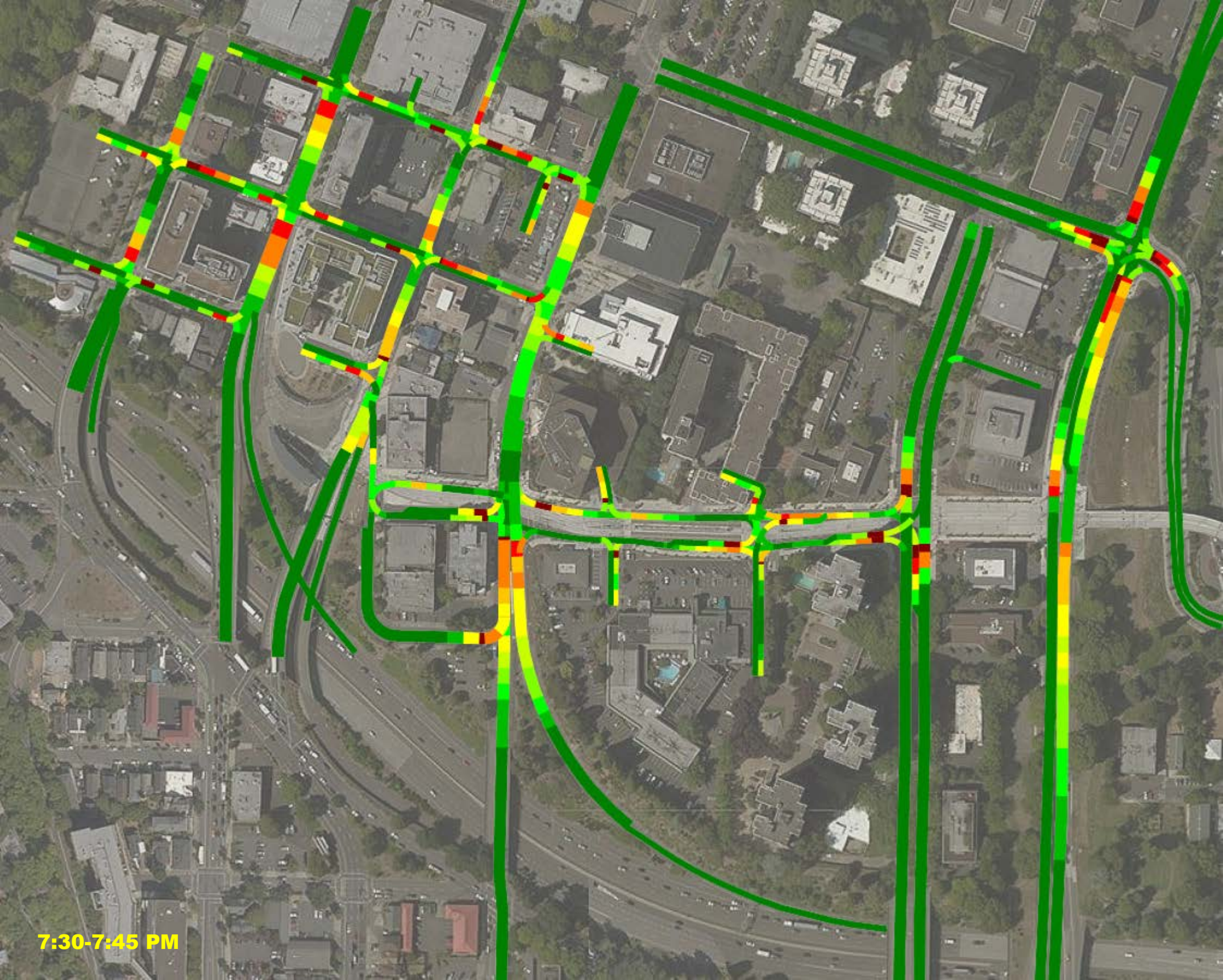
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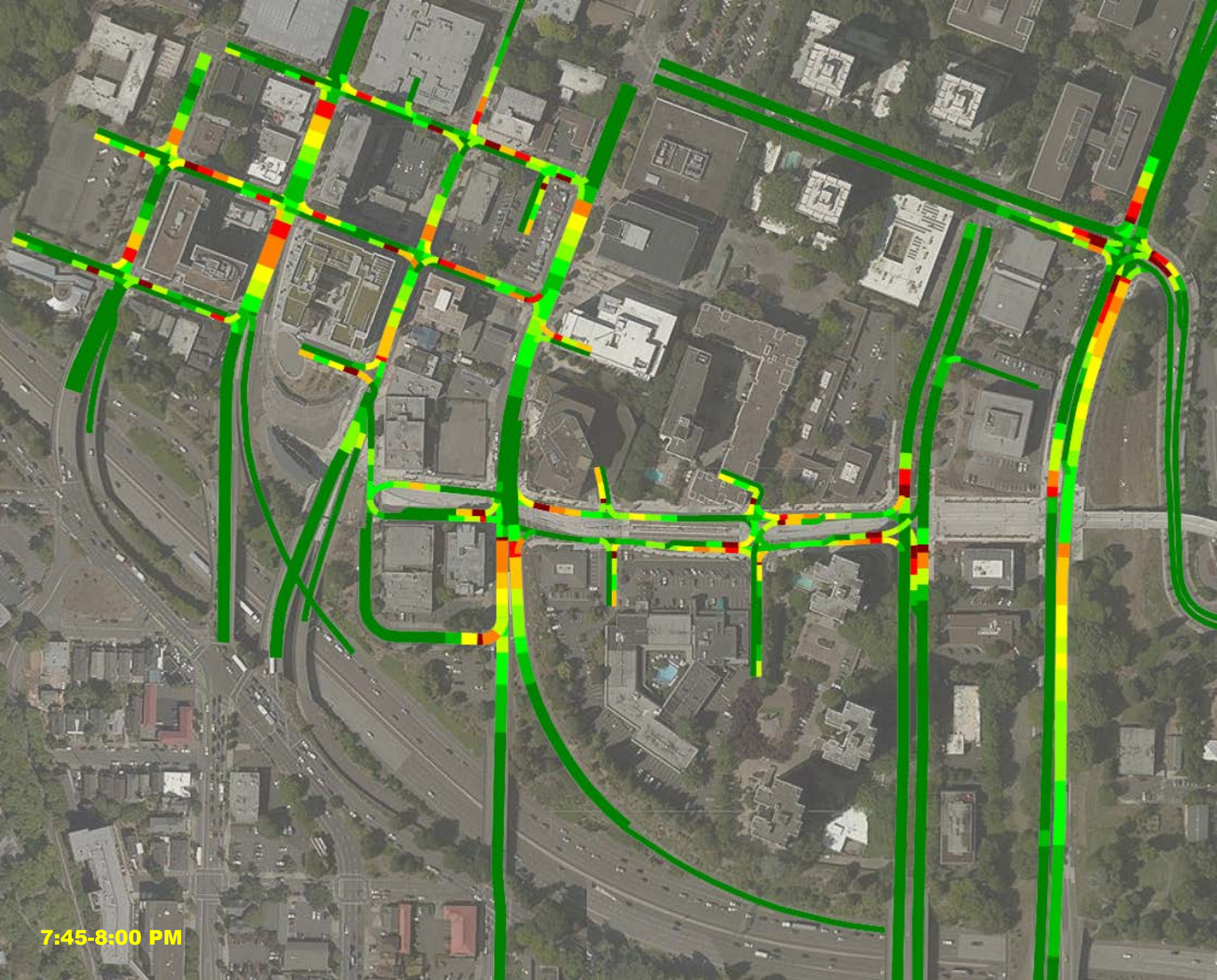
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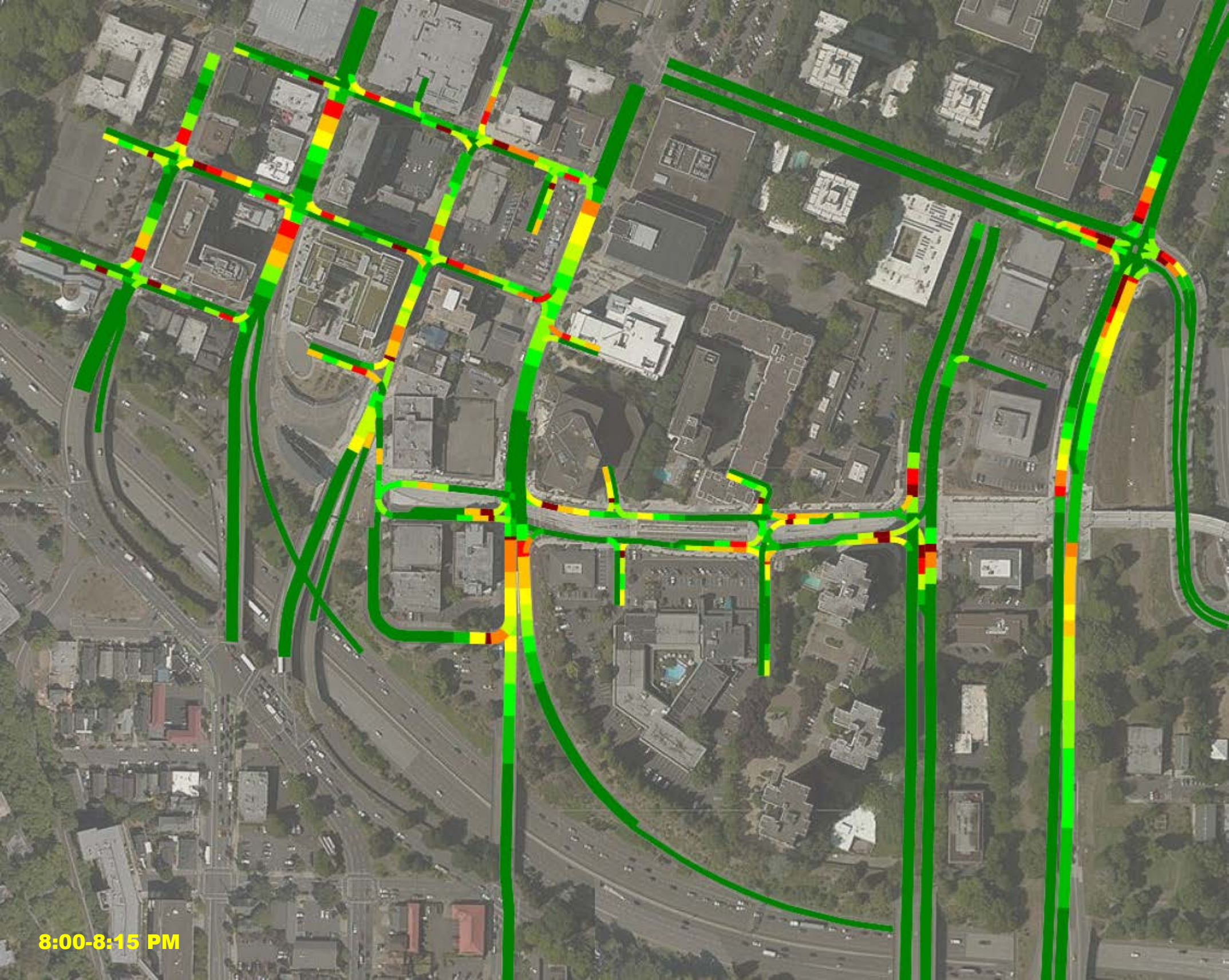
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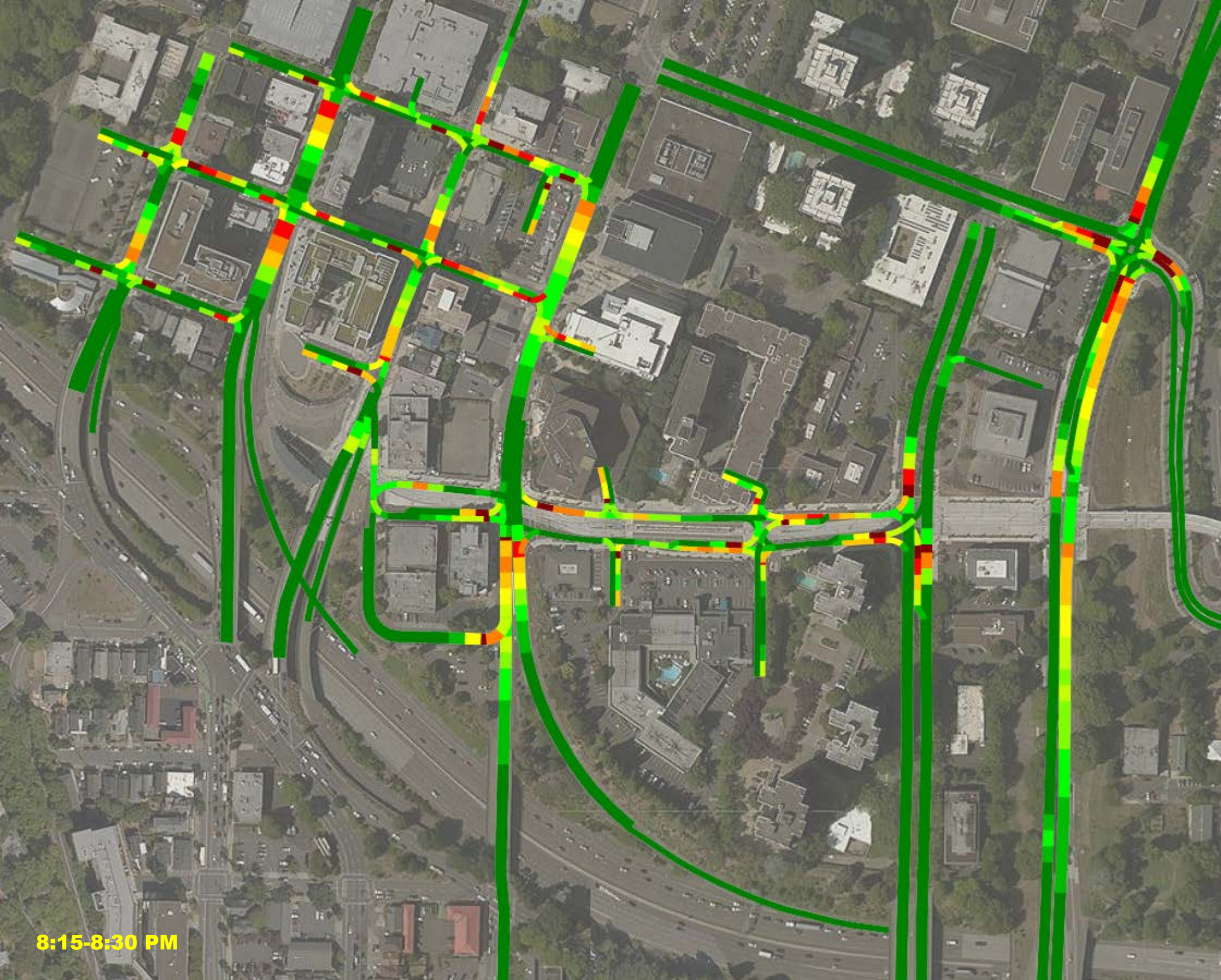
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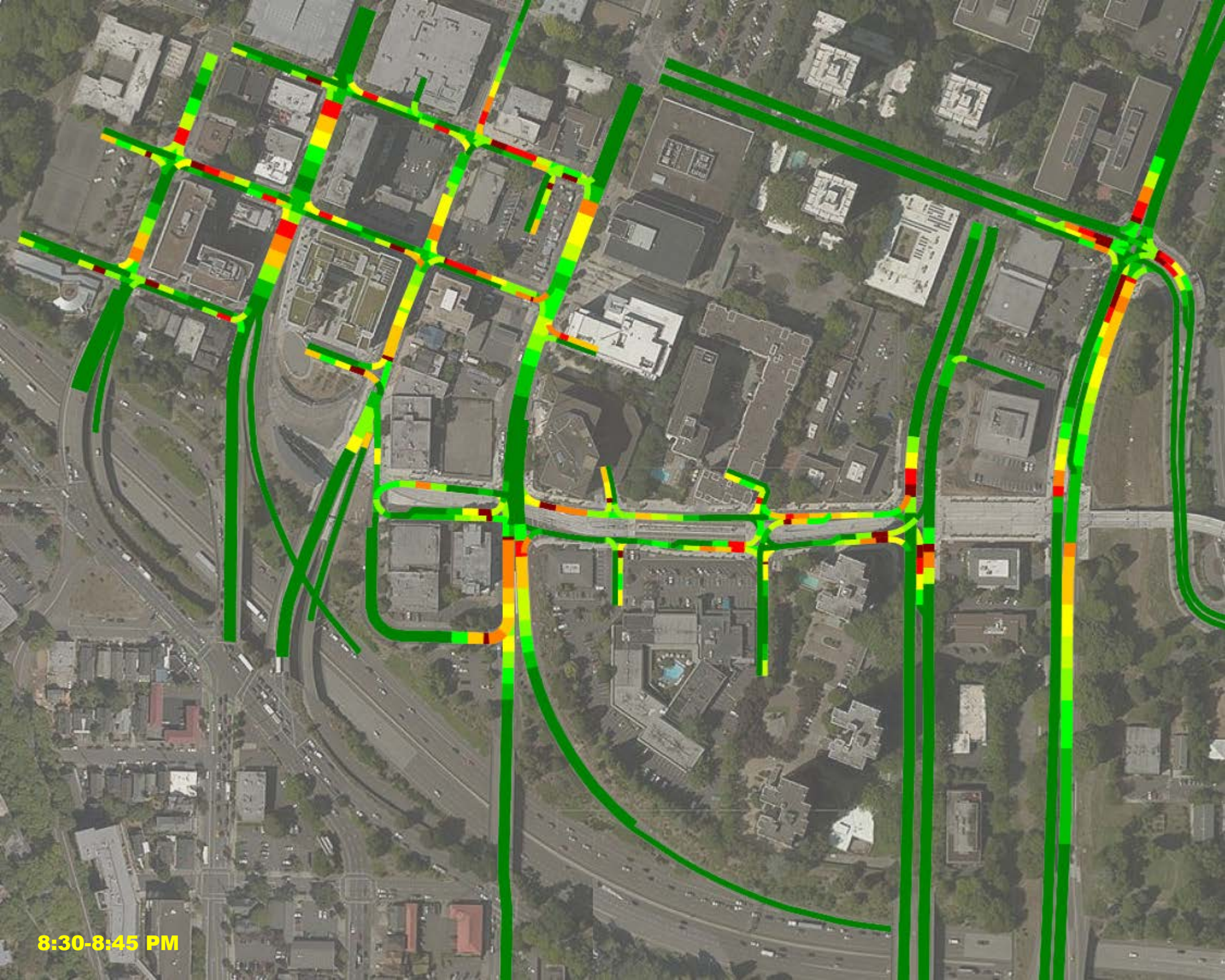
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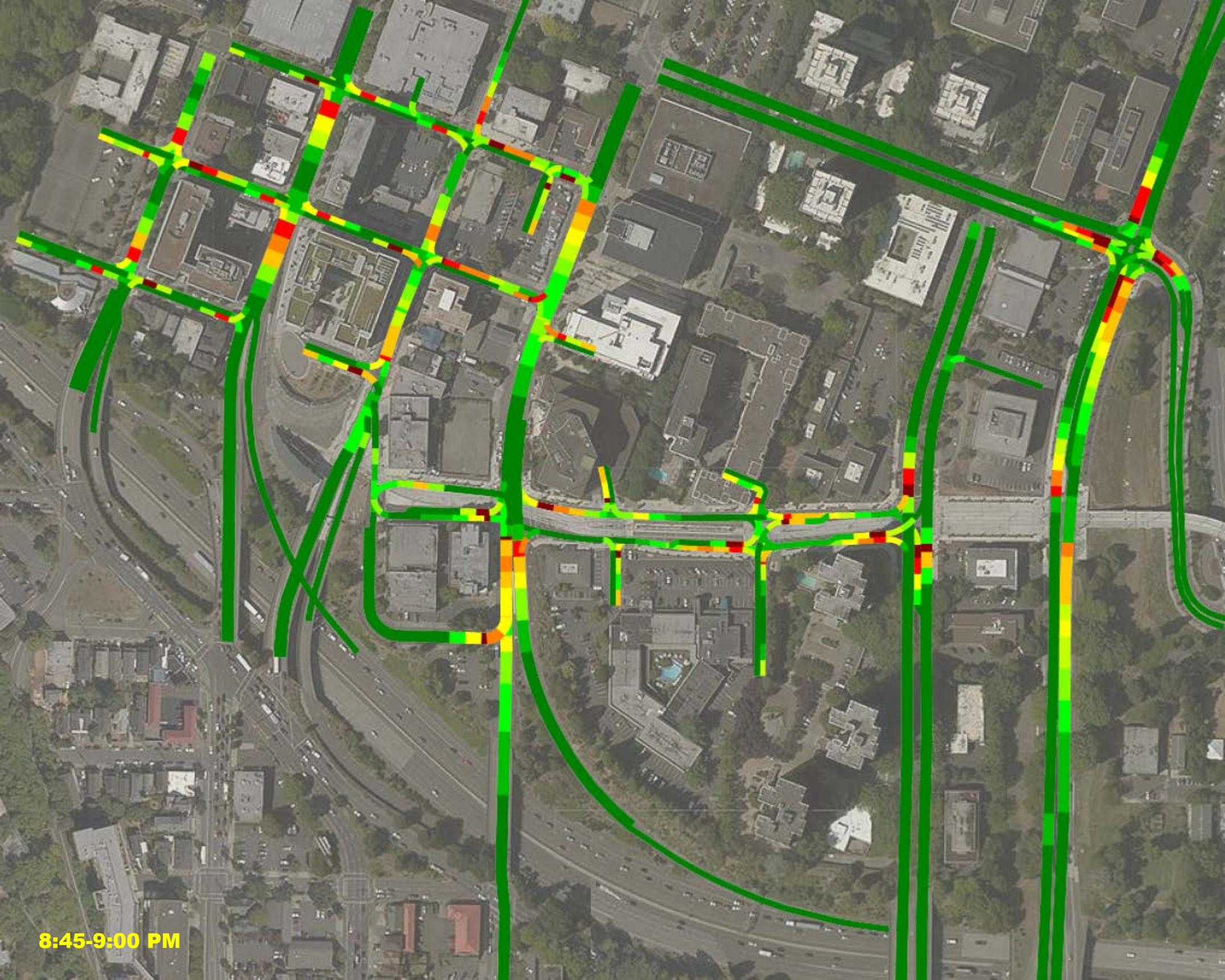
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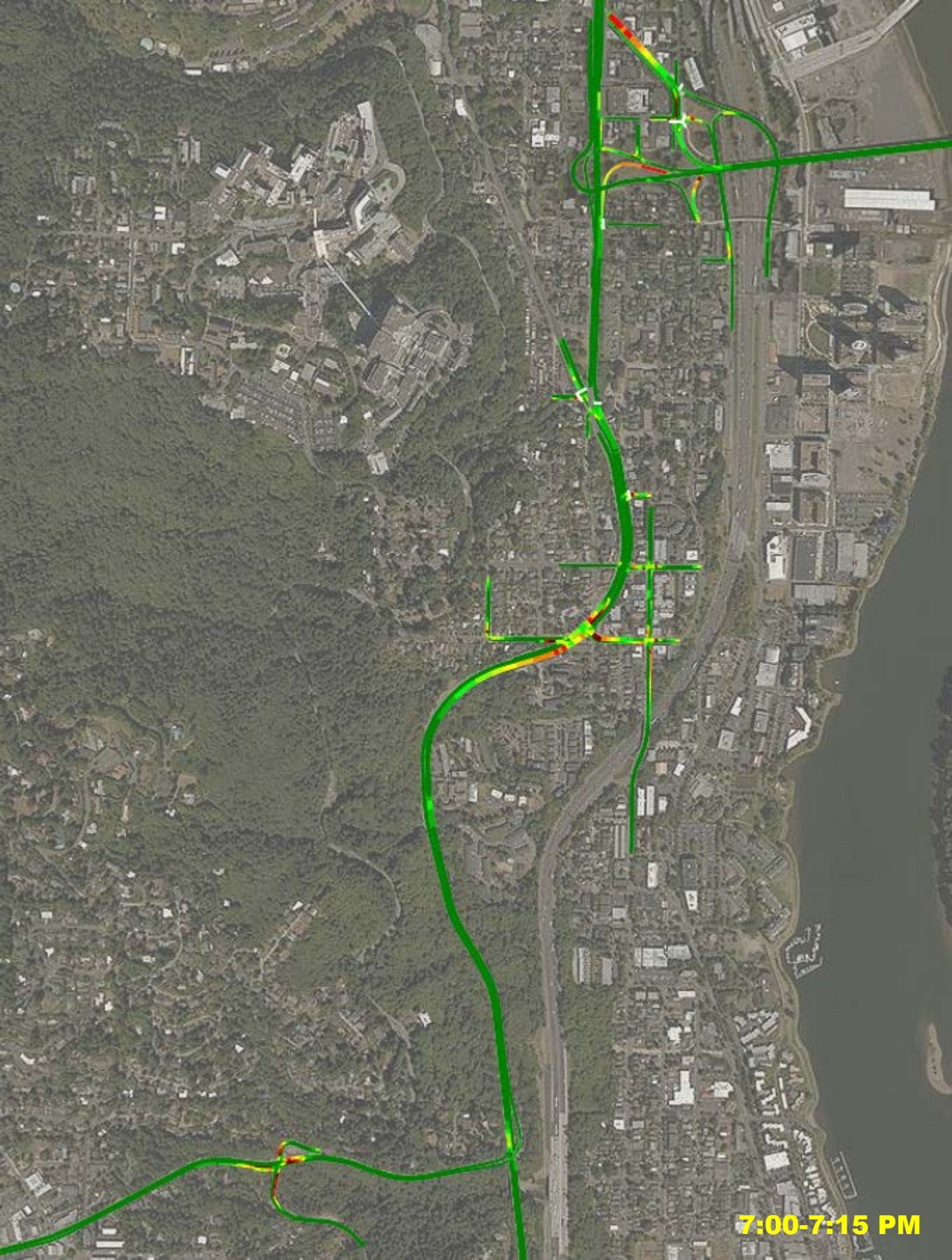
Appendix H

Vissim Hamilton AM Model Queue Plots

Metro SW Corridor DEIS- Segment A - AM model

Future No-Build Vissim Model Methodology and Results Memorandum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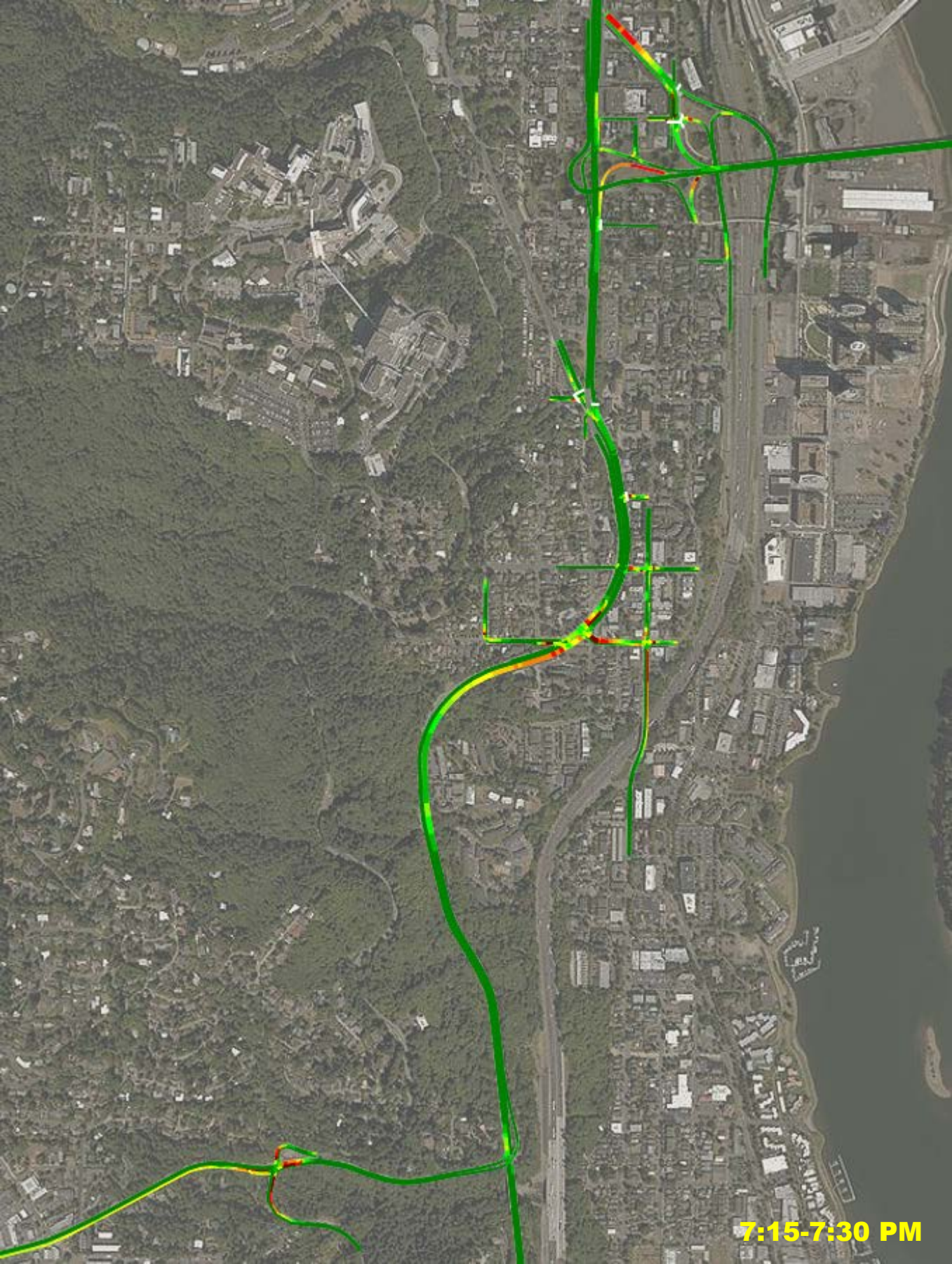
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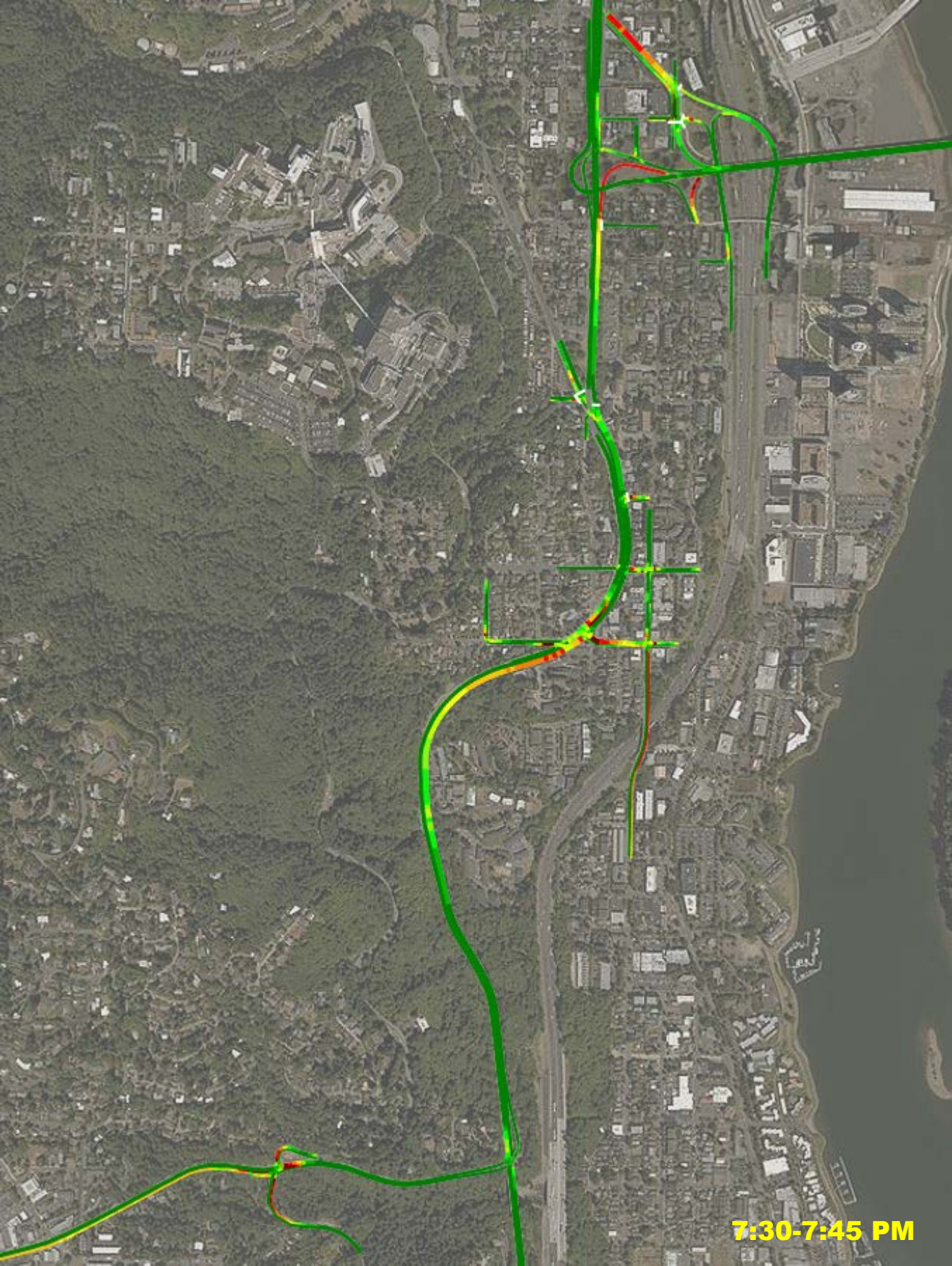
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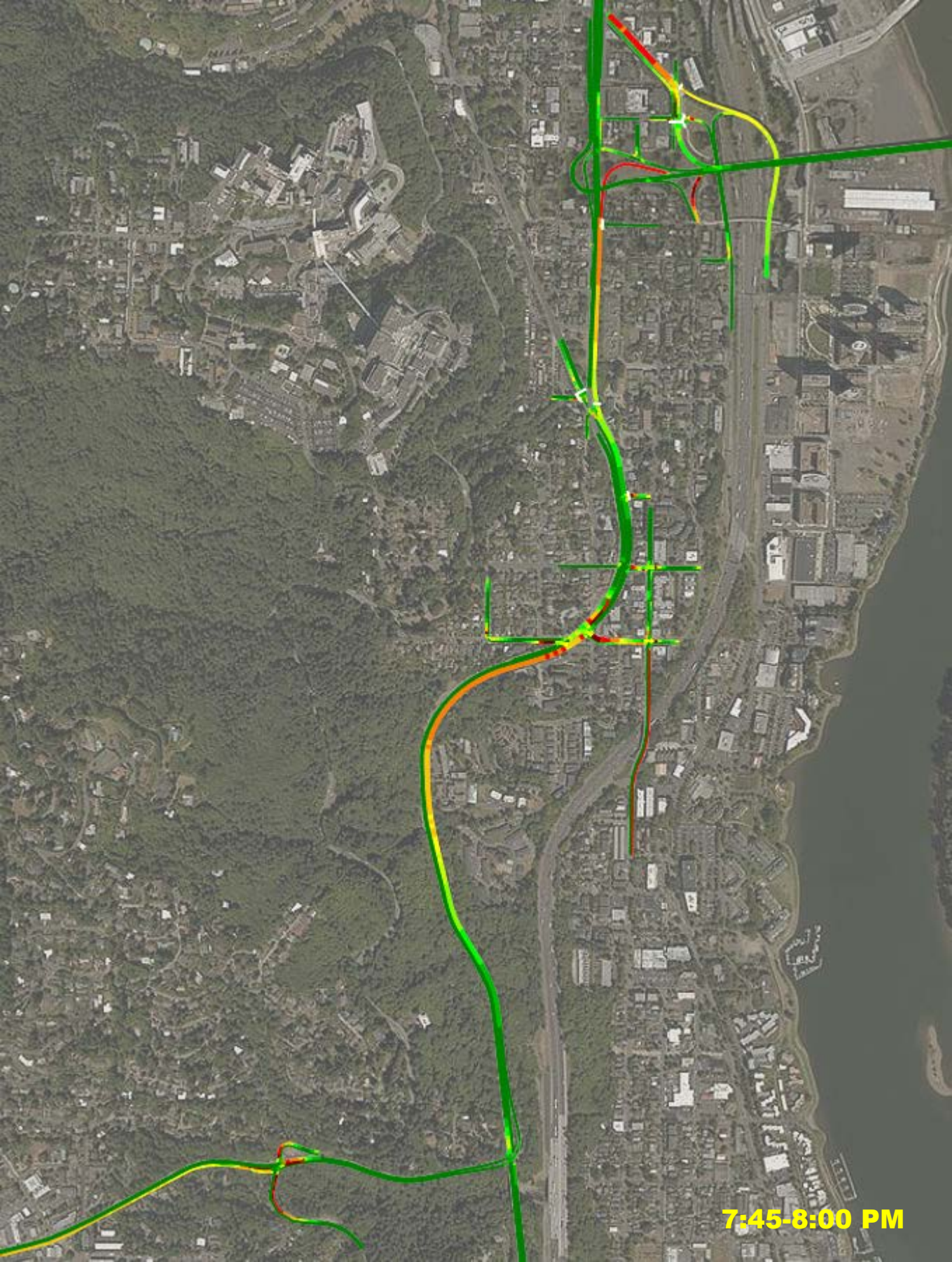
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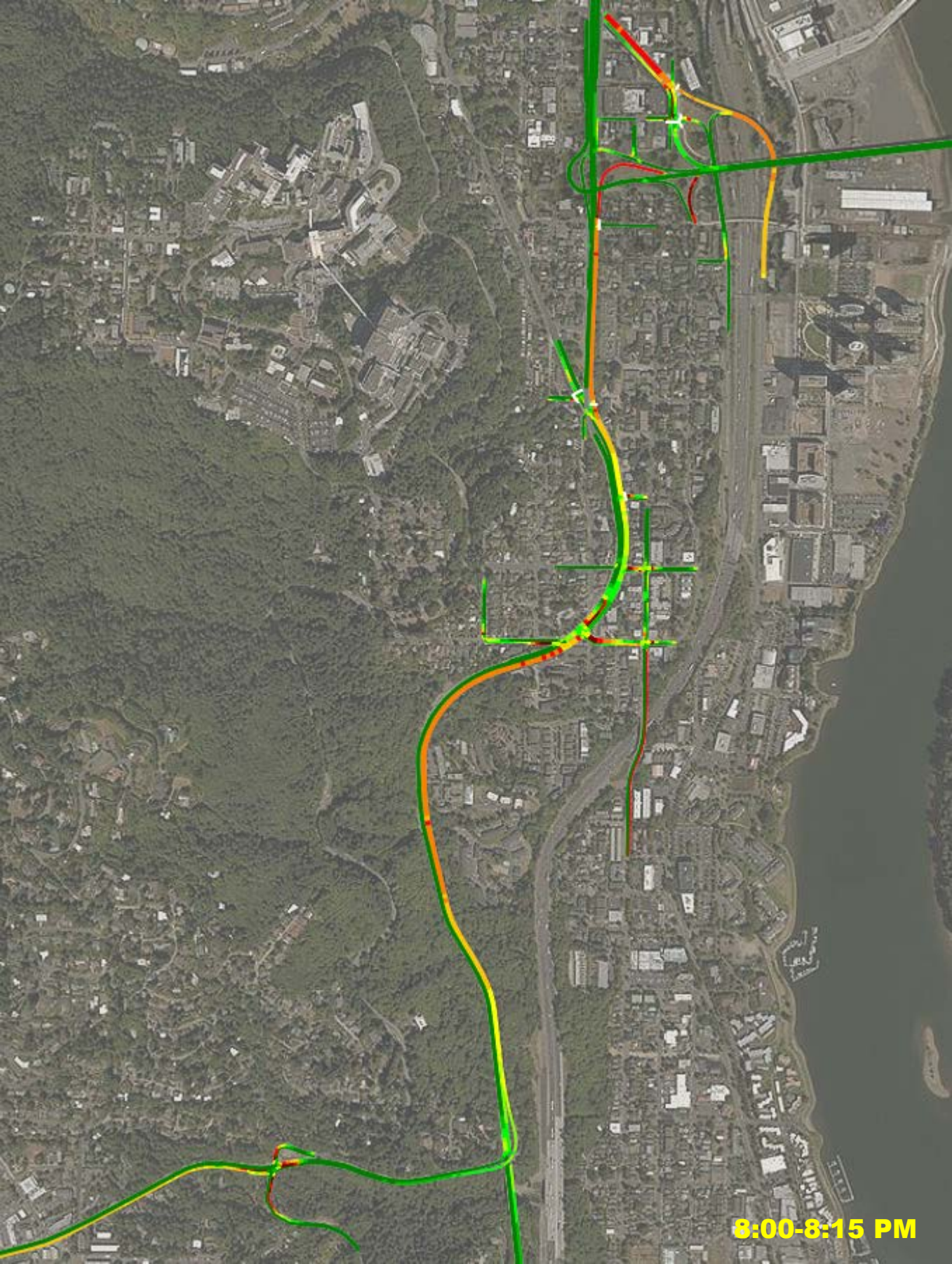
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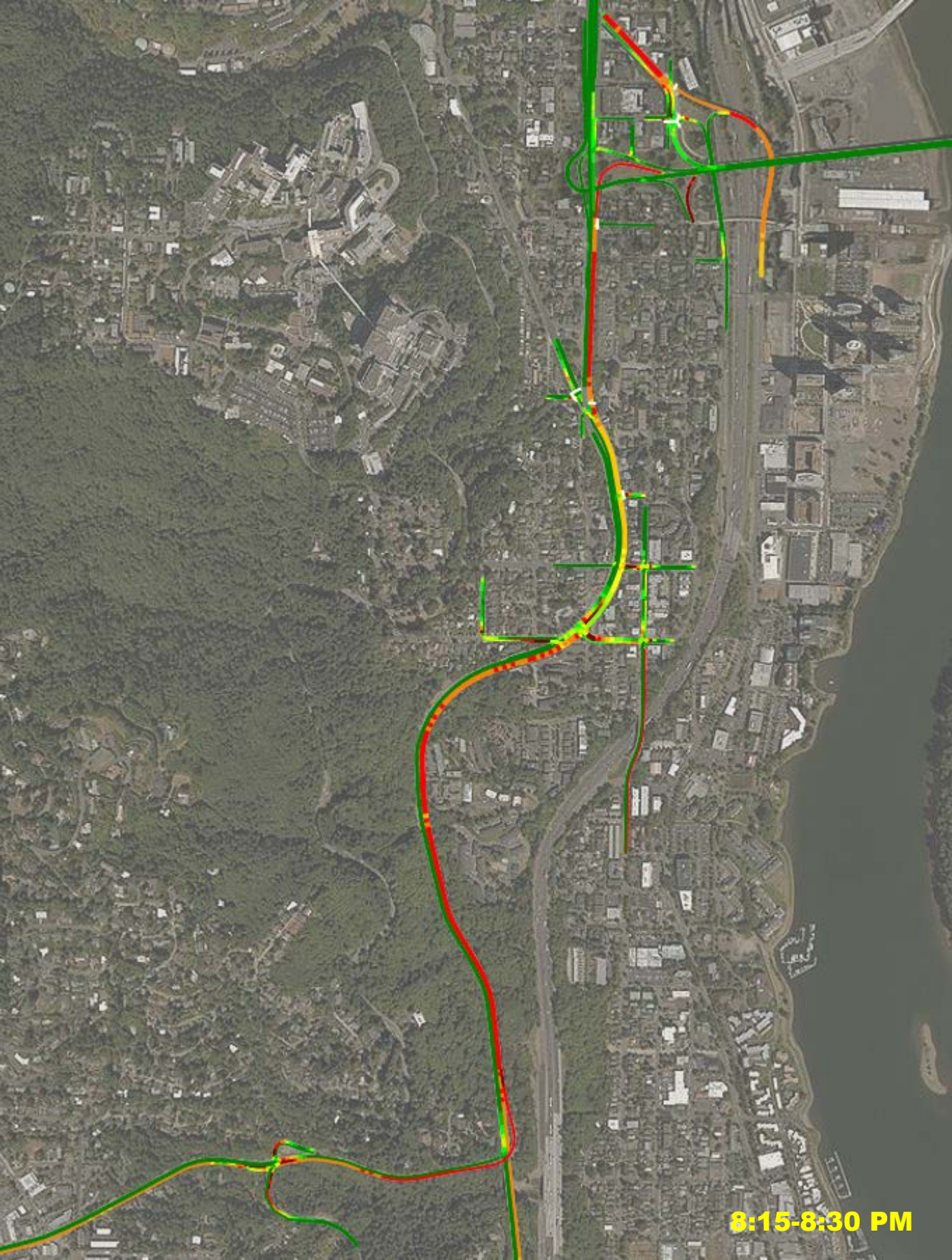
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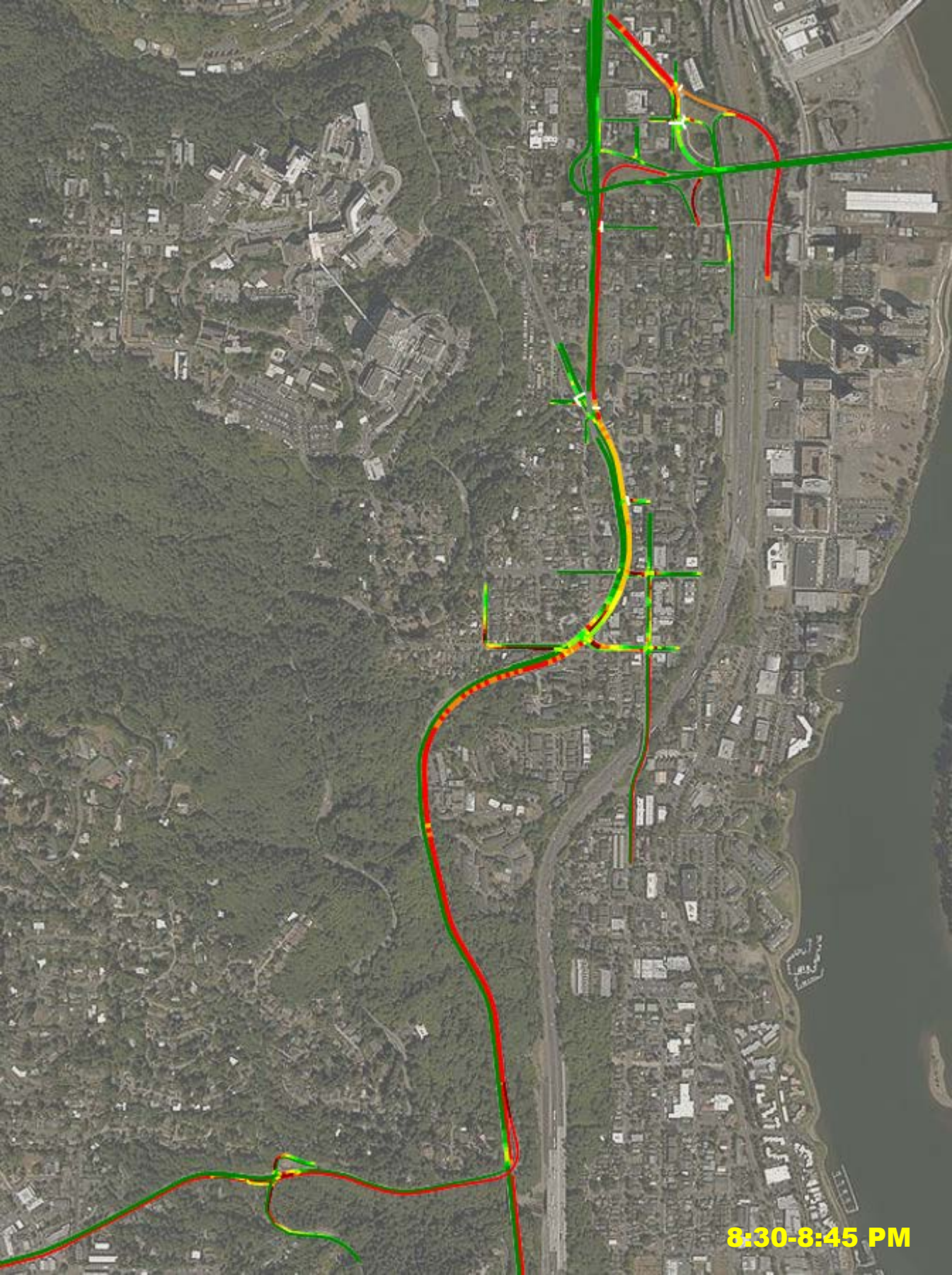
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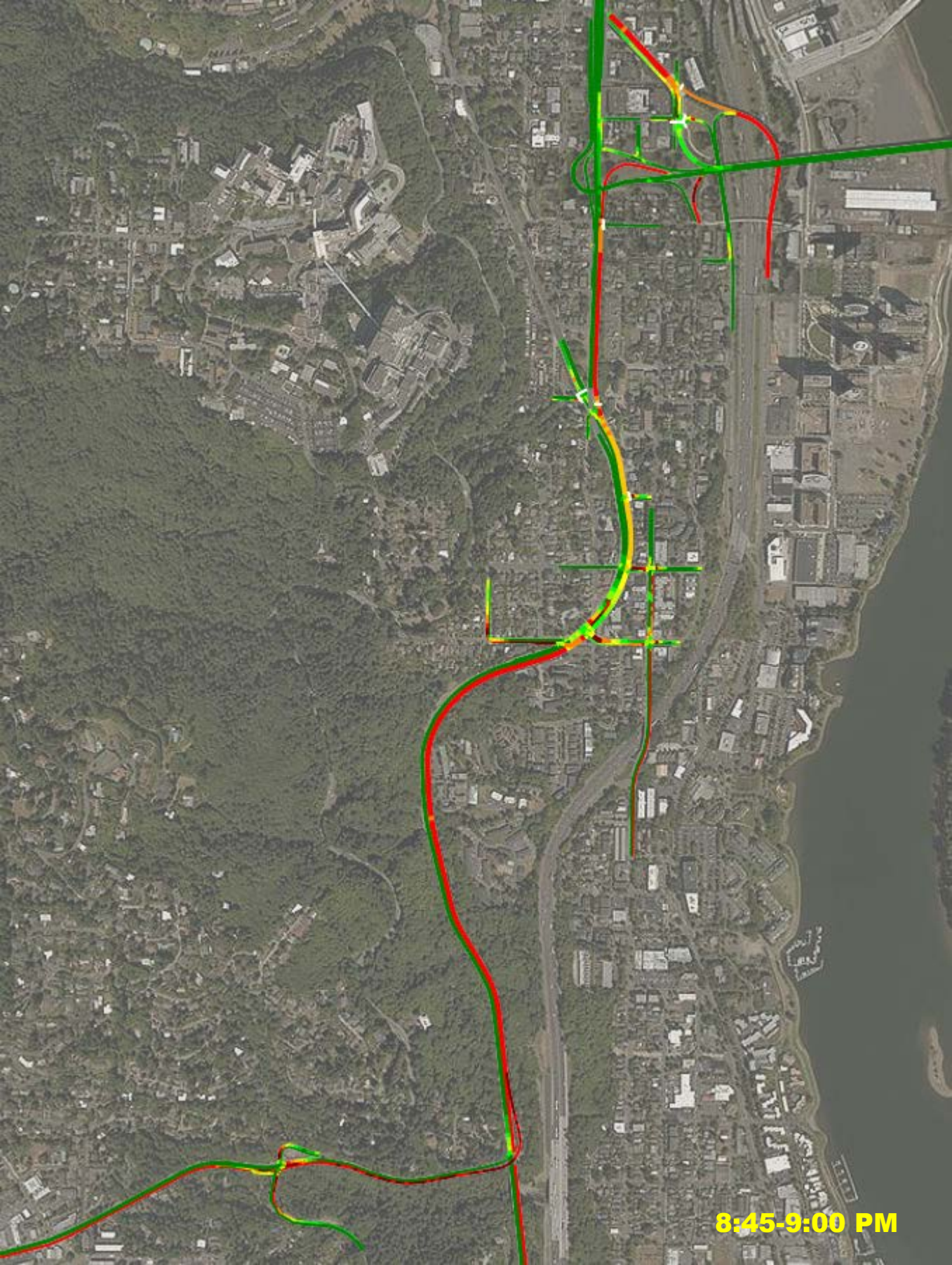
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