CHAPTER 5: APPENDICES

5.2 Appendix B: Preliminary Design Schematics

B.1 I-5 Bottlenecks

B.2 I-205 Bottlenecks
B.3 I-84 Bottlenecks
B.4 I-405 Bottlenecks
B.5 US 26 Bottlenecks

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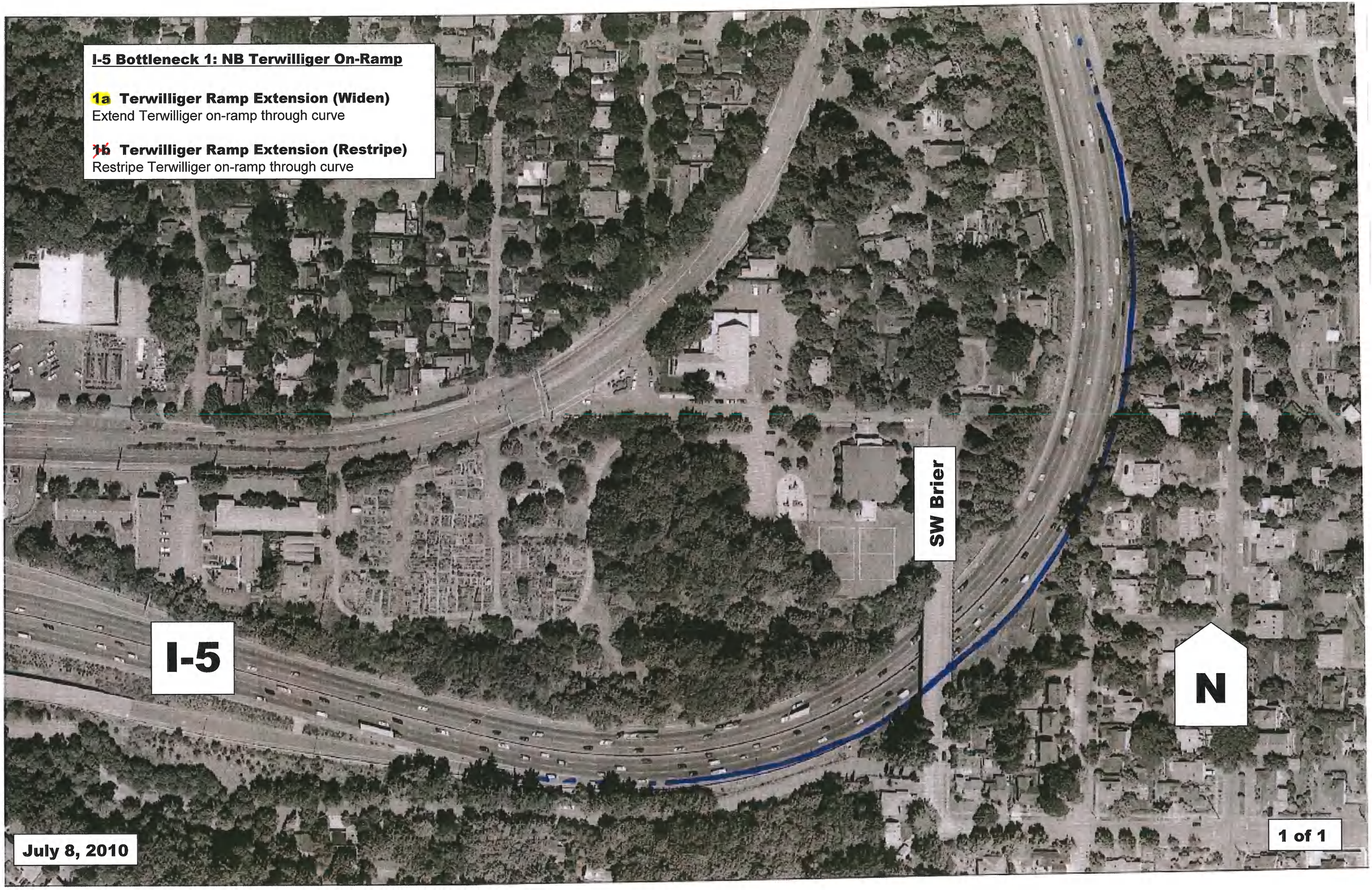
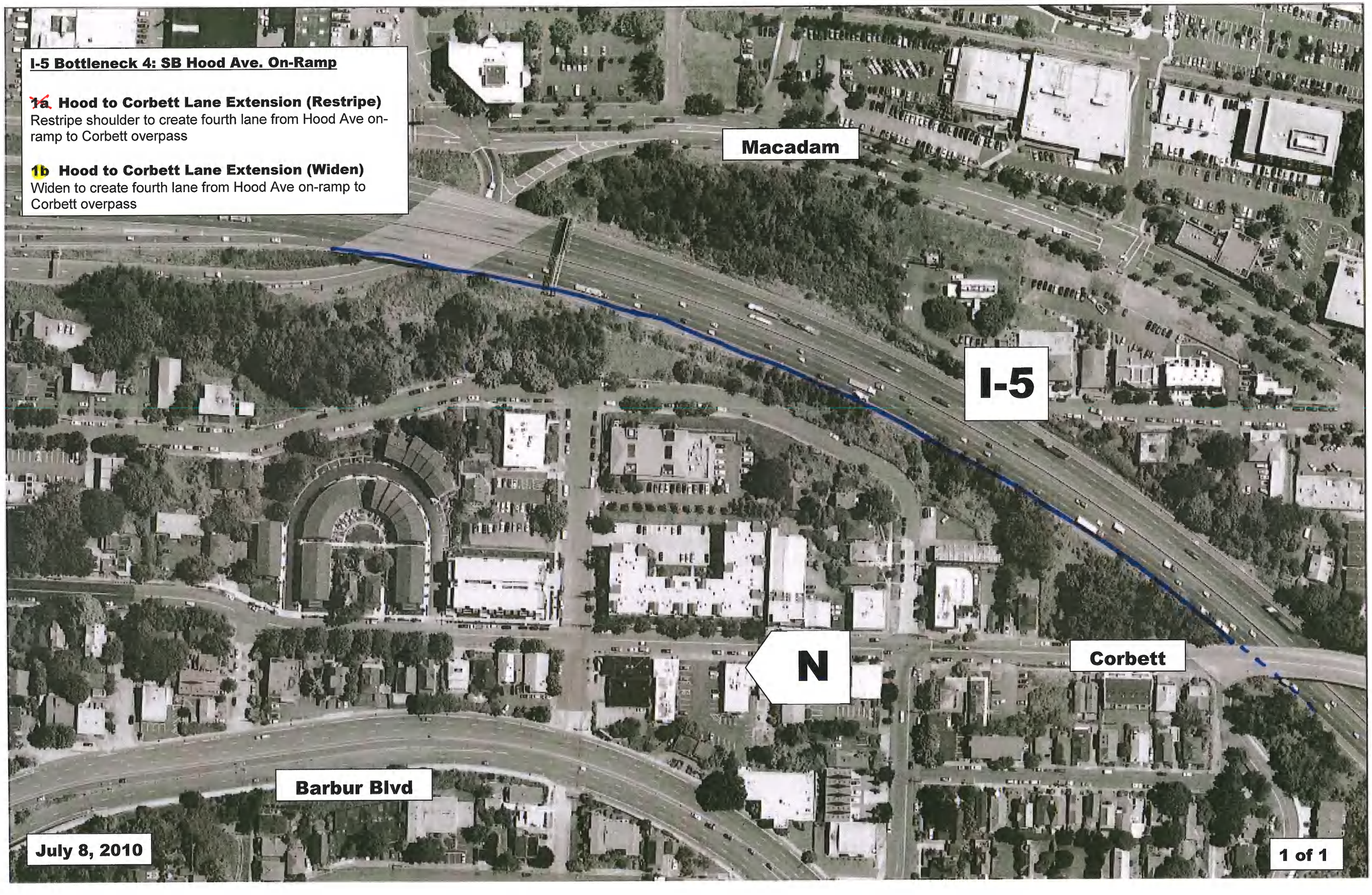
C-BOS: I-5 PROPOSED IMPROVEMENTS

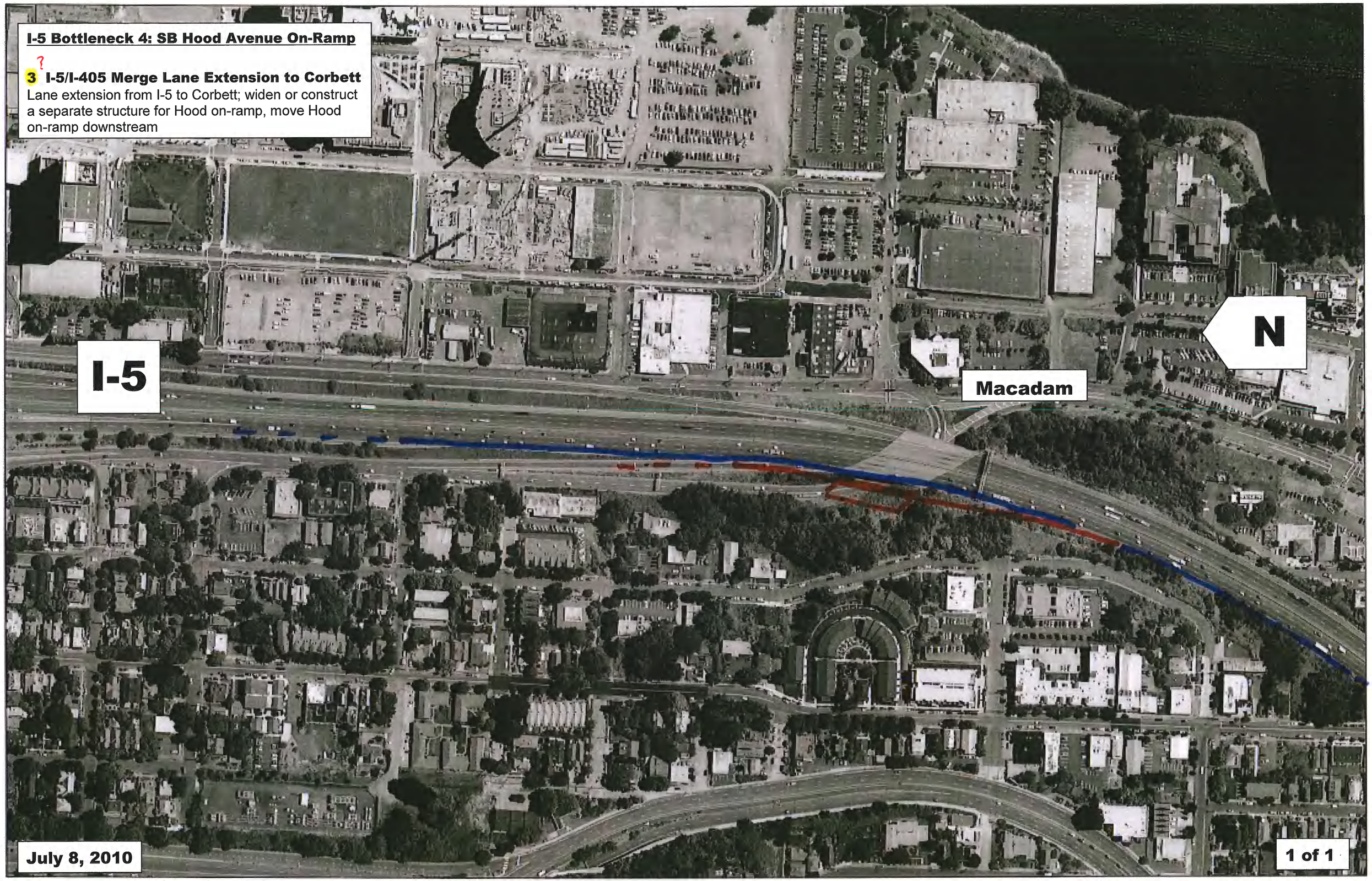
Corridor	Name	Bottle-neck	Study Area	Op-tion	Project Name	Description	Cost Elements	Comments	Priority
I-5	Corridor-wide	Corr-Wide	I-405 - south UGB		Corridor Active Traffic Management	Use corridor-wide active management signage to warn of queueing ahead;	**$2M-$4M**	Funding being pursued for future study of active management signage of major corridors. Future study of region corridors to address implemen-tation of active management/variable speed signage.	
I-5	SB Hood Ave. ON-Ramp Bottleneck	4	Harbor Drive to Terwilliger	1b	Hood to Corbett Lane Extension Widen	Widen to create fourth lane from Hood Ave ON-ramp to Corbett overpass	**$??M:** 1,500 ft of Shoulder pavement and possibly walls	May require shifting striping of both the SB & NB lanes.	
I-5		4		3	I-5/I-405 Merge Lane Extension to Corbett	Lane extension from I-5 to Corbett; widen or contsruct a separate structure for Hood ON-ramp, move Hood ON-ramp downstream	**$??M:** 1,200 ft of shoulder widening; 1,200 ft ramp construction; 200 ft bridge widening	May be high cost project.	
I-5		4		4	Restripe Harbor Drive On-ramp to I-405	Restripe Harbor Drive as a single lane left side merge to the left lane of I-405 rather than dropping I-405 lane	**$??M:** Minor Costs	Improves speed balance and promotes better utilization of left lane, which helps downstream merges. (see I-405 Option #4b)	
I-5		4		7	Harbor Drive Relaignment	Realign Harbor Drive to outside of I-405. Let I-405 add both lanes	**$??M:** Historical, not from Design Panel	(see I-405 Option #4b)	
I-5	NB Terwilliger ON-Ramp Bottleneck	1	Terwilliger Curves	1a	Terwilliger Ramp Extension (Widen)	Extend Terwilliger ON-ramp through curve	**$??M:** 330 ft bridge construction; 1,000 ft ramp construction (+1,000 ft ramp construction for better rearview sight)	Extended accel lane should be barrier separated to prevent early merge.	
I-5		1		2	ATMS	Install ATMS throughout curves. (extending concept from I-405)	**$??M:** Minor Costs		
I-5	SB Carman Lane Drop Bottleneck	5	OR 217 to Lower Boones Ferry	1	Ramp Meter	Ramp meter on HWY 217	**$??M:** Minor Costs		
I-5		5		3	Carman to Lower Boones Aux Lane	Carry 4th lane from Carman to Lower Boones Ferry Rd.	**$1.25M:** 1,200ft of Carman on ramp recon-struction; 800 ft of Lower Boones off ramp reconstruction	Project in 2013-2015 STIP.	
I-5	SB Nyberg St. OFF-Ramp Bottleneck	6	Nyberg Rd. to Lower Boones Ferry Rd.	3a-1 (new)	Lower Boones Ferry Rd,. To Ny-berg Rd. Aux Ln	Carry 4th lane/aux lane from Lower Boones Ferry Rd. to Nyberg St. interchange	**$10.0M - $12.0M**		
I-5		6		3a-2 (new)	Nyberg Rd. to I-205 Aux Lane	Carry 4th lane/aux lane from Nyberg St. interchange to I-205	**$10.0M - $18.0M**		
I-5	NB Lower Boones Ferry OFF-Ramp Bottleneck	2	Nyberg Rd. to Lower Boones Ferry Rd.	2a	Reconstruct Lower Boones Ferry Rd. NB OFF-Ramp	Increase Lower Boones Road OFF-ramp from one lane to two	**$1M - $2M:** 1,200 ft of ramp reconstruction		
I-5		2		2b-1 2b-2	I-5 NB Aux Lane extension, Nyberg Rd. to Carman Dr.	Extend 4th lane/aux lane from Nyberg through Lower Boones Ferry (2b-1); Lower Boones Ferry adds 5th lane through Carman Dr. interchange; Carman Dr. interchange merges into 5 lanes (2b-2)	**$??M:** 6,200 ft of Aux construction; 800ft ramp modification (2b-1 & 2b-2 combined)		

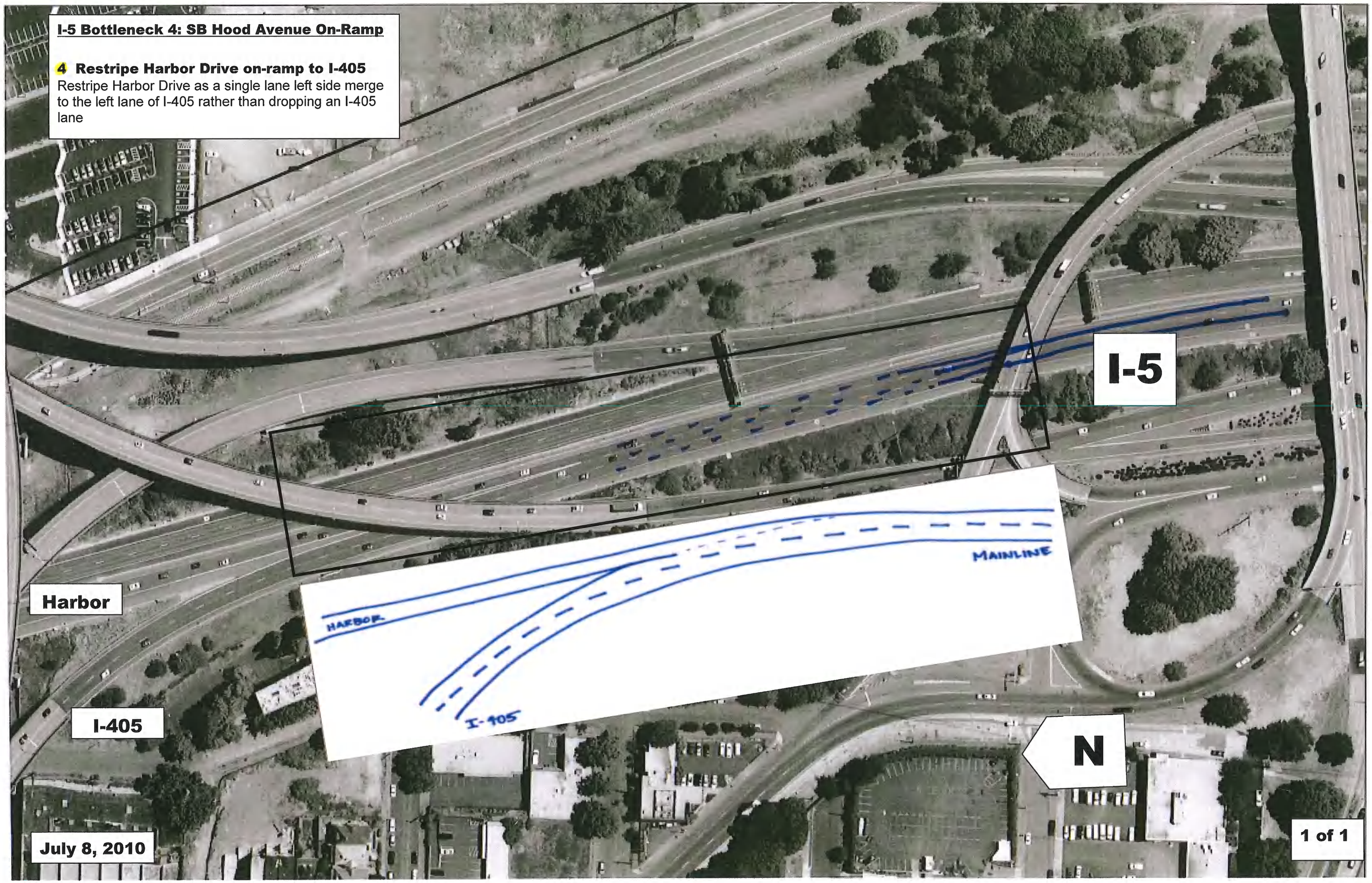
C-BOS: I-5 PROPOSED IMPROVEMENTS

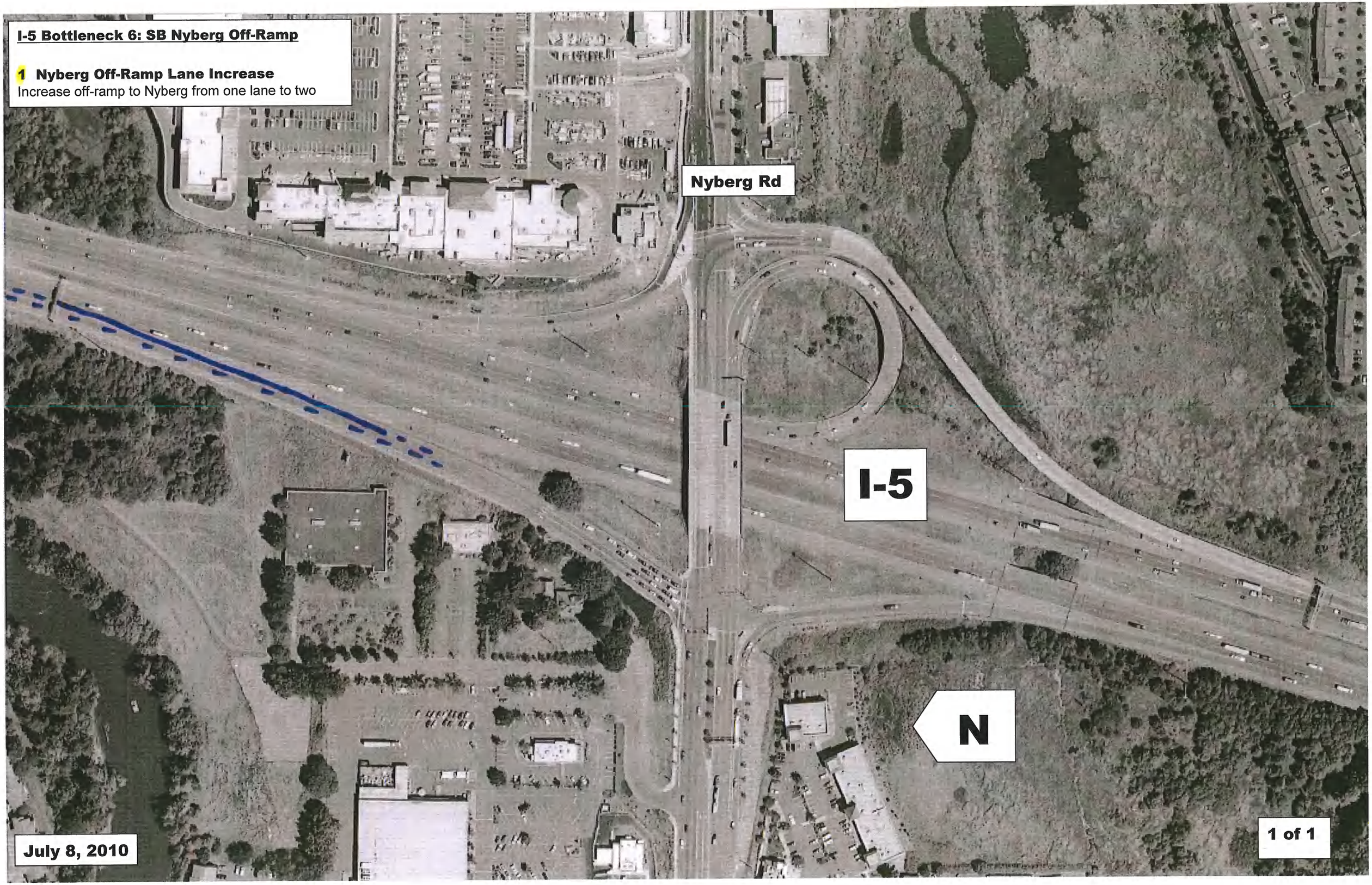
Corridor	Name	Bottle-neck	Study Area	Op-tion	Project Name	Description	Cost Elements	Comments	Priority
						OPTIONS CONSIDERED BUT NOT FORWARDED			
	SB Nyberg OFF-Ramp Bottleneck	6	Lower Boones Ferry to Nyberg Rd.	1	Nyberg Rd.OFF-Ramp Lane Increase	Increase OFF-ramp to Nyberg Rd. from one lane to two.	**$??M:** Ramp reconstruction	OFF-ramp already widened with recent Pres job.	
	SB Hood Ave. ON-Ramp Bottleneck	4	Harbor Drive to Terwilliger	1a	Hood to Corbett Lane Extension Restripe	Restripe shoulder to create fourth lane from Hood Ave ON-ramp to Corbett overpass	**$??M:** Minor Costs	Sight lines/safety concerns.	
		4		2a	Hood to Brier Lane Extension Restripe	Restripe shoulder to create fourth lane from Hood Ave ON-ramp to Brier overpass	**$??M:** Minor Costs	Cannot be done as a restripe.	
		4		2b	Hood to Brier Lane Extension Widen	Widen to create fourth lane from Hood Ave ON-ramp to Brier overpass	**$??M:** 8,500 ft of shoulder pavement and possibly walls; rock cut	Construction costs would likely exceed project study limits.	
		4		5	Hood Ave Braid	Braid Hood Ave on-ramp, separating it and carrying it over the I-5 OFF-ramp to OR 43	**$??M:** 800 ft of structure; 1200 ft of ramp reconstruction; potential right of ways	Significant structure changes /access issues that need to be resolved. Does not address mainline issues.	
		4		6	US26 WB to I-5 SB Realignment	Realign 26 westbound to I-5 SB ramp to the east (includes South Waterfront to I-5 SB traffic); realign and separate I-5 SB connection to OR 43 to the west	**$??M:** 2,400 ft of ramp reconstruction; 200 ft new structure	How this project will affect local access and routes; Gibbs St. structure. Fatal flaws: political; feasibility; risk.	
	NB Terwilliger ON-Ramp Bottleneck	1	Terwilliger Curves	1b	Terwilliger Ramp Extension (Restripe)	Restripe Terwilliger ON-ramp through curve	**$??M:** Minor Costs	Not feasible due to constraints of Brier O'Xing.	
				3	Terwilliger Interchange Reconfiguration	Reconfigure Terwilliger Interchange - relocate the westbound Terwilliger ON-ramp and Bertha ON-ramp to a loop ON-ramp and relocate northbound Terwilliger OFF-ramp to new Spring Garden OFF-ramp	**$??M:** Multiple ramp and bridge reconstruction	Political issues, Traffic operations at Barbur and Bertha/access, although worth further investigation.	
	SB Carman Lane Drop Bottlneck	5	OR 217 to Lower Boones	2	ATMS	Add ATMS where HWY 217 meets 1-5; rechannelization of 217	**$??M:** Minor Costs	For better lane utilization. Benefit unclear.	
	NB Lower Boones OFF-Ramp Bottleneck	2	Nyberg to Lower Boones Ferry	1	Nyberg ON Ramp	Move WB to NB Nyberg ON ramp onto the existing loop ON-ramp	**$??M:** Ramp Modification	Ramp volumes too high.	
		2		2c	Lower Boones/Carman Peak Shoulder	Peak period shoulder use between OFF and ON-ramps at Lower Boones and Carman	**$??M:** 4,000 ft of Aux construction / shoulder improvements	Better addressed at corridor refinement level.	
		2		3	Nyberg/Lower Boones Braid	Braid Nyberg ON ramps with Lower Boones OFF ramps		Environmental/ cost issues	

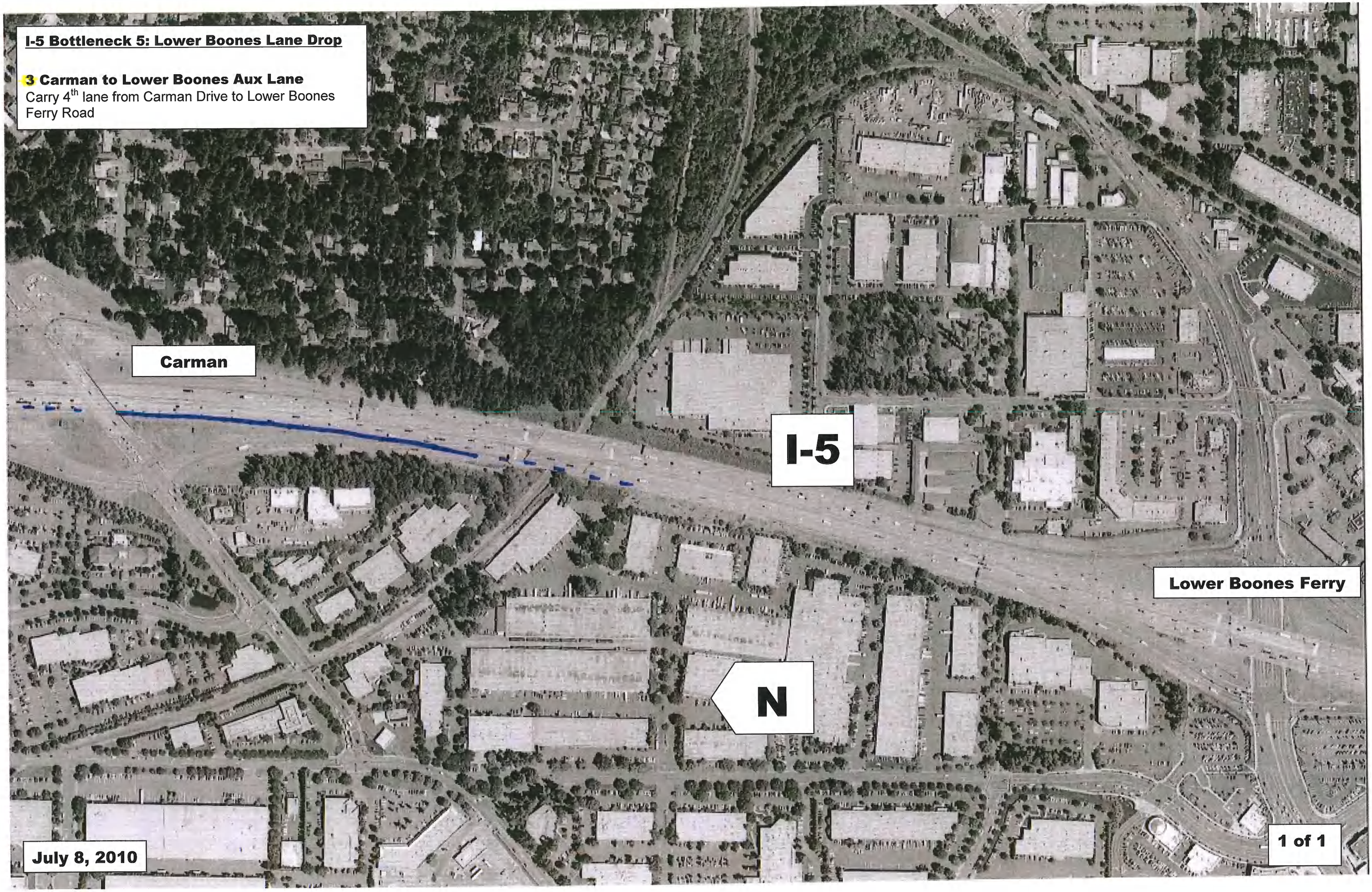

I-5 Bottleneck 1: NB Terwilliger On-Ramp
1a Terwilliger Ramp Extension (Widen)
Extend Terwilliger on-ramp through curve
1b Terwilliger Ramp Extension (Restripe)
Restripe Terwilliger on-ramp through curve
SW Brier
I-5
N
July 8, 2010
1 of 1

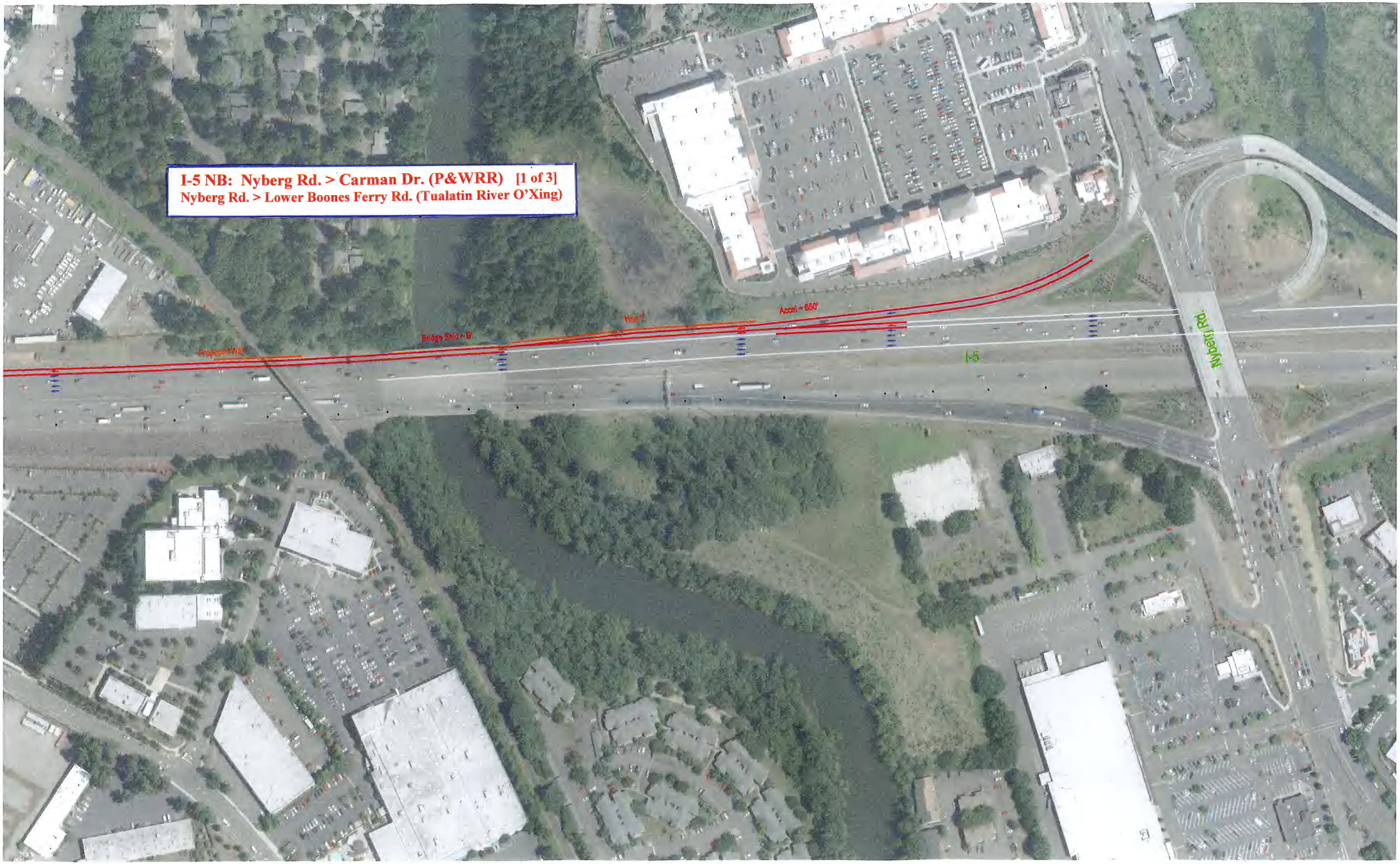

I-5 Bottleneck 4: SB Hood Ave. On-Ramp
~~1a~~ Hood to Corbett Lane Extension (Restripe)
Restripe shoulder to create fourth lane from Hood Ave on-ramp to Corbett overpass
1b Hood to Corbett Lane Extension (Widen)
Widen to create fourth lane from Hood Ave on-ramp to Corbett overpass
Macadam
I-5
N
Corbett
Barbur Blvd
July 8, 2010
1 of 1

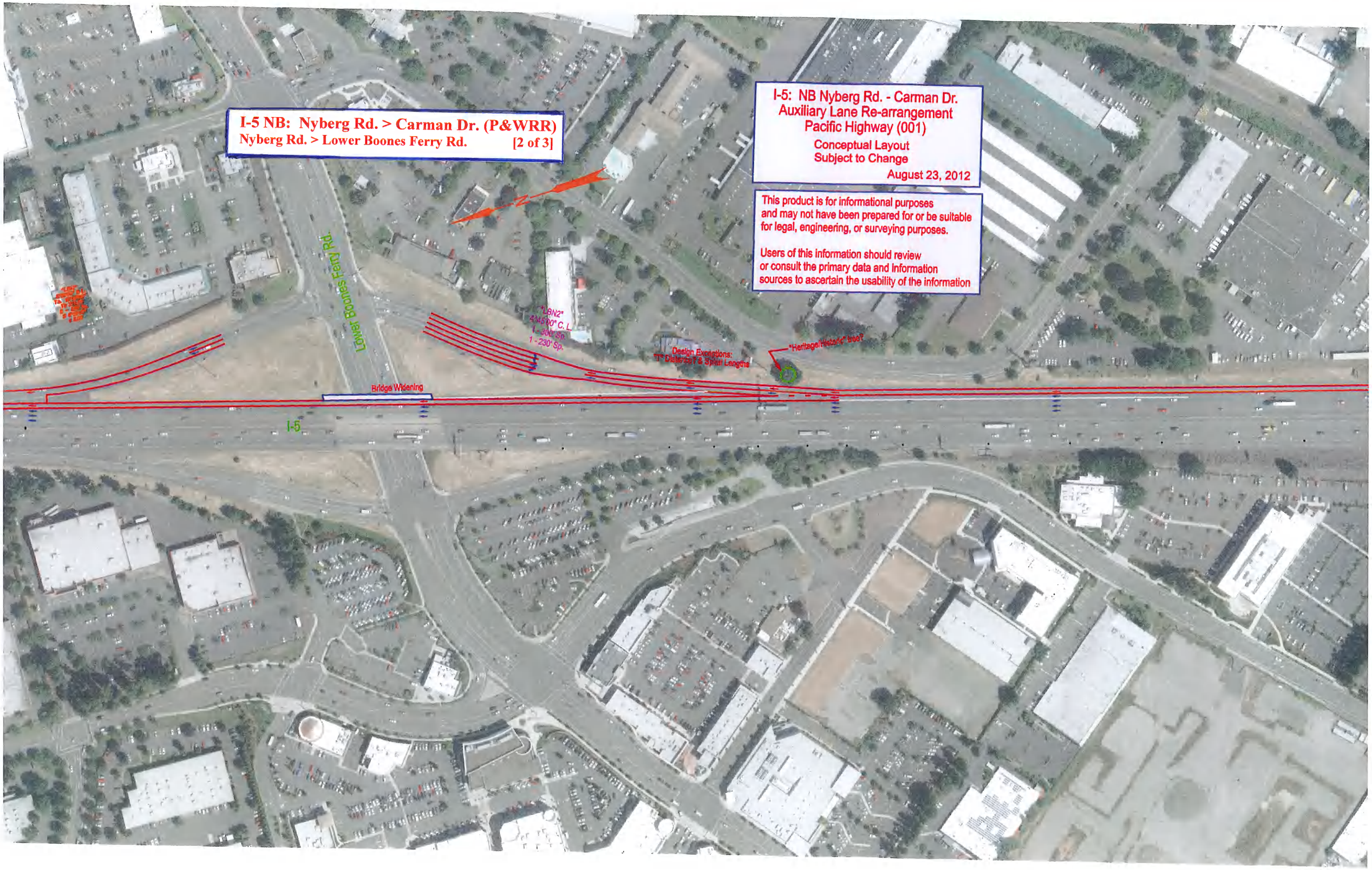

I-5 Bottleneck 4: SB Hood Avenue On-Ramp
?
3 I-5/I-405 Merge Lane Extension to Corbett
Lane extension from I-5 to Corbett; widen or construct a separate structure for Hood on-ramp, move Hood on-ramp downstream
I-5
Macadam
N
July 8, 2010


I-5 Bottleneck 4: SB Hood Avenue On-Ramp
4 Restripe Harbor Drive on-ramp to I-405
Restripe Harbor Drive as a single lane left side merge to the left lane of I-405 rather than dropping an I-405 lane
I-5
Harbor
I-405
HARBOR
MAINLINE
I-405
N
July 8, 2010
1 of 1


I-5 Bottleneck 6: SB Nyberg Off-Ramp
1 Nyberg Off-Ramp Lane Increase
Increase off-ramp to Nyberg from one lane to two
Nyberg Rd
I-5
N
July 8, 2010
1 of 1

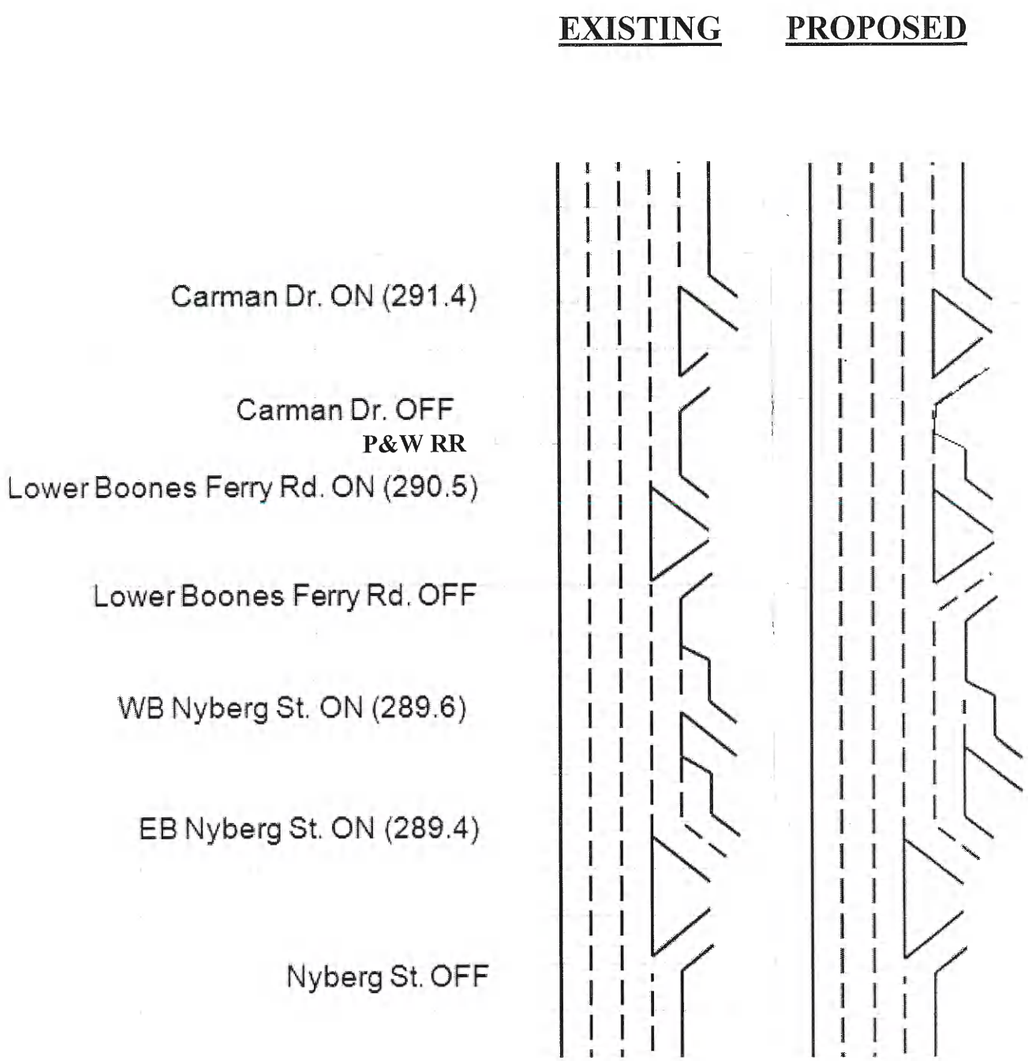

I-5 Bottleneck 5: Lower Boones Lane Drop
3 Carman to Lower Boones Aux Lane
Carry 4th lane from Carman Drive to Lower Boones Ferry Road
Carman
I-5
Lower Boones Ferry
N
July 8, 2010
1 of 1

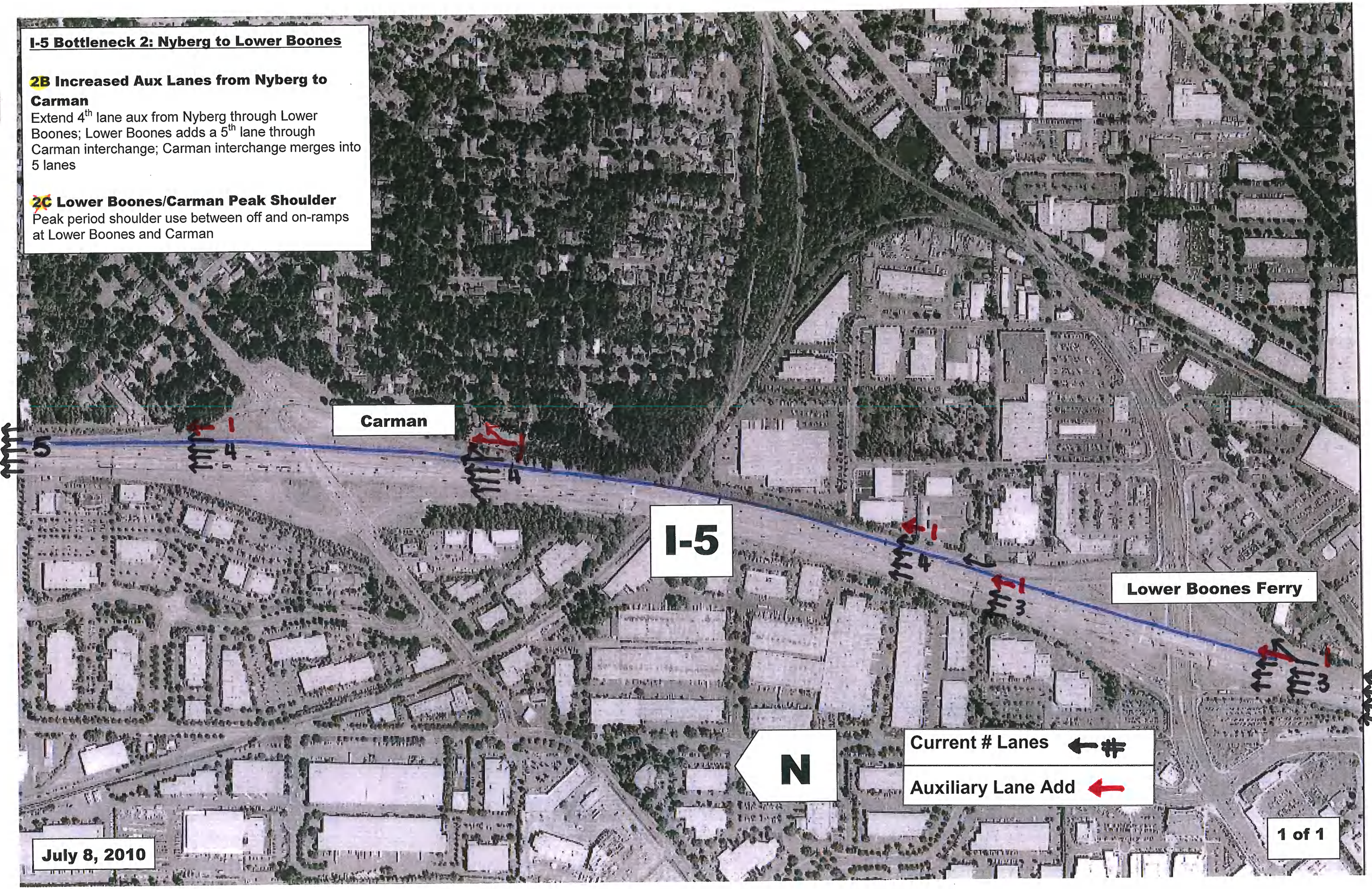

I-5 NB: Nyberg Rd. > Carman Dr. (P&WRR) [1 of 3]
Nyberg Rd. > Lower Boones Ferry Rd. (Tualatin River O'Xing)
Proposed Wall
Bridge Shld ~ 8'
Wall 7
Accel ~ 650'
I-5
Nyberg Rd.

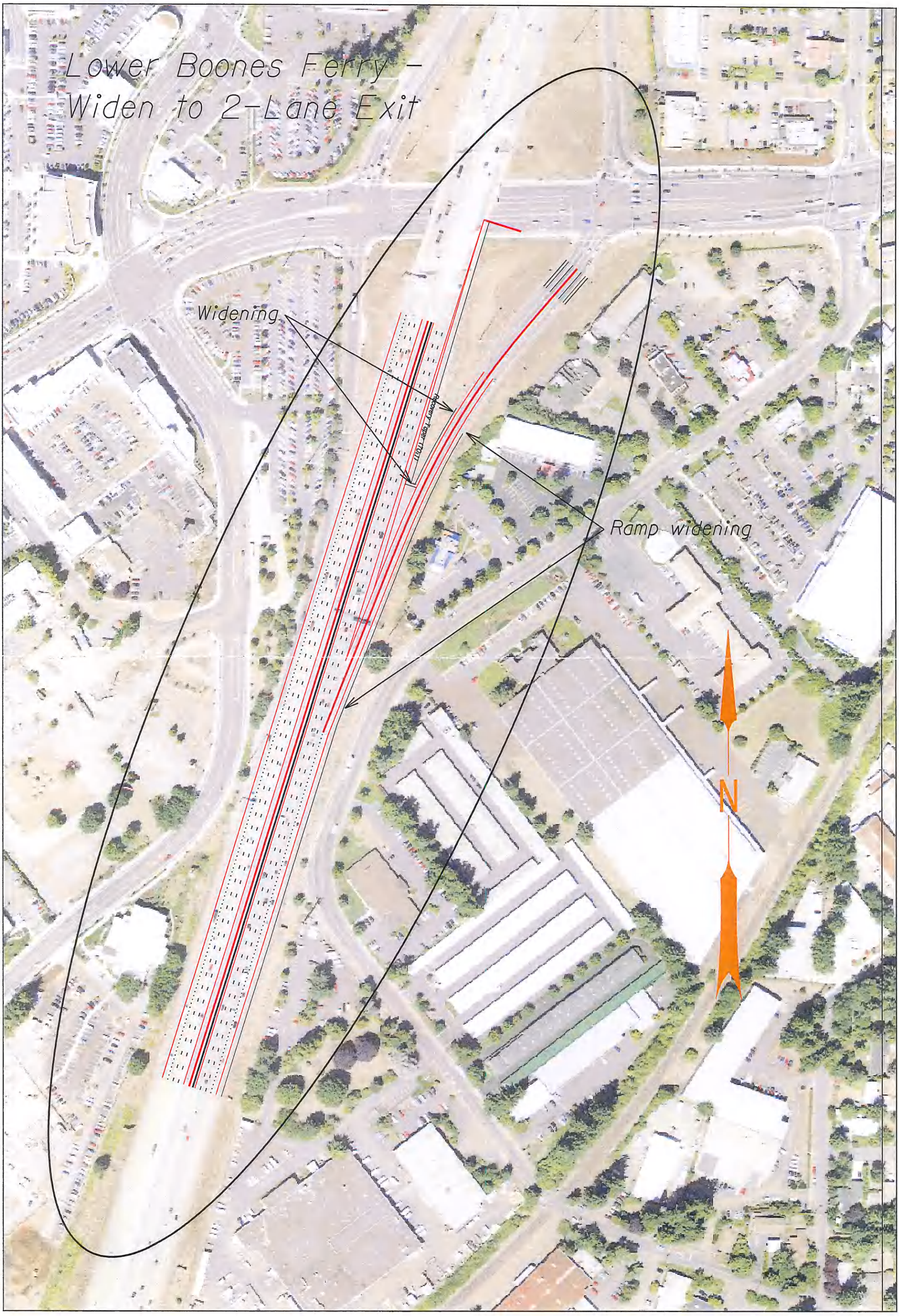

I-5 NB: Nyberg Rd. > Carman Dr. (P&WRR)
Nyberg Rd. > Lower Boones Ferry Rd. [2 of 3]
I-5: NB Nyberg Rd. - Carman Dr.
Auxiliary Lane Re-arrangement
Pacific Highway (001)
Conceptual Layout
Subject to Change
August 23, 2012
This product is for informational purposes and may not have been prepared for or be suitable for legal, engineering, or surveying purposes.
Users of this information should review or consult the primary data and information sources to ascertain the usability of the information
Lower Boones Ferry Rd.
"L8N2" 4M500" C. L. 1-300' Sp. 1-230' Sp.
Design Exceptions: 11' Distances & 3000' Lengths
"Heritage/Historic" tree?
Bridge Widening
I-5

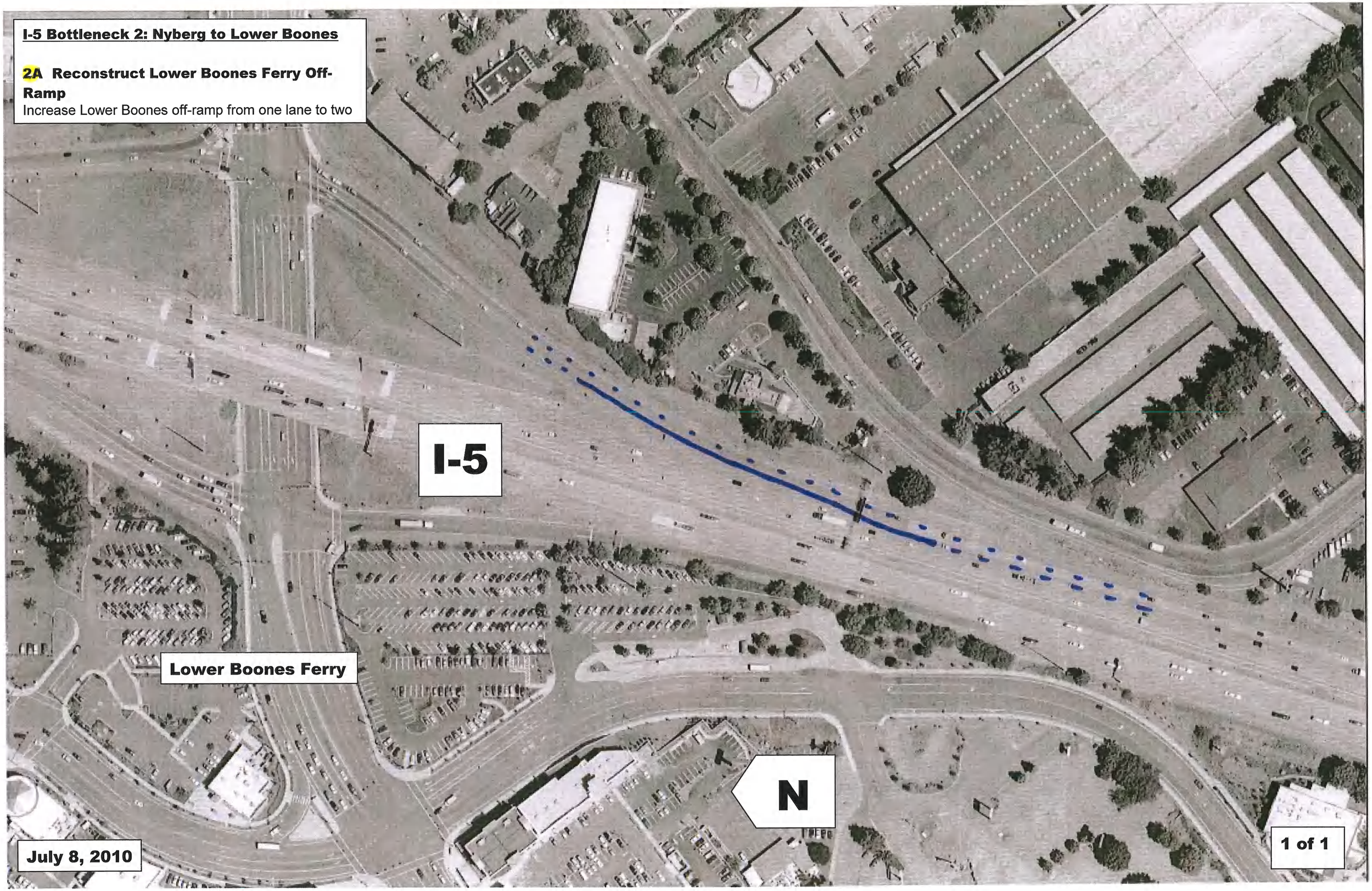
I-5 NB: Nyberg Rd. > Carman Dr. (P&WRR)
Lower Boones Ferry Rd. > P&WRR O'Xing [3of 3]
Carman Dr. EXIT ramp
P&WRR
I-5
Wall ?

I-5 NB: Nyberg Rd. > Carman Dr. (P&WRR)




I-5 Bottleneck 2: Nyberg to Lower Boones
2B Increased Aux Lanes from Nyberg to Carman
Extend 4th lane aux from Nyberg through Lower Boones; Lower Boones adds a 5th lane through Carman interchange; Carman interchange merges into 5 lanes
2C Lower Boones/Carman Peak Shoulder
Peak period shoulder use between off and on-ramps at Lower Boones and Carman
Carman
I-5
Lower Boones Ferry
N
Current # Lanes
Auxiliary Lane Add
July 8, 2010
1 of 1


Lower Boones Ferry -
Widen to 2-Lane Exit
Widening
Ramp widening
N


I-5 Bottleneck 2: Nyberg to Lower Boones
2A Reconstruct Lower Boones Ferry Off-Ramp
Increase Lower Boones off-ramp from one lane to two
I-5
Lower Boones Ferry
N
July 8, 2010
1 of 1

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CHAPTER 5: APPENDICES

5.2 Appendix B: Preliminary Design Schematics
B.1 I-5 Bottlenecks
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B.5 US 26 Bottlenecks

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C-BOS: I-205 PROPOSED IMPROVEMENTS

Corridor	Name	Bottle-neck	Study Area	Op-tion	Project Name	Description	Cost Elements	Comments	Priority
I-205	Corridor-wide	Corr-Wide	I-5 - Columbia River		Corridor Active Traffic Management	Use corridor-wide active management signage to warn of queueing ahead;	**$2M-$4M**	Funding being pursued for future study of active management signage of major corridors. Future study of region corridors to address implemen-tation of active management/variable speed signage.	
I-205	SB I-84 WB OFF-Ramp Bottleneck	7	I-205 to I-84 WB Ramp Reconfigura-tion	1	I-205 to I-84 WB Ramp Reconfigurati on	Merge two I-205 NB to I-84 WB flyover lanes together, then merge this lane with I-205 SB to I-84 WB lane, then add this single lane to I-84 WB	**< $1M:** Mainly restriping, minimal pavement -	Proposal modified: make I-205 SB the add-lane, and make I-205 NB into a single-lane merge. Could create negative consequences for I-205 NB. (see I-84 Options #7a & #7b)	
I-205		7	I-84/I-205 SB Braid	2	I-84/I-205 SB Braid	Braid I-84 WB to I-205 SB movement with I-205 SB to I-84 WB movement	**$34.6M:** Structures -- 8,400' SF bridge for weave, 83,000 cu yds earthwork, 75,000 sf retaining wall, 130,000 sf pavement.	May be expensive project for benefit generated.	
I-205		7	I-84 WB Approach to I-205 Widening	4	I-84 WB Approach to I-205 Widening	I-84 WB 4-lane approach currently a 2/2 split -- left two lanes go to I-205 NB/SB, right two lanes continue on I-84 WB. Change to 3/2 split, with three lanes providing access to I-205 NB/SB	**$3.2M**: Sign bridge, 2,000 SF retaining wall, 5,000 cu yds earthwork, additional lane 40,000 sf.	(see I-84 Options #7a & #7b)	
I-205		7		5	Review signing				
	I-205								
I-205	SB Stark/Wash-ington ON-Ramp Bottleneck; SB Division /Powell OFF-Ramp Bottleneck	8,9	EB I-84 ON-Ramp to Division/ Powell OFF-Ramp	1	Auxiliary Lane, I-84 EB ON-ramp to Division / Powell OFF-ramp	Constructs new aux lane from I-84 EB ON-ramp to Stark/Washington on-ramp (already an aux lane between Stark/Washington and Division/ Powell)	**$4.5M**		
I-205		8,9		1A	I-84 EB Approach to I-205 SB Reconfigurati on	Reconfigures the three lanes eastbound approaching I-205 SB to a 2-2 split (2 lanes southbound onto I-205 SB)	**$??M:** TBD	Appears to conflict with current RTP project that carries third I-84 EB lane to I-205 NB OFF-ramp. Project would preclude having a third lane EB on I-84 beyond the I-205 SB OFF-ramp. Does not relate directly to I-205 operation.	
I-205		8,9		2	Second Aux Lane, Washington / Stark ON-ramp to Division / Powell OFF-ramp	Constructs additional aux lane between Stark / Washington and Division / Powell (assumes that first aux lane has been carried through from I-84 EB ON-ramp, as in Option 1)	**$27.4M**	Cannot drop two lanes at Powell/Division --- so would have to be a 5>4/2 split, necessitating a fourth lane all the way to Foster Rd. Widening should be to the inside.	
I-205	NB Division & Powell ON-Ramp Bottleneck	4	Aux Lane, Powell ON-Ramp to Division ON-Ramp	1	Aux Lane, Powell ON-ramp to Division ON-ramp	Constructs/stripes new auxiliary lane from NB Powell ON-ramp to the aux lane that begins at the Division ON-ramp	**$??M:** TBD		

C-BOS: I-205 PROPOSED IMPROVEMENTS

Corridor	Name	Bottle-neck	Study Area	Op-tion	Project Name	Description	Cost Elements	Comments	Priority
I-205		4	Aux lane, Stark/ Washington OFF-ramp to Glisan OFF-ramp	2a	Aux lane, Stark / Washington OFF-ramp to Glisan OFF-ramp	Constructs/stripes new auxiliary lane from existing upstream aux lane at NB Stark/Washington OFF-ramp to Glisan OFF-ramp	**$??M:** TBD		
I-205		4	Aux Lane, Washington / Stark ON-ramp to I-84 WB OFF-ramp	2b	Aux Lane, Washington / Stark ON-ramp to I-84 WB OFF-ramp	Constructs/stripes new auxiliary lane from NB Stark/Washington ON-ramp to I-84 WB OFF-ramp.	**$??M:** TBD		
I-205	NB Foster Rd. ON-Ramp Bottleneck	5	Foster Rd. to Powell Blvd.	1	Aux Lane, Foster ON-ramp to Powell OFF-ramp	Constructs/stripes new NB auxiliary lane from Foster ON-ramp to Powell OFF-ramp.	**$10.5M:** 88,000 SF pavement, 13,000 cu yds earthwork, 32,000 sf wall.		
I-205	NB I-84 WB ON-Ramp Bottleneck	3	EB I-84 OFF Ramp to Airport Way	1	Northbound Aux Lane from I-84 EB ON-ramp (Restripe)	Aux/add lane from I-84 EB ON-ramp to Sandy Blvd. OFF-ramp by restriping	**< $1M:** Restriping.		
	I-205								
I-205	NB I-84 WB ON-Ramp Bottleneck	3	Northbound Aux Lane from I-84 EB ON-ramp (Widen)	2	Northbound Aux Lane from I-84 EB ON-ramp (Widen)	Aux/add lane from I-84 EB ON-ramp to Sandy Blvd. OFF-ramp by widening	**$6.7M**	Models the same as Option 1. Existing ramp geometry at Sandy Blvd. OFF-ramp substandard. Possible impacts to existing I-205 MUP. Possible sound wall near Maywood Park neighborhood.	
I-205		3	Aux lane extension to Columbia WB OFF-ramp	2A	Aux lane extension to Columbia WB OFF-ramp	Extends aux lane from option 1/2 from Sandy OFF-ramp to Columbia OFF-ramp	**$6.5M**	Higher volumes exiting at Columbia Blvd. interchange than Sandy Blvd. Better traffic performance in this segment if continue aux lane to Columbia Blvd. Further analysis suggested re: possible impact to I-205 MUP; possible impacts to OFF-ramp; limited space for treating stormwater run-off.	
I-205		3	Aux lane extension to Airport Way WB OFF-ramp	2b-1	Aux lane extension to Airport Way WB OFF-ramp	Extends aux lane from Option A from Columbia OFF-ramp to Airport Way WB OFF-ramp (aux lane already in place between Columbia ON-ramp and Airport Way WB OFF-ramp)	**$4.9M**	Possible railroad coordination issues.	
I-205		3	Additional aux lane between Columbia ON-ramp and Airport Way WB OFF-ramp	2b-2	Additional aux lane between Columbia ON-ramp and Airport Way WB OFF-ramp	Constructs new aux lane (fifth lane) from Columbia ON-ramp to Airport Way WB OFF-ramp	**$16.1M:** Two new lanes from Columbia OFF-ramp to Airport Way WB OFF-ramp.	Possible railroad coordination issues.	

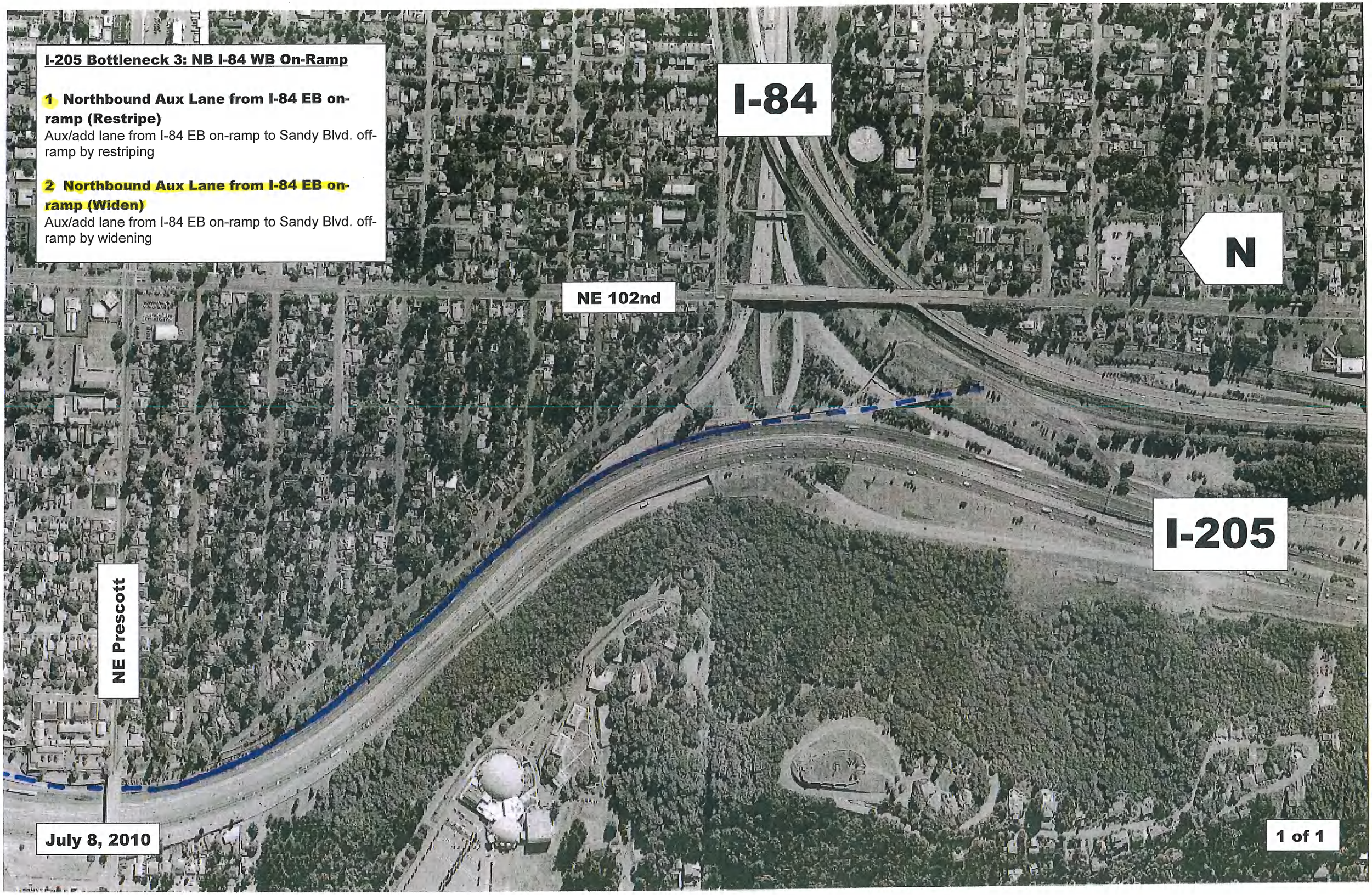
C-BOS: I-205 PROPOSED IMPROVEMENTS

Corridor	Name	Bottle-neck	Study Area	Op-tion	Project Name	Description	Cost Elements	Comments	Priority
I-205	Milwaukie Expy ON-ramp to Gladstone/82nd Dr. OFF-ramp	10	I-205 Aux Lanes: Gladstone to OR 212/224	1	I-205 Aux Lanes: Gladstone to OR 212/224	Auxiliary lanes in both directions -- OR 212/224 to Gladstone interchange (82nd Dr.)	**$18.5M:** Previously estimated, covers both directions	Historical. Not from Design Panel.	
I-205	Abernethy Bridge to Stafford Rd. interchange	11	I-205 Climbing Lanes, Abernethy Br. to 10th	1	I-205 Climbing Lanes, Abernethy Br. to 10th	New SB truck climbing lane from Abernethy Bridge to 10th St.	**$56.8M:** Previously estimated, covers both directions.	Designers believe this climbing lane can be 'shoe-horned' into existing pavement at significalntly lower cost than what was estimated previously.	
						OPTIONS CONSIDERED BUT NOT FORWARDED			
	SB I-84 WB OFF-Ramp Bottleneck	7	EB I-84 ON-Ramp to Glisan OFF-Ramp	3	Major Split, I-205 SB to I-84 WB	Split off I-205 SB to I-84 WB movement onto new, grade-separated roadway upstream of the I-84 WB to I-205 SB ramp, aligned to the west	**$26.1M:** sign bridges, retaining walls, 50,000 cu yds earthwork pavement.	Likely very expensive and politically difficult (rock blasting). Feasibilty issues. Puts more pressure on the Columbia I-84 WB weave.	
	SB Stark / Washington ON-Ramp Bottleneck; SB Division / Powell OFF-Ramp Bottleneck	8,9	EB I-84 ON-Ramp to Division / Powell OFF-Ramp		Close Glisan ON-ramp			Dropped	
	NB I-84 WB ON-Ramp Bottleneck	3	EB I-84 OFF-Ramp to Airport Way	3	Remove lane from I-205 NB between I-	Restripe, reduces I-205 NB mainline to two lanes so that I-84 EB ON-ramp becomes an add lane	**< $1M:** Restriping.	ORS 366 freight mobility/reduction in capacity issues. Political and operational issues.	
				4	Lane drop between I-84 EB OFFramp and I-84 EB ONramp	Similar to option 3, except drops lane in between ramps rather than dropping at I-84 EB OFF-ramp	**< $1M:** Restriping	ORS 366 freight mobility/reduction in capacity issues. Similar benefits as Option 3, but be worse operationally.	
				5	Close Sandy Blvd. exit		**< $1M:** No construction.	Politically difficult.	

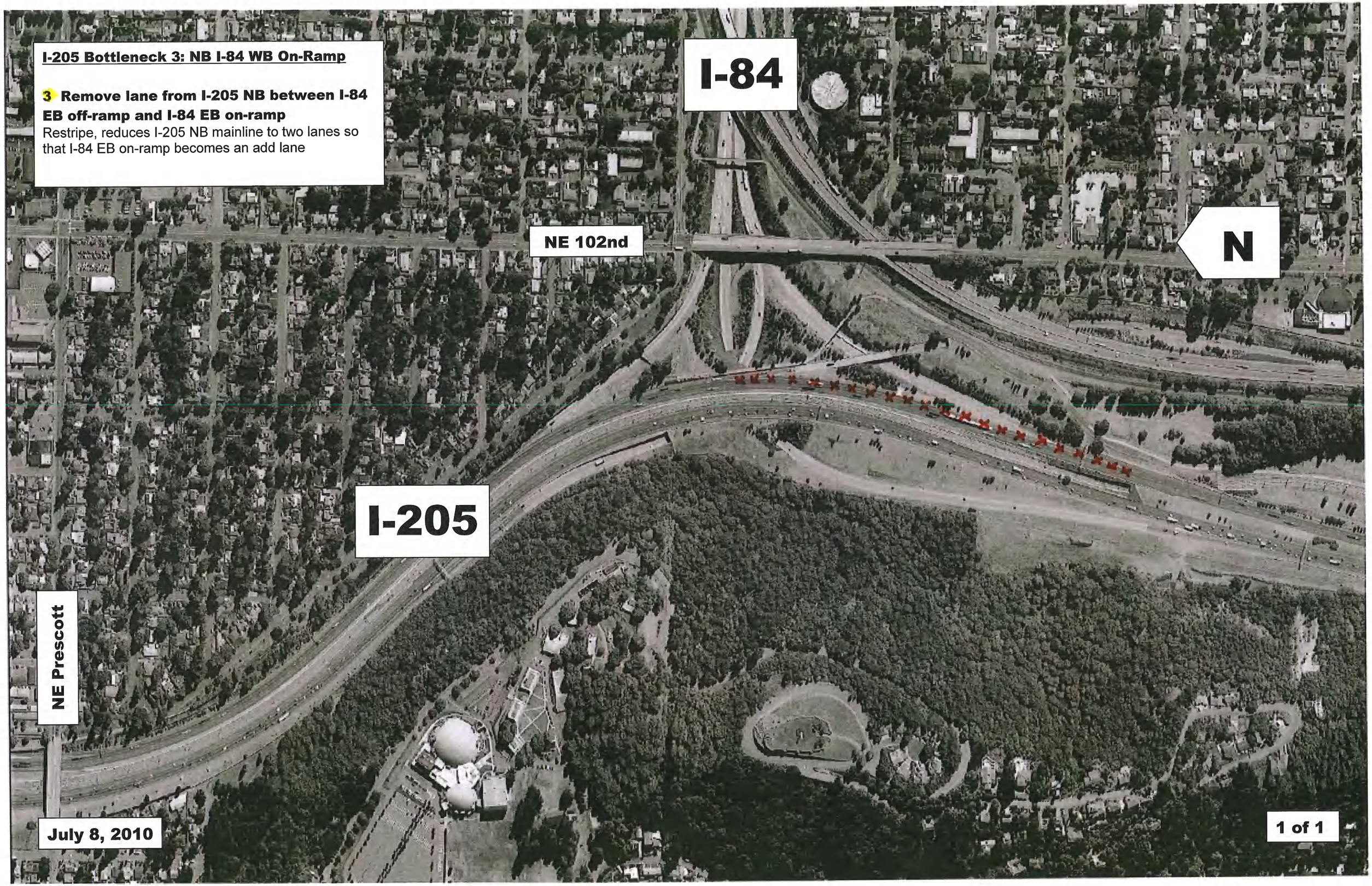
I-205 Bottleneck 3: NB I-84 WB On-Ramp

1 Northbound Aux Lane from I-84 EB on-ramp (Restripe)
Aux/add lane from I-84 EB on-ramp to Sandy Blvd. off-ramp by restriping

2 Northbound Aux Lane from I-84 EB on-ramp (Widen)
Aux/add lane from I-84 EB on-ramp to Sandy Blvd. off-ramp by widening



Add Aux Lane from I-84 WB
to Sandy Blvd (Minor widening option)
Confirm Ramp Geometry
Recovery Taper
(May require rebuild of gore
or Design Exception)
Match Existing Ramp
Design Exception for Sight distance
Widen and add barrier
Existing Accel Lane Taper
I-84 WB to NB
1205
I-84 EB to NB
N
0
500
1000


I-205 Bottleneck 3: NB I-84 WB On-Ramp
3 Remove lane from I-205 NB between I-84 EB off-ramp and I-84 EB on-ramp
Restripe, reduces I-205 NB mainline to two lanes so that I-84 EB on-ramp becomes an add lane
I-84
NE 102nd
N
I-205
NE Prescott
July 8, 2010
1 of 1

I-205 Bottleneck 3: NB I-84 WB On-Ramp

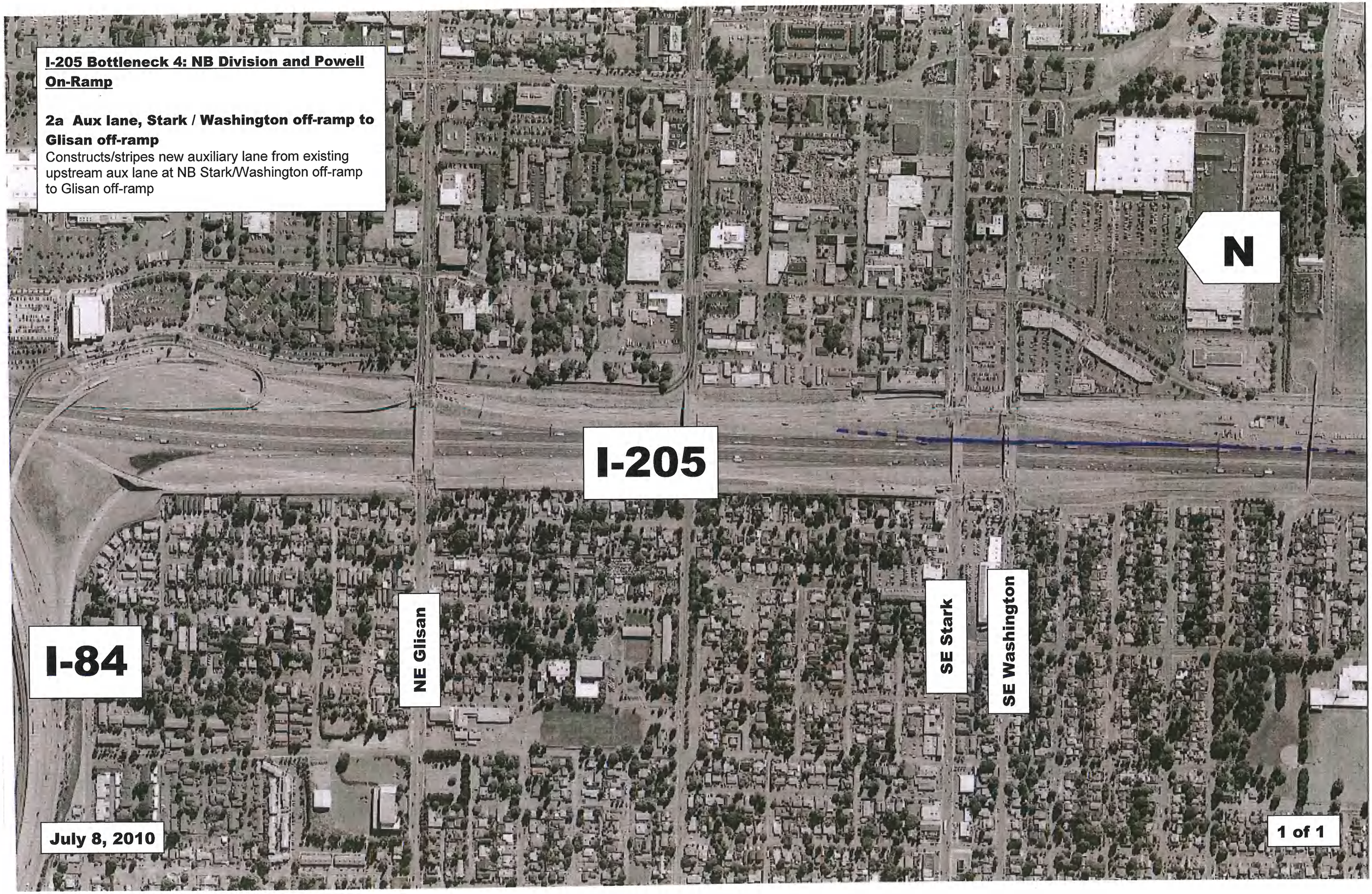
~~4~~ Lane drop between I-84 EB off-ramp and I-84 EB on-ramp

Similar to option 3, except drops lane in between ramps rather than dropping at I-84 EB off-ramp

I-205 Bottleneck 4: NB Division and Powell On-Ramp

2a Aux lane, Stark / Washington off-ramp to Glisan off-ramp

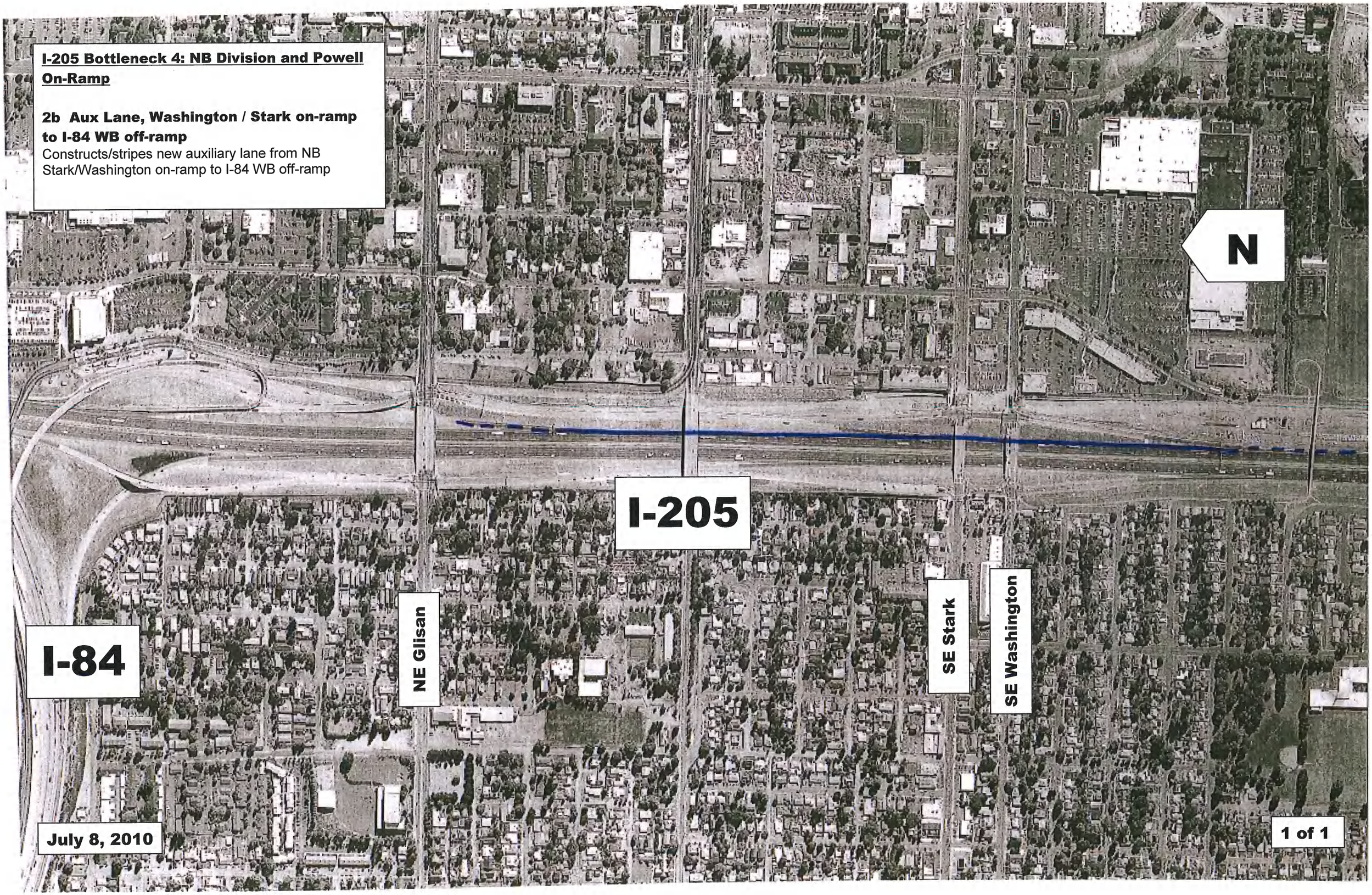
Constructs/stripes new auxiliary lane from existing upstream aux lane at NB Stark/Washington off-ramp to Glisan off-ramp



I-205 Bottleneck 4: NB Division and Powell On-Ramp

2b Aux Lane, Washington / Stark on-ramp to I-84 WB off-ramp

Constructs/stripes new auxiliary lane from NB Stark/Washington on-ramp to I-84 WB off-ramp



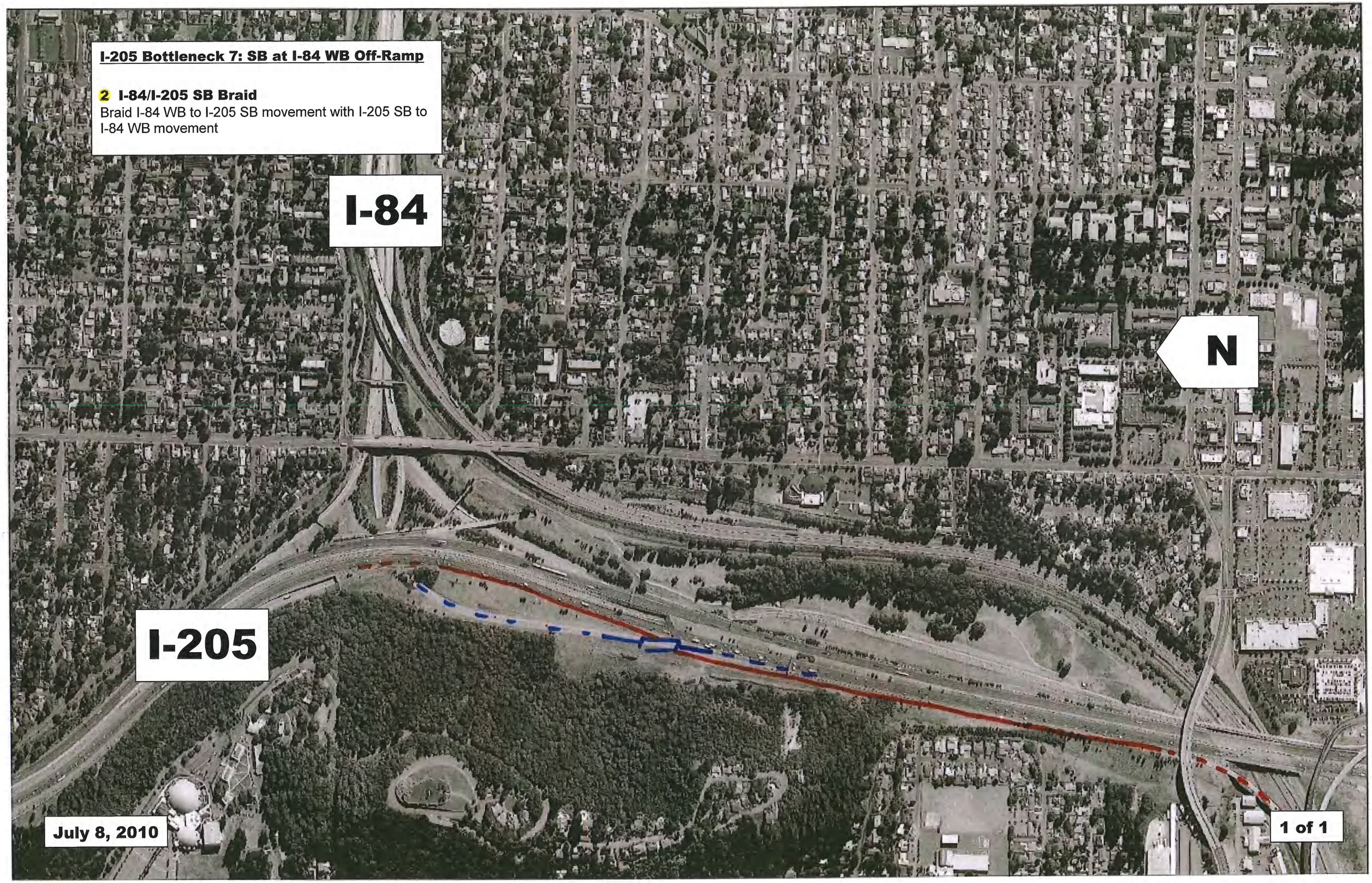
July 8, 2010

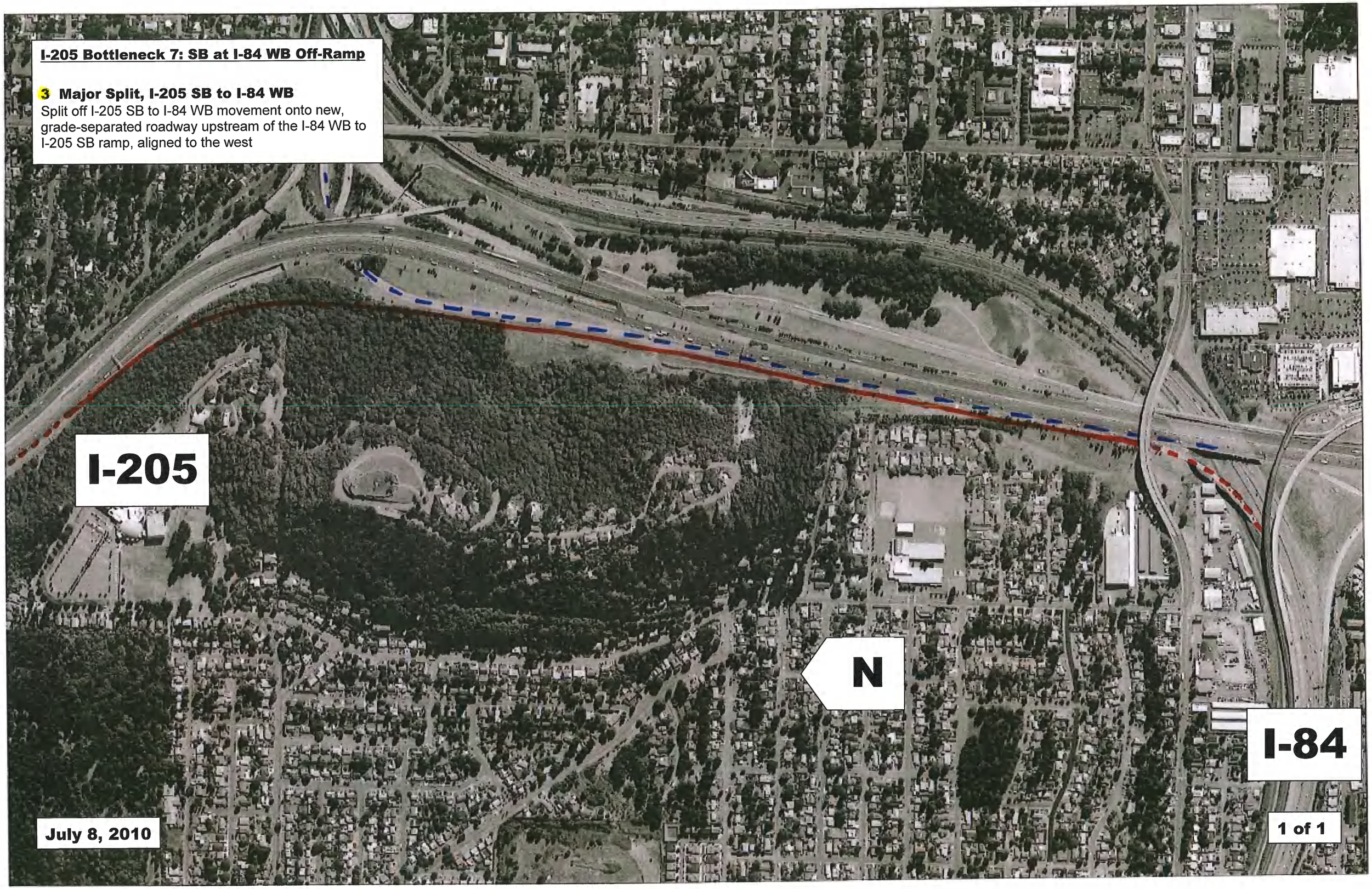
I-205 Bottleneck 5: NB Foster On-Ramp

1 Aux Lane, Foster on-ramp to Powell off-ramp

Constructs/stripes new NB auxiliary lane from Foster on-ramp to Powell off-ramp.

I-205 Bottleneck 7: SB at I-84 WB Off-Ramp
1 I-205 to I-84 WB Ramp Reconfiguration
Merge two I-205 NB to I-84 WB flyover lanes together, then merge this lane with I-205 SB to I-84 WB lane, then add this single lane to I-84 WB
NE Halsey
I-84
I-205
N
July 8, 2010
1 of 1

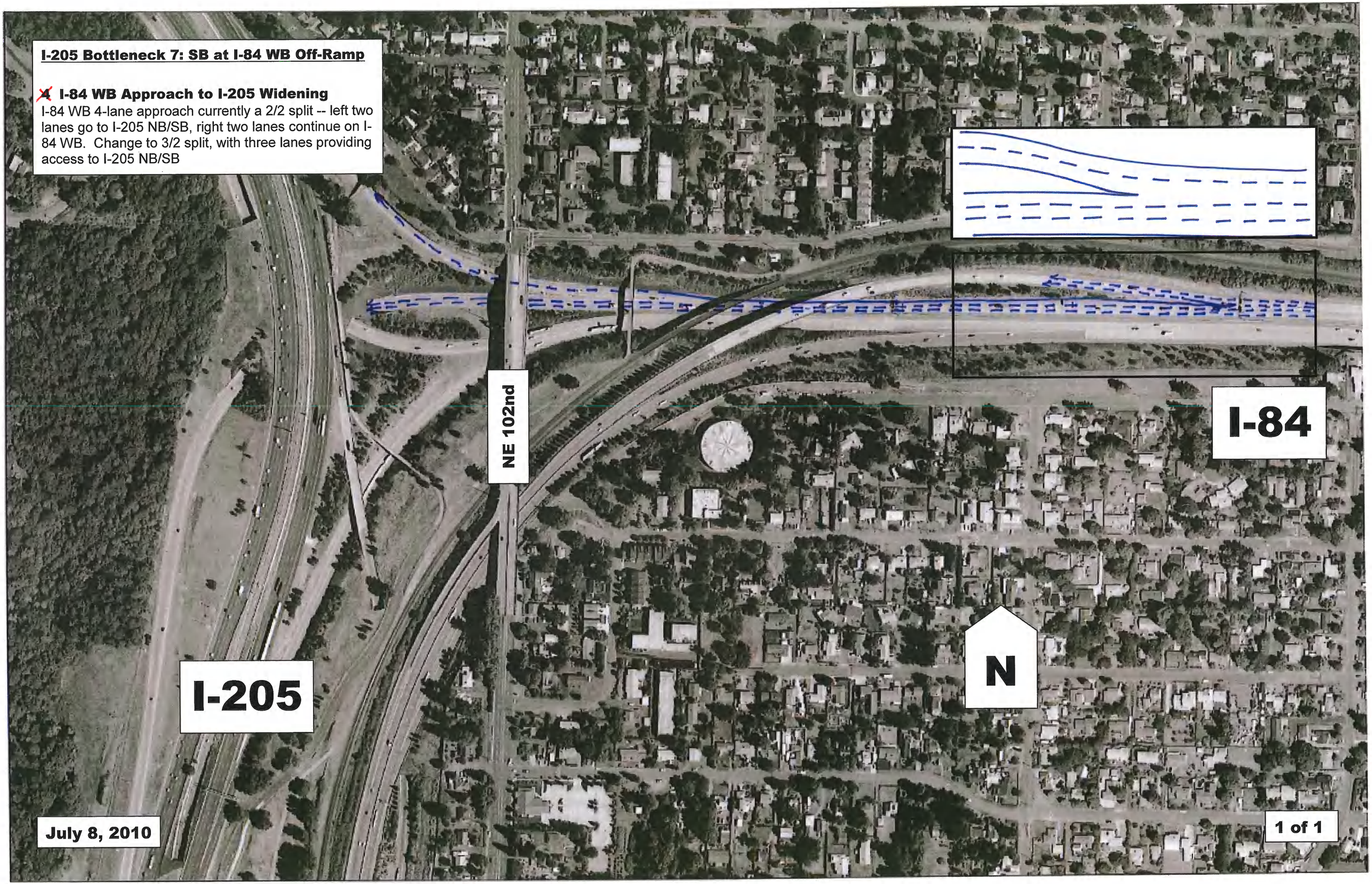

I-205 Bottleneck 7: SB at I-84 WB Off-Ramp
2 I-84/I-205 SB Braid
Braid I-84 WB to I-205 SB movement with I-205 SB to I-84 WB movement
I-84
N
I-205
July 8, 2010
1 of 1


I-205 Bottleneck 7: SB at I-84 WB Off-Ramp
3 Major Split, I-205 SB to I-84 WB
Split off I-205 SB to I-84 WB movement onto new, grade-separated roadway upstream of the I-84 WB to I-205 SB ramp, aligned to the west
I-205
N
I-84
July 8, 2010
1 of 1

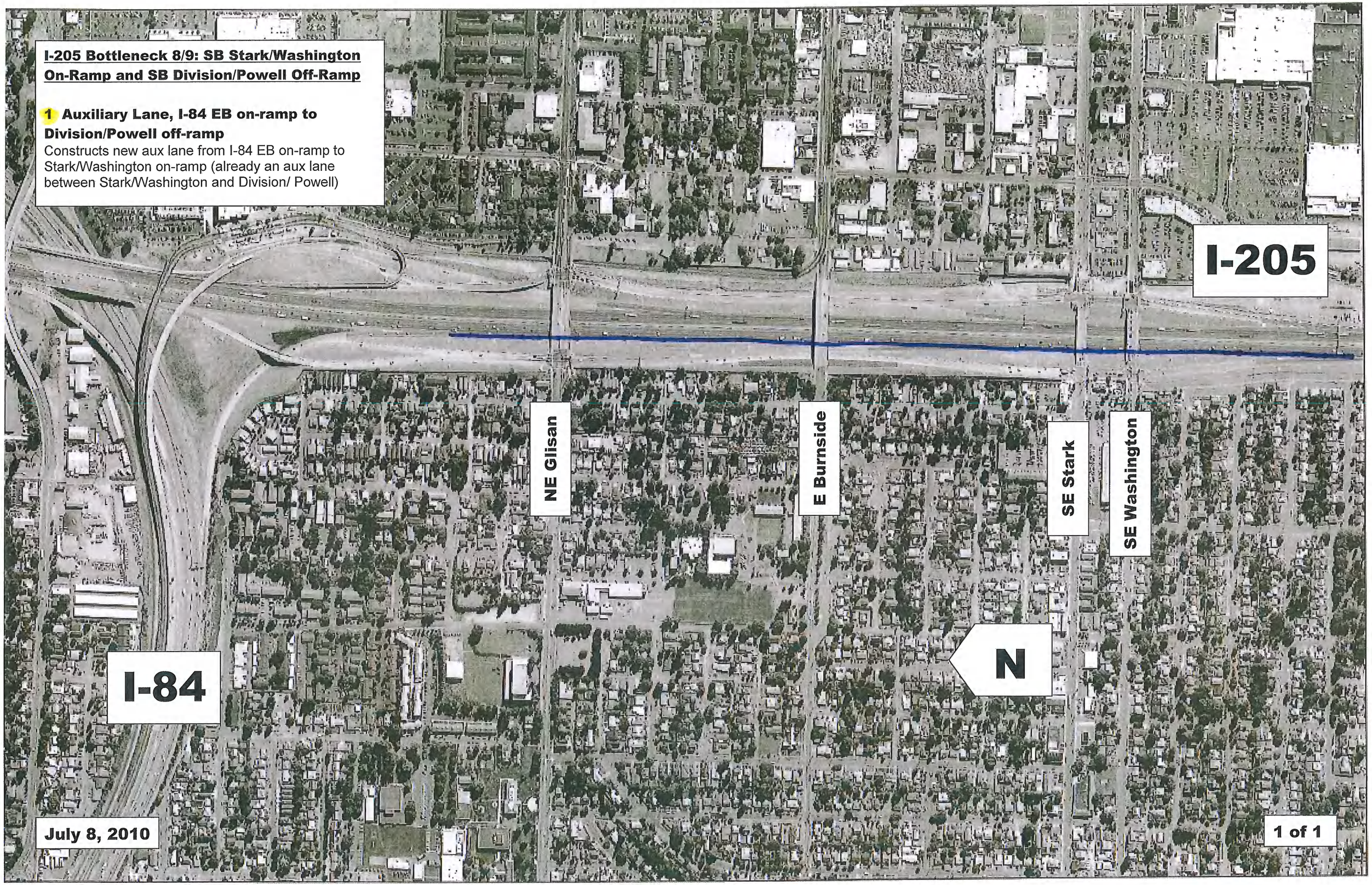
I-205 Bottleneck 7: SB at I-84 WB Off-Ramp

~~4~~ I-84 WB Approach to I-205 Widening

I-84 WB 4-lane approach currently a 2/2 split -- left two lanes go to I-205 NB/SB, right two lanes continue on I-84 WB. Change to 3/2 split, with three lanes providing access to I-205 NB/SB



I-84 EB
I-205 SB: Add Auxiliary Lane:
I-84 EB ENTRANCE-ramp to Stark/Washington Auxiliary Lane
Glisan St.
Extend existing Accel lane
Segment 2
0
500
1000
Barrier/Wall?
Burnside St.
Modify Ramp?
Confirm Ramp profile
Extend existing Accel lane
Segment 1
Stark St.
Barrier/Wall?
Washington St.
Soundwall?
Segment 2 already has soundwall
Segment 1 may be protected by earth berm
Match existing Aux Lane
End Widening


I-205 Bottleneck 8/9: SB Stark/Washington On-Ramp and SB Division/Powell Off-Ramp
1 Auxiliary Lane, I-84 EB on-ramp to Division/Powell off-ramp
Constructs new aux lane from I-84 EB on-ramp to Stark/Washington on-ramp (already an aux lane between Stark/Washington and Division/ Powell)
I-205
NE Glisan
E Burnside
SE Stark
SE Washington
N
I-84
July 8, 2010
1 of 1

I-205 Bottleneck 8/9: SB Stark/Washington On-Ramp and SB Division/Powell Off-Ramp

~~1A~~ I-84 EB Approach to I-205 SB Reconfiguration

Reconfigures the three lanes eastbound approaching I-205 SB to a 2-2 split (2 lanes southbound onto I-205 SB)

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I-205 Bottleneck 8/9: SB Stark/Washington On-Ramp and SB Division/Powell Off-Ramp

2 Second Aux Lane, Washington/Stark on-ramp to Division/Powell off-ramp

Constructs additional aux lane between Stark / Washington and Division / Powell (assumes that first aux lane has been carried through from I-84 EB on-ramp, as in Option 1)

I-205 Bottleneck 8/9: SB Stark/Washington On-Ramp and SB Division/Powell Off-Ramp

2 Second Aux Lane, Washington/Stark on-ramp to Division/Powell off-ramp

Constructs additional aux lane between Stark / Washington and Division / Powell (assumes that first aux lane has been carried through from I-84 EB on-ramp, as in Option 1)

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CHAPTER 5: APPENDICES

5.2 Appendix B: Preliminary Design Schematics
B.1 I-5 Bottlenecks
B.2 I-205 Bottlenecks
B.3 I-84 Bottlenecks
B.4 I-405 Bottlenecks
B.5 US 26 Bottlenecks

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C-BOS: I-84 PROPOSED IMPROVEMENTS

Corridor	Name	Bottle-neck	Study Area	Op-tion	Project Name	Description	Cost Elements	Comments	Priority
	I-84 EB								
I-84 EB	I-5 SB/NB Merge Bottleneck	**2**	I-5 SB/I-5 NB merge @ Grand Ave. ON-Ramp	**2a**	I-5 SB/NB Merge	Add deflectors or profile striping for separation between Grand Ave ON-ramp and I-5 NB > I-84 EB; widen mainline to accommodate barriers and shy distance	**$2.7M - $3.5M:** add 600'L x 25'W roadway length & 800'L x 25'W ramp width ($0.58M); 1,400' L x (4'+10')/2 H retaining walls ($0.59M); sign bridge ($0.5M); 4 light poles ($0.06M); Plus PE/CE/ contingency ($1.4M).	I-5 NB > I-84 EB merges soon upon touching I-84; Grand Ave. ON-Ramp drivers attempt mainline merge sooner than necessary. Will require some cutting-back of existing retaining wall. Considered extending accel lane out further but expensive to widen 12th Ave. O'Xing.	
I-84 EB	Irving St./16th ON-Ramp Bottleneck	**X**	Irving St./ 16th ON-Ramp	**2b**	Irving St./16th Ave. ON-Ramp	Congestion appears only to occur when ramp meters are OFF; consider turning on ramp meter sooner, or extend period longer.	**$0:**	Consider turning on ramp meter sooner, or extend period longer. Need to check ramp meter parameters.	
I-84 EB	Corridor-wide	Corr-Wide	I-5 - I-205	**3c**	Corridor Active Traffic Management	Use corridor-wide active management signage to warn of queueing ahead;	**$2M-$4M:**	Funding being pursued for future study of active management sign-age of major corridors. Future study of region corridors to address imple-mentation of active management/ variable speed signage.	
	I-84 WB								
I-84 WB	I-5 to I-84 WB Bottleneck	**4**	Ramp to I-5/I-84 Diverge (MLK/Grand Ave. - RQ)	**4a**	I-84 - I-5 Diverge Ramp Lanes Configuration	I-84WB approach to I-5 NB/I-5 SB split should consider 3-2-1 split @ I-5 diverge, instead of current 3-2-2 split; assign 2-lanes SB & 1 Lane NB (then widen to 2-lanes NB); restripe?	**$1M:** 1/2 mile sign bridge ($300K); 1 mile sign support ($50K); restriping ($13.6K); plus PE/CE/contin-gency ($436.4K).	Long-term need; long-term solution requires 2-lane I-84 WB to I-5 NB near MLK/ Grand Ave; may conflict with UPRR Graham Line connec-tion; need traffic analysis of lane capacity/demand of different lane split configurations. Analysis of the existing lane by lane volumes immediately downstream of the I-84 WB/ I-5 NB & SB split shows there is poor lane balance. The middle lane is currently operating at capacity for a number of hours throughout the day while the outside lane is underutilized. Converting the 3-2-2 lane split into 3-2-1 split (with 1 lane to I-5 NB) at the I-5 diverge will result in much better lane balance and improved traffic flow. Extend exit gore point further to east.	
I-84 WB	I-5 NB OFF	**4**	33rd Ave. ON-Ramp - I-5 SB/NB split	**4b**	Signage Upgrade 33rd ON-Ramp/ Glisan St. ON-Ramp - I-5 NB/I-5 SB diverge	Signage is misleading; sight distance issue at curve to I-5 NB; improve signage; may require new/large sign structures;	**$1M - $2M**	Signage of upcoming I-5 NB/SB split is not clear. Need correct signage showing I-5 NB/SB diverge details, and move further upstream. Need review how to better depict I-5 NB/SB split, and where to place advance signage.	
	I-84 WB								
I-84 WB		**4**	MLK/Grand Ave. - I-5 NB/I-5SB diverge	**4c1**	Signage Upgrade /extend start of ON-Ramp - I-5 NB/I-5 SB diverge. (*no* accommodatio n for streetcar on MLK/Grand)	Extend gore point east 1,500'; enhance signage on Grand Ave. O'Xing, and sign bridge west of 12th Ave. O'Xing; keep 3-2-2 split. *assume R/R encroachment can be worked out; assume vertical clearance can be maintained; assume bridge supports can be replaced -- need confirm possible.	**$8M-$10M:** Widen 1,500'L x 10'W mainline merge approach ($275K); upgrade signage ($350K); bridge sup-port/column type change ($2M-$3M); plus PE/CE/contingency ($3.1M); **ADD**: 450'L x 10'W WB>NB ramp bridge widening ($900K); plus PE/CE/ contingency ($1.04M).	Uncertain of physical feasibility due to location of support piers close to highway. Need to review O'Xing structure piers for physical feasibility for widening mainline.	

C-BOS: I-84 PROPOSED IMPROVEMENTS

Corridor	Name	Bottle-neck	Study Area	Op-tion	Project Name	Description	Cost Elements	Comments	Priority
	I-84 WB								
I-84 EB		new	MLK/Grand Ave. - I-5 NB/I-5SB diverge	4c2	Signage Upgrade /extend start of ON-Ramp - I-5 NB/I-5 SB diverge. (accom-modation for streetcar on MLK/Grand)	Extend gore point east 1,500'; enhance signage on Grand Ave. O'Xing, and sign bridge west of 12th Ave. O'Xing; keep 3-2-2 split. *assume R/R encroachment can be worked out; assume vertical clearance can be maintained; assume bridge span will be replaced and streetcar tracks replaced --- need confirm.	**$9M-$11M:** Option 4c1 costs *plus*: 50' x (12'x4' + 8'x1' + 8'x2') Grand Ave. adjustments ($720K); 50' x (12'x4' + 8'x1' + 8'x2') MLK Blvd. adjustments ($$720K). Plus PE/CE/contingency ($4.6M). Plus streetcar replacement.		
	I-84 WB								
I-84 WB	Glisan St. ON-Ramp Bottleneck	6	I-205 SB ON-Ramp to Glisan St. ON-Ramp	6a	Glisan St. ON-Ramp Signage Improvements	Install a flashing beacon on top of the existing "SLOW" sign or on the Curve Warning sign, and a part-time restriction electronic "Stopped Vehicles Ahead" sign along with loop detectors on the ramp.	**$500K-$1M:**	Poor horizontal curve/sight-distance at point of ON-ramp entrance; structure also causes poor sight-distance; left lane brake lights affects other lanes. The a.m. and p.m. peak hour ramp volume is 450 vph and 480 vph, respectively. The horizontal curve and going under I-84 causes poor sight distance. Analysis of the crash history within the last 5 years reveals that there were ten crashes occurred on the ramp. Seven of the crashes occurred during the time when the ramp meter was not activated, indicating that the crashes occurred during the non-peak period, during which mainline traffic would flow more smoothly. Install improved signage/warning lights to address safety issued. Top 5% SPIS site.	
I-84 WB		6	I-205 SB ON-Ramp to Glisan St. ON-Ramp	6b	Glisan St. ON-Ramp O'Xing	Replace/reconstruct U'Xing entrance to I-84 with O'Xing to improve sight distance and have WB ON-ramp connect at same elevation as mainline.	**$12M-$13M:** O'Xing = 300' x 30'W ($1.8M-$2.2M); 900'+ ramp ($700K - $1M); 900' x 20' retaining wall ($2.5M); plus PE/CE/contingency ($7M-$7.3M)	Analysis of the crash history within the last 5 years reveals that there were ten crashes occurred on the ramp. Seven of the crashes occurred during the time when the ramp meter was not activated, indicating that the crashes occurred during the non-peak period, during which mainline traffic would flow more smoothly. Top 5% SPIS site.	
I-84 WB		new	I-205 SB ON-Ramp to Glisan St. ON-Ramp	6d	Glisan St. ON-Ramp O'Xing	Close ramp.	**$200,000:** scarify ramp pavement; add detour signage	New. Top 5% SPIS site.	
I-84 WB	I-205 SB to I-84 WB Merge Bottleneck	7	I-205 SB Ramp to I-84 WB Ramp	7a com-bine with 7b	I-205 to I-84 WB Ramp Reconfig-uration	Merge two I-205 NB to I-84 WB flyover lanes together; then merge this lane with I-205 SB ramp to I-84 WB; then add this single lane to I-84 WB main-line; extend accel lane out further; re-stripe NB>WB ramp; separate/re-build some of SB>WB ramp from mainline.	**$3.5M - $4M:** restripe 5,550' of mainline & SB > WB ramp, and 5,600' of NB > WB ramp ($22.3K); widen & pave roadway (1,850'L x 33'W) ($1.3M); construct retaining wall (1,400'L x 5'H) ($350K); plus PE/CE/contingency ($1.5M - $2M).	As described in I-205 Design Panel work: Bottleneck #7 Option #1. Need to model as part of I-205 corridor.	
	I-84 WB								
I-84 WB		7	I-205 SB Ramp to I-84 WB Ramp	7b (new)	I-205 to I-84 WB Ramp Reconfig-uration	2010 modified proposal: make I-205 SB the add-lane; make I-205 NB into single-lane merge.	**$1M - $2M** (?):Mainly restriping; some pavement widening?	Modification of 7a as described in I-205 Design Panel work: Bottleneck #7 Option #1. May create negative consequences for I-205 NB. Need to model as part of I-205 corridor.	
I-84 WB	Corridor-wide	Corr-Wide	I-5 to I-205	8a (new)	Interchange Entrance Ramp Closures.	Remove selective interchange ramps (Irving St./16th Ave. ON-ramp?; Willow St. ON-ramp?; 58th Ave. ON-ramp?)	**$500K - $1M per ramp:** (scarify pavement; close ramps; detour signage);sign mitigation ($50K-$100K).	May not be politically feasible. Business & neighborhood resistance likely. Politically difficult.	

C-BOS: I-84 PROPOSED IMPROVEMENTS

Corridor	Name	Bottle-neck	Study Area	Op-tion	Project Name	Description	Cost Elements	Comments	Priority
	I-84 WB								
I-84 WB	Corridor-wide	Corr-Wide	I-5 to I-205	**8b (new)**	Time-of-day, Directional Interchange Ramp Closures.	Install peak period-operated ramp gates to actively manage Entrance to mainline /allow Exit-Only movements during PM peak hours; and manage Exit-Only movements and selective Entrance-Only access during AM peak hours.	**$250K - $350K per ramp site:** (to include gate, cabinet, camera, ptr sign, and communications)	May not be politically feasible. Business & neighborhood resistance likely. Need to model effects of constraining ramp Entrance to mainline by active management of selected ON-ramps. Recommend modeling 4-5 interchange locations for active management. Recommend modeling to test effectiveness of active management of 1/2 or 3/4 or all inbound/ outbound interchange ramps.	
						OPTIONS CONSIDERED BUT NOT FORWARDED			
	I-84 EB								
	I-5 to I-84 Bottleneck	**1**	I-5 SB ON (Rose Qtr - Grand Ave.)	**1a**	I-5 SB ON to I-84 EB (ramp)	Construct 2-lane SB>EB ramp to just before Grand Ave ON-Ramp; go under MLK/Grand Ave. O'Xings	**$62M-$88M:** 2,800' flyover ramp 40'-45'	Long-term improvement. Can be a later phase after 1b. *Exceeds Study cost limits.* The 16th Ave ON-ramp has to be closed because its merge junction is at the termination of the proposed 4th EB lane. This option would not be feasible with the 16th Ave ON-ramp open. The ON-ramp traffic would have to merge into the 4th lane and then change to lane 3 immediately downstream due to lane reduction.	
	I-5 to I-84 Bottleneck	**1**	Grand Ave. ON - SE 21th Ave.	**1b**	I-5 SB ON to I-84 EB (mainline)	Widen mainline with extension of 4th EB lane, from Grand Ave. ON-Ramp through 21st Ave. O'Xing; install retaining wall; reconstruct 12th Ave. O'Xing.	**$20M-$21M:** 3,000'L x 16'W main-line widening and extension of 4th lane ($1.5M-$2.5M) ; 3,000'L x 20'H retaining wall ($6M); replace/reconst. 12th Ave. O'Xing to accommodate 4th lane ($4.5M); PE/CE/contingency ($8M-$9M)	Need to model. This option is not feasible with 16th Ave. ON-ramp open, because ramp merge junction is at termination of proposed 4th EB lane. Traffic from 16th Ave. ON-ramp would need to merge into the 4th lane, and then change to lane 3 immediately downstream due to lane reduction. Does not add much value if accel lane does not extend further. Consider extending 4th lane to 33rd as Aux lane. See Option 1e.	
	I-5 to I-84 Bottleneck	**1**	Grand Ave. ON - SE 21th Ave.	**1c**	I-5 SB ON to I-84 EB (mainline)	Same as 1b, or retain existing configuration of I-5 SB ON ramp; continue further east and close SE 16th Ave. ON ramp	**$500K - $1M:** (minimal additional cost to 1b -- scarify ramp pavement; add detour signage)	May be politically difficult to close ramp. . Does not show a great deal of benefits. Truck use of SE 16th Ave. ON-Ramp significant. Politically difficult to close ramp. VISSIM model run of I-84 may clarify diversion routes from SE 16th Ave. The model shows that with 16th Ave. EB ON-ramp (830 vph in the p.m. peak hour) closed, 20% of the ON-ramp traffic would divert to I-5 SB ramp connection, and another 20% would use I-5 NB ramp connection. 10% would travel to the Grand Ave. ON-ramp, while another 20% would use the 39th Ave. ON-ramp to access I-84 EB. The remaining 30% of the 16th Ave. ON-ramp would use alternative parallel routes to head EB. There is some benefit in terms of allowing the Grand Ave ON-ramp traffic to have more time an distance to merge in with the I-5 traffic prior to the termination of the proposed 4th lane. It would spread out the merging conflicts on the 4th EB lane; however, this benefit may bsem to be not significant for a price tag of $20.5M - $22.0M improvement.	
		1		**1c**	I-5 SB ON to I-84 EB (mainline) **(continued)**			The existing bottleneck at the Grand Ave ON-ramp merge junction is partly due to the short spacing (~600') between the I-5 SB ramp connection and Grand Ave ON-ramp and the high ON-ramp volume. Similar benefit may be achieved by lengthening the Grand Ave ON-ramp and moving the ramp meter for a few hundred feet to the east to increase the ramp storage, enabling decrease in ramp meter rate, (i.e. provide more separation between the I-5 SB ON-ramp and the Grand Ave ON-ramp	

C-BOS: I-84 PROPOSED IMPROVEMENTS

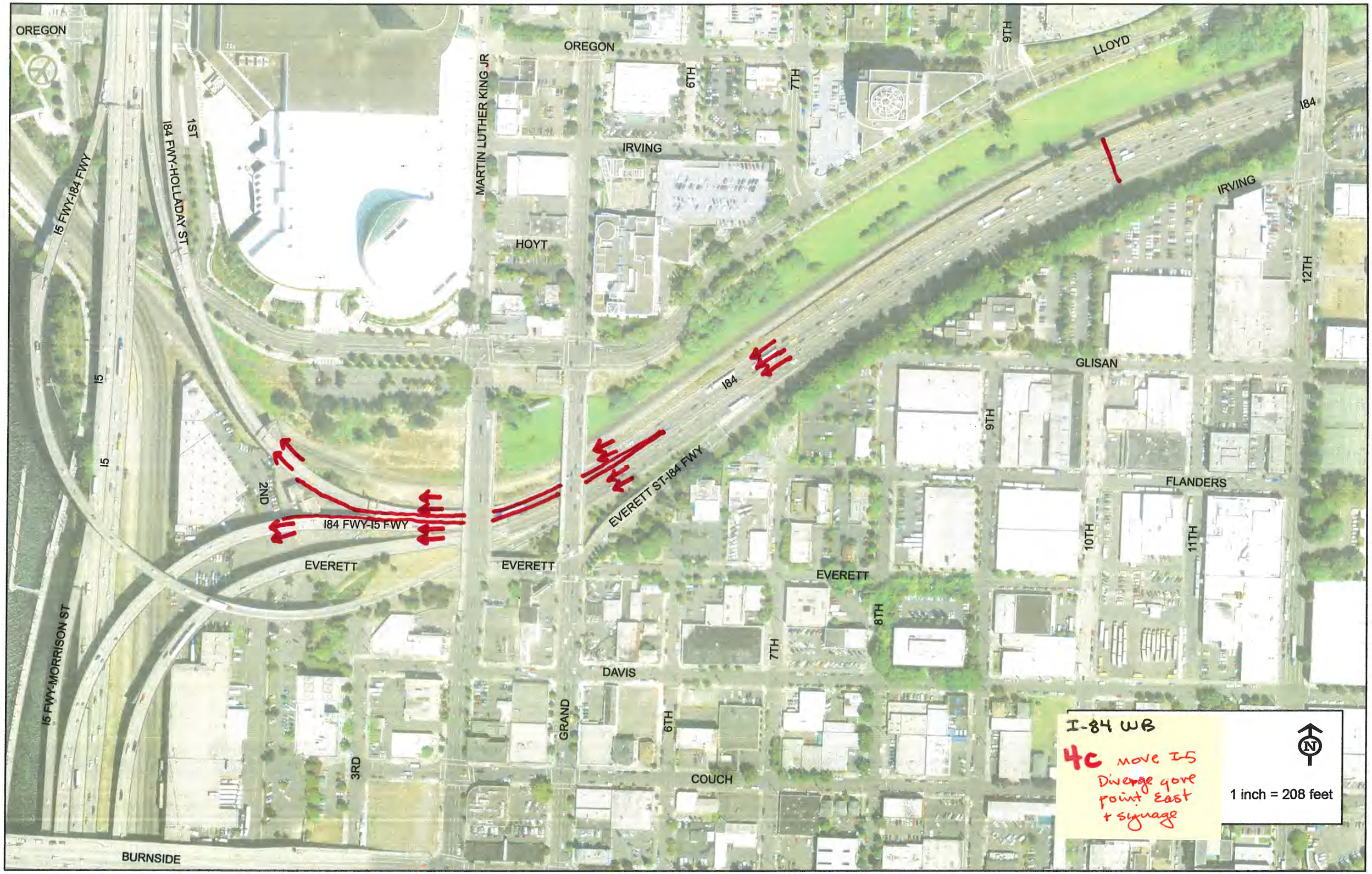
Corridor	Name	Bottle-neck	Study Area	Op-tion	Project Name	Description	Cost Elements	Comments	Priority
		1	I-5 SB ON-Ramp - SE 21th Ave.	**1d**	Combined I-5 SB ON-Ramp & Mainline Improve-ments to 21st	TOTAL of 1a + 1b or 1c	**$88M - $118M:**	*Exceeds Study cost limits.*	
	39th Ave. ON-Ramp Bottleneck	**3**	39th Ave. ON-Ramp to I-5 NB/SB ON-Ramp	**3a**	39th Ave. ON-Ramp	XXX	**$??M:**	No recommendation	
		3	33rd Ave - 39th Ave.	**3b**	Interchange/ ramp consolidation @ 33rd Ave. interchange	Relocate EB 39th ON & OFF ramps back to 33rd Ave, interchange, and create 3/4 interchange @ 33rd Ave; WB traffic still exits at Halsey St.	**$10M:** 1,200' x 20'H retaining wall ($3.6M); 1,200' x 30' W ramp ($0.9M); plus PE/CE/contingency ($5.5M). Cost est. low; need widen 33rd Ave. O'Xing.	May not be feasible. More of a system improvement than addressing a bottleneck. Would need to widen EB OFF-ramp to 3 lanes (now 2 lanes). Closing the 39th exit-ramp would result in the need for widening the 33rd Avenue exit-ramp to allow for a three-lane section to accommodate two left turn lanes and a separate right turn lane with adequate storage. The existing right turn lane on the 33rd exit-ramp is only a short flared right turn pocket that can store only 2 vehicles. The cost estimate might not have included the cost to widen the 33rd Ave exit-ramp. This option does not seem to provide much benefit unless we can provide an on-ramp from 33rd Ave that is much longer than the existing 39th Ave ON-ramp, which has only about 350 feet (x 2 lanes) of storage. The existing bottleneck at 39th Ave ON-ramp would just be moved to the 33rd Avenue Interchange. Is the horizontal curve at the 39th Avenue on-ramp merge junction a contributing factor at this bottleneck?	
		3	I-5 NB merge with I-84 EB	**1e (new)**	Separate I-5 NB merge with I-84 EB	Separate I-5 NB merge with I-84 EB from I-5 NB ramp 2,200'; Consider adding/extending 4th lane to 33rd as Aux lane.	**$78M:** auxiliary lane/shoulders ($4.8M) retaining wall; 12th Ave. O'Xing struc-ture renovation ($5.2M); 28th Ave. O'Xing structure renovation ($6.2M); 7,950'L x 25'H retaining walls/barriers ($19.9M). Plus PE/CE/contingency ($41.9M). Plus ROW (not included).	Need to model. More valuable/beneficial than 1b. *Exceeds Study cost limits.*	
	I-84 WB								
		5	Sandy Blvd. ON-Ramp to 33rd Ave. ON-Ramp	**5c**	Sandy Blvd/33rd Ave. C-D road interchange consolidation	Combine Sandy Blvd. ON-ramp with new 33rd Ave. OFF-Ramp via Aux/C-D road; no 33rd Ave. NB>I-84 WB ON-ramp left-turn allowed at signal on interchange	**$34M - $40M:** rebuild 2 spans (87'L x 60'W) of 33rd Ave. structure ($1.1M); rebuild 33rd Ave. WB ON-ramp (330'L x 40'W) ($2.6M); rebuild northern portion of Sandy Blvd. structure (150' x 88' W) ($2.6M); rebuild Sandy Blvd. ON-ramp (1,340'L x 40'W) ($10.7M) to 33rd Ave.; pave WB 33rd Ave. roadway ON-ramp (400'L x 36') ($317K); pave 800'L x 28' ($493K). Plus PE/CE/contingency ($16.1M - $22.1M). Low end cost estimate assumes partial structure rebuild; high end assumes structure demolitions/new.	Need to assess impacts to local streets; trafffic signal at new 33rd Ave. interchange connection may be too close to 33rd x Broadway signal; need traffic analysis of traffic demand/signal capacities (new + Broadway x 33rd Ave.). Syncro/ HCS analysis indicates combining traffic volumes from 33rd Ave. & Sandy Blvd. creates too heavy a traffic demand. Need assess impacts of two traffic signals (on Broadway x 33rd Ave. & new signal on O'Xing). The Sandy Blvd WB ON-ramp carries 970 vph in the a.m. peak hour and 800 vph in the p.m. peak hour while the 33rd Ave ON-ramp WB has 530 vph in the a.m. and 450 vph in the p.m.	

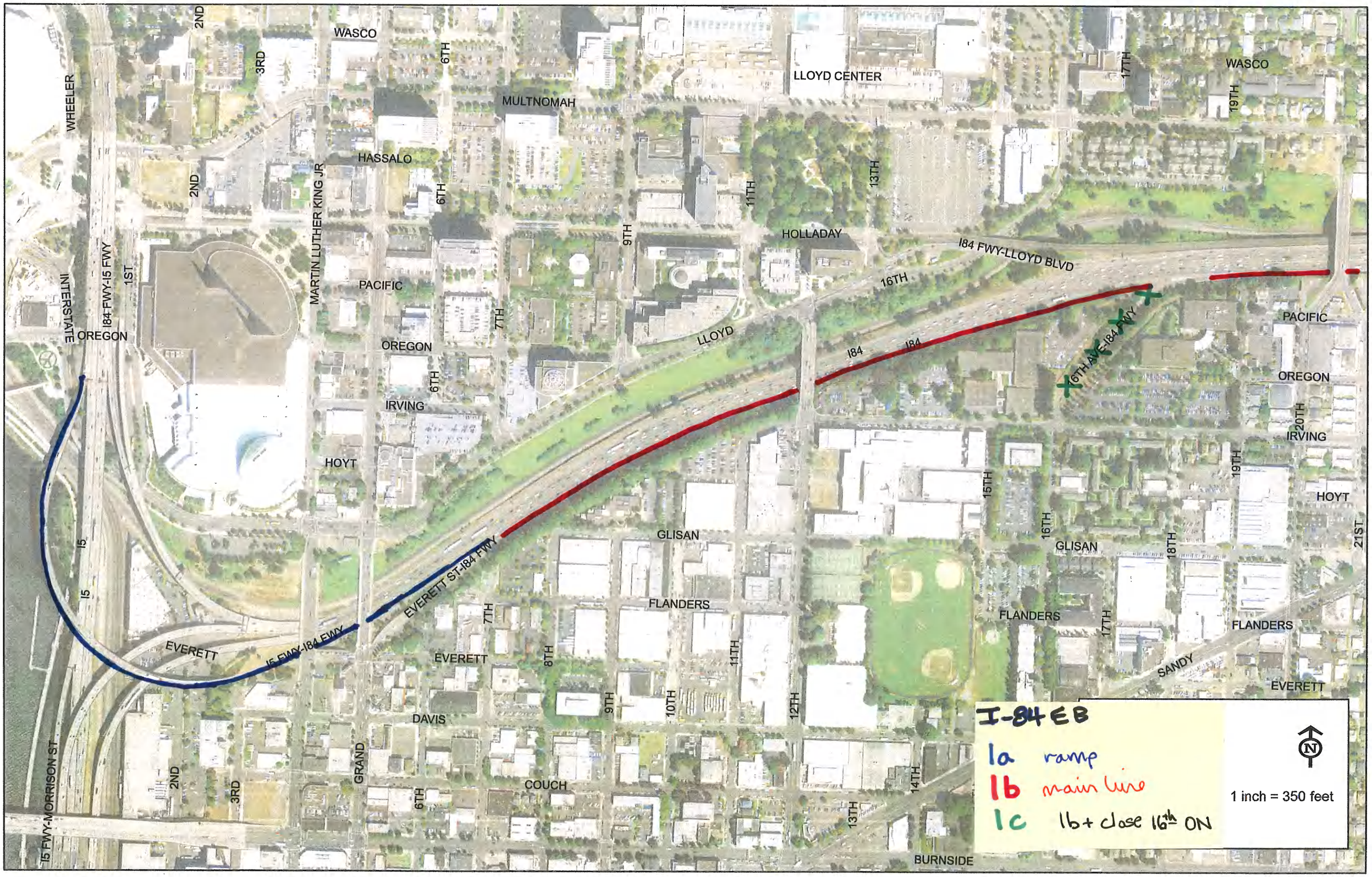
C-BOS: I-84 PROPOSED IMPROVEMENTS

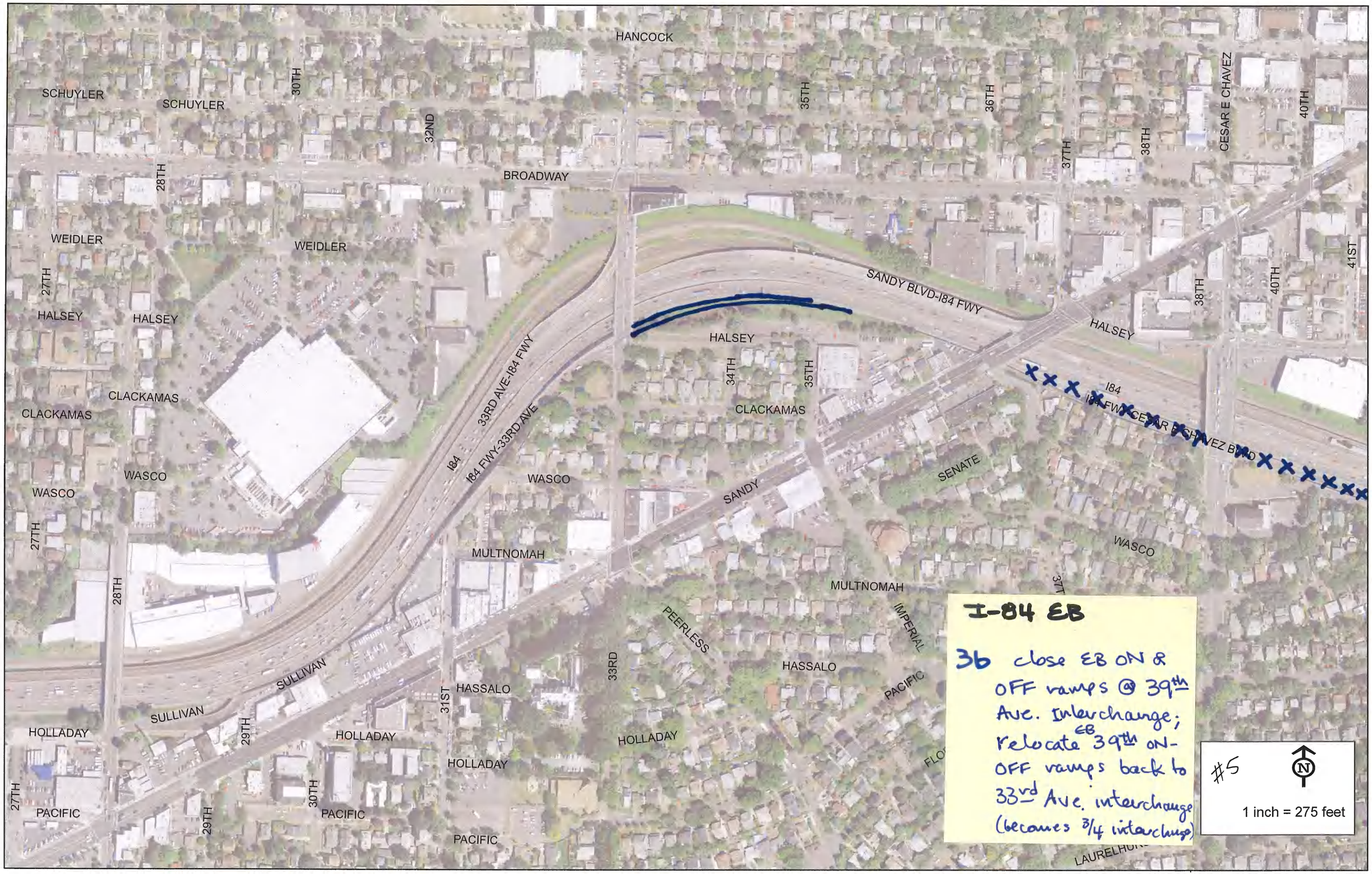
Corridor	Name	Bottle-neck	Study Area	Op-tion	Project Name	Description	Cost Elements	Comments	Priority
		5	Sandy Blvd. ON-Ramp to 33rd Ave. ON-Ramp	5c	Sandy Blvd/33rd Ave. C-D road interchange consolidation **(continued)**			The existing 33rd ON-ramp operates with only a single lane ramp meter and it is not wide enough to allow for 2-lane ramp meters. The combined a.m. peak hour volume of 1,500 vph would exceed the capacity of a single lane or 2-lane ramp meters. The existing ramp meter storage of approximately 400' is much too short for ramp meter operations to process the combined total ON-ramp volume. Queue spillback on the ramp would impact the signal at Broadway. There is only about 180 feet of separation on 33rd Ave between the EB ON-ramp and the signal at Broadway. This would be too close for adequate signal operations.	
		5	33th Ave - 39th Ave.	5e	Sandy Blvd interchange consolidation	XXX	**$??M:**	Could not make work	
	I-84 WB								
		6	I-205 SB ON-Ramp to Glisan St. ON-Ramp	6c	60th Ave. ON-Ramp	Have WB ON-ramp connect to mainline off NE 60th Ave.	No cost estimate.	Not feasible. Conflicts with LRT station west of 60th Ave. O'Xing. Conflicts with pedestrian movements from 60th Ave. to LRT station.	
	33rd Ave. ON-Ramp Bottleneck	5	Sandy Blvd. ON-Ramp to 28th Ave. O'Xing	5a	East of Sandy Blvd. ON-ramp/ Auxiliary Ln. to 28th Ave. O'Xing	Have Sandy Blvd. ON-Ramp come on as a separate Aux lane from mainline, and have 33rd Ave. merge with Aux lane further west; some widening required. Keep I-84 separate from Sandy until after 33rd merge. Lane drops at Lloyd Center OFF-ramp.	**> $50M:** Exceeds Study cost limits.	Heavy mainline volumes, aux lane, moderate ramp volumes; merge conflicts from Sandy Blvd. ON-ramp - 33rd Ave. ON-ramp, and motorists merging to Lloyd Center OFF-ramp; will require shoulders for each ON-ramp lane, and barriers; very tight segment to widen, beyond short segment that does not conflict with LRT alignment; 5a may not be feasible by itself - would need to do 5b also. Insufficient space to widen highway (barriers + shoulders); combining Sandy blvd. ON & 33rd Ave. ON traffic volumes creates too heavy a traffic demand for common merge with mainline. *Exceeds Study cost limits.*	
		5	33rd Ave - 39th Ave.	5d	Interchange/ramp consolidation @ 33rd Ave. interchange	Relocate EB 39th ON & OFF ramps back to 33rd Ave, interchange, and create 3/4 interchange @ 33rd Ave; WB traffic still exits at Halsey St.	**$10M:** 1,200' x 20'H retaining wall ($3.6M); 1,200' x 30' W ramp ($0.9M); plus PE/CE/contingency ($5.5M).	May not be feasible. This Option is more closely related to I-84 EB Bottleneck 3. See Option 3b.	
		5	33rd Ave. ON-Ramp	5b	33rd Ave. ON-ramp extension	Extend 33rd ON-ramp acceler-ation lane west to provide more time for merge; keep 33rd ON-ramp accel lane separate; some widening required.	**> $50M:** Exceeds Study cost limits.	Very tight segment to widen, beyond short segment. May not be feasible. Need to model. Same issue as with Option 5a. Exceeds Study cost limits.	

OREGON
OREGON
MARTIN LUTHER KING JR
6TH
7TH
9TH
LLOYD
I84
IRVING
IRVING
HOYT
12TH
GLISAN
I84
9TH
FLANDERS
10TH
11TH
I5 FWY-I84 FWY
1ST
I84 FWY-HOLLADAY ST
I5
I5
2ND
I84 FWY-I5 FWY
EVERETT ST-I84 FWY
EVERETT
EVERETT
EVERETT
8TH
7TH
DAVIS
GRAND
6TH
COUCH
3RD
I5 FWY-MORRISON ST
BURNSIDE
I-84 EB
2a Add profile striping @ Grand Ave. ON-ramp to provide greater separation from mainline merge.
N
1 inch = 208 feet

WASCO
MULTNOMAH
HASSALO
PACIFIC
OREGON
IRVING
HOYT
GLISAN
FLANDERS
EVERETT
DAVIS
COUCH
BURNSIDE
SANDY
LLOYD
HOLLADAY
LLOYD CENTER
WHEELER
INTERSTATE
I84 FWY-I5 FWY
MARTIN LUTHER KING JR
EVERETT ST-I84 FWY
I5 FWY-I84 FWY
I5 FWY-MORRISON ST
GRAND
I84 FWY-LLOYD BLVD
16TH AVE-I84 FWY
I84
I5
1ST
2ND
3RD
6TH
7TH
8TH
9TH
10TH
11TH
12TH
13TH
14TH
15TH
16TH
17TH
18TH
19TH
20TH
21ST
I-84 EB
2a Add profile striping @ Grand Ave. ON-Ramp to provide greater separation from main line merge.
N
h = 350 feet


OREGON
OREGON
MARTIN LUTHER KING JR
6TH
7TH
9TH
LLOYD
I84
IRVING
IRVING
HOYT
I5 FWY-I84 FWY
1ST
I84 FWY-HOLLADAY ST
12TH
GLISAN
I84
9TH
I5
I5
2ND
I84 FWY-I5 FWY
EVERETT ST-I84 FWY
FLANDERS
10TH
11TH
EVERETT
EVERETT
EVERETT
8TH
7TH
DAVIS
I5 FWY-MORRISON ST
GRAND
6TH
3RD
COUCH
BURNSIDE
I-84 WB
4c move I-5
Diverge gore
point East
+ signage
1 inch = 208 feet
N


WASCO
MULTNOMAH
HASSALO
PACIFIC
OREGON
IRVING
HOYT
GLISAN
FLANDERS
EVERETT
DAVIS
COUCH
BURNSIDE
LLOYD CENTER
HOLLADAY
LLOYD
I84 FWY-LLOYD BLVD
16TH
I84
6TH AVE-I84 FWY
EVERETT ST-I84 FWY
I5 FWY-I84 FWY
I5 FWY-MORRISON ST
I84-FWY-I5 FWY
INTERSTATE
WHEELER
MARTIN LUTHER KING JR
GRAND
SANDY
I5
1ST
2ND
3RD
6TH
7TH
8TH
9TH
10TH
11TH
12TH
13TH
14TH
15TH
16TH
17TH
18TH
19TH
20TH
21ST
I-84 EB
1a ramp
1b main line
1c 1b + close 16th ON
1 inch = 350 feet
N



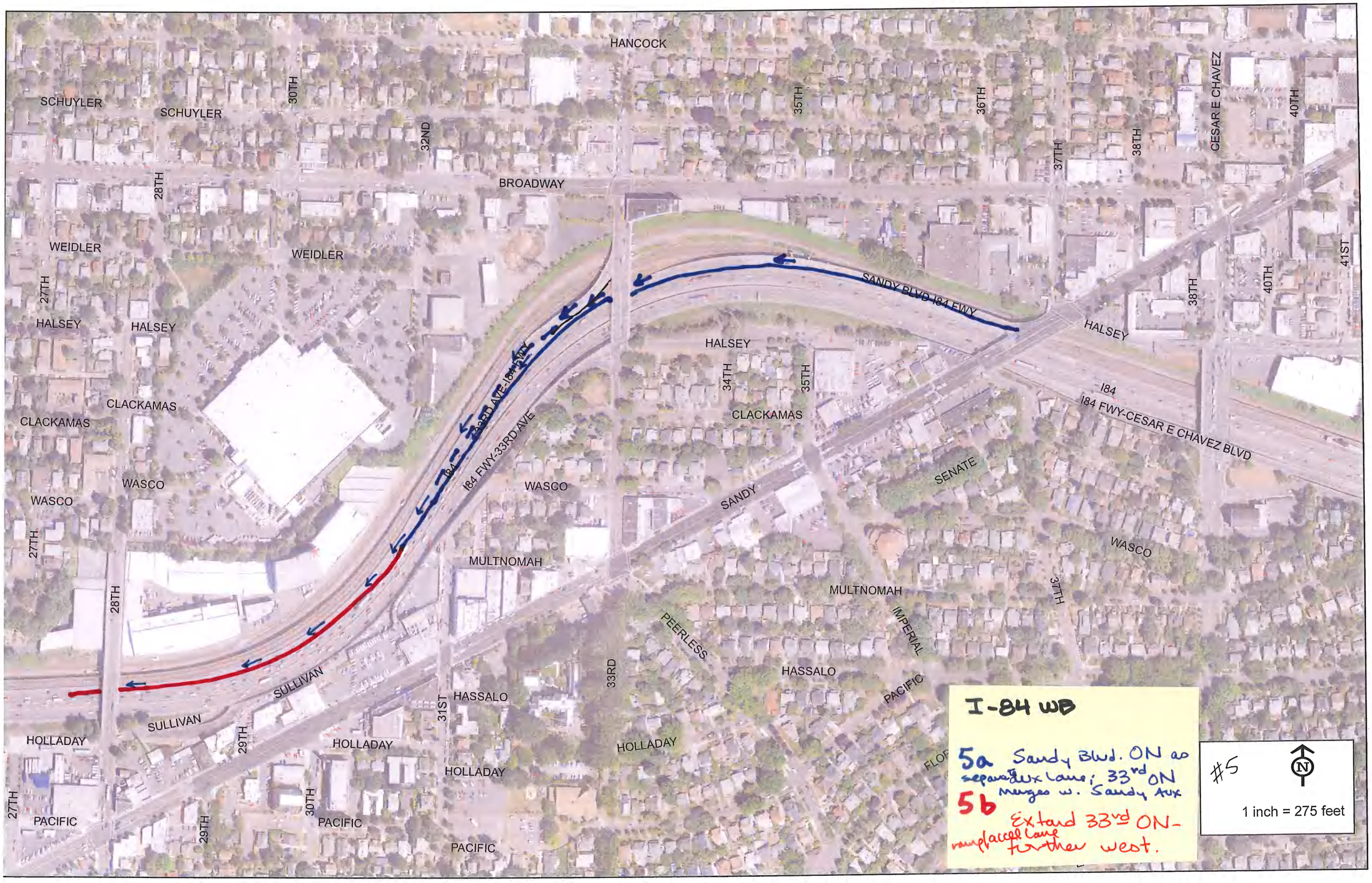
I-84 EB

3b close EB ON & OFF ramps @ 39th Ave. Interchange; Relocate EB 39th ON-OFF ramps back to 33rd Ave. interchange (becomes 3/4 interchange)

#5

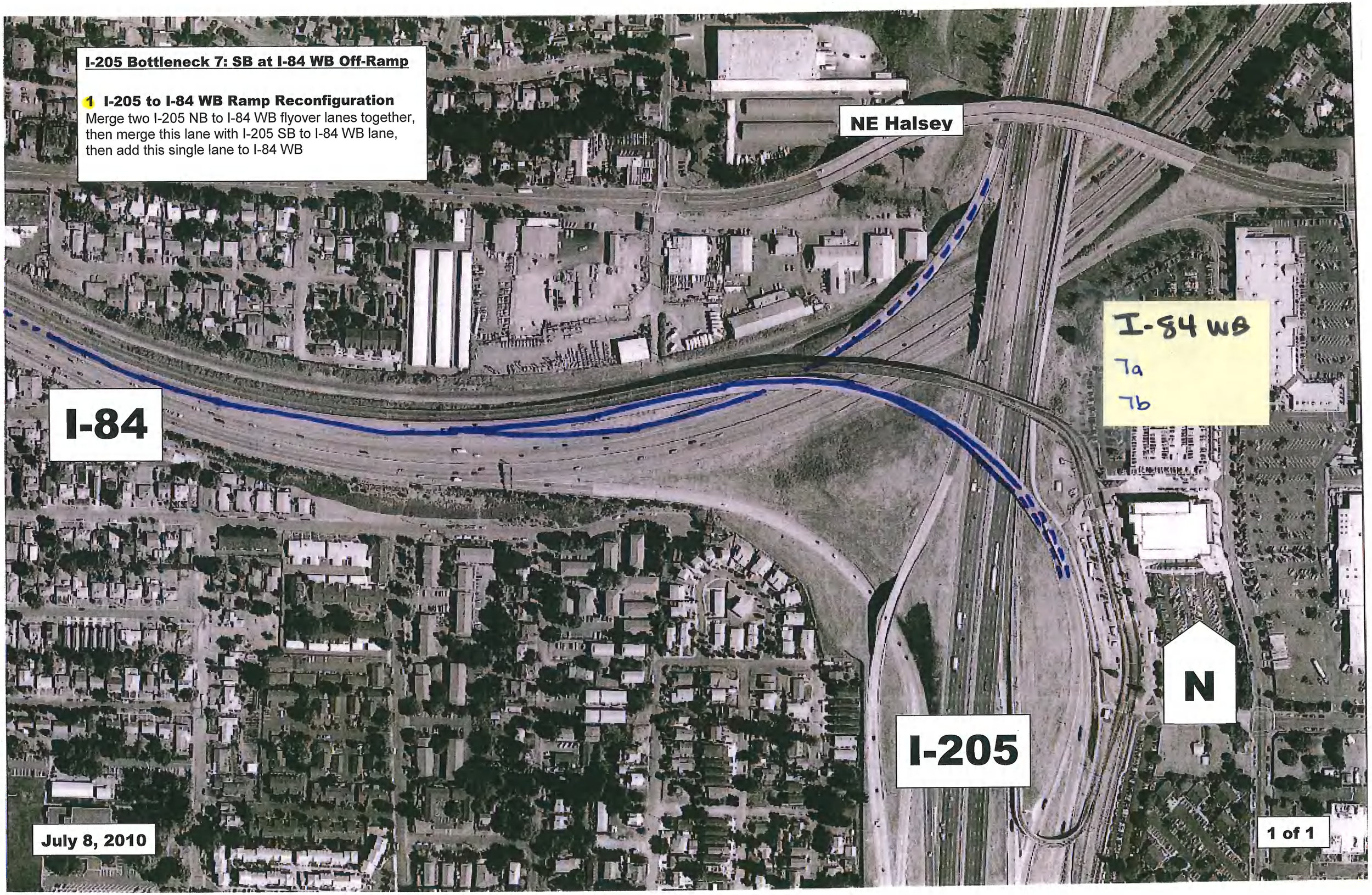
1 inch = 275 feet

OREGON
OREGON
MARTIN LUTHER KING JR
6TH
7TH
9TH
LLOYD
I84
IRVING
IRVING
HOYT
1ST
I84 FWY-HOLLADAY ST
I5 FWY-I84 FWY
I5
I5
2ND
I84
I84 FWY-I5 FWY
EVERETT ST-I84 FWY
EVERETT
EVERETT
EVERETT
GLISAN
9TH
FLANDERS
10TH
11TH
12TH
8TH
7TH
DAVIS
GRAND
6TH
COUCH
3RD
I5 FWY-MORRISON ST
BURNSIDE
I-84 WB
4a Restripe I-5 diverge as 3-2-1 split
4b signage improvements
N
1 inch = 208 feet


HANCOCK
SCHUYLER
SCHUYLER
30TH
32ND
35TH
36TH
37TH
38TH
CESAR E CHAVEZ
40TH
41ST
BROADWAY
28TH
WEIDLER
WEIDLER
27TH
HALSEY
HALSEY
SANDY BLVD-I84 FWY
HALSEY
HALSEY
38TH
40TH
34TH
35TH
CLACKAMAS
CLACKAMAS
I84
I84 FWY-CESAR E CHAVEZ BLVD
I84 FWY-33RD AVE
WASCO
WASCO
WASCO
SENATE
SANDY
27TH
MULTNOMAH
MULTNOMAH
37TH
28TH
PEERLESS
IMPERIAL
33RD
HASSALO
HASSALO
PACIFIC
SULLIVAN
SULLIVAN
31ST
HOLLADAY
HOLLADAY
HOLLADAY
HOLLADAY
29TH
27TH
PACIFIC
PACIFIC
PACIFIC
30TH
29TH
I-84 WB
5a Sandy Blvd. ON as separate Aux Lane; 33rd ON merges w. Sandy Aux
5b Extend 33rd ON-ramp/accel lane further west.
#5
N
1 inch = 275 feet

HANCOCK
SCHUYLER
SCHUYLER
30TH
32ND
35TH
36TH
37TH
38TH
CESAR E CHAVEZ
40TH
41ST
BROADWAY
28TH
WEIDLER
WEIDLER
27TH
HALSEY
HALSEY
SANDY BLVD-I84 FWY
HALSEY
38TH
40TH
HALSEY
33RD AVE-I84 FWY
34TH
35TH
I84
I84 FWY-CESAR E CHAVEZ BLVD
CLACKAMAS
CLACKAMAS
CLACKAMAS
I84
I84 FWY-33RD AVE
WASCO
WASCO
WASCO
SANDY
SENATE
WASCO
27TH
MULTNOMAH
MULTNOMAH
37TH
28TH
PEERLESS
IMPERIAL
33RD
HASSALO
SULLIVAN
HASSALO
PACIFIC
31ST
SULLIVAN
HOLLADAY
29TH
HOLLADAY
HOLLADAY
HOLLADAY
FLORAL
27TH
30TH
PACIFIC
PACIFIC
29TH
PACIFIC
LAUREL
I-84 WB
5C Sandy Blvd.
ON-ramp on GD
road to 33rd
#5
1 inch = 275 feet

WEIDLER
45TH
HALSEY
43RD
44TH
46TH
49TH
EUCLID
CLACKAMAS
51ST
WASCO
53RD
WASCO
58TH
59TH
MULTNOMAH
61ST
HASSALO
HOLLADAY
I84
SENATE
WASCO
48TH
MULTNOMAH
48TH
52ND
MULTNOMAH
HASSALO
HASSALO
HASSALO
I84
I84 FWY-43RD AVE
HAZELFERN
49TH
PACIFIC
55TH
57TH
WILLOW
47TH
OREGON
OREGON
IRVING
CENTER COMMONS
42ND
LAURELHURST
43RD
IRVING
GLISAN ST-I84 FWY
I84 FWY-GLISAN ST
HOYT
ST
ROYAL
57TH
60TH
FIR
IRVING
LADDINGTON
HOYT
HOYT
GLISAN
58TH
57TH
41ST
HOYT
55TH
44TH
45TH
49TH
FLANDERS
52ND
EVERETT
DAVIS
I-84 WB
66 replace U'Xing w. O'Xing ON-ramp
#6
N
1 inch = 300 feet


I-205 Bottleneck 7: SB at I-84 WB Off-Ramp
1 I-205 to I-84 WB Ramp Reconfiguration
Merge two I-205 NB to I-84 WB flyover lanes together, then merge this lane with I-205 SB to I-84 WB lane, then add this single lane to I-84 WB
NE Halsey
I-84 WB
7a
7b
I-84
I-205
N
July 8, 2010
1 of 1

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CHAPTER 5: APPENDICES

5.2 Appendix B: Preliminary Design Schematics
B.1 I-5 Bottlenecks
B.2 I-205 Bottlenecks
B.3 I-84 Bottlenecks
B.4 I-405 Bottlenecks
B.5 US 26 Bottlenecks

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C-BOS: I-405 PROPOSED IMPROVEMENTS

Corridor	Name	Bottle-neck	Study Area	Op-tion	Project Name	Description	Cost Elements	Comments	Priority
I-405	Corridor-wide	Corr-Wide	I-5 - I-205	**3c**	Corridor Active Traffic Management	Use corridor-wide active management signage to warn of queueing ahead;	**$2M-$4M:**	Funding being pursued for future study of active management signage of major corridors. Future study of region corridors to address implemen-tation of active management/variable speed signage.	
I-405 SB	Hwy 30 ON-ramp Bottleneck	**2**	Hwy 30 ON-Ramp to I-405 SB Merge	**2a (new)**	Hwy 30 ON-Ramp to I-405 SB 2>1 Merge (3-lns SB I-405 @ US 30 Merge)	Restripe from existing parallel 2-lane merge on Hwy 30 ON-Ramp, to 1-lane before merging with I-405 SB. Re-tain existing Fremont Bridge split (4 to 3+2) and carry 3-lanes I-405 SB to US 30 single-lane merge.	**$2M - $5.4M:**	A merge issue moreso than weave issue. High speed differentials between lanes (outside lanes free flow). Parallel merge. (1) A.M. peak hour is the dominant peak hour for this merge/weave section between US30 SB ON-ramp and the exit-ramp to Everett St. The SB mainline a.m. peak hour volume is 3,200-3,600 vph; the US30 SB ON-ramp carries about 1,450 vph in the a.m. and the Everett St. exit-ramp volume is 460 vph. The current lane geometry requires traffic in the inside lane of the US30 ON-ramp to merge with the traffic in the outside lane of the SB I-405 mainline. A weaving maneuver for traffic in the outside lane on the US30 ON-ramp heading to SB I-405 can be made downstream of the merging area. Due to the relatively high volume on the SB I-405 mainline, the existing three SB lanes at the US30 SB ON-ramp junction should be maintained.	
I-405 SB		**2**	Hwy 30 ON-Ramp to I-405 SB Merge	**2a (new)**	Hwy 30 ON-Ramp to I-405 SB 2>1 Merge (3-lns SB I-405 @ US 30 Merge) **(continued)**			(2) In addition, analysis of the lane by lane volumes at the west end of the Fremont Bridge shows that the existing upstream 4-2-3 lane split at the WB US30 exit-ramp currently provides good lane balance. Eliminating the "inside merge" conflict would be desirable as a means of enhancing traffic safety and creating a simplified weaving section that would operate at LOS C-D.	
I-405 SB		**2**	Hwy 30 ON-Ramp to I-405 SB Merge	**2a (new)**	Hwy 30 ON-Ramp to I-405 SB 2>1 Merge (3-lns SB I-405 @ US 30 Merge) **(continued)**			The Future 2035 a.m. and p.m. Regional Travel Demand Model was reviewed and it shows no significant traffic growth (only an increase of ~100 vph to 150 vph) on the US30 ON-ramp In the past 8-10 years, Region Traffic has eliminated this type of 'tapered inside merge/ convergence' design on various freeways as a means of safety enhance-ment. Sign spacing appears to be adequate with the right lane termination begins at around MP 1.31 and the end of taper at MP 1.01. Freight mobility should not be a problem in terms of accommodating over-dimensional load with the ramp reduced to a single lane. Need to be aware of OR366.215 concerning lane reduction on the US 30 ramp	
I-405 SB	Everett St. ON-ramp Bottleneck	**3**	Everett St. ON-Ramp to US 26 OFF-Ramp	**3a**	Static Signage & Sight Distance Improvements	Add additional static signage SB (cantelever sign from side just before Morrison St. O'Xing); extend gore point of Everett St. ON-ramp, to prevent earlier weaving; clear landscaping to improve sight distance.	**$1M:**	Weave problem. Lane drop at Couch St. OFF-ramp. Limited signage preceeding US 26 OFF-ramp. Aim is to get motorists to use left-lane, to improve lane utilization. (restriping and signage costs do NOT incl. any PE/CE/ Contingency costs). Note: no schematic drawn	
I-405 SB		**3**	Everett St. ON-Ramp to US 26 OFF-Ramp	**3b**	Install active variable speed signage by lane.	Use active variable speed signs by lane?	**$2M-$4M**	(restriping and signage costs do NOT incl. any PE/CE/Contingency costs). Need better cost estimate. (Mark/Canh/ Dennis) Note: no schematic drawn	
I-405 SB		**3**	Everett St. ON-Ramp to US 26 OFF-Ramp	**3c**	Extend Everett St. ON-Ramp to US 26 OFF-Ramp Merge/ Gore South	Push Everett St. ON-ramp gore point further south (Alder St.).	**$5K-$15K:** extend double solid line/ profile striping 700' ($2.8K); plus traffic staging; plus PE/CE/contingency ($2.2K-$4.2K);	To be studied further. Need better cost estimate. Note: no schematic drawn.	

C-BOS: I-405 PROPOSED IMPROVEMENTS

Corridor	Name	Bottle-neck	Study Area	Op-tion	Project Name	Description	Cost Elements	Comments	Priority
I-405 SB		**3**	Everett St. ON-Ramp to US 26 OFF-Ramp	**3d2 (new)**	Close Everett St. ON-Ramp.	Close Everett St. ON-ramp. Add 3rd lane @ Couch St. OFF-ramp. Traffic wanting to go to US 26 from Everett St. can go via 13th Ave. > Taylor St./Clay St. > US 26. Traffic wanting to go to I-405 SB from Everett St. can go via 13th Ave. > Montgoverry St. > I-405 SB.	**$??M - $??M:**	New proposal. Need model ramp closure. May be difficult politically to close this ramp.	
I-405 SB		**3**		**3e**		Everett St.ON to 26 OFF. Shoulder widening, restripe, realign; trim landscaping.	**$215K-$270K:**	Improve sight distance.	
I-405 SB	US 26 ON-ramp/Broad way OFF-ramp	**4**	US 26 WB OFF-ramp to Broad-way OFF-ramp	**4b**	Re-order merge priorities of SB I-5/I-405/Harbor Dr	Re-order merge priorities of SB I-405/SB I-5/SB Harbor Dr, between Freemont Br. & Ross Island Br., to accommodate higher traffic volumes on I-5 SB.	**$50M +/-?:** Re-assign priority merge to higher volume SB I-5 instead of to SB I-405; re-locate SB Harbor Dr to west, under I-405 ramps to merge into SB I-405; maintain 2-lane I-5 SB ON-ramp as 2-lane merge; SB I-405/ SB Harbor Dr merge with SB I-5.	Model different lane configuration to analyze change. Need better cost estimate. Suggest traffic analysis be conducted before cost estimate prepared. Exceeds Study cost limits? (see I-5 Options #4 & #7)	
	I-405 SB								
I-405 SB		**4**	US 26 ON-Ramp to Broadway OFF-Ramp	**4c1**	Limit Montgomery St. ON-Ramp to Broadway OFF Ramp *only* as frontage road to Ross Is Bridge.	Barrier separate Montgomery St. ON-ramp and then use it as a C-D frontage road to Ross Island Bridge. Install signage on US 26 to Ross Island Bridge and to CBD.	**$15M:** 325'L x 15'H retaining wall ($488K); reconstruct 12th Ave. O'Xing - 428'L x 51'W x 200'H ($4.4M); assume NB side of wall can remain "untouched" with bridge replace-ment; new 1,000'L x 15'H SB wall for C-D road ($1.5M); 1,000' barrier between I-405 mainline & C-D road ($35K); sign bridge re-place ($250K); 1,000' L x 28' roadway widen-ing ($616K); PE/CE/contingency ($8.2M).	Eliminates conflicts of merge to I-405. Come OFF at Market St. from US 26, then get ON Mont-gomery St. ramp to Ross Island Bridge. SB I-405 motorists would still have choice to Ross Island Bridge & Broadway OFF. Sign for Market St. to Ross Island Bridge	
I-405 SB	US 26 ON-ramp/Broad way OFF-ramp	**4**		**4c2**	Montgomery St. ON-Ramp closure.	Close Montgomery St. ON-Ramp. Local traffic only.	**$200K:** scarify ramp pavement; add detour signage	Relatively low ramp volumes (~800 vph) may not cause significant merge/weave conflicts. Need model for traffic impacts. The Montgomery St. SB ON-ramp carries about 480 vehicles and 800 vehicles in the a.m. and p.m. peak hour, respectively. The dominant peak hour for I-405 SB is the p.m. peak. With the Montgomery St. ON-ramp closed, 22% (200 veh.) divert to Taylor St. ON-ramp and then to Broadway St./Ross Island Br exit; 18% (150 veh.) divert to Broadway St. to head to Ross Island Bridge; and 12% (100 veh.) divert to Broadway St. ON-ramp to I-405 SB. HCM weave analysis does not show significant improvement in terms of LOS based on density in the section between US26 ON-ramp and Broadway St./Ross Island Br. exit-ramp.	
I-405 SB	US 26 ON-ramp/Broad way OFF-ramp	**4**		**4c2**	Montgomery St. ON-Ramp closure. **(continued)**			However, there would be actual operational benefits: (1) Eliminate the short weave distance of 620' and short separation of 400' between the US26 on-ramp and Montgomery ON-ramp. (2) Eliminate the weave conflicts. As a result, the mainline I-405 SB should flow better with the Montgomery St. SB ON-ramp closed. This ramp serves traffic from PSU and it is the complimentary ON-ramp to the 12th Ave exit-ramp in the NB I-405 direction. Closing either ramp would be political. The Broadway St. ON-ramp is narrow and functions as a single lane ramp meter. Can it be widened to the inside to allow for two-lane ramp meter to accommodate additional demand with Montgomery St. SB ON-ramp closed?	

C-BOS: I-405 PROPOSED IMPROVEMENTS

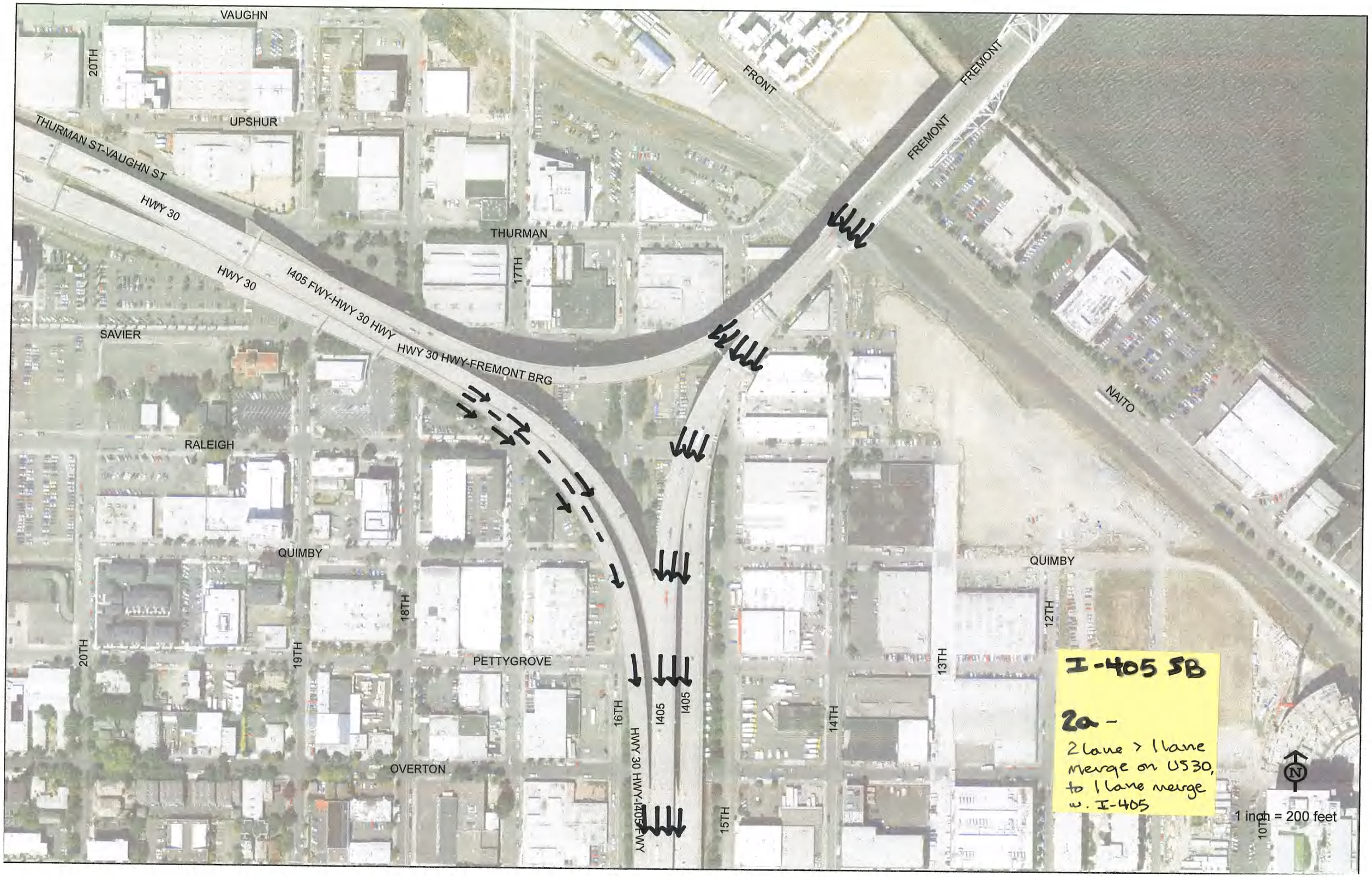
Corridor	Name	Bottle-neck	Study Area	Op-tion	Project Name	Description	Cost Elements	Comments	Priority
I-405 SB		4		4e	Prohibit left-turn from SW Broadway to NB 6th Ave	Eliminate EB > NB left-turn from Broadway to 6th Ave.	**$200K:**	People trying to get ON at I-405 NB block intersection for I-405 SB OFF causing back up. Would enhanced green time allow for better movement? Couple with I-405 NB Option 1b.	
I-405 SB						ODOT will be initiating a variable speed project on I-5 & I-405 south end (Broadway to I-5 South)			
						OPTIONS CONSIDERED BUT NOT FORWARDED			
	I-405 NB								
	US 26/12th Ave. Bottle-neck	1	I-5 NB ON-Ramp to US 26/12th Ave. OFF-ramp	1	US 26/12th Ave. OFF-Ramp Start @ 5th Ave. OFF	Pull US 26 ON-ramp back 1,800' to before SW 5th Ave.; renovate structures at 6th Ave. (100'x100'x300')/Broadway (250'x100'x300')/ Park Ave. O'Xing (250'x100'x300'); close 6th Ave. OFF-ramp (?); 1,500' x 20' retaining wall; traffic signal;	**$110M + ROW:**	Congestion starts at SW 6th Ave. ON-ramp. High speed differentials between lanes (center & inside lanes OK). Plus separate queuing back from I-5 and US 26. Exceeds Study cost limits. Not physically feasible. Insufficient space to widen under structures/columns/ retaining wall next to roadway.	
	I-405 NB								
		1		1a	12th Ave. OFF-Ramp Closure	Close 12th Ave OFF-ramp	**$200K:** scarify ramp pavement; add detour signage	Volumes are low but would take ~1,200 vehicles out of weave section. May be politically difficult to close 12th Ave. OFF-ramp. Need start with HCS analysis to assess impacts/benefits of closing ramp on weave section; as well as, to determine impacts of closed 12th Ave. OFF traffic diverted to 6th Ave. OFF-ramp. The weaving distance between the 6th Ave on-ramp and US26/12th Ave exit-ramp is about 730 feet. The existing a.m. and p.m. peak hour volume is 320 vph and 380 vph, respectively. The a.m. peak hour is the dominant peak hour for I-405 NB. Of the 12th Ave exit-ramp traffic, 1/3 comes from I-5 NB and 2/3 comes from I-5 SB (with most via I-84 WB). .	
		1		1a	13th Ave. OFF-Ramp Closure **(continued)**			With the ramp closure, 13% (45 veh.) of the 12th Ave ramp traffic would divert to 4th Ave exit-ramp; 27% ((86 veh.) to 6th Ave; 34% (109 veh.) to Salmon St./14th Ave. The rest would use other routes, e.g. I-5 SB to Morrison Bridge. HCM weave analysis shows an improvement in LOS from "D" to "C" (based on density in the weave segment) with the 12th Ave exit-ramp closed. The volume diverted to 4th Ave and 6th Ave exits is not high so the two exit-ramps should handle the additional demand. However, traffic from I-5 NB has to weave across 2 lanes to exit to either the 4th Ave or 6th Ave exit-ramp. That may not be desirable. Also, the 12th Ave exit-ramp serves traffic to the PSU area. Closing the exit-ramp would be political	
		1		1b	6th Ave ON-Ramp Meter & Restripe as Double Lane ON-Ramp	Add ramp meter at 6th Ave.ON-ramp; install as close to gore as possible; restripe existing single-lane ON-ramp as dual-lane ramp; connect dual-lane ramp restriping to restriping of two-lane NB 6th Ave. to three-lanes over O'Xing.	**$400K - $600K:** Couple with closing EB>NB left-turn at 6th Ave (I-405 SB Option 4E).	Less traffic through weave with very aggressive weave. Will need to accommodate bike traffic (bike lane) over 6th Ave. O'Xing. Middle-lane of restriped 3-ln 6th Ave may be an 'Option' lane that would allow choice of NB I-405 ramp or thru-ln NB on 6th Ave. Need to review 6th Ave. O'Xing structure width to determine if restriping (2-lane approach to 2-lane ON-ramp/1-lane NB thru/NB bike lane) is physically feasible. Structure flairs wider to north to accommodate OFF-ramp. Co-ordinate with I-405 SB Option 4E.	

C-BOS: I-405 PROPOSED IMPROVEMENTS

Corridor	Name	Bottle-neck	Study Area	Op-tion	Project Name	Description	Cost Elements	Comments	Priority
	I-405 NB								
		1		1c	6th Ave ON-Ramp limited to WB US 26	6th Ave ON-ramp signed for WB US 26 only. Install barrier to prevent merge with NB I-405 main-line. Close access to 12th Ave OFF-ramp from NB I-405.	**$1M-$5M:** Some widening.	Signed but not forced (would need barrier: can't sign for two options). Model for impacts/traffic diversion.	
		1		1d		Remove 6th Ave ON, add 4th Ave. ON & braid w. 6th Ave. OFF	**$75M-$90M:**	Exceeds Study cost limits.	
		1		1e		Add 1st Ave. ON and close 6th Ave. and 4th Ave. OFF	**$21M-$25M:**	Politically difficult. Unfeasible.	
		1		1f		Add 1st Ave. ON but with flyover and close 6th Ave. OFF	**>$50M:**	Insufficient vertical clearance under structures. Exceeds Study cost limits.	
		1		1g (new)		Braid 6th Ave. ON-ramp with US 26 EXIT.	**>$50M:**	Would require construction of rigid-frame U'Xing to effect braid. Exceeds Study cost limits.	
	I-405 SB								
		2		2b	Hwy 30 ON/OFF-Ramp Merge	Restripe Fremont Bridge split to I-405 SB & US 30 as 4-lane split to 2 + 2; move Bridge split/ diverge gore point to east.	**$2M-$5M:**	A merge issue moreso than weave issue. Model for lane balance. Reducing the 3-lane SB mainline section to a 2-lane section would result in poor lane balance at the existing upstream 4-2-3 lane split at the WB US30 exit-ramp. The a.m. peak hour volume for the SB Mainline traffic is more than twice as high as the US30 SB on-ramp volume. It would not make sense to reduce the 3-lane mainline section to 2 lanes from a capacity perspective.	
		2		2c	Hwy 30 ON/OFF-Ramp Merge	Retain existing Fremont Bridge split at bridge end (4 to 3+2); lane drop to 2-lanes @ US 30 ON-ramp entrance (US 30 ON-ramp remains as 2-lane merge).	**$2M-$5M:**	A merge issue moreso than weave issue. Model for lane balance. Reducing the 3-lane SB mainline section to a 2-lane section would result in poor lane balance at the existing upstream 4-2-3 lane split at the WB US30 exit-ramp. The a.m. peak hour volume for the SB Mainline traffic is more than twice as high as the US30 SB on-ramp volume. It would not make sense to reduce the 3-lane mainline section to 2 lanes from a capacity perspective	
	I-405 SB								
		3		2d	Hwy 30 ON-Ramp	Carry 4th lane through/past Everett St. OFF-ramp, and 3-lanes past Couch; single-lane diverge @ Everett; 4-lane to 3-2 lane @ Couch/Burnside (2-lane to US 26); 2 or 3 lanes past Burnside	**$12M - $17M:** Compare with separate cost estimates for 2E & 2F; combined lane extensions/additions	Model for lane balance. .	
		3		2e	Add 3rd lane.	Add 3rd lane from Couch St. OFF-ramp drop to US 26 WB	**$6M - $10M:** rebuild 700' Couch St. OFF-ramp as 2-lane exit ($524K); construct 200'L x 5'H retaining wall between ramp & mainline ($100K); widen mainline 2,160'L x 24'W ($1.14M); rebuild Everett St. ON-ramp 1,050'L x 18'W ($416K); remove & reduild Taylor St. ON-ramp 200'L x 30' ($132K) with 2 x 200'L x 10'H retaining walls ($400K); plus sign bridge ($?); plus PE/CE/contingency ($3.3M-$5.3M).	Model for lane balance. Segments are too short to accommodate weaving/merging/lane changes. Addition of 3rd ln may require adding ~1,200' accel lane from Everett St. ON-Ramp to accommodate 3rd lane. Need to model for lane balance. Need better cost estimate, if accel ln need be added to accommodate 3rd ln. (1) Under Options 2d, 2e and 2f, Everett St. ON-ramp would become a merge lane. HCS merge junction analysis shows that the merge junction in the p.m. peak hour would operate at capacity due to the high ON-ramp volume and the high volume exiting to Sunset Highway in the p.m. peak. With the 3rd SB lane extending from Couch St. exit-ramp, traffic entering from Everett St. ON-ramp that want to head to I-5 South would have to make a merging maneuver first and then make a lane change to weave over to the middle. (2) In addition, if the 3rd lane requires adding an accel lane of ~*1200' long, then definitely there would not be adequate weaving distance between the proposed merge and the exit-ramp to Sunset Highway. Overall, we don't see a meaningful benefit.	

C-BOS: I-405 PROPOSED IMPROVEMENTS

Corridor	Name	Bottle-neck	Study Area	Op-tion	Project Name	Description	Cost Elements	Comments	Priority
	I-405 SB								
		3		2f	Add 4th lane.	Add 4th lane from Everett St. OFF- ramp to Couch St. OFF-ramp; add accel ln to west.	**$6M - $7M:**	Model for lane balance.	
		2		2g	Hwy 30 ON-Ramp to I-405 SB 2>1 Merge (2-lns SB I-405 @ US 30 Merge)	Restripe US 30 ON to be single merge to I-405. 2 lanes merge into one lane on US 30. Retain existing Fremont Bridge split (4 to 3+2), but drop one lane to carry 2 lanes to US 30 ON-ramp merge.	**$2M - $5.4M:**	A merge issue moreso than weave issue. Model for lane balance	
		3	Everett St. ON-Ramp to US 26 OFF-Ramp	3d1	Extend Everett St. ON-Ramp over closed Taylor St. ON-Ramp/slip ramp to US 26	Extend Everett St. ON-Ramp onto Taylor St. ON-Ramp (Taylor St. Ramp closed) past Salmon St; physical barrier separates Everett St. ON-Ramp and I-405; connection [slip ramp] from Everett ON-Ramp to US 26 past Salmon St.; widen 2,000' from Alder St.; 1,200' of retaining wall along west edge of I-405, to add shoulders (need confirm sufficient space available);	**$10M-$15M:** rebuild 2,400'L x 32'W Everett St.>Taylor St. ON-ramp segment (up to Columbia St. structure) ($1.7M); 450'L x 26'W slip ramp to US 26 ($257K); construct 800'L x 20'H retaining wall, Salmon St. > Columbia St.($1.6M); construct 215'L x 5'H retaining wall, between SB>WB ramp & Taylor St. ON-ramp ($108K); install 2,000' barrier, between mainline & new Everett St. ramp ($100K); signage/sign structure ($770K); plus PE/CE/contin-gency ($5.5M-$7.5M)	Provides opportunity for Everett St. ON-Ramp motorists to access both US 26 & I-405 SB. May negatively impact US 26 downstream. Need to model for traffic impacts. Need confirm physically feasible. Concern with spacing, and traffic volume point loading. Lane balance and topography issues.	
				3f		Combine Clay St. to US 26 WB by using Jefferson St./SW 14th Ave. reroute to right side of ON-ramp. Close Clay St. ON-ramp to WB US 26.	**$8.5M-$10.5M:**	Utilize local street network but build next to I-405 to US 26 WB. One lane ON from Jefferson St. Will need new wall.	
	I-405 SB								
	US 26 ON-ramp/Broadway OFF-ramp	4	US 26 WB OFF-ramp to Broad-way OFF-ramp	4a	US 26 ON-Ramp/Broadway OFF-ramp	Close Taylor St. ON-Ramp. Replace/relocate existing US 26 ON-Ramp to I-405 SB with flyover ramp, as 2-lane to 1-lane ramp before merging with new Montgomery St. ON-ramp; remove existing Montgomery St. ON-Ramp; add new Montgomery St. ON-Ramp from east side of I-405 as add lane to I-405 lane to Broadway OFF-ramp; retaining wall; renovate 12th Ave. O'Xing; slip ramp from US 26 ramp to I-405 ramp to Brdway OFF-ramp.	**$77M-$110M:** 1,200' for ramp/lane to Broadway OFF-ramp; 1,500' US 26 to Broadway OFF-Ramp (2-lns); 1,600' slip ramp US 26 to Broadway OFF; 200'x12' H retaining wall; US 26 700' Ave. flyover structure to SB I-405 (?); 300' Montgomery St. ON-Ramp from east side of I-405; 300' slip ramp to Broadway; 50' modification of 12th Ave. O'Xing structure (need Bridge Unit to assess cost of renovation);	Weave problem. US 26 ON-ramp & Montgomery St. ON-ramp merge, and back up at Broadway OFF-ramp. Lane speed imbalance. Separate queuing from Broadway OFF-ramp. *Exceeds Study cost limits.*	
		4		4c3	Montgomery St. ON-Ramp clo-sure - peak hrs only/.	Close Montgomery St. ON-Ramp during peak hours only --- or adjust/slow ramp meter rates. Local traffic only.	**$1.1M-$1.2M:**	Relatively low ramp volumes (~800 vph) may not cause significant merge/weave conflicts. Need model for traffic impacts. Long daily peak period does not lend itself to peak-hour closure. The on-ramp volume is high (800 - 1200 vph) throughout most of the hours during the day except for the period between 10 a.m. and 2 p.m.. During the 10a.m. - 2 p.m. period, the volume ranges from 600 vph to 750 vph. It does not seem it would be desirable to carry this option forward because of the long peak period.	
		4		4d		Close Taylor St. and Montgomery St.ON-ramps; braid with Broadway OFF	**> $50M:**	Exceeds Study cost limits.	


VAUGHN
20TH
UPSHUR
THURMAN ST-VAUGHN ST
HWY 30
HWY 30
I405 FWY-HWY 30 HWY
HWY 30 HWY-FREMONT BRG
THURMAN
17TH
FRONT
FREMONT
FREMONT
SAVIER
NAITO
RALEIGH
QUIMBY
QUIMBY
18TH
19TH
20TH
PETTYGROVE
16TH
I405
I405
HWY 30 HWY-I405 FWY
OVERTON
15TH
14TH
13TH
12TH
10TH
I-405 SB
2a -
2 lane > 1 lane
Merge on US30,
to 1 lane merge
w. I-405
N
1 inch = 200 feet

VAUGHN
20TH
UPSHUR
THURMAN ST-VAUGHN ST
HWY 30
HWY 30
I405 FWY-HWY 30 HWY
HWY 30 HWY-FREMONT BRG
THURMAN
17TH
SAVIER
FRONT
FREMONT
FREMONT
NAITO
RALEIGH
QUIMBY
QUIMBY
18TH
19TH
20TH
PETTYGROVE
16TH
I405
I405
HWY 30 HWY-I405 FWY
OVERTON
15TH
14TH
13TH
12TH
11TH
10TH
I-405 SB
2b 4>2+2
split
1 inch = 200 feet
N

VAUGHN
20TH
UPSHUR
THURMAN ST-VAUGHN ST
HWY 30
HWY 30
I405 FWY-HWY 30 HWY
HWY 30 HWY-FREMONT BRG
THURMAN
17TH
SAVIER
FRONT
FREMONT
FREMONT
NAITO
RALEIGH
QUIMBY
QUIMBY
18TH
20TH
19TH
PETTYGROVE
16TH
I405
I405
HWY 30 HWY-I405 FWY
OVERTON
15TH
14TH
13TH
12TH
11TH
10TH
I-405 SB
2C 473+2 @
bridge divage
drop 3 2 lns on
I-405 @ US 30 ON
1 inch = 200 feet
N

VAUGHN
20TH
UPSHUR
THURMAN ST-VAUGHN ST
HWY 30
HWY 30
I405 FWY-HWY 30 HWY
HWY 30 HWY-FREMONT BRG
THURMAN
17TH
FRONT
FREMONT
FREMONT
SAVIER
RALEIGH
NAITO
QUIMBY
QUIMBY
18TH
19TH
20TH
PETTYGROVE
16TH
I405
I405
HWY 30 HWY-FREMONT FWY
14TH
13TH
12TH
11TH
OVERTON
15TH
10TH
I-405 SB
~~2A~~ 2G 2 ln > 1 ln
merge on US30
+ 1 ln merge to
I-405
N
inch = 200 feet

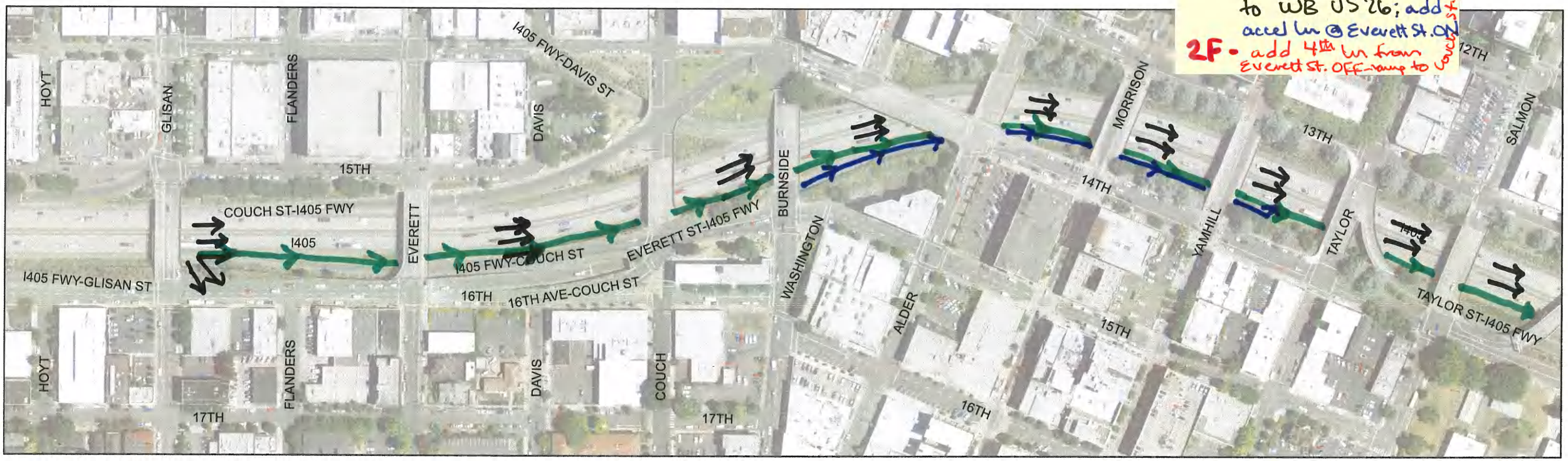
I-405 SB

2d - combination of 2E & 2F

2E - add 3rd ln from Couch St. Off-Ramp to WB US 26; add accel ln @ Everett St. ON

2F - add 4th ln from Everett St. OFF-ramp to Couch St. OFF-ramp

inch = 200 feet



I-405 SB map 1

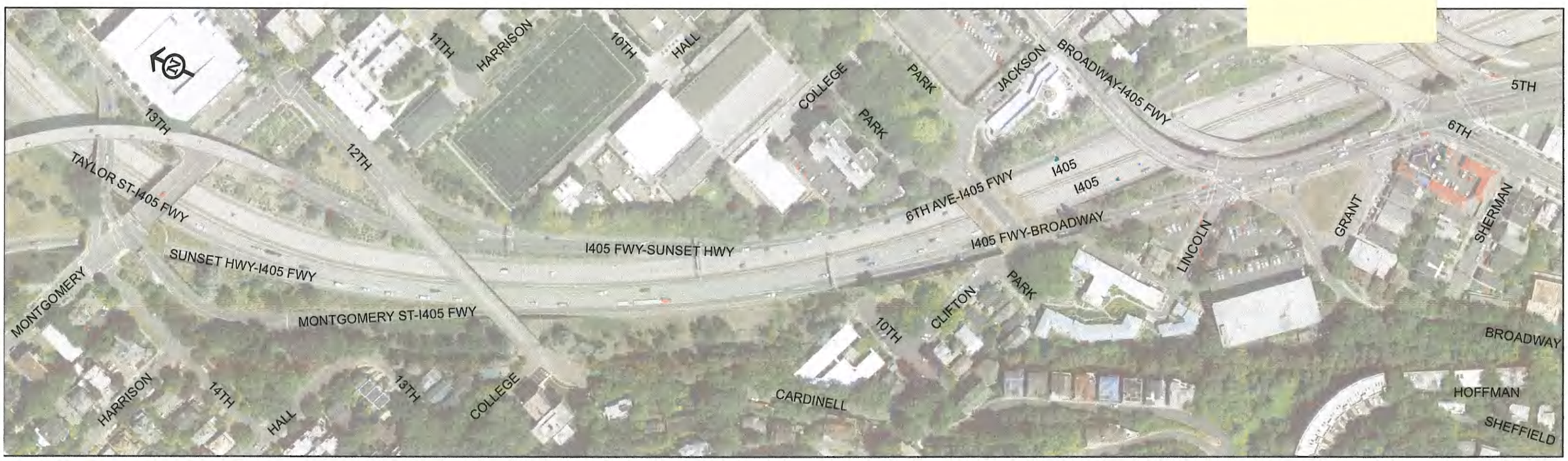
3d Extend Everett St. ON-Ramp > Salmon St.; widen 2,000' from Alder > Columbia; 1,500' retain. wall

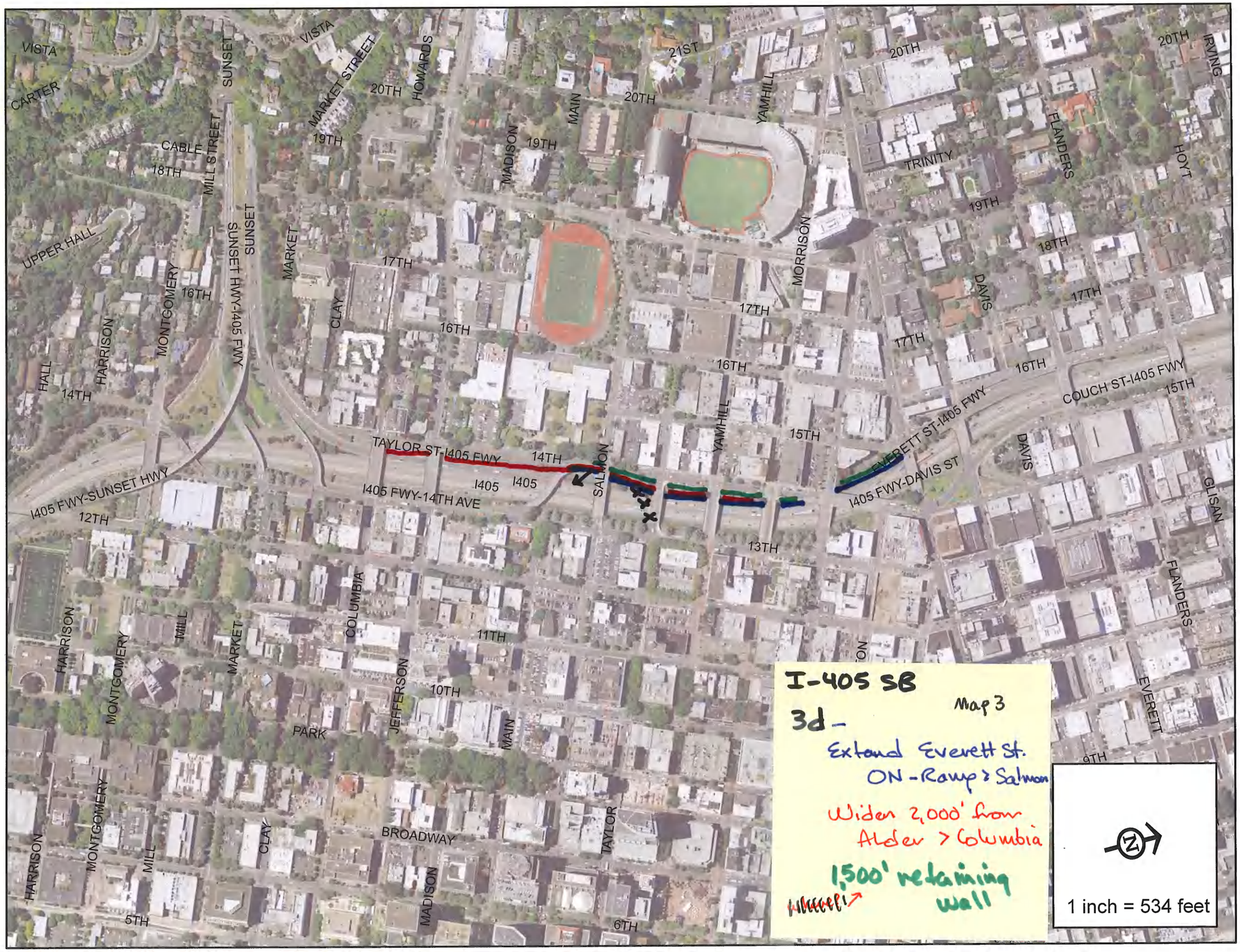
1 inch = 200 feet

I-405 SB

3d-map 2

1 inch = 200 feet





I-405 SB

Map 3

3d -

Extend Everett St.
ON-Ramp > Salmon

Widen 2,000' from
Alder > Columbia

1,500' retaining
wall

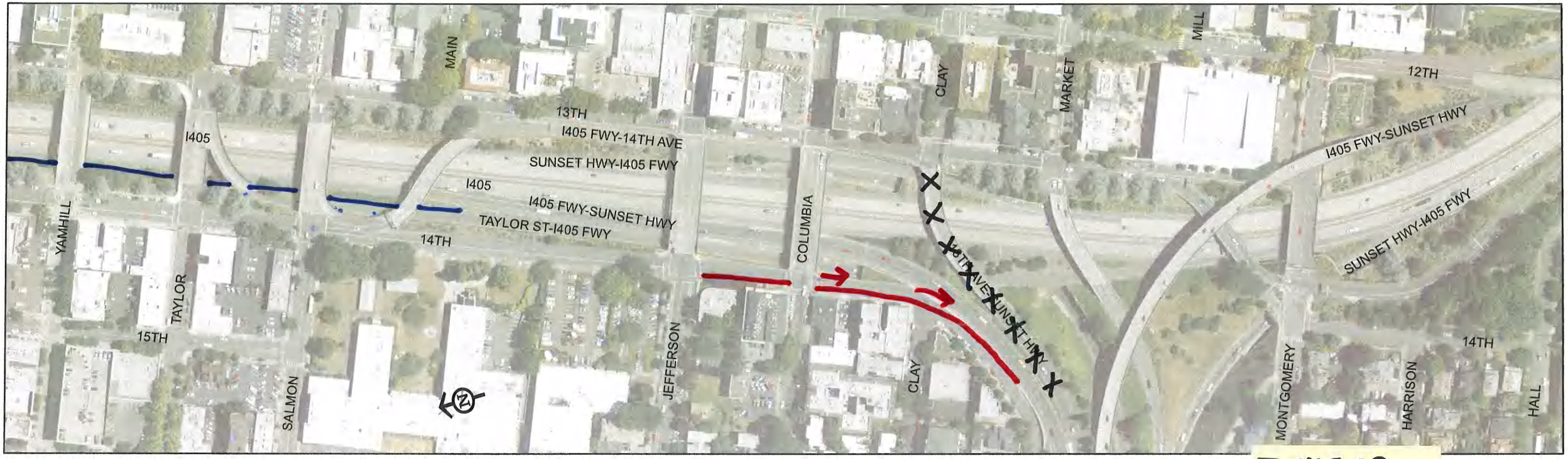
1 inch = 534 feet

J-405 SB Map 1

3E Everett St. ON-ramp > US 26 OFF shoulder widening

3F close Clay St. WB ON-Ramp; Route Jefferson + 14th Ave to US 26 WB

1 inch = 200 feet

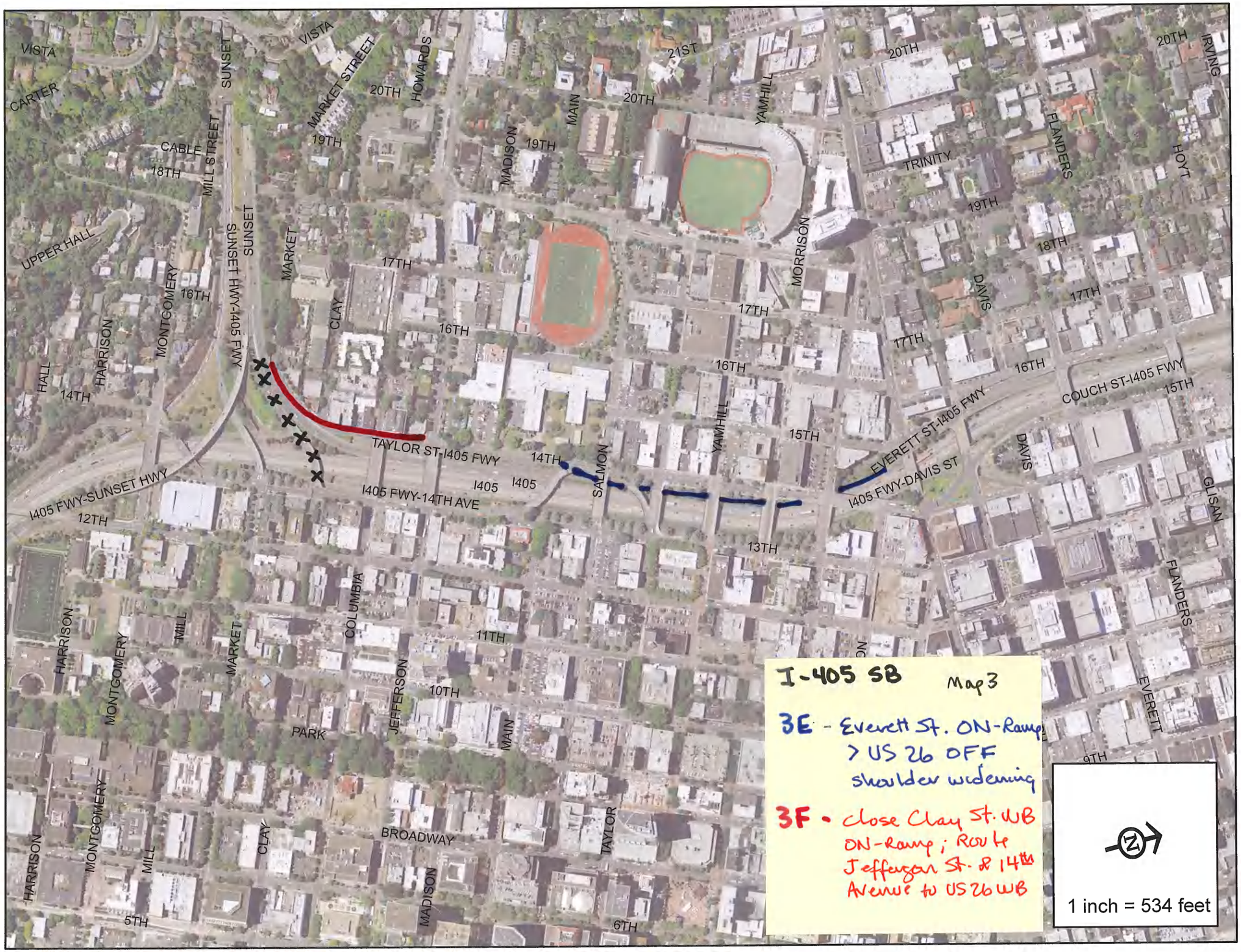


I-405 SB

3E map2

3F

1 inch = 200 feet


VISTA
CARTER
CABLE
UPPER HALL
HALL
SUNSET
MILL STREET
SUNSET HWY-I405 FWY
MONTGOMERY
HARRISON
MARKET STREET
MARKET
CLAY
HOWARDS
MADISON
MAIN
YAMHILL
MORRISON
TRINITY
FLANDERS
DAVIS
HOYT
IRVING
GLISAN
EVERETT
COUCH ST-I405 FWY
EVERETT ST-I405 FWY
I405 FWY-DAVIS ST
TAYLOR ST-I405 FWY
I405 FWY-SUNSET HWY
I405 FWY-14TH AVE
I405
SALMON
COLUMBIA
JEFFERSON
PARK
BROADWAY
TAYLOR
MILL
21ST
20TH
19TH
18TH
17TH
16TH
15TH
14TH
13TH
12TH
11TH
10TH
9TH
6TH
5TH
I-405 SB
Map 3
3E - Everett St. ON-Ramp > US 26 OFF shoulder widening
3F - close Clay St. WB ON-Ramp; Route Jefferson St. & 14th Avenue to US 26 WB
N
1 inch = 534 feet

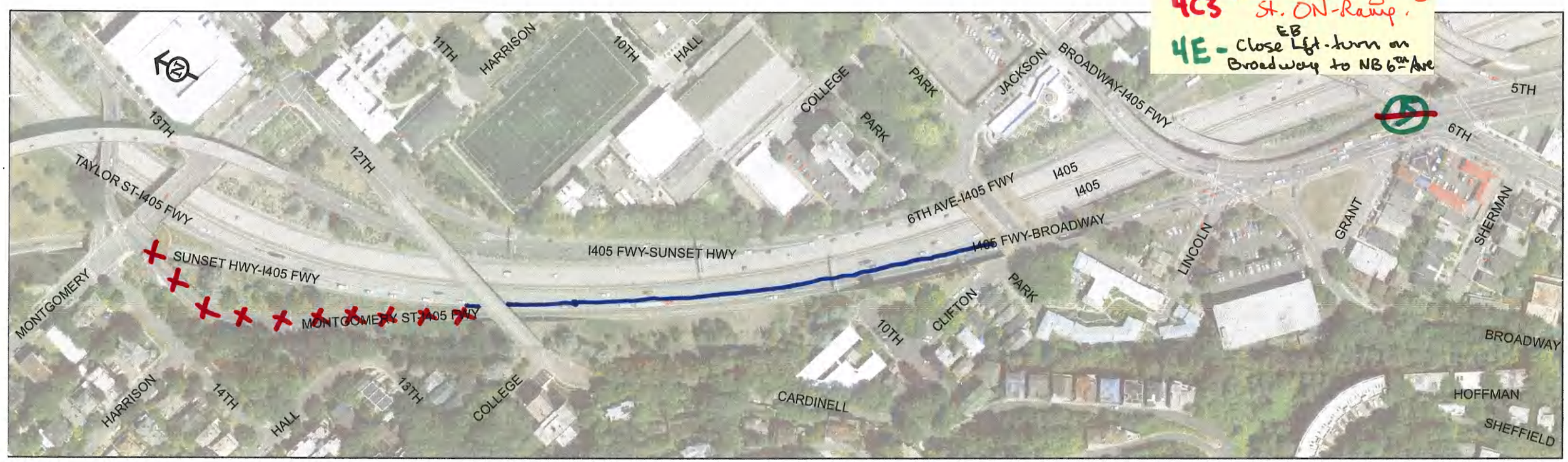
I-405 SB

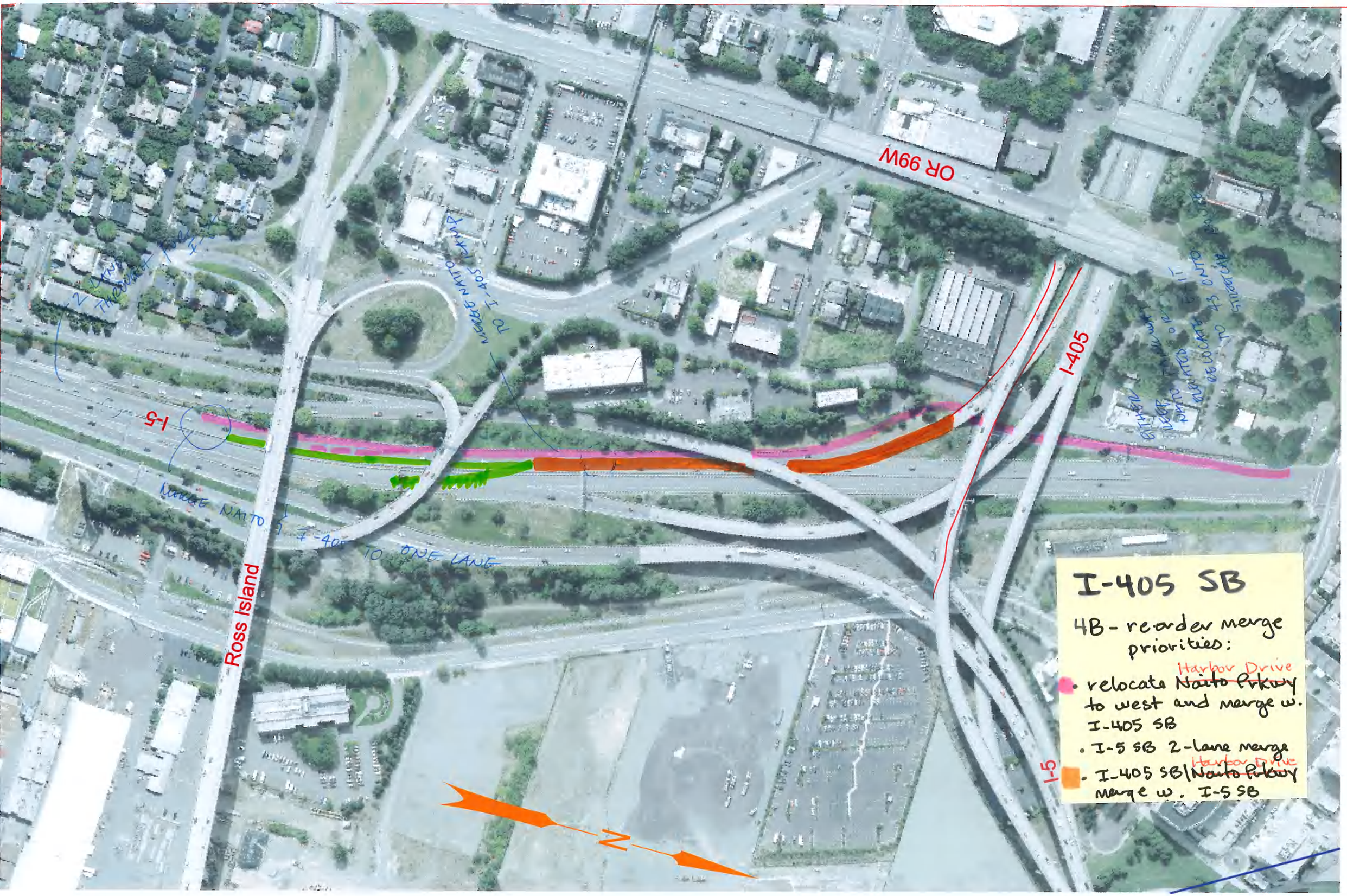
4C1 - Montgomery St. ON-ramp limited to Broadway OFF-Ramp Only (Ross Is. Bov.)

4C2 > Close Montgomery St. ON-Ramp.
4C3

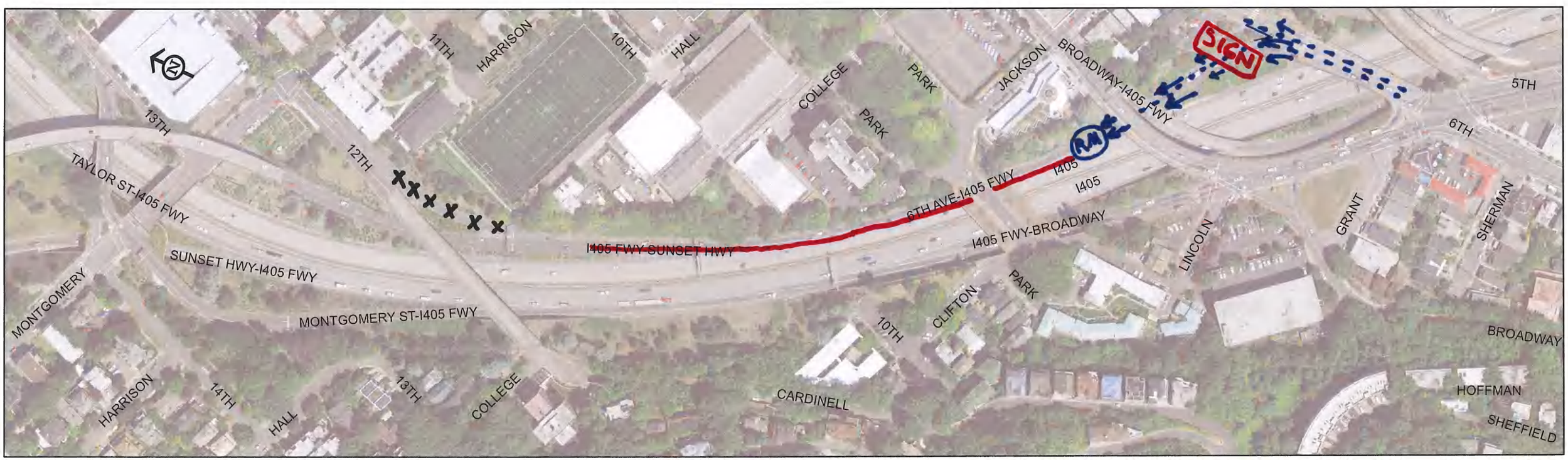
4E - Close EB Left-turn on Broadway to NB 6th Ave

1 inch = 200 feet




OR 99W
I-405
I-5
Ross Island
N
I-405 SB
4B - reorder merge priorities:
• relocate ~~Naito Prkwy~~ Harbor Drive to west and merge w. I-405 SB
• I-5 SB 2-lane merge
• I-405 SB/~~Naito Prkwy~~ Harbor Drive merge w. I-5 SB

1 inch = 200 feet



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CHAPTER 5: APPENDICES

5.2 Appendix B: Preliminary Design Schematics
B.1 I-5 Bottlenecks
B.2 I-205 Bottlenecks
B.3 I-84 Bottlenecks
B.4 I-405 Bottlenecks
B.5 US 26 Bottlenecks

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C-BOS: US 26 PROPOSED IMPROVEMENTS

Corridor	Name	Bottle-neck	Study Area	Op-tion	Project Name	Description	Cost Elements	Comments	Priority
		Signage planned for US 26 EB					Includes CE, PE & Contingency		
US 26 EB	Hwy 217 On-Ramp Bottleneck	**1**	Cedar Hills ON-Ramp to Hwy 217 ON-Ramp/ Lane Drop	**1a**	Hwy 217 to US 26 EB ON-Ramp Striping Modification	Extend solid double line, or separator (profile striping) 3,000' from painted gore past first lane drop. Establishes single lane ON traffic, and prohibits US 26 EB mainline from early weave to outside	**$30K - $50K:** extend 3,000' of solid double line (profile striping) ($12,000); may need to grind pavement and re-pave; traffic staging can be costly; need PE/CE/contingency.	Could reduce motorist merging over: pushes merges farther down the line. Recommend sensitivity modeling to assess how long accel lane needs to be to be beneficial. Identify speed by lane, to help assess effectiveness of extending lane.	
US 26 EB		**1**		**1b**	Hwy 217 Guide Signage	Mainline and ramp guide signs on/near OR 217 & US 26; thru traffic merge left.	**$2M-$4M:** Identify number/spacing of improved signage, from OR 217 to I-405.	Might have safety benefits and help with upcoming diverge for US 26/I-405. High crashes: would be beneficial to forewarn drivers about speed differentials. Need better cost estimate of number/spacing of signage. (Canh/Mark/ Dennis) Future study of region corridors to address imple-mentation of active management/ variable speed signage (as per OR 217).	
US 26 EB	Corridor-wide	**1**	I-405 - Brookwood Interchange	**1c**	Corridor Active Traffic Management	ATM variable signs indicating lane assignments and variable speeds; per lane side or overhead.	**$2M-$4M:** Identify number/location of variable message signs, from OR 217 to I-405.	Might have safety benefits and help with upcoming diverge for US 26/I-405. High crashes: would be beneficial to forewarn drivers about speed differentials. Need better cost estimate of number/spacing of signage. (Canh/Mark/ Dennis) Future study of region corridors to address imple-mentation of active management/ variable speed signage (as per OR 217).	
US 26 EB		**1**		**1d-2**	Hwy 217 to US 26 EB Merge Lane (re-stripe)	Modify acceleration lane with profile striping, from OR 217 ON to Sylvan/Scholls Ferry OFF.	**< $1M:**	Downscoping of Option # 1d-1 (auxiliary lane). Restripe merge area with 8' solid profile striping, and lane merge arrows.	
US 26 EB	I-405 Diverge Bottleneck	**3**	Skyline/Scholls Ferry Rd. ON-Ramp to I-405 Diverge	**3a**	Jefferson St. Option	Close Market St. OFF-ramp and use Jefferson St. for downtown exit. Open Jefferson St. to two lanes. Several structures; widening not possible.	**< $5M:** signage is ~ $100K - $150K, depending on how many to be installed; cost of mitigation (local street improvements) cannot be assessed at this level (without input from Traffic); cost to remove Market St. OFF-ramp (7,200 sq. ft.) uncertain. Plus PE/CE/contingency.	Perhaps politically unfeasible. Might have issues getting drivers to PGE park. Analyze roundabout. Remove bus stop in intersection. Check timing for trains and driver delay. May need to be combined with other improvements. Insofar as EB US 26 > CBD does not queue back like EB US 26 > I-405 NB & SB; routing traffic to Jefferson St. OFF will *not* gain much benefit. Need start with HCS analysis to assess concerns with overloading local street system (2,200 vph in p.m. peak) (200' blocks); and conflicts with: LRT; round-about; peds., PGE Park; before determining whether to model this option.	
	US 26 EB								
US 26 EB		**3**		**4b**		Realign to outside from diverge with less of an angle to I-405 SB using the same structure. Market St. structure may not be impacted. Combine 14th Ave. & Taylor St.	**$??M:**	Braid Montgomery St. with Taylor St.? Sight distance not particularly an issue: perhaps put up signage saying queue ahead would have same impact and aggressive ramp metering for Montgomery St.ON-ramp. Does not address problem. Congestion problems are primarily generated on I-405, not US 26. Consider in conjunction with I-405 SB corridor bottleneck #4.	
US 26 EB		**3**		**4c**		EB US 26 ramp to SB I-405 widen to south (inside) and realign. New struc-ture under Montgomery St. Improve sight distance and maybe two lanes.	**$??M:**	Does not address the problem. Congestion problems are primarily generated on I-405, not US 26. Consider in conjunction with I-405 SB corridor bottleneck #4.	
	US 26 WB								
US 26 WB	I-405 x US 26 Merge Bottleneck	**6**	I-405 Ramps at US 26 x I-405 Merge	**6a**	Striping Plan	Look at original construction lay-out plans for striping. Perhaps wasn't striped correctly.	**$??M:**	Review construction lay-out plans for striping. Recommend sensitivity modeling *to assess* impacts/benefits from enhanced striping.	

C-BOS: US 26 PROPOSED IMPROVEMENTS

Corridor	Name	Bottle-neck	Study Area	Op-tion	Project Name	Description	Cost Elements	Comments	Priority
						OPTIONS CONSIDERED BUT NOT FORWARDED			
	US 26 EB								
	Hwy 217 On-Ramp Bottleneck	1	Cedar Hills ON-Ramp to Hwy 217 ON Ramp/Lane Drop	1d-1	Hwy 217 to US 26 EB Aux Lane	Modify acceleration lane into an auxiliary lane from OR 217 ON to Sylvan/Scholls Ferry OFF. 11' lanes, 4'-6-8' shoulders.	**$6M:** 1 mile of 2" overlay ($2.0M); 1 mile of barrier/median ($185K); signs & sign bridges ($400K); 1 mile of solid stripping ($21K); 1 mile of skip stripping ($13K); PE/CE/contingency ($3.1M) assume one mile of lane changing or restriping US 26 centerline for typical: barrier-6'shld-12'ramp-12'WB In-12'WB In-12'WB In-10'median-12'EB In-12'EB In-12'EB In-12'aux In-6'shld-barrier	May need to alter lane width and shoulder width to accommodate trucks; i.e., 12', 12', 11', 11' (lanes); 6', 4' (shoulders). Need to model effects/benefits of adding auxiliary lane. Does not provide much benefit. Lane narrowing a concern re: freight movement. Limited demand for Sylvan OFF-Ramp as destination of OR 217 > US 26 EB trips. VISUM flow bundle shows only about 15% Sylvan exit-ramp traffic originates from OR 217 ON-Ramp. Exit ramp volumes to Sylvan low (~500 vph). HCM does not show any significant benefit. Grade in this segment is ~4.25%, and truck movement does not appear to be a problem. Resumption of long-closed ramp meter at OR 217 ON-ramp (due to construction) should improve flows. Recommend downscope proposal as restriping of merge area, with profile 8'-wide solid stripe, and lane merge arrows. (Opt.#1d-2)	
	Skyline/Scholls Ferry On-Ramp Bottleneck	2 INC	Hwy 217 ON Ramp to Skyline/ Scholls Ferry ON-Ramp					2a: acceleration lane appears to be short	
	US 26 WB								
	I-405 SB On-Ramp Bottleneck	4	US 26 Mainline to I-405 Mainline	4a		EB US 26 to SB I-405 entrance ramp realign/relocation. Realign market ramp to allow for larger radius for I-405 SB. Termini: EB US 26 diverge to SB I-405 ramp. Improve sight distance. Two structures potentially affected ((maybe market) and I-405 SB structure). Modifi-cation of wing wall under Mont-gomery St. Structure in between 13th Ave. and Montgomery St. may need to be altered. Pull back ramp: merge sooner. Combine 14th Ave. and Taylor St.	**$32.4M:** 300' x 200'(roadwork), (ramp) 3,000' x 40'H, (walls) 1,300' - 1,400' (structure) 300' (sign bridge)	Braid Montgomery St. with Taylor St.? Sight distance not particularly an issue: perhaps put up signage saying queue ahead would have same impact and aggressive ramp metering for Montgomery St. ON-ramp.	
	US 26 WB								
	I-405 NB On-Ramp Bottleneck	5	US 26 Mainline to I-405 Mainline	5a1		Bring ramp up to Market St. structure and then back down to join with the I-405 NB ON ramp. Relocate I-405 NB to widening structure of Market St.	**$??M:**	Instead of merge lane have aux lane that goes N to Fremont Br.(add lane miles at 14th Ave. OFF and Burnside St. ON) cut back mostly landscaping with impact to 1 wall. Impact ramp meter (1). Can't clear the freeway and get down to ramp. Not physically feasible.	
		5		5a2		Close Market St. Bring I-405 NB up over Market St. and then back down to I-405 NB ON-ramp.	**$??M:**	Not physically feasible. Would result in poor loading.	
		5		5a3		Close Market St. but realign center lane to Montgomery St. Could then use the market exit to support I-405 NB	**>$50M**	*Exceeds Study cost limits.* Does not address the problem. Not physically feasible. Would result in poor loading.	
		5		5b		Close Market St. OFF and use Jefferson St. for downtown exit. Open Jefferson St. to two lanes	**$??M:**	Alternative: Use gate arms on Market for temp closure? Politically challenging to close Market St. and use Jefferson St. as alternative.	

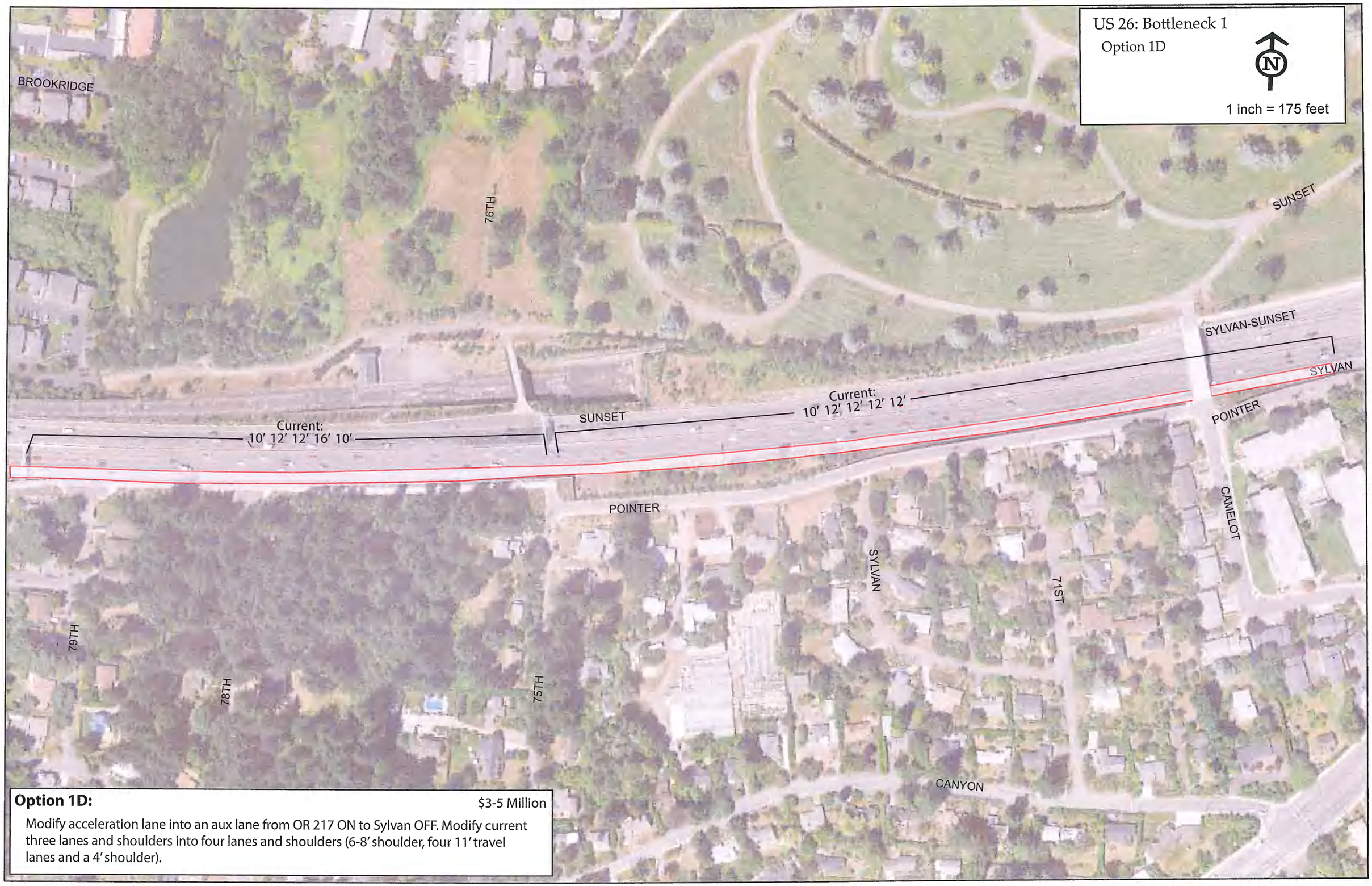
C-BOS: US 26 PROPOSED IMPROVEMENTS

Corridor	Name	Bottle-neck	Study Area	Op-tion	Project Name	Description	Cost Elements	Comments	Priority
		5		6b		Restrict lane change through tunnel with double white striping.	$??M:	Need to analyze further but may not address bottleneck (1/4 mile). Center lane is underutilized now, but provides gaps for merges/weaves.	
	US 26 WB								
	I-405 x US 26 Merge Bottleneck	6	I-405 Ramps at US 26 x I-405 Merge	6c		Flyover from I-405 NB to US 26 WB to tie into future truck lane.	$??M:	Limited benefits compared to cost. Not physically feasible; insufficient length. Why move highest volumes?	
		6		6d		Realign Clay St. ON-ramp to outside south side of US 26 (left of I-405 NB)	$??M:	I-405: would give priority to US 26 instead of I-405: 2(I-405 SB), 1(I-405 NB) merge (Clay St.): perhaps merge Clay St. to right side merge. realign Clay St. to north side with single lane, 405 NB two lanes, SB ramp single lane in middle. Down to three just before tunnel merge.	

Beaverton-Tigard Highway
US 26 EB
1a Extend
double line, or
profile striping
to discourage
early weaves
N
1

Sunset Highway
N
2

US 26: Bottleneck 1
Options 1A, 1B, 1C
N
1 inch = 200 feet
BARNES
MONTEREY
SUNSET-BARNES
SUNSET
HWY 217-SUNSET
SUNSET
PARK
96TH
KNOLLCREST
90TH
89TH
88TH
87TH
87TH
0'
~1200'
~1500'
ARDENWOOD
INGLEWOOD
KATHERINE
85TH
GAYLE
84TH
Option 1A: Minimal Cost
Extend solid line 1200'-1500' from painted gore past first lane drop. Establishes single lane for final OR 217 merge. Prohibits US 26 EB mainline from early weave to outside. Discourages mainline from thinking OR 217 is an add lane instead of merge.
Option 1B: $7 Million
Add mainline and ramp guide signs every half mile from OR 217 to I-405.
Option 1C: $7 Million
Add ATM/Variable Signage from OR 217 to I-405 every half mile: ITS signing, lane assignment signs, variable speed signs.



Option 1D: $3-5 Million

Modify acceleration lane into an aux lane from OR 217 ON to Sylvan OFF. Modify current three lanes and shoulders into four lanes and shoulders (6-8' shoulder, four 11' travel lanes and a 4' shoulder).

US 26: Bottleneck 3
Option 3A
N
1 inch = 333 feet
Option 3A: Cost Unknown
Close Market (1400 volume PM Peak) and redirect to Jefferson (800 volume PM Peak)
MADISON
KINGS
KING
20TH
19TH
MAIN
MADISON
18TH
17TH
16TH
TAYLOR
15TH
SALMON
21ST
HOWARDS
20TH
16TH
JEFFERSON
I405
13TH
COLUMBIA
17TH
19TH
CLAY
14TH
I405
MARKET
KINGSTON
CARTER
KINGSTON
MILL STREET
CLAY
CABLE
18TH
16TH
MARKET
MONTGOMERY
SUNSET
CARTER
MONTGOMERY
UPPER HALL
MILL
HARRISON
JACKSON
21ST
VISTA
14TH
11TH
HALL
12TH
16TH
HARRISON
14TH
13TH
COLLEGE
21ST
MYRTLE
CLIFTON
18TH
17TH
CARDINELL
13TH
10TH
SUNSET
LAUREL
19TH

US 26: Bottleneck 4
Option 4A, 4B, 4C
N
1 inch = 200 feet
Option 4A: ~$32.4 Million
Realign Market to allow for realigning I-405 SB Entrance Ramp.
Option 4B: Cost Unknown
Realign Market to allow for realigning I-405 SB Entrance Ramp.
Option 4C: Cost Unknown
EB US 26 to I-405 SB realignment and widening to two lanes.
MARKET STREET
19TH
17TH
CLAY
MARKET
14TH
I405 FWY-SUNSET HWY
I405 FWY-14TH AVE
JEFFERSON
COLUMBIA
I405
MONTGOMERY
SUNSET
SUNSET
MILL STREET
SUNSET HWY-I405 FWY
13TH AVE-SUNSET HWY
TAYLOR ST-I405 FWY
13TH
CLAY
MARKET
I405
CABLE
18TH
16TH
MONTGOMERY
11TH
MILL
UPPER HALL
HARRISON
JACKSON
VISTA
14TH
HALL
12TH
MONTGOMERY ST-I405 FWY
10TH
HARRISON
19TH
CLIFTON
18TH
17TH
16TH
14TH
13TH
COLLEGE
CARDINELL
13TH
COLLEGE
MYRTLE

US 26: Bottleneck 6
Option 6B, 6C, 6D
N
1 inch = 200 feet
Option 6B: Cost Unknown
Restripe US 26 WB within the tunnel to double white striping, restricting lane changes.
Option 6C: Cost Unknown
Build truck bypass flyover from existing 405 northbound entrance ramp to right lane of US 26 westbound to tie into truck lane downstream.
Option 6D: Cost Unknown
Realign Clay St. On-ramp to outside lane of US 26 westbound.
MARKET STREET
19TH
17TH
CLAY
14TH
I405 FWY-SUNSET HWY
I405 FWY-14TH AVE
JEFFERSON
COLUMBIA
I405
MONTGOMERY
SUNSET
SUNSET
MARKET
MILL STREET
SUNSET HWY-I405 FWY
13TH AVE-SUNSET HWY
TAYLOR ST-I405 FWY
13TH
CLAY
CABLE
18TH
16TH
MONTGOMERY
I405
MARKET
11TH
UPPER HALL
HARRISON
MILL
JACKSON
VISTA
HALL
14TH
12TH
MONTGOMERY ST-I405 FWY
10TH
19TH
HARRISON
CLIFTON
18TH
17TH
16TH
14TH
13TH
COLLEGE
CARDINELL
MYRTLE
13TH
COLLEGE