

UTAH DEPARTMENT OF TRANSPORTATION
REGION ONE

Concept Report

West Center St Traffic Study, NSL

PIN No. 12822
Project No. S-R199(167)

Project Location
North Salt Lake
Redwood Road (SR-68) & Center Street Intersection
Redwood Road (SR-68) & I-215 Interchange



October 2015

CONCEPT REPORT SUMMARY

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SECTION 1: General Information

Project Name:	West Center St Traffic Study, NSL		
Project Manager:	Brett Slater	County:	Davis
Pin Number:	12822	Begin Mile Post:	
Project Number:	S-R199(167)	End Mile Post:	
Route Number:	0068	Design Year:	
Functional Classification:	Principal Arterial	Design Speed:	50 mph

Describe the Purpose/Need for this Project:

The project includes intersection improvements at Redwood Road (SR-68) and Center Street (North Salt Lake) to accommodate future traffic needs in North Salt Lake. The project also includes interchange modifications at I-215 & Redwood Road to improve eastbound exiting traffic as well as meeting future traffic needs.

Major Project Risks:

1. Existing pavement condition (reconstruction or rehabilitation)
2. Right-of-Way takes along Redwood Rd to accommodate 140' section
3. Use of existing bridge for DDI option
4. Proximity of sewer lift station at EB exit ramp
5. ATMS hub located at NW corner of interchange
6. Potential wetlands in SE quadrant of interchange

Project Estimate and Timeline:

Planning Estimate:		Proposed Construction FY:	
Total Project Cost (Current Year):		Estimated Construction Duration:	
Construction Year Estimate (2012):		Recommended Commission Approved Amount:	

Signature Block:

Project Manager	Date	Region Preconstruction Engineer	Date
Region STIP Workshop Chair	Date	Region Director	Date
Prepared By	Date		

CONCEPT REPORT SUMMARY

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SECTION 2: Design Information (Executive Summary)

Roadway / Pavement Summary (Activities 54C, 58C, 76C)	Estimated Construction Cost:	\$
<i>Center St Intersection</i>		\$2,644,077
<i>Diverging Diamond Interchange Option</i>		\$2,606,851
<i>Diamond Interchange Option</i>		\$2,664,359
<i>Improvements along the project include the following:</i>		
<ul style="list-style-type: none">• <i>Widening Redwood Rd to 2-lanes each direction plus a center turn lane</i>• <i>10' wide multi-use path along the west side of Redwood and south side of Center St</i>• <i>5' sidewalks along east side of Redwood</i>• <i>Dual left turn lanes for WB Center St</i>• <i>Exclusive right turn lanes on each leg of intersection</i>• <i>New curb & gutter along all roadways</i>• <i>DDI Configuration:</i><ul style="list-style-type: none">○ <i>New bridge adjacent to existing bridge</i>○ <i>Pedestrian movements in center of DDI</i>○ <i>EB exit ramp improvements to alignment/grade</i>• <i>Diamond Configuration:</i><ul style="list-style-type: none">○ <i>New bridge to replace existing due to magnitude of widening</i>○ <i>Improvements to grades for EB exit ramp traffic</i>○ <i>Pedestrian movements along west side</i>• <i>Pavement assumed to be replaced full depth</i><ul style="list-style-type: none">○ <i>6" HMA</i>○ <i>6" UTBC</i>○ <i>12" Granular Borrow</i>• <i>Drainage:</i><ul style="list-style-type: none">○ <i>New storm drain system with inlet spacing ~300'</i>○ <i>Assumes discharge into adjacent drainage ditch near Interchange</i>		
<i>Opportunity to Reduce Cost:</i>		
<ul style="list-style-type: none">• <i>Eliminate the 5' sidewalk (and corresponding ROW) on the east side of Redwood Rd from I-215 to Center St. Under the current configuration, the sidewalk would involve significant strip takes and impacts to existing parking. This would not preclude the sidewalk from being installed at a later date. Pedestrians would use the multi-use path on the west side of Redwood Rd. This could potentially reduce the 2015 costs by:</i><ul style="list-style-type: none">○ <i>Construction: (\$70,000)</i>○ <i>Right-of-Way: (\$746,000)</i>• <i>Utilize the existing pavement section on Redwood Rd. The current concept includes a full reconstruction of all streets. By utilizing the existing granular and base courses in the existing roadway and replacing the top HMA surface, the overall construction costs could potentially be reduced by (\$983,000). A detailed pavement design was not prepared for this study.</i>		

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Traffic and Safety Summary (Activity 64C)	Estimated Construction Cost:	\$
<i>Center St Intersection</i>		\$169,450
<i>Diverging Diamond Interchange Option</i>		\$561,050
<i>Diamond Interchange Option</i>		\$374,200
<i>Includes new traffic signal at Redwood Rd/Center St as well as a new signal system for each of the interchange options. Lighting is assumed to be included in new signal systems but not corridor wide. Pavement marking is assumed to be standard striping paint with pavement messages being preformed thermoplastic.</i>		

Structures Summary (Activity 62C)	Estimated Construction Cost:	\$
<i>Center St Intersection</i>		\$0
<i>Diverging Diamond Interchange Option</i>		\$3,227,375
<i>Crossovers are placed near the existing diamond intersections and configured such that the NB traffic will utilize the existing bridge over I-215 and that SB traffic will use a new bridge over I-215 constructed parallel to the existing bridge with some separation due to the geometry of the DDI. The existing bridge has sufficient width to accommodate the needs of the interchange layout and the new bridge would be constructed to accommodate 2 lanes plus pedestrian movements.</i>		
<i>Diamond Interchange Option</i>		\$4,594,375
<i>Due to the magnitude of the widening to achieve the width for all traffic lanes, shoulder, and pedestrian movements, the existing bridge would not qualify for widening but would need to be completely replaced.</i>		
<i>Both interchange types include box culvert extensions for the drainage channel just south of the interchange.</i>		

Environmental Summary (Activity 52C)	Estimated Mitigation Cost:	\$
<i>Center St Intersection</i>		\$0
<i>Diverging Diamond Interchange Option</i>		\$100,000
<i>Diamond Interchange Option</i>		\$100,000
<i>Both interchange options anticipate some wetland impact in the southwest quadrant of the interchange.</i>		
<i>No other major environmental items are anticipated in the project</i>		

CONCEPT REPORT SUMMARY

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Right of Way Summary (Activity 56C)	Estimated Property Cost:	\$
<i>Center St Intersection</i>		\$1,499,950
<i>Diverging Diamond Interchange Option</i>		\$42,690
<i>Diamond Interchange Option</i>		\$0
<i>See cost summary for additional detail. In general, property values were estimated at \$6/sf (\$260k/acre). No relocations are anticipated with either option. Due to the extensive widening on Redwood Rd, impacts to existing parking are included in some of the individual parcels. Both interchange options primarily stay within the existing R/W and do not have significant property impact.</i>		

Utility and Railroad Summary (Activity 68C)	Estimated Relocation Cost:	\$
<i>Center St Intersection</i>		\$250,000
<i>Diverging Diamond Interchange Option</i>		\$100,000
<i>Diamond Interchange Option</i>		\$100,000
<i>Assumes that UDOT is only responsible for 50% of private utility costs. All power poles along Redwood Rd will need to be relocated due to the new section width. About 15 fire hydrants need to be relocated, 20 water services need to be restored, and 15 manholes need to be reconstructed. Unknown utility impacts were assigned a cost for miscellaneous work.</i>		

ITS Summary (Activity 66C)	Estimated Construction Cost:	\$
<i>Center St Intersection</i>		\$0
<i>Diverging Diamond Interchange Option</i>		\$100,000
<i>Diamond Interchange Option</i>		\$100,000

Public Involvement Summary (Activity 60C)	Estimated Cost:	\$
<i>Public involvement will require coordination with local municipalities, local residences, and local businesses regarding project construction schedule, traffic impacts, and access impacts.</i>		

Miscellaneous Summary:

CONCEPT REPORT

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Media Relations Form Complete (Activity # 78C)

**PIN:12822 PROJECT # PROJECT NAME: W Center St Traffic Study NSL
Cost Estimate - Concept Level**

Prepared By: Horrocks Engineers Date 8/14/2015

Proposed Project Scope: Widen Redwood Rd + Interchange Options

Approximate Route Reference Mile Post (BEGIN) =	(END) =
Project Length = 0.000 miles	ft
Current FY Year (July-June) = 2015	
Assumed Construction FY Year = 2019	
Construction Items Inflation Factor = 1.22	4 yrs for inflation
Assumed Yearly Inflation for Engineering Services (PE and CE) (%/yr) = 3.0%	
Assumed Yearly Inflation for Right of Way (%/yr) = 2.0%	
Items not Estimated (% of Construction) = 15.0%	
Preliminary Engineering (% of Construction + Incentives) = 8.0%	
Construction Engineering (% of Construction + Incentives) = 10.0%	

Construction Items	DDI + Intersection	Diamond + Intersection	Remarks
Public Information Services	\$27,138	\$30,988	
Roadway and Drainage	\$5,250,928	\$5,308,436	
Traffic and Safety	\$730,500	\$543,650	
Structures	\$3,227,375	\$4,594,375	
Environmental Mitigation	\$100,000	\$100,000	
ITS	\$100,000	\$100,000	
	Subtotal	\$9,435,941	\$10,677,449
	Items not Estimated (15%)	\$1,415,391	\$1,601,617
	Construction Subtotal	\$10,851,332	\$12,279,066
P.E. Cost	P.E. Subtotal	\$869,938	\$984,262 8%
C.E. Cost	C.E. Subtotal	\$1,087,423	\$1,230,327 10%
Right of Way	Right of Way Subtotal	\$1,542,640	\$1,499,950
Utilities	Utilities Subtotal	\$350,000	\$350,000
Incentives	Incentives Subtotal	\$22,895	\$24,205
Miscellaneous	Miscellaneous Subtotal	\$0	\$0

Cost Estimate (ePM screen 505)	DDI + Intersection	
	2015	2019
P.E.	\$870,000	\$979,000
Right of Way	\$1,543,000	\$1,670,000
Utilities	\$350,000	\$425,000
Construction	\$10,851,000	\$13,189,000
C.E.	\$1,087,000	\$1,223,000
Incentives	\$23,000	\$28,000
Aesthetics	0.75% \$81,000	\$98,000
Change Order Contingency	9.00% \$984,000	\$1,196,000
UDOT Oversight	\$0	\$0
Miscellaneous	\$0	\$0
TOTAL	\$15,789,000	\$18,808,000

Cost Estimate (ePM screen 505)	Diamond + Intersection	
	2015	2019
P.E.	\$984,000	\$1,108,000
Right of Way	\$1,500,000	\$1,624,000
Utilities	\$350,000	\$425,000
Construction	\$12,279,000	\$14,925,000
C.E.	\$1,230,000	\$1,384,000
Incentives	\$24,000	\$29,000
Aesthetics	0.75% \$92,000	\$112,000
Change Order Contingency	9.00% \$1,113,000	\$1,353,000
UDOT Oversight	\$0	\$0
Miscellaneous	\$0	\$0
TOTAL	\$17,572,000	\$20,960,000

Project Assumptions/Risks

1	8
2	9
3	10
4	11
5	12
6	13
7	14

PIN:12822 PROJECT # PROJECT NAME: W Center St Traffic Study NSL
Cost Estimate - Concept Level

Prepared By: Horrocks Engineers

Date 10/30/2015

Proposed Project Scope: New DDI

Approximate Route Reference Mile Post (BEGIN) =	(END) =
Project Length = 0.000 miles	ft
Current FY Year (July-June) = 2015	
Assumed Construction FY Year = 2020	
Construction Items Inflation Factor = 1.27	5 yrs for inflation
Assumed Yearly Inflation for Engineering Services (PE and CE) (%/yr) = 3.0%	
Assumed Yearly Inflation for Right of Way (%/yr) = 2.0%	
Items not Estimated (% of Construction) = 15.0%	
Preliminary Engineering (% of Construction + Incentives) = 8.0%	
Construction Engineering (% of Construction + Incentives) = 10.0%	

Construction Items	Cost	Remarks
<u>Public Information Services</u>	\$19,025	
<u>Roadway and Drainage</u>	\$2,606,851	
<u>Traffic and Safety</u>	\$561,050	
<u>Structures</u>	\$3,227,375	
<u>Environmental Mitigation</u>	\$100,000	
<u>ITS</u>	\$100,000	
	Subtotal	
	\$6,614,301	
	Items not Estimated (15%)	
	\$992,145	
	Construction Subtotal	
	\$7,606,446	
P.E. Cost	P.E. Subtotal	8%
	\$609,231	
C.E. Cost	C.E. Subtotal	10%
	\$761,539	
Right of Way	Right of Way Subtotal	
	\$42,690	
Utilities	Utilities Subtotal	
	\$100,000	
Incentives	Incentives Subtotal	
	\$8,944	
Miscellaneous	Miscellaneous Subtotal	
	\$0	

Cost Estimate (ePM screen 505)	2015	2020
P.E.	\$609,000	\$706,000
Right of Way	\$43,000	\$47,000
Utilities	\$100,000	\$127,000
Construction	\$7,606,000	\$9,661,000
C.E.	\$762,000	\$883,000
Incentives	\$9,000	\$11,000
Aesthetics	0.75% \$57,000	\$72,000
Change Order Contingency	9.00% \$690,000	\$876,000
UDOT Oversight	\$0	\$0
Miscellaneous	\$0	\$0
TOTAL	\$9,876,000	\$12,383,000

PROPOSED COMMISSION REQUEST	TOTAL	\$9,876,000	TOTAL	\$12,383,000
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Project Assumptions/Risks

1 Existing bridge over I-215 remains	8	_____
2 Sewer lift station is avoided	9	_____
3 ATMS hub is not relocated	10	_____
4 Pedestrian route is down the middle of the DDI	11	_____
5	12	_____
6	13	_____
7	14	_____

Roadway and Drainage

PIN:12822 PROJECT # PROJECT NAME: W Center St Traffic Study NSL

Item #	Item	Quantity	Units	Price	Cost	Remarks
Roadway						
012850010	Mobilization	1	Lump	\$761,000.00	\$761,000.00	10% of construction
015540005	Traffic Control	1	Lump	\$380,500.00	\$380,500.00	5% of construction
01557001*	Maintenance of Traffic	1	Lump	\$76,100.00	\$76,100.00	1% of construction
015720020	Dust Control and Watering	1,591	1000 gal	\$15.00	\$23,865.00	
020560005	Borrow (Plan Quantity)	0	cu yd	\$15.00	\$0.00	
020560015	Granular Borrow (Plan Quantity)	6,839	cu yd	\$18.00	\$123,102.00	
023160020	Roadway Excavation (Plan Quantity)	5,000	cu yd	\$15.00	\$75,000.00	
027210020	Untreated Base Course (Plan Quantity)	3,488	cu yd	\$25.00	\$87,200.00	
027410060	HMA - 3/4 Inch	7,015	Ton	\$80.00	\$561,200.00	
027710025	Concrete Curb and Gutter Type B1	1,080	ft	\$15.00	\$16,200.00	
027760010	Concrete Sidewalk	10,270	sq ft	\$3.20	\$32,864.00	
027760020	Concrete Median Filler	48,500	sq ft	\$2.00	\$97,000.00	
027710017	Concrete Curb Type B5	4,130	ft	\$14.00	\$57,820.00	
Roadway Subtotal					\$2,291,851	
Drainage						
023730010	Loose Riprap	250	cu yd	\$200.00	\$50,000.00	
026101386	18 Inch Irrigation/Storm Drain, Class C, smooth	3,000	ft	\$65.00	\$195,000.00	
026330130	Concrete Drainage Structure 5 ft to 7 ft deep - CB 9	20	Each	\$3,500.00	\$70,000.00	
Drainage Subtotal					\$315,000	
PI						
013150010	Public Information Services	1	Lump	\$19,025.00	\$19,025	0.25% of construction

Traffic, Safety & ITS

PIN:12822 PROJECT # PROJECT NAME: W Center St Traffic Study NSL

Item #	Item	Quantity	Units	Price	Cost	Remarks
Traffic						
027650050	Pavement Marking Paint	156	gal	\$25.00	\$3,900.00	
027680105	Pavement Message (Preformed Thermoplastic)	50	Each	\$150.00	\$7,500.00	
028410086	W-Beam Guardrail 72 inch Wood Post	300	ft	\$18.00	\$5,400.00	
028430035	Crash Cushion Type G	2	Each	\$3,000.00	\$6,000.00	
	Cast In Place Concrete Constant Slope Barrier 42 Inch	3,150	ft	\$55.00	\$173,250.00	
028910028	Sign Type A-1, 12 Inch X 36 Inch	50	Each	\$300.00	\$15,000.00	
Signals						
02892001D	Traffic Signal System	2	Lump	\$150,000.00	\$300,000.00	
Lighting						
16525001D	Highway Lighting System	1	Lump	\$50,000.00	\$50,000.00	
Traffic and Safety Subtotal					\$561,050	
ITS						
	ITS Improvements	1	Lump	\$100,000.00	\$100,000.00	
ITS Subtotal					\$100,000	

Structures

PIN:12822 PROJECT # PROJECT NAME: W Center St Traffic Study NSL

Item #	Item	Quantity	Units	Price	Cost	Remarks
Bridges						
	Bridge Over I-215	12,000	sq ft	\$200.00	\$2,400,000.00	Assumed 240x50 (deck area)
023320010	Embankment for Bridge	10,000	cu yd	\$40.00	\$400,000.00	
Walls						
	Retaining Wall	4,000	Sq ft	\$65.00	\$260,000.00	Assumed LxH (wall area)
	Retaining Wall (Wetlands)	1,075	Sq ft	\$65.00	\$69,875.00	Assumed 215'x5' (wall area)
Sign Structures						
Hydraulics						
	Extend Box Culvert	65	ft	\$1,500.00	\$97,500.00	
Geotech						
Structures Subtotal					\$3,227,375	

Environmental and Landscaping

PIN:12822 PROJECT # PROJECT NAME: W Center St Traffic Study NSL

Item #	Item	Quantity	Units	Price	Cost	Remarks
Environmental						
	Wetland Mitigation	1	Lump	\$100,000.00	\$100,000.00	
Temporary Erosion Control						
Landscaping						
Environmental Mitigation Subtotal					\$100,000	

Utilities, Right of Way, and Incentives

PIN:12822 PROJECT # PROJECT NAME: W Center St Traffic Study NSL

Item #	Item	Quantity	Units	Price	Cost	Remarks
Utilities						
	Miscellaneous	1	Lump	\$100,000.00	\$100,000.00	
Utilities Subtotal					\$100,000	
Right-of-way						
	(11020018)	7,115	sq ft	\$6.00	\$42,690.00	
Right-of-Way Subtotal					\$42,690	
Incentives						
00000602*	Hot Mix Asphalt (HMA) Incentive	1	Lump	\$8,944.13	\$8,944.13	
Incentives Subtotal					\$8,944	

PIN:12822 PROJECT # PROJECT NAME: W Center St Traffic Study NSL
Cost Estimate - Concept Level

Prepared By: Horrocks Engineers Date 10/30/2015

Proposed Project Scope: Wide Diamond Option

Approximate Route Reference Mile Post (BEGIN) =	(END) =
Project Length = 0.000 miles	ft
Current FY Year (July-June) = 2015	
Assumed Construction FY Year = 2020	
Construction Items Inflation Factor = 1.27	5 yrs for inflation
Assumed Yearly Inflation for Engineering Services (PE and CE) (%/yr) = 3.0%	
Assumed Yearly Inflation for Right of Way (%/yr) = 2.0%	
Items not Estimated (% of Construction) = 15.0%	
Preliminary Engineering (% of Construction + Incentives) = 8.0%	
Construction Engineering (% of Construction + Incentives) = 10.0%	

Construction Items	Cost	Remarks
<u>Public Information Services</u>	\$22,875	
<u>Roadway and Drainage</u>	\$2,664,359	
<u>Traffic and Safety</u>	\$374,200	
<u>Structures</u>	\$4,594,375	
<u>Environmental Mitigation</u>	\$100,000	
<u>ITS</u>	\$100,000	
	Subtotal	
	\$7,855,809	
	Items not Estimated (15%)	
	\$1,178,371	
	Construction Subtotal	
	\$9,034,180	
P.E. Cost	P.E. Subtotal	8%
	\$723,555	
C.E. Cost	C.E. Subtotal	10%
	\$904,443	
Right of Way	Right of Way Subtotal	
	\$0	
Utilities	Utilities Subtotal	
	\$100,000	
Incentives	Incentives Subtotal	
	\$10,254	
Miscellaneous	Miscellaneous Subtotal	
	\$0	

Cost Estimate (ePM screen 505)	2015	2020
P.E.	\$724,000	\$839,000
Right of Way	\$0	\$0
Utilities	\$100,000	\$127,000
Construction	\$9,034,000	\$11,475,000
C.E.	\$904,000	\$1,048,000
Incentives	\$10,000	\$13,000
Aesthetics	0.75% \$68,000	\$86,000
Change Order Contingency	9.00% \$819,000	\$1,040,000
UDOT Oversight	\$0	\$0
Miscellaneous	\$0	\$0
TOTAL	\$11,659,000	\$14,628,000

PROPOSED COMMISSION REQUEST	TOTAL	\$11,659,000	TOTAL	\$14,628,000
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Project Assumptions/Risks

1 I-215 bridge replaced	8
2 Sewer lift station avoided	9
3 ATMS hub not relocated	10
4 10' wide trail on West side	11
5 Potential wetland impacts (SE quadrant)	12
6	13
7	14

Roadway and Drainage

PIN:12822 PROJECT # PROJECT NAME: W Center St Traffic Study NSL

Item #	Item	Quantity	Units	Price	Cost	Remarks
Roadway						
012850010	Mobilization	1	Lump	\$915,000.00	\$915,000.00	10% of construction
015540005	Traffic Control	1	Lump	\$457,500.00	\$457,500.00	5% of construction
01557001*	Maintenance of Traffic	1	Lump	\$91,500.00	\$91,500.00	1% of construction
015720020	Dust Control and Watering	1,658	1000 gal	\$15.00	\$24,870.00	
020560005	Borrow (Plan Quantity)	0	cu yd	\$15.00	\$0.00	
020560015	Granular Borrow (Plan Quantity)	7,815	cu yd	\$18.00	\$140,670.00	
023160020	Roadway Excavation (Plan Quantity)	5,000	cu yd	\$15.00	\$75,000.00	
027210020	Untreated Base Course (Plan Quantity)	3,996	cu yd	\$25.00	\$99,900.00	
027410060	HMA - 3/4 Inch	8,042	Ton	\$80.00	\$643,360.00	
027710025	Concrete Curb and Gutter Type B1	1,995	ft	\$15.00	\$29,925.00	
027760010	Concrete Sidewalk	9,030	sq ft	\$3.20	\$28,896.00	
027760020	Concrete Median Filler	1,310	sq ft	\$2.00	\$2,620.00	
027710017	Concrete Curb Type B5	187	ft	\$14.00	\$2,618.00	
Roadway Subtotal					\$2,511,859	
Drainage						
023730010	Loose Riprap	100	cu yd	\$200.00	\$20,000.00	
026101386	18 Inch Irrigation/Storm Drain, Class C, smooth	1,500	ft	\$65.00	\$97,500.00	
026330130	Concrete Drainage Structure 5 ft to 7 ft deep - CB 9	10	Each	\$3,500.00	\$35,000.00	
Drainage Subtotal					\$152,500	
PI						
013150010	Public Information Services	1	Lump	\$22,875.00	\$22,875	0.25% of construction

Traffic, Safety & ITS

PIN:12822 PROJECT # PROJECT NAME: W Center St Traffic Study NSL

Item #	Item	Quantity	Units	Price	Cost	Remarks
Traffic						
027650050	Pavement Marking Paint	320	gal	\$25.00	\$8,000.00	
027680105	Pavement Message (Preformed Thermoplastic)	30	Each	\$150.00	\$4,500.00	
028410086	W-Beam Guardrail 72 inch Wood Post	300	ft	\$18.00	\$5,400.00	
028430035	Crash Cushion Type G	2	Each	\$3,000.00	\$6,000.00	
	Cast In Place Concrete Constant Slope Barrier 42 Inch	1,660	ft	\$55.00	\$91,300.00	
028910028	Sign Type A-1, 12 Inch X 36 Inch	30	Each	\$300.00	\$9,000.00	
Signals						
02892001D	Traffic Signal System	2	Lump	\$100,000.00	\$200,000.00	
Lighting						
16525001D	Highway Lighting System	1	Lump	\$50,000.00	\$50,000.00	
Traffic and Safety Subtotal					\$374,200	
ITS						
	ITS Improvements	1	Lump	\$100,000.00	\$100,000.00	
ITS Subtotal					\$100,000	

Structures

PIN:12822 PROJECT # PROJECT NAME: W Center St Traffic Study NSL

Item #	Item	Quantity	Units	Price	Cost	Remarks
Bridges						
	New Bridge	20,210	sq ft	\$200.00	\$4,042,000.00	Assumed 215x94 (deck area)
023320010	Embankment for Bridge		cu yd	\$40.00		
Walls						
	Retaining Wall	5,350	Sq ft	\$65.00	\$347,750.00	Assumed LxH (wall area)
	Retaining Wall (Wetlands)	2,225	Sq ft	\$65.00	\$144,625.00	Assumed 445'x5' (wall area)
Sign Structures						
Hydraulics						
	Extend Box Culvert	40	ft	\$1,500.00	\$60,000.00	
Geotech						
Structures Subtotal					\$4,594,375	

Environmental and Landscaping

PIN:12822 PROJECT # PROJECT NAME: W Center St Traffic Study NSL

Item #	Item	Quantity	Units	Price	Cost	Remarks
Environmental						
	Wetland Mitigation	1	Lump	\$100,000.00	\$100,000.00	
Temporary Erosion Control						
Landscaping						
Environmental Mitigation Subtotal					\$100,000	

Utilities, Right of Way, and Incentives

PIN:12822 PROJECT # PROJECT NAME: W Center St Traffic Study NSL

Item #	Item	Quantity	Units	Price	Cost	Remarks
Utilities						
	Miscellaneous	1	Lump	\$100,000.00	\$100,000.00	
Utilities Subtotal					\$100,000	
Right-of-way						
Right-of-Way Subtotal					\$0	
Incentives						
00000601*	Pavement Smoothness Incentive	1	Lump			
00000602*	Hot Mix Asphalt (HMA) Incentive	1	Lump	\$10,253.55	\$10,253.55	
00000603*	Stone Matrix Asphalt (SMA) Incentive	1	Lump			
00000604*	Open Graded Surface Course Incentive	1	Lump			
00000605*	Bonded Wearing Course Incentive	1	Lump			
00000606*	Early Completion - Time	0	Cal'd			
00000607*	Lane Rental Incentive	0	Hours			
00000608*	Miscellaneous Incentive	1	Lump			
Incentives Subtotal					\$10,254	

PIN:12822 PROJECT # PROJECT NAME: W Center St Traffic Study NSL
Cost Estimate - Concept Level

Prepared By: Horrocks Engineers Date 10/30/2015

Proposed Project Scope: Redwood Rd & Center St Intersection

Approximate Route Reference Mile Post (BEGIN) =	(END) =
Project Length = 0.000 miles	ft
Current FY Year (July-June) = 2015	
Assumed Construction FY Year = 2019	
Construction Items Inflation Factor = 1.22	4 yrs for inflation
Assumed Yearly Inflation for Engineering Services (PE and CE) (%/yr) = 3.0%	
Assumed Yearly Inflation for Right of Way (%/yr) = 2.0%	
Items not Estimated (% of Construction) = 15.0%	
Preliminary Engineering (% of Construction + Incentives) = 8.0%	
Construction Engineering (% of Construction + Incentives) = 10.0%	

Construction Items	Cost	Remarks
<u>Public Information Services</u>	\$8,113	
<u>Roadway and Drainage</u>	\$2,644,077	
<u>Traffic and Safety</u>	\$169,450	
<u>Structures</u>	\$0	
<u>Environmental Mitigation</u>	\$0	
<u>ITS</u>	\$0	
	Subtotal	
	\$2,821,640	
	Items not Estimated (15%)	
	\$423,246	
	Construction Subtotal	
	\$3,244,886	
P.E. Cost	P.E. Subtotal	8%
	\$260,707	
C.E. Cost	C.E. Subtotal	10%
	\$325,884	
Right of Way	Right of Way Subtotal	
	\$1,499,950	
Utilities	Utilities Subtotal	
	\$250,000	
Incentives	Incentives Subtotal	
	\$13,951	
Miscellaneous	Miscellaneous Subtotal	
	\$0	

Cost Estimate (ePM screen 505)	2015	2019
P.E.	\$261,000	\$294,000
Right of Way	\$1,500,000	\$1,624,000
Utilities	\$250,000	\$304,000
Construction	\$3,245,000	\$3,944,000
C.E.	\$326,000	\$367,000
Incentives	\$14,000	\$17,000
Aesthetics	0.75% \$24,000	\$29,000
Change Order Contingency	9.00% \$294,000	\$357,000
UDOT Oversight	\$0	\$0
Miscellaneous	\$0	\$0
TOTAL	\$5,914,000	\$6,936,000

PROPOSED COMMISSION REQUEST	TOTAL	\$5,914,000	TOTAL	\$6,936,000
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Project Assumptions/Risks

1 Reconstruction of Redwood Rd with full depth HMA is included	8	_____
2 Final pavement recommendation could potentially be PCCP	9	_____
3 Included the NSL 140' wide typical section	10	_____
4 Contaminated soils could be present	11	_____
5	12	_____
6	13	_____
7	14	_____

Roadway and Drainage

PIN:12822 PROJECT # PROJECT NAME: W Center St Traffic Study NSL

Item #	Item	Quantity	Units	Price	Cost	Remarks
Roadway						
012850010	Mobilization	1	Lump	\$324,500.00	\$324,500.00	10% of construction
015540005	Traffic Control	1	Lump	\$162,250.00	\$162,250.00	5% of construction
01557001*	Maintenance of Traffic	1	Lump	\$32,450.00	\$32,450.00	1% of construction
015720020	Dust Control and Watering	704	1000 gal	\$15.00	\$10,560.00	
020560005	Borrow (Plan Quantity)	0	cu yd	\$15.00	\$0.00	
020560015	Granular Borrow (Plan Quantity)	10,208	cu yd	\$18.00	\$183,744.00	
023160020	Roadway Excavation (Plan Quantity)	21,067	cu yd	\$15.00	\$316,005.00	
027210020	Untreated Base Course (Plan Quantity)	5,383	cu yd	\$25.00	\$134,575.00	
027410060	HMA - 3/4 Inch	10,942	Ton	\$80.00	\$875,360.00	
027710025	Concrete Curb and Gutter Type B1	7,305	ft	\$15.00	\$109,575.00	
027760010	Concrete Sidewalk	11,190	sq ft	\$3.20	\$35,808.00	
Roadway Subtotal					\$2,184,827	
Drainage						
026101386	18 Inch Irrigation/Storm Drain, Class C, smooth	5,450	ft	\$65.00	\$354,250.00	
026330130	Concrete Drainage Structure 5 ft to 7 ft deep - CB 9	30	Each	\$3,500.00	\$105,000.00	
Drainage Subtotal					\$459,250	
PI						
013150010	Public Information Services	1	Lump	\$8,112.50	\$8,113	0.25% of construction

Traffic, Safety & ITS

PIN:12822 PROJECT # PROJECT NAME: W Center St Traffic Study NSL

Item #	Item	Quantity	Units	Price	Cost	Remarks
Traffic						
027650050	Pavement Marking Paint	298	gal	\$25.00	\$7,450.00	
027680105	Pavement Message (Preformed Thermoplastic)	20	Each	\$150.00	\$3,000.00	
028910028	Sign Type A-1, 12 Inch X 36 Inch	30	Each	\$300.00	\$9,000.00	
Signals						
02892001D	Traffic Signal System	1	Lump	\$150,000.00	\$150,000.00	
Lighting						
Traffic and Safety Subtotal					\$169,450	
ITS						
ITS Subtotal					\$0	

Utilities, Right of Way, and Incentives

PIN:12822 PROJECT # PROJECT NAME: W Center St Traffic Study NSL

Item #	Item	Quantity	Units	Price	Cost	Remarks
Utilities						
	Reconstruct Manhole	15	Each	\$1,000.00	\$15,000.00	
	Restore Water Service	20	Each	\$1,500.00	\$30,000.00	
	Relocate Hydrant	15	Each	\$2,000.00	\$30,000.00	
	Gas	1	Lump	\$37,500.00	\$37,500.00	Misc Loops Assumed 50/50 Split UDOT Portion Only
	Power - Redwood Rd	1	Lump	\$50,000.00	\$50,000.00	Assumed 50/50 Split UDOT Portion Only
	Power - Center St	1	Lump	\$12,500.00	\$12,500.00	Assumed 50/50 Split UDOT Portion Only
	Telecomm	1	Lump	\$75,000.00	\$75,000.00	Misc Loops Assumed 50/50 Split UDOT Portion Only
Utilities Subtotal					\$250,000	
Right-of-way						
	271 S 885th (012350101)	6,030	sq ft	\$6.00	\$36,180.00	
	(011000033)	2,825	sq ft	\$6.00	\$16,950.00	
	(011000030)	5,260	sq ft	\$6.00	\$31,560.00	
	(011000027)	7,135	sq ft	\$6.00	\$42,810.00	
	101 S Redwood Rd (014100002)	29,185	sq ft	\$6.00	\$175,110.00	
	845 W Center St (014100001)	12,135	sq ft	\$6.00	\$72,810.00	
	95 N 700 (010830083)	5,420	sq ft	\$6.00	\$32,520.00	
	800 W Center St (014010001)	580	sq ft	\$6.00	\$3,480.00	
	(011000032)	10,290	sq ft	\$6.00	\$61,740.00	
	895 W Center St (011000025)	2,720	sq ft	\$6.00	\$16,320.00	
	170 S Redwood Rd (011000005)	5,650	sq ft	\$6.00	\$33,900.00	
	(011000006)	2,315	sq ft	\$6.00	\$13,890.00	
	(011000041)	1,005	sq ft	\$6.00	\$6,030.00	
	(011300001/011300021)	7,775	sq ft	\$6.00	\$46,650.00	
	Right-of-Way Admin	14	Each	\$15,000.00	\$210,000.00	
	Parking Impacts	1	Lump	\$400,000.00	\$400,000.00	East side of Redwood Rd between interchange and Center St
	Right-of-Way Contingency	1	Lump	\$300,000.00	\$300,000.00	
Right-of-Way Subtotal					\$1,499,950	
Incentives						
	00000602* Hot Mix Asphalt (HMA) Incentive	1	Lump	\$13,951.05	\$13,951.05	
Incentives Subtotal					\$13,951	



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Imagery © Google



W Center Street Traffic Study NSL

DDI Option

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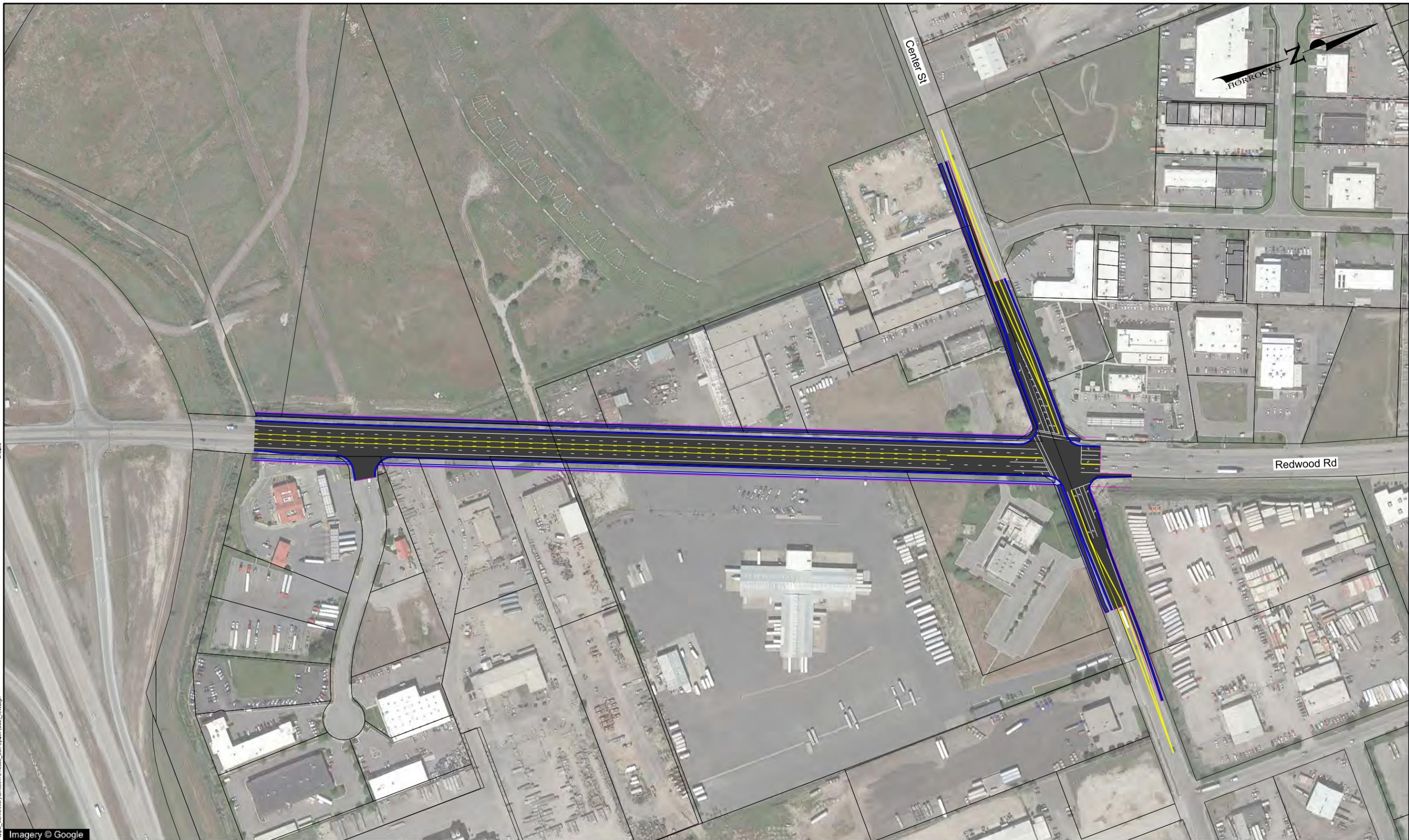


W Center St Traffic Study NSL

Wide Diamond Option

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7/20/2015



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Imagery © Google

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W Center Street Traffic Study NSL

REDWOOD RD & CENTER ST

SCALE:
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DATE:
7/20/2015

Appendix

Traffic Evaluation



MEMORANDUM

To: City of North Salt Lake and UDOT Region One
From: Avenue Consultants
Date: September 23, 2015
Subject: West Center Street Traffic Study

This memo describes a traffic study performed for the City of North Salt Lake and UDOT Region One that evaluated several issues around the area of Legacy Parkway, I-215, Center Street, and Redwood Road (SR-68). The specific items studied were:

1. The need for a new interchange on Legacy Parkway at Center Street
2. The need for full system-to-system ramps at the interchanges of I-215 & Legacy Parkway and I-215 & I-15
3. Capacity improvements for the intersection of Center Street and Redwood Road
4. Capacity improvements for the interchange of I-215 and Redwood Road

Each of these items was studied for future 2040 conditions, as described in the following sections.

Analysis Methodology

The analyses performed for this study were performed using the Wasatch Front Regional Council's travel demand model and the VISSIM traffic operations analysis software. This section describes how each of those tools were used.

Travel Demand Modeling

Version 7.0.2 of the WFRC travel demand model was used for this study. The travel model uses land use information and the transportation network (roadway and transit) as inputs and projects usage of each component of the transportation system. At the beginning of the study, land use information including existing and projected residential and employment data was obtained from WFRC and summarized for North Salt Lake. These results were discussed with city staff to ascertain their reasonableness, which resulted in several modifications to land use data, namely shifting households and employment between zones to more accurately reflect the city's existing and future land use.

TAZ Splits

The WFRC model contains ten Traffic Analysis Zones (TAZs) within the North Salt Lake area, which are roughly within the corporate limits. TAZs are the geographic building blocks of the travel model and land use data assumptions are made for each of them. Five TAZs within the North Salt Lake area were split bringing the total number of TAZs for the city to sixteen. These splits included locations where existing roadways produce a natural division, such as along Redwood Road, Legacy Parkway, and Center Street, as well as large or narrow TAZs. These TAZ splits allow the model to more finely distribute traffic on the surrounding roadway network so that it can be sensitive to the alternatives studied.



Land Use Data

Within the North Salt Lake area there were 4,130 households and 11,820 jobs in 2011. The jobs are divided into three subcategories: retail, industrial, and other (office). Totals by category are shown in Table 1.

Table 1 – Residential and Employment Totals for North Salt Lake

Land Use Category	2011	2040	Change	% Change
Households	4,130	6,820	2,690	65%
Population	12,510	17,060	4,550	36%
Household Size	3.03	2.50	-0.53	-17%
Total Employment	11,820	16,180	4,360	37%
Retail	1,180	1,760	580	49%
Industrial	4,280	4,760	480	11%
Other	6,360	9,660	3,300	52%

Between 2011 and 2040 there is a projected growth of 2,690 households for a 65% increase from 4,130 households in 2011 to 6,820 households in 2040. Employment is expected to grow by 4,360 jobs for a 37% increase from 11,820 jobs in 2011 to 16,180 jobs in 2040. The growth in employment is spread between the three subcategories with the greatest increase in other employment with 3,300 additional jobs followed by retail with 580 additional jobs and finally industrial with 480 additional jobs.

Land Use Redistribution

North Salt Lake staff were largely in agreement with the household projections by WFRC for 2040. One small adjustment to the WFRC land use was shifting some households out of the southwest quadrant of the Redwood Road and Center Street intersection (TAZ 490) where household numbers were twice what the city expected. Other TAZ household projections were consistent with the number of units in current or planned developments. The final distribution of households by TAZ is shown in the *Household Growth per TAZ (2011 to 2040)* figure located in the appendix.

Employment numbers required greater redistribution. City-wide employment growth was consistent with North Salt Lake expectations, but growth numbers at the individual TAZ level were adjusted. Employment from several high growth TAZs were distributed to neighboring TAZs where WFRC had projected reductions in employment. The redistribution of employment resulted in growth for all TAZs. The final distribution of total employment by TAZ is shown in the *Total Employment Growth per TAZ (2011 to 2040)* figure located in the appendix.

Transportation Network

Base assumptions for Legacy Parkway includes three lanes in each direction, an increased speed limit of 70 MPH, and the removal of commercial vehicle restrictions. Consistent with the Regional Transportation Plan, Redwood Road was assumed to have a five-lane cross-section along its entire length.

Traffic Operations Analysis

As mentioned, the VISSIM software was used to evaluate traffic operations. VISSIM is a micro-simulation tool that is very robust in its capabilities. It was selected in part because it allows for the evaluation of innovative solutions such as a Diverging Diamond Interchange (DDI). Another benefit of VISSIM is that it can model in detail the interaction between traffic signals in the model, which is especially important when considering a diamond interchange, such as on Redwood Road at I-215, because of the distance close proximity of the two signals.



Traffic Counts

To prepare the VISSIM model, existing traffic volumes were collected on Tuesday, November 18, 2014. Intersection turning movement counts were performed at twelve intersections on Redwood Road between Recreation Drive and 500 South, at Center Street and Foxboro Street, and at the Legacy Parkway interchange on 500 South. The counts were collected between 7:00 AM and 9:00 AM and between 4:00 PM and 6:00 PM. The PM peak hour was determined to be from 4:45 PM to 5:45 PM. Vehicle volumes in the PM peak hour were then balanced between intersections and driveways through the project area. Where there were long distances between study intersections, “dummy” driveways were added to account for the differences in vehicle volumes. The existing traffic volumes are shown in the *2014 Weekday Peak Hour Turning Movement Volumes* figure located in the appendix.

Existing traffic signal timing data were obtained for the UDOT Traffic Operations Center and entered into the VISSIM model. The existing models were then calibrated to mimic existing traffic congestion. Where possible VISSIM standard settings were maintained, changes were only made when deemed appropriate to match existing traffic patterns during the calibration process.

Future Traffic Volumes

Future year traffic volumes were developed using the WFRC travel demand model and the balanced 2014 traffic volumes. The travel model was run for the base year (2011) and for the future year (2040). AM and PM peak hour volumes were developed for 2040 using principles described in the National Highway Cooperative Research Program (NCHRP) Report 255 document. In short, the travel model was used to estimate the growth between the base year and the future year for each intersection leg for traffic into and out of the intersection. That growth was then applied to the 2014 traffic count volumes and the resulting volumes balanced to ensure the correct number of inbound and outbound vehicles on each leg of the intersection. The estimated 2040 traffic volumes are shown in the *2040 Weekday Peak Hour Turning Movement Volumes* figure located in the appendix.

Interim year volumes for 2025, 2030, and 2035 were estimated for each intersection turning movement via linear interpolation between the 2014 and 2040 volumes.

VISSIM Analysis

For each VISSIM analysis (e.g. existing conditions, 2040 no build, 2040 build), the model was run at least 10 times and the results averaged. The key measure of effectiveness extracted from the VISSIM models was average vehicle delay, which was used to determine level of service (LOS), as described in the *2010 Highway Capacity Manual*. Level of service was calculated for signalized intersections and interchanges. A description of their respective LOS criteria is shown in Table 2, below.

Table 2 – Signalized Intersection and Interchange Level of Service Criteria

Level of Service	Traffic Conditions	Signalized Intersection Average Delay (seconds/vehicle)	Interchange Average Delay (seconds/vehicle)
A	Free Flow Operations / Insignificant Delay	0 ≤ 10.0	0 ≤ 15.0
B	Smooth Operations / Short Delays	> 10.0 and ≤ 20.0	> 15.0 and ≤ 30.0
C	Stable Operations / Acceptable Delays	> 20.0 and ≤ 35.0	> 30.0 and ≤ 55.0
D	Approaching Unstable Operations / Tolerable	> 35.0 and ≤ 55.0	> 55.0 and ≤ 85.0
E	Unstable Operations / Significant Delays Begin	> 55.0 and ≤ 80.0	> 85.0 and ≤ 120.0
F	Very Poor Operations / Excessive Delays Occur	> 80.0	> 120.0

Source: Highway Capacity Manual 2010, Transportation Research Board



Beginning with the no build models, where no changes were made except to signal timings, additional features were then added to the models to identify improvement needs and their impacts on the level of service. In addition to added features such as right turn pockets, signal timings changes were made as necessary. This is based on the assumption that future signal timings will be optimized upon the completion of any roadway improvement projects.

Center Street Interchange and System-to-System Connections

The WFRC travel model was used to analyze the need for a new Center Street interchange on Legacy Parkway and new system-to-system ramps at the interchanges of I-215 at Legacy Parkway and I-15. Specifically, the new system-to-system ramps at Legacy Parkway would be to and from the west, while at I-15 they would be to and from the south. The analyses were performed for 2040 conditions.

Interchange Scenarios

The following four interchange scenarios were analyzed:

1. No System-to-System Ramps
2. With System-to-System Ramps
3. Center Street Interchange
4. 1100 North Interchange

The *No System-to-System Ramps* scenario includes the current system-to-system ramp configurations. The *With System-to-System Ramps* scenario includes the addition of ramps to allow for the movement of traffic from Legacy Parkway to I-15 south and vice versa. This would require four new system-to-system ramps: two ramps at the Legacy Parkway/I-215 interchange and two ramps at the I-215 to I-15 interchange. The *Center Street Interchange* scenario includes a full interchange on Legacy Parkway at Center Street, in addition to the four new system-to-system ramps. Finally, the *1100 North Interchange* scenario moves the new interchange north on Legacy Parkway to 1100 North and keeps the new system-to-system connections. While the feasibility of an interchange at 1100 North would be highly unlikely, given current development in the area, this scenario was used illustratively to analyze the sensitivity of demand with regard to moving the interchange farther north.

The resulting ramp and arterial volumes for each of the four scenarios are shown in the *Estimated 2040 Daily Volumes* figures located in the appendix. Table 3 summarizes total volumes by interchange.

Table 3 – 2040 Daily Volumes by Interchange Scenario

Scenario	Total Estimated 2040 Daily Volumes					
	System-to-System Ramps		Interchange Ramps			
	I-215 East to/from Legacy	I-15 South to/from I-215	Redwood Road	500 South	Center Street	1100 North
No System-to-System Ramps	n/a	n/a	25,600	11,200	n/a	n/a
With System-to-System Ramps	60	8,800	31,200	11,200	n/a	n/a
Center Street Interchange	1,000	8,600	24,800	10,400	12,000	n/a
1100 North Interchange	1,400	9,400	28,200	6,200	n/a	11,200

General conclusions from the analysis include the following:

- The 2040 demand for a new interchange on Legacy Parkway between 500 South and Legacy Parkway is low. The 12,000 vehicles per day using a Center Street interchange and the 11,200 using an 1100 North interchange hardly justify a new interchange.
- Demand at a Center Street interchange is mainly to and from the south with 4,900 vehicles per day for each direction. The demand for ramps to/from the north at a new Center Street interchange is quite low with only 1,100 vehicles per day in each direction. The low demand to and from the north counters the original thought that businesses along the Center Street corridor would like to have better access to and from the north on Legacy Parkway.
- A new interchange on Legacy Parkway benefits Redwood Road. In 2040, the volumes for the Redwood Road ramps to and from the west are reaching between 10,500 and 11,800 vehicles per day in each direction. With an additional interchange these volumes drop 20% to 25% to between 7,900 to 9,400 vehicles per day in each direction.
- As a potential new interchange is moved farther north, 500 South interchange ramp volumes drop significantly. As the interchange is moved from Center Street to 1100 North, daily volumes at the 500 South interchange drop by 40% from 10,400 to 6,200 vehicles per day. Redwood Road volumes increase 13% from 24,800 to 28,200 vehicles per day.
- Additional system-to-system ramps at the I-215 Legacy are not in high demand. In 2040, only 30 vehicles per day for each direction were shown to use these ramps. If a new interchange was added on Legacy Parkway, the demand for these ramps would jump to about 500 to 700 vehicles per day in each direction.
- Related to the previous point, Redwood Road is the main beneficiary from the addition of the system-to-system ramps at I-15/I-215. This is illustrated by the jump in traffic for the ramps to/from the east to Redwood Road. Without additional system-to-system ramps, in 2040, the Redwood Road ramps to/from the east are underutilized with only 1,000 vehicles per day on the ramps. Adding the system-to-system ramps brings the volume up to 5,100 vehicles per day in each direction. Adding a new interchange on Legacy Parkway does drop the volumes on these ramps but only down to between 4,500 and 4,700 vehicles per day in each direction.

Interchange Influence Areas

A helpful way of visualizing the demand for an interchange is the use of interchange influence areas. Interchange influence areas are approximation destination locations within the study area that are best served by the specified interchange. Interchange influence areas are generated from the travel demand model output that shows quickest paths (taking into account congested travel times) to various locations within the study area. The interchange influence areas for 2040 trips into the study area were calculated and mapped for the following three origins: from the south using I-15 northbound, from the south using I-215 northbound, and from the north using either Legacy or I-15 southbound.

The interchange influence areas were calculated only for the *Center Street Interchange* scenario, which includes new system-to-system ramps and a new interchange on Legacy at Center Street. The areas and associated total daily trips for each trip origin and interchange can be found in the *Interchange Influence Areas* figure located in the appendix. For each origin a separate set of influence areas is generated with a different color for the interchange(s) used. For example, in the *Trips from I-15 Northbound* set, the influence area highlighted in green is the approximate destination area for trips using I-15 interchanges that originated from the south on I-15 northbound. Table 4 contains the daily trips for each influence area. The number of trips do not include all trips into the study area but only those originating from the three designated areas.



Table 4 – Interchange Influence: 2040 Daily Trips into Study Area Using a Specific Interchange

Origin of Trips Coming into the Study Area	Number of Daily Trips that Use:				
	I-15 Interchanges	Redwood Rd Interchange	Center Street Interchange	500 South Interchange	Total
From south using NB I-15	4,300	4,300	270	10	8,880
From south using NB I-215	1,650	7,600	5,200	2,600	17,050
From north using SB Legacy/I-15*	5,800	130	600	1,800	8,330
Total	11,750	12,030	6,070	4,410	34,260

*As measured from north of I-15 and Legacy Parkway interchange

The main take away from this exercise is the relatively small influence area for the Center Street interchange. At only 6,070 vehicles, this is half of the influence area of the Redwood Road interchange or the I-15 interchanges. For trips from the south on I-15 and I-215, most of the interchange influence area is west of Redwood Road and South of 1100 North. This tells us that those that are coming from the south and heading north on Redwood Road up to and past 1100 North will likely use the Redwood Road interchange rather than use Center Street and then turn onto Redwood Road. For trips from the north, the interchange influence area for the Center Street interchange is concentrated around the interchange and to the east until Redwood Road. For those coming from the north headed to destinations east of Redwood Road along Center Street, they would most likely use I-15 rather than the Legacy Parkway and Center Street to arrive at this area.

The majority of the demand for the Center Street interchange is to and from the south, which demand is also served by the Redwood Road interchange. Due to the overall low demand for the Center Street interchange, particularly to and from the north, North Salt Lake and UDOT Region One decided not to further pursue the interchange at this time.

Redwood Road and Center Street Intersection

To meet the expected 2040 traffic demand, the following alternatives were considered at the Redwood Road and Center Street intersections. A number of the alternatives “mix and match” features at the intersection to determine which combination would be most beneficial. In addition to the improvements described below at the Redwood Road and Center Street intersection, two through lanes in the northbound and southbound directions were assumed on Redwood Road from the I-215 interchange to 500 South. The seven alternatives evaluated at Redwood Road and Center Street were:

1. No build, signal timing changes only
2. Widen Redwood Road north and south of intersection
3. EB and WB right turn pockets on Center Street
4. WB dual left turn lanes on Center Street
5. EB right turn pocket and WB dual left turn lanes on Center Street
6. EB and WB right turn pocket with WB dual left turn lanes on Center Street
7. EB and WB right turn pockets on Center Street with NB right turn pocket on Redwood Road
8. EB and WB right turn pocket with WB dual left turn lanes on Center Street and NB right turn pocket on Redwood Road

Each of alternatives were evaluated for 2040 using future volume forecasts. In this evaluation the average delay per vehicles was determined at the Redwood Road and Center Street intersection. From this the LOS for the



intersection was determine for each alternative. The delay and LOS for each of the alternative evaluated is shown in Table 5.

Table 5 – Center Street and Redwood Rd Intersection Alternatives Delay and LOS

#	Intersection Alternative	Intersection Delay	Intersection LOS
1	Signal Timing Changes	119	F
2	Widen Redwood Road	116	F
3	EB & WB Turn Pockets	51	D
4	Dual WB Left Turn Lanes	76	E
5	EB Right Turn Pocket & Dual WB Left Turn Lanes	68	E
6	EB & WB Right Turn Pockets & Dual WB Left Turn Lanes	38	D
7	EB, WB & NB Turn Pockets	41	D
8	EB, WB & NB Right Turn Pockets & Dual WB Left Turn Lanes	36	D

The delay and LOS for each movement at the Center Street and Redwood Road intersection was also determined. The *Redwood Road & Center Street Improvement Concepts Performance* figure located in the appendix shows the LOS for each movement in more detail with a color code which illustrates the LOS. Based on this evaluation the recommended alternative at the intersection of Center Street and Redwood Road is to add EB, WB and NB right turn pockets and dual WB left turn lanes (Alternative #8).

Redwood Road and I-15 Interchange

At the I-215 interchange on Redwood Road there is a large directional movement from EB on the freeway to the north of the interchange and from the south on Redwood Road onto WB I-215. To meet the existing demand and expected growth, especially considering how the WB left turn queue on the ramp currently backs onto mainline I-215, three interchange alternatives were evaluated. For each alternative a NB and SB through lane was added to the existing geometry on the freeway overpass. In addition dual left turn lanes for the WB left turn coming off the of the I-215 ramp were needed in each of the following alternatives:

1. Wide diamond interchange with additional NB and SB through lanes at existing intersections and dual EB left turn lanes on I-215 ramp
2. Diverging Diamond Interchange with two through lanes and dual EB left turn lanes on I-215 ramp (similar to the new 500 South interchange on I-15)
3. Tight diamond interchange with two NB and SB through lanes on Redwood Road and dual EB left turn lanes on I-215 ramp

Each alternative was evaluated for 2040 conditions using future volume forecasts. In this evaluation the average delay per vehicle was determined at the I-215 and Redwood Road interchange. The delay for both the EB and WB interchange intersections were combined. From this the LOS for the interchange was determine for each alternative. The delay and LOS for each of the alternative evaluated is shown in Table 6.

Table 6 – Redwood Interchange Alternatives Delay and LOS

#	Alternative	Interchange Delay	Interchange LOS
1	Wide Diamond	27	B
2	Diverging Diamond	27	B
3	Tight Diamond	27	B



The LOS for each of the movements at the I-215 interchange is shown in the *Redwood Road & I-215 Interchange Improvement Concepts Performance* figure located in the appendix. The LOS is displayed by the color code in the figure for the individual intersection movements while the delay and LOS shown is for the interchange. Based on the traffic evaluation the three alternatives for the Redwood Road I-215 interchange perform at a similar LOS and average delay per vehicle. Because of the similarities in traffic performance between the three alternatives the main determining factor will be the cost of each of the different alternatives.

In addition to identifying the 2040 demand at the Redwood Rd and I-215 interchange, interim interchange improvements were evaluated for 2025, 2030 and 2035. This interim solution assumed that the existing Redwood Road bridge over I-15 could be reconfigured as DDI with two northbound lanes and a single southbound lane across the existing structure. The average delay per vehicle and LOS for each of the years evaluated is shown in Table 7.

Table 7 – Interim DDI Delay and LOS

Year	Delay	LOS
2025	43	C
2030	56	D
2035	62	D

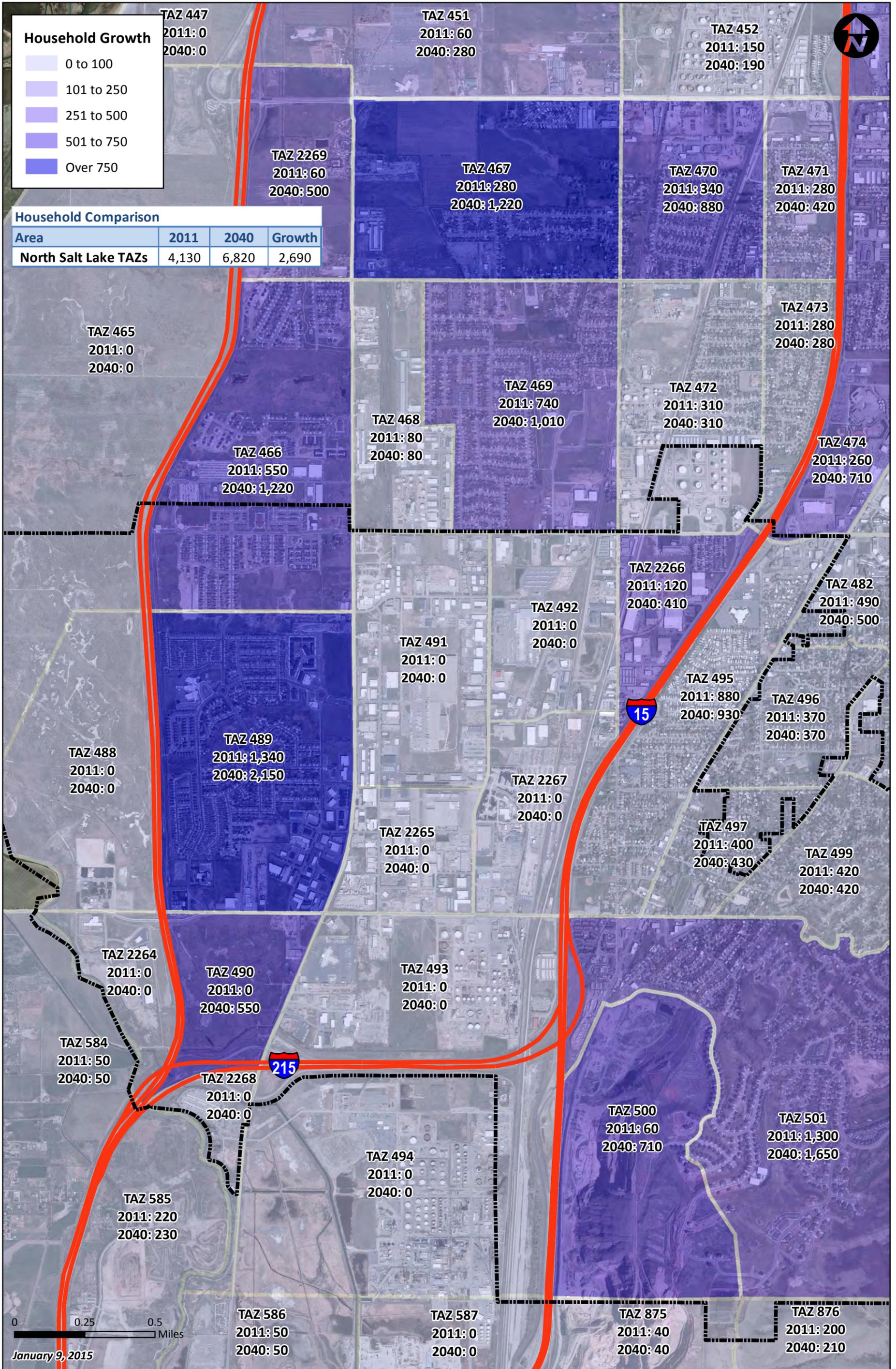
The LOS for each of the movements at the I-215 interchange for the interim solution is shown in the *Redwood Road & I-215 Interchange Interim Solution Concepts Performance* figure located in the appendix. The LOS is displayed by the color code in the figure for the individual intersection movements while the delay and LOS shown is for the interchange. In 2035 the demand in the northbound direction at the interchange exceeded capacity by 20%.

Conclusion

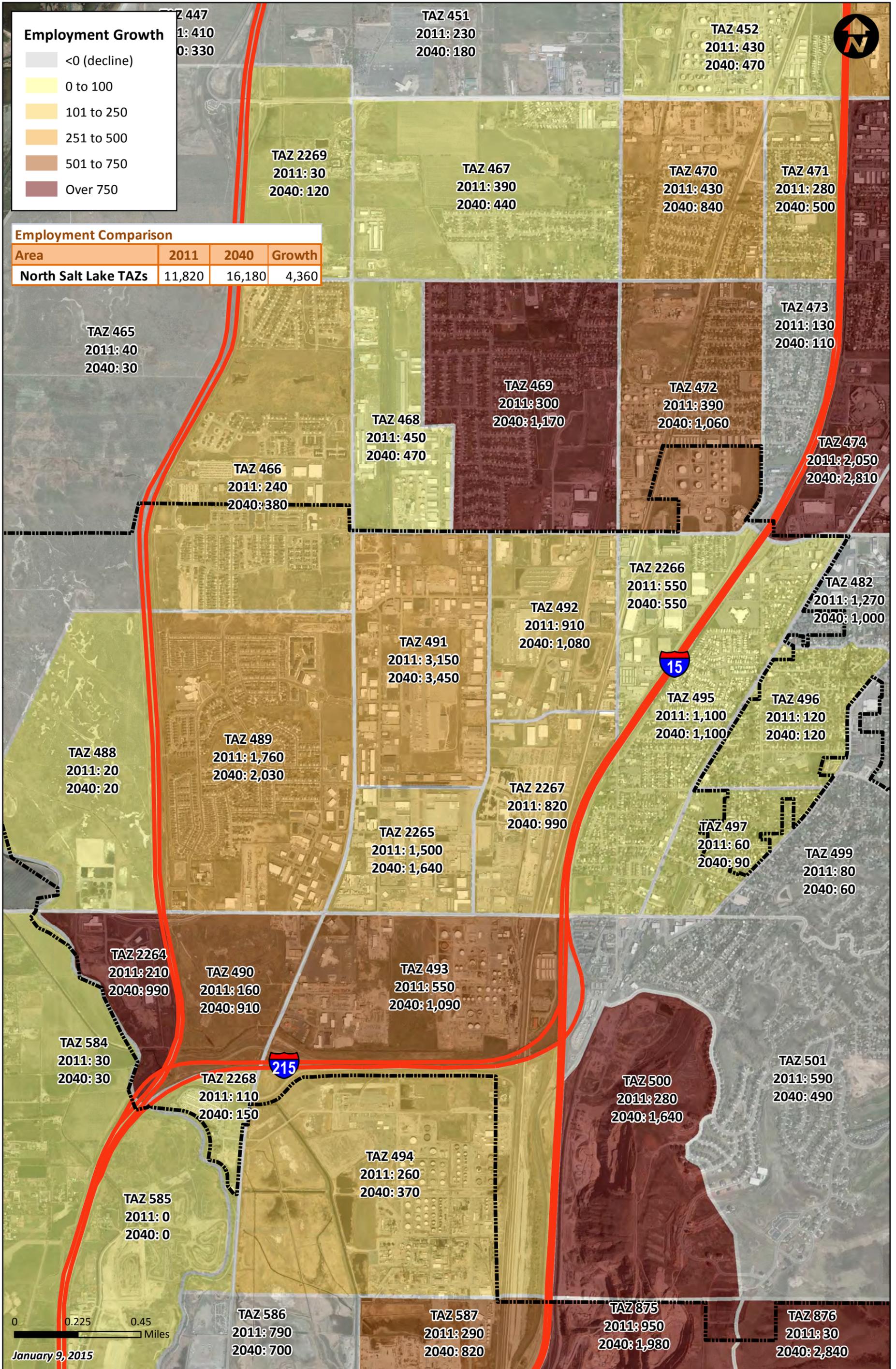
Based on the 2040 analysis as described in this memo, the following conclusions can be made:

1. Insufficient demand exists for a new interchange on Legacy Parkway at Center Street. The existing interchange locations at Redwood Road & I-215 interchange and 500 South & Legacy Parkway interchange are sufficient for 2040 traffic demand in the study area.
2. Insufficient demand exists for new system-to-system ramps at the interchanges of I-215 & Legacy Parkway and I-215 & I-15. However, right-of-way should still be preserved so as to not limit the possibility of constructing these ramps in the future.
3. To meet 2040 traffic demands at the Center Street and Redwood Road intersection, it is recommended that the intersection be improved to include eastbound, westbound, and northbound right turn pockets, as well as dual westbound left turn lanes (Alternative #8). Based on estimated 2040 volumes, this would result in LOS D operations with an average of 36 seconds of delay per vehicle.
4. Depending on cost and impacts, either the diverging diamond interchange or wide diamond interchange are recommended to meet 2040 demands at the I-215 & Redwood Road interchange. From a traffic perspective both options work well in 2040 with an interchange LOS B and an average of 27 seconds of delay per vehicle. Interim improvements, including a modified DDI (two lanes northbound, one lane southbound) on the current bridge structure, could function well for traffic demands through the year 2030 with an interchange LOS D and an average of 56 seconds of delay per vehicle.

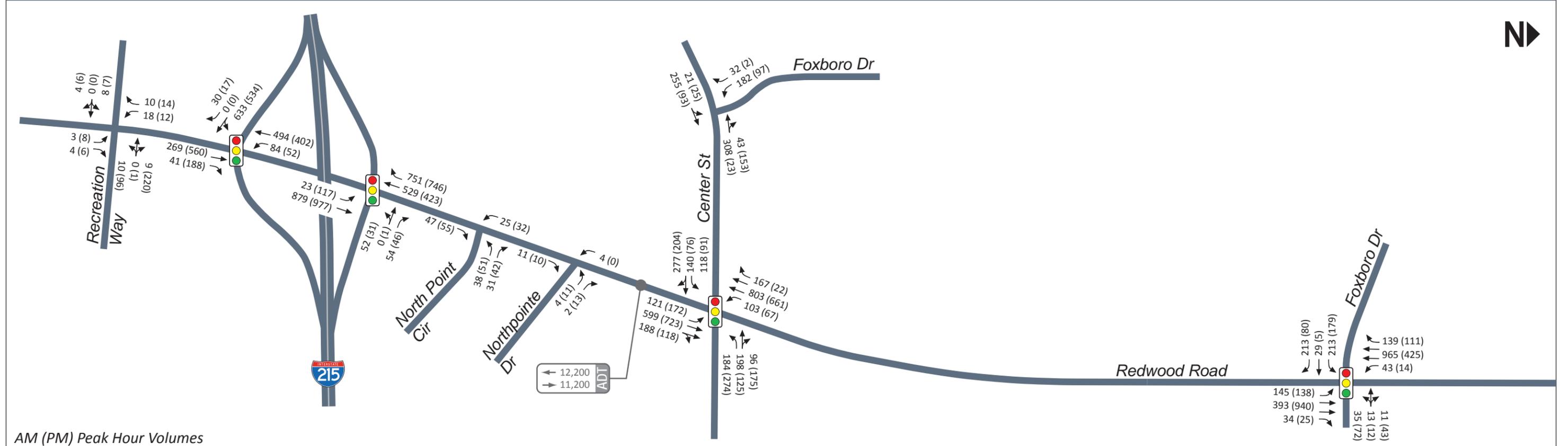
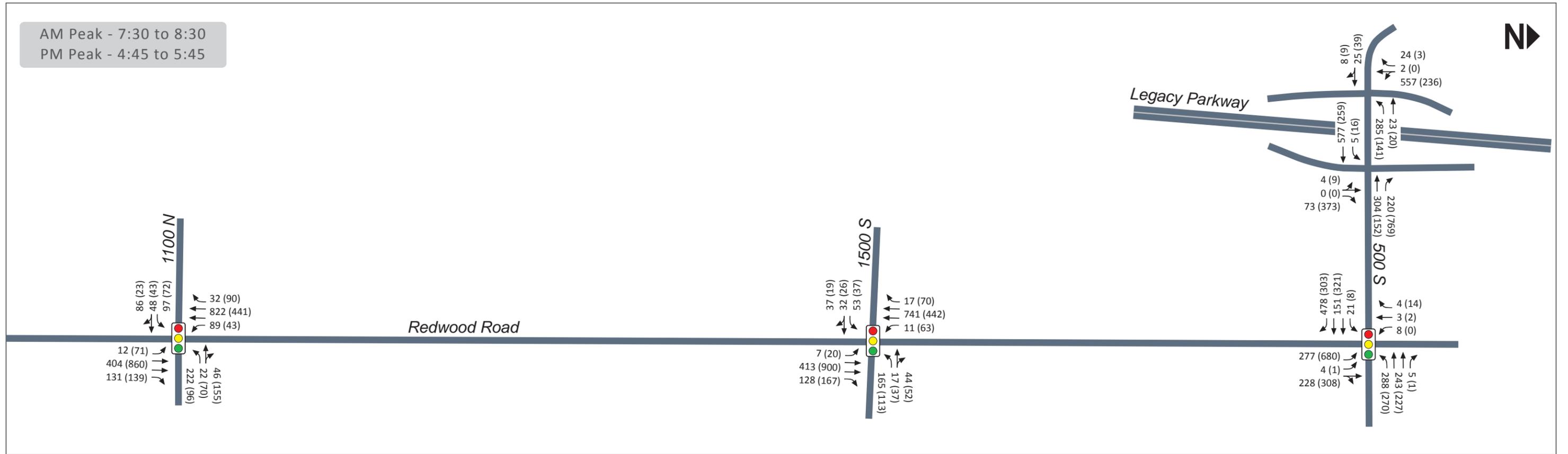
Household Growth per TAZ (2011 to 2040)



Total Employment Growth per TAZ (2011 to 2040)

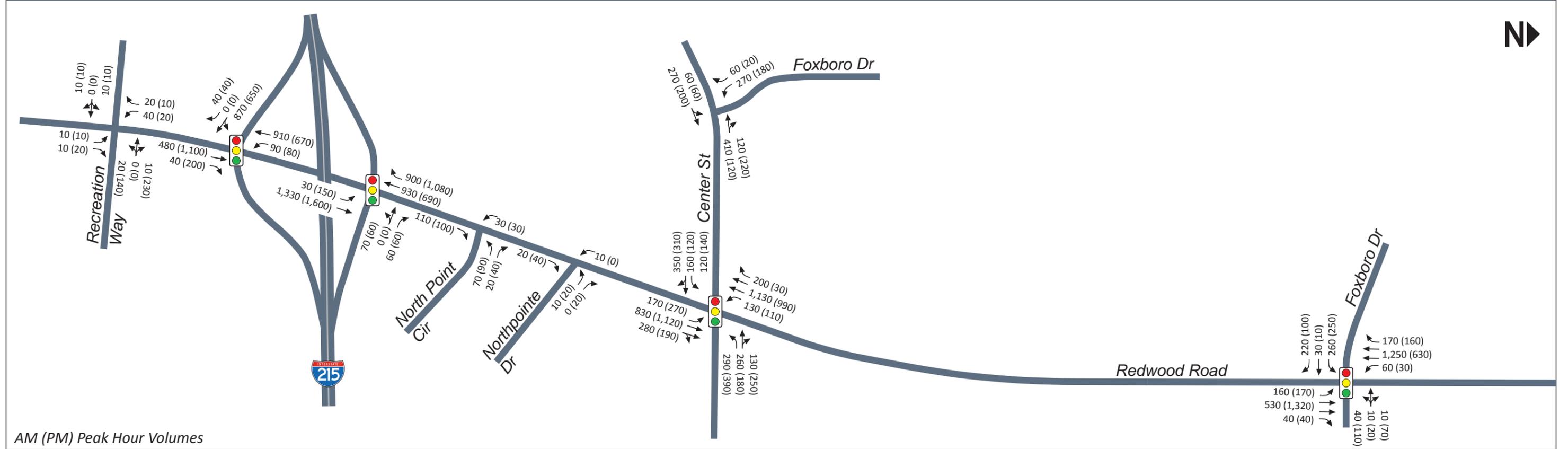
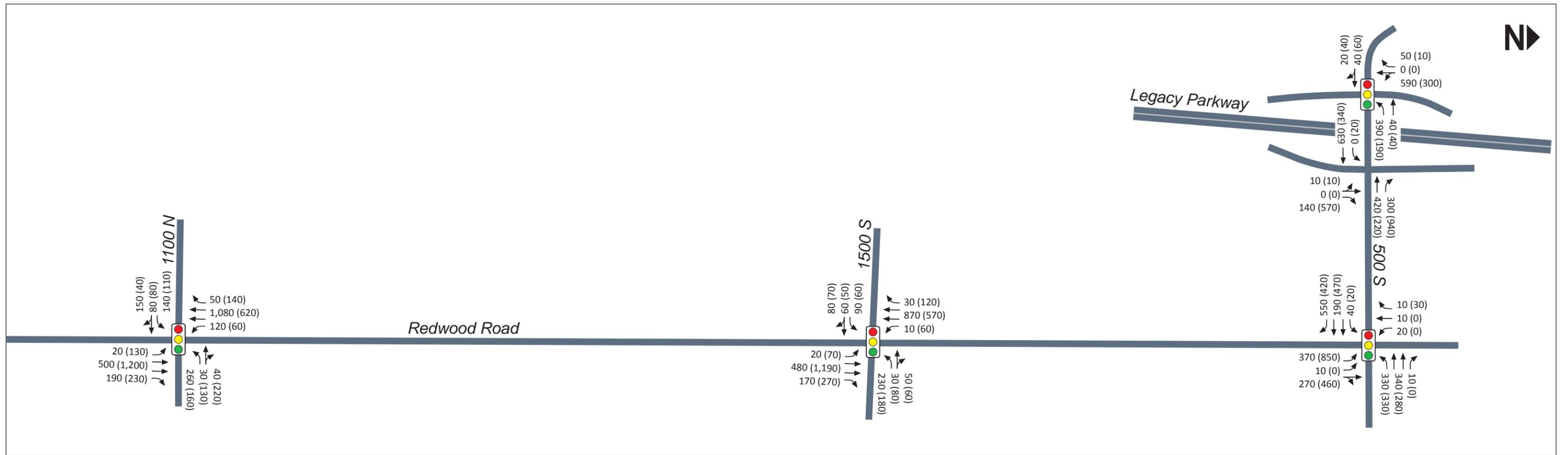


AM Peak - 7:30 to 8:30
 PM Peak - 4:45 to 5:45



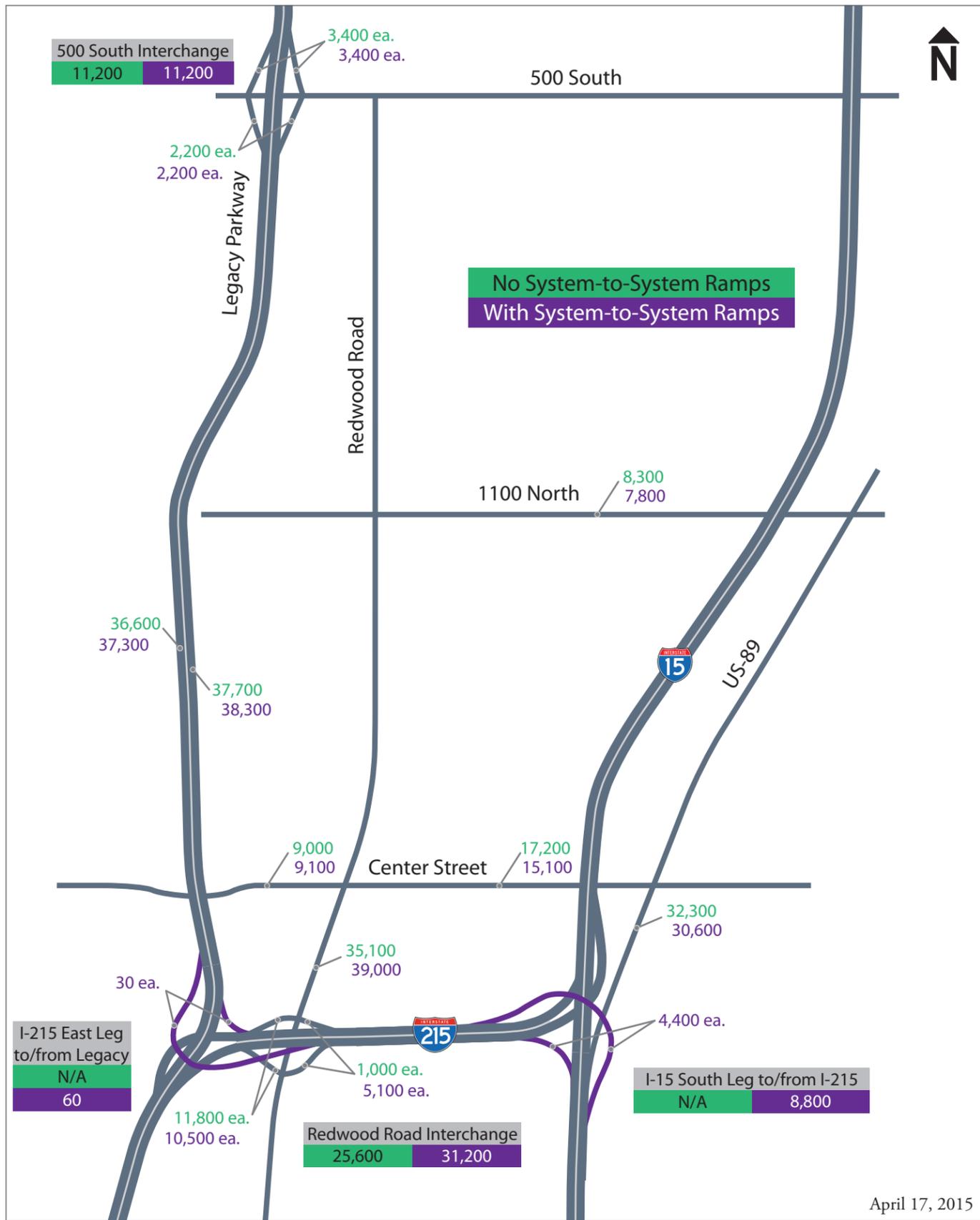
AM (PM) Peak Hour Volumes

North Salt Lake West Center Street Study
 2014 Weekday Peak Hour Turning Movement Volumes

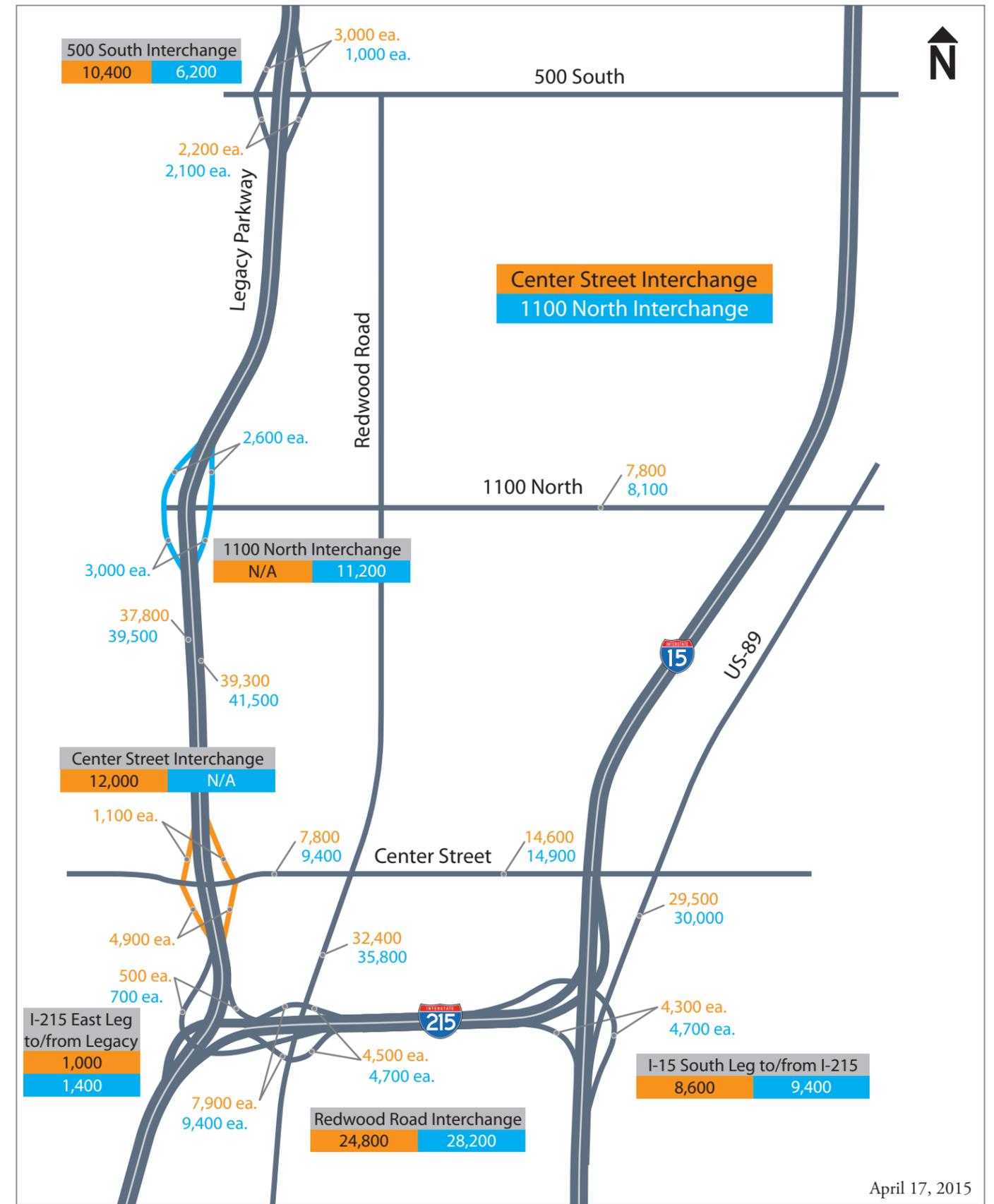


AM (PM) Peak Hour Volumes

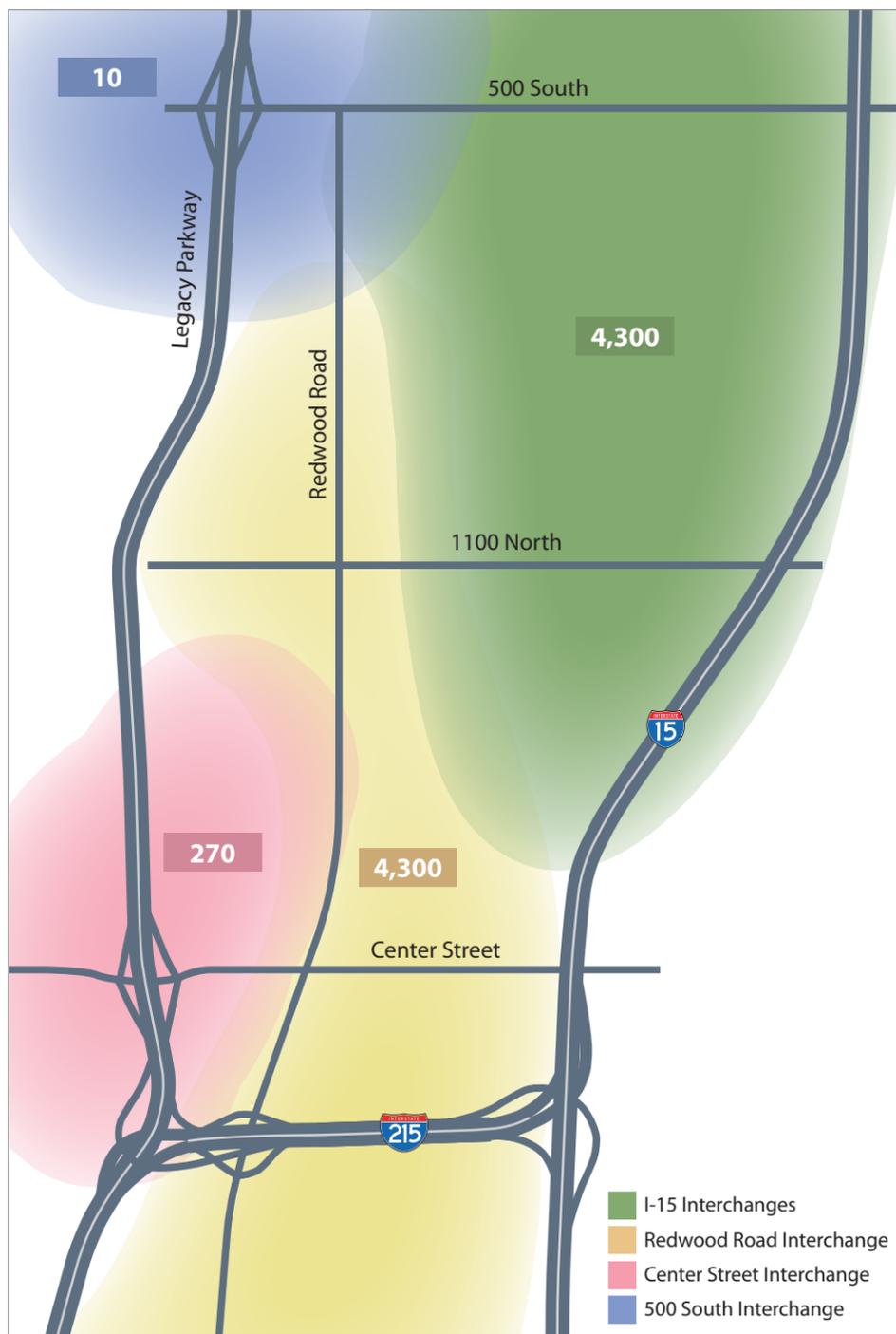
North Salt Lake West Center Street Study
2040 Weekday Peak Hour Turning Movement Volumes



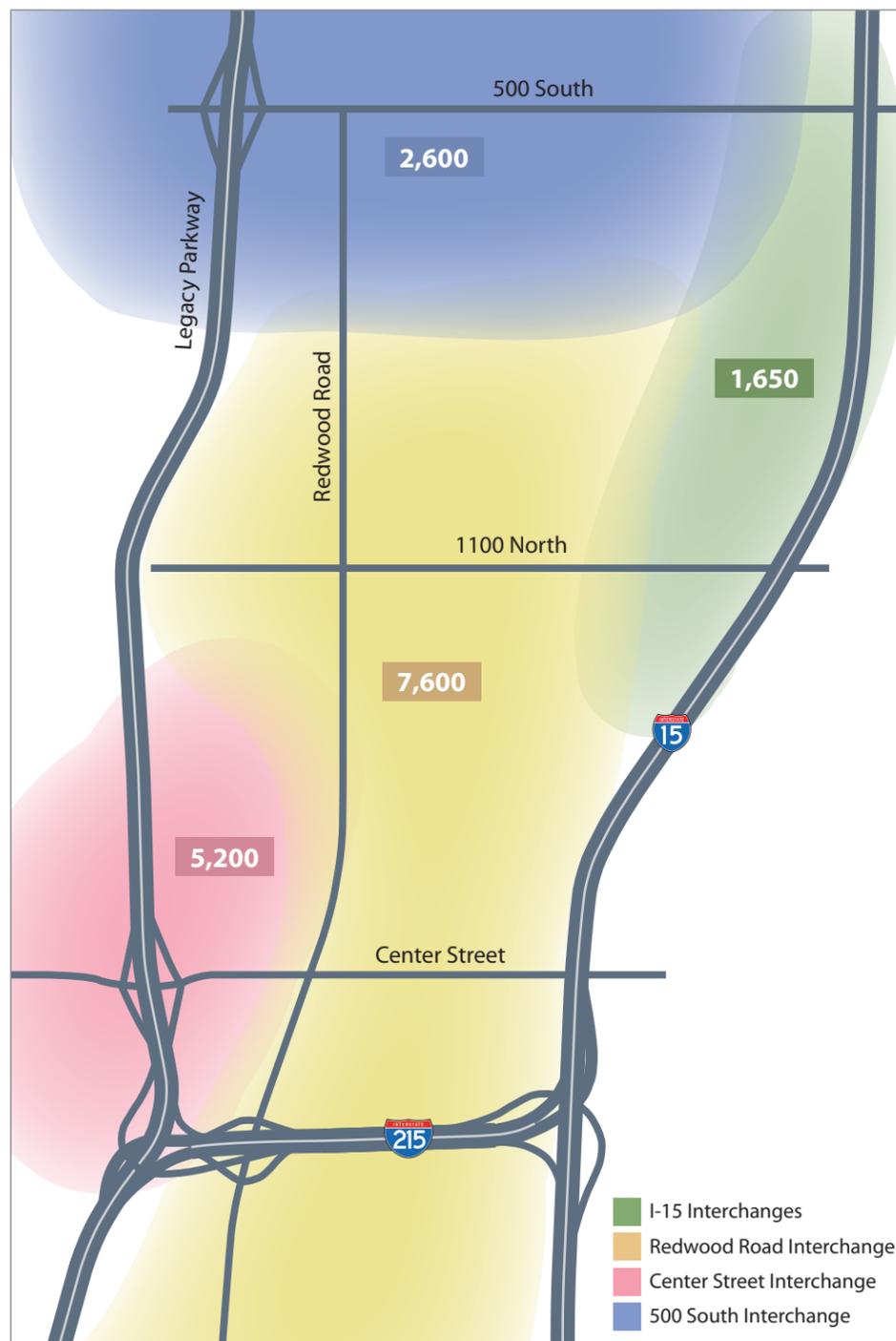
North Salt Lake West Center Street Study
 Estimated 2040 Daily Volumes (No vs. With System-to-System Ramps)



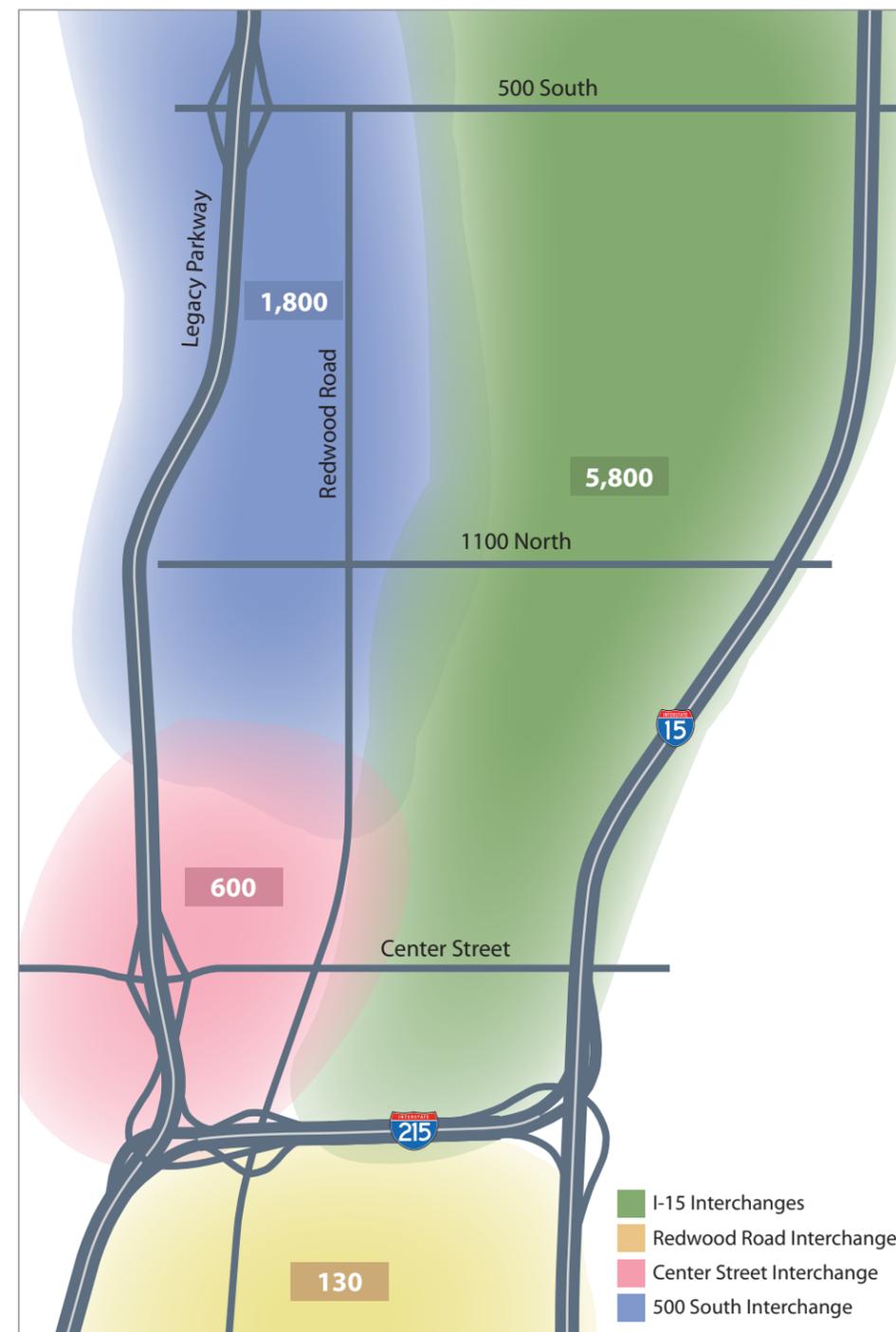
North Salt Lake West Center Street Study
 Estimated 2040 Daily Volumes (Center Street vs. 1100 North Interchange)



Trips from Northbound I-15



Trips from Northbound I-215



Trips from Southbound Legacy/I-15*

*as measured from north of I-15 and Legacy Pkwy Interchange

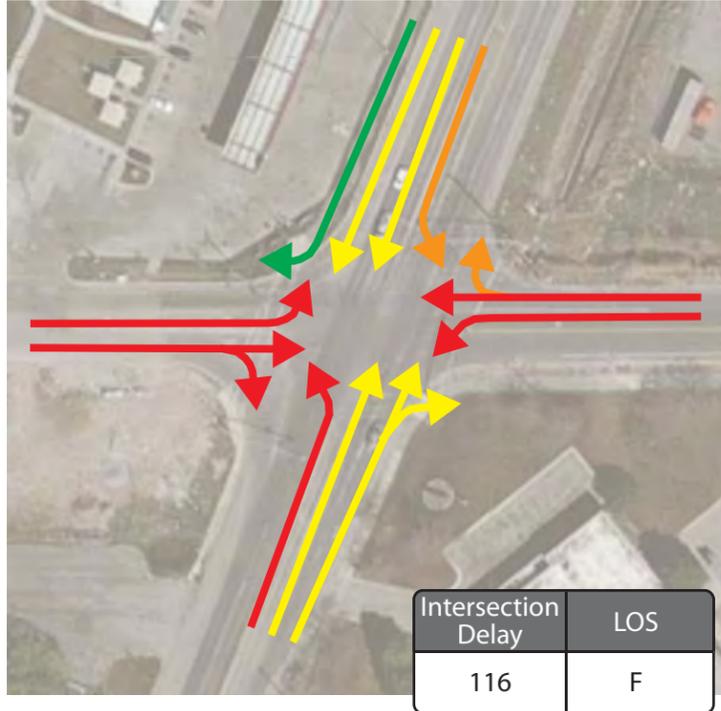
April 16, 2015

Redwood Road & Center Street

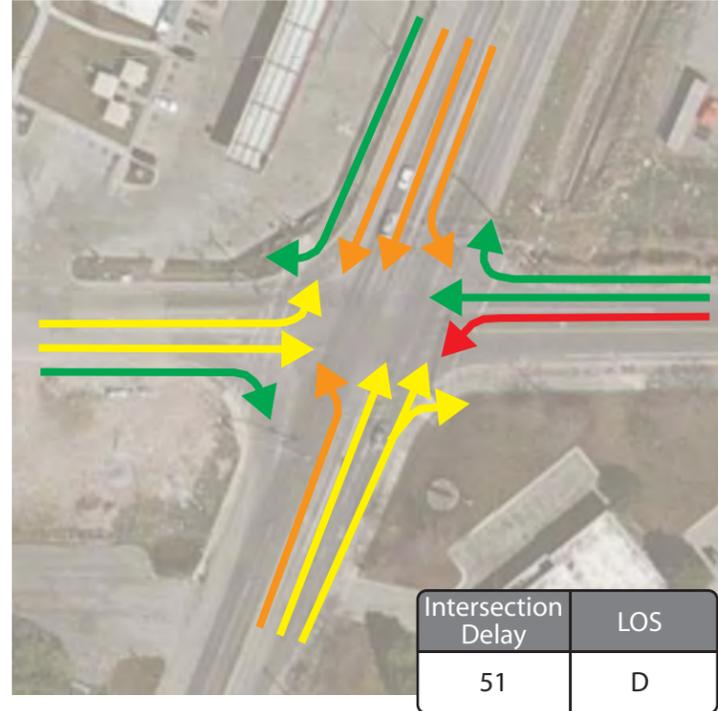
Improvement Concepts Performance

2040 PM Peak Hour Conditions

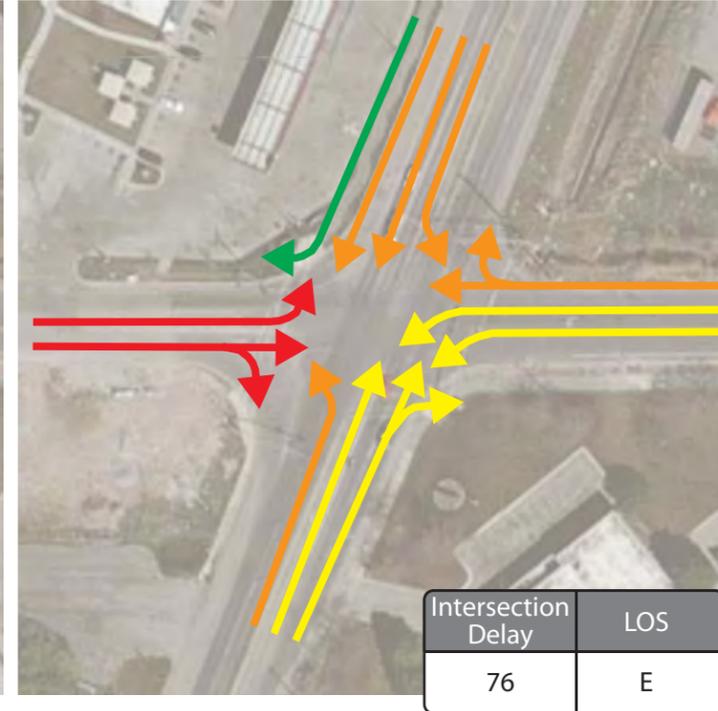
1. Redwood Road Widening Only



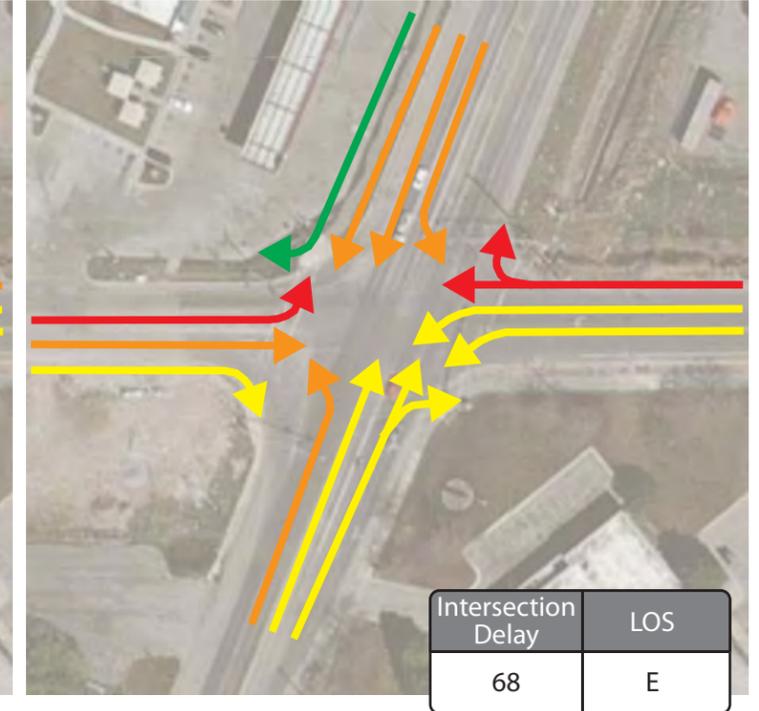
2. EB & WB Right Turn Pockets



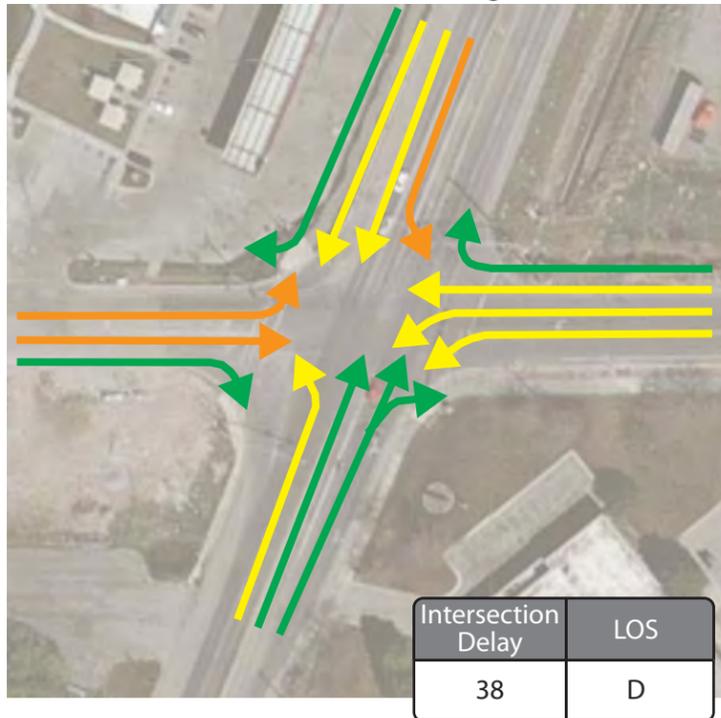
3. WB Dual Left Turn Lanes



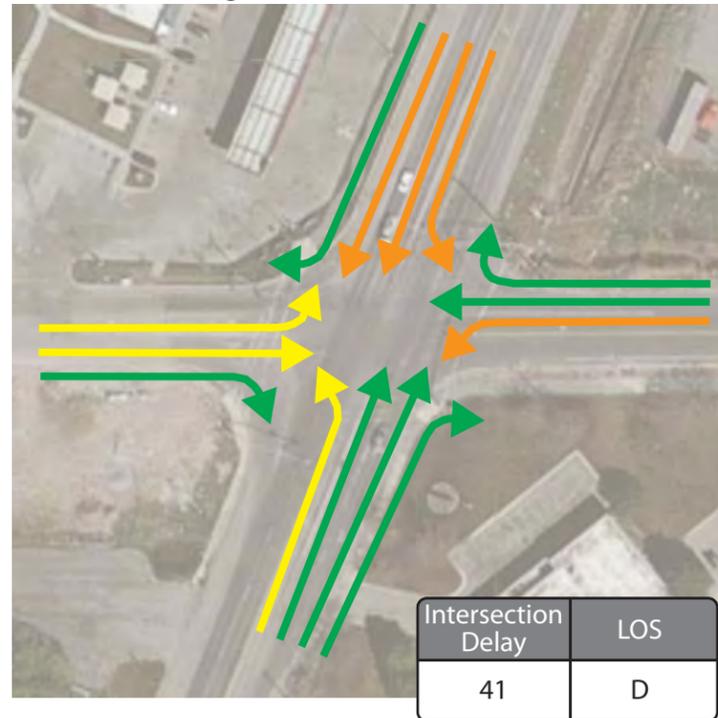
4. WB Dual Left Turn Lanes & EB Right Turn Pocket



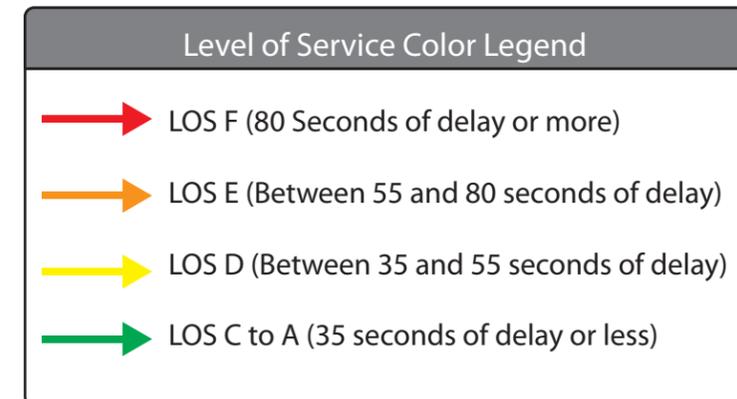
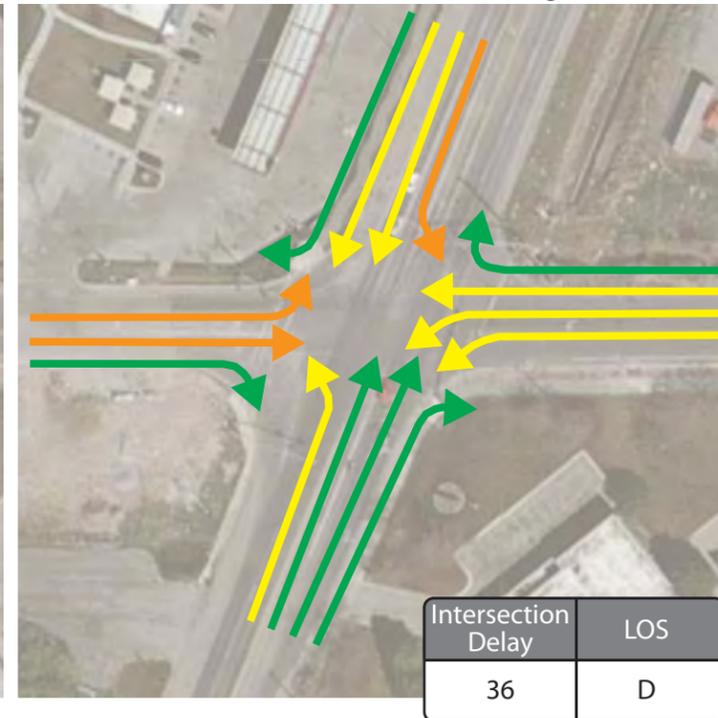
5. WB Dual Left Turn Lanes & EB/WB Right Turn Pockets



6. EB, WB & NB Right Turn Pockets



7. WB Dual Left Turn Lanes & EB/WB/NB Right Turn Pockets

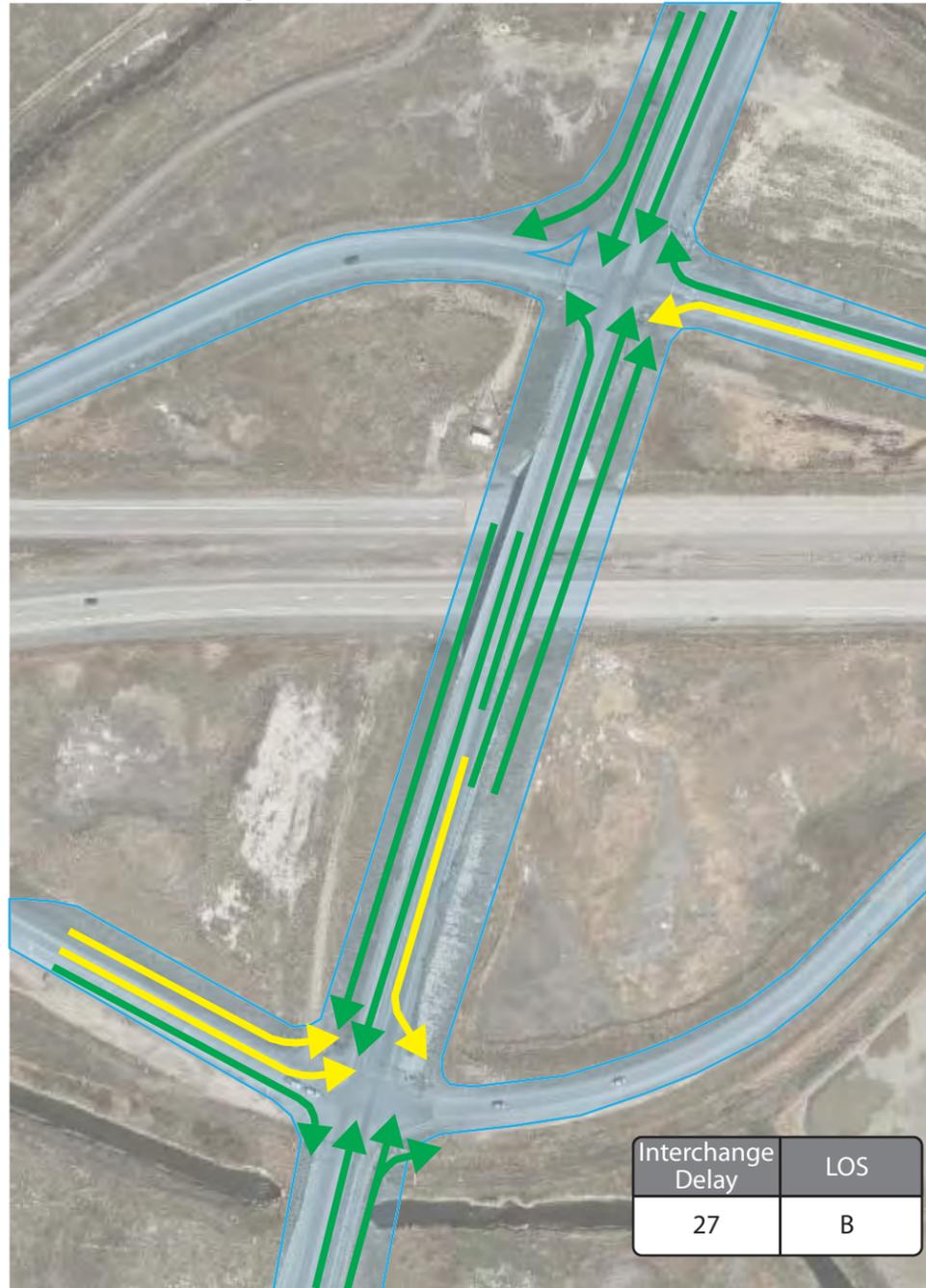


Redwood Road & I-215 Interchange

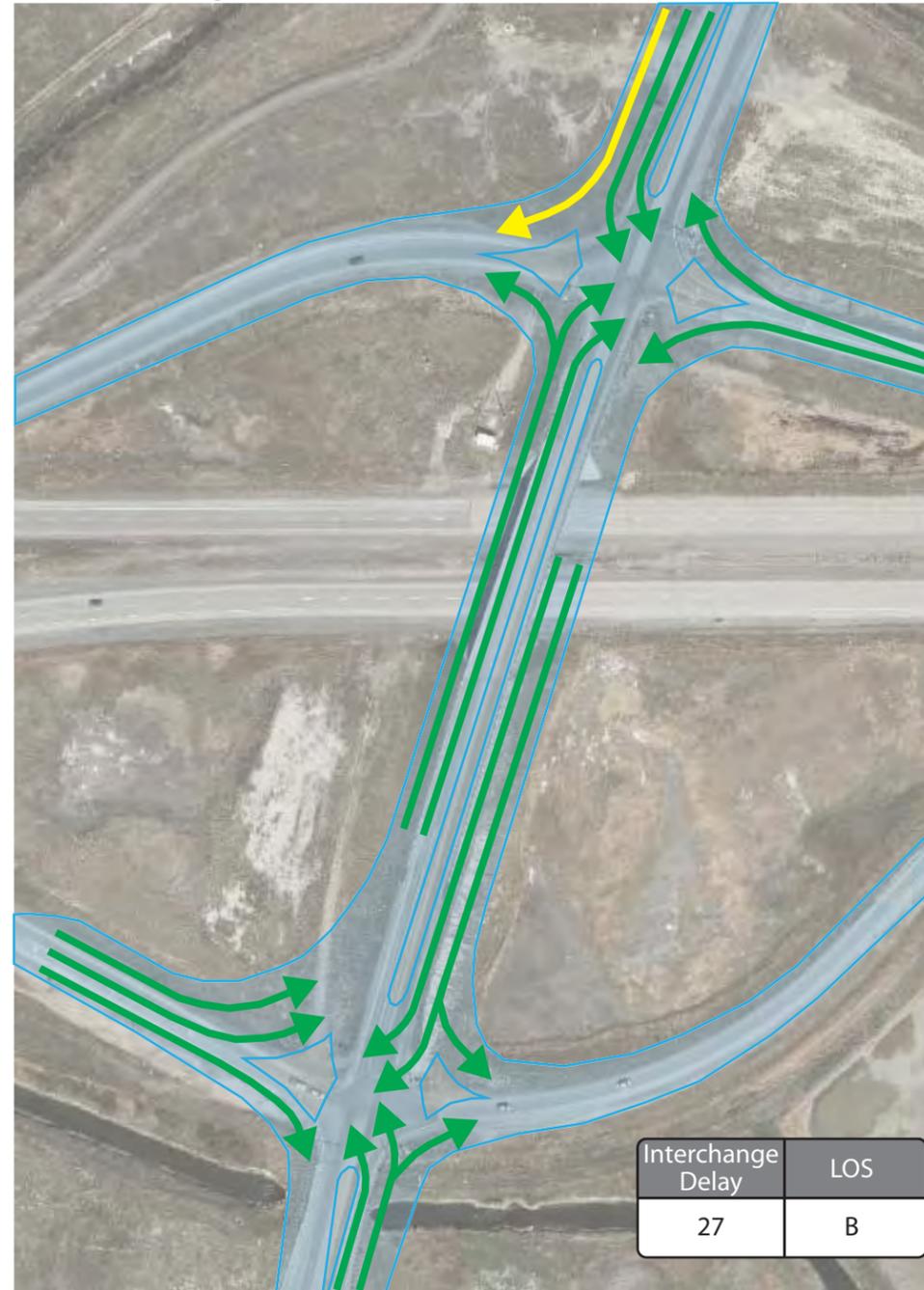
Improvement Concepts Performance

2040 PM Peak Hour Conditions

1. Two NB/SB through lanes & two EBL turn lanes



2. DDI Interchange with two NB/SB Lanes & two EBL turn lanes



3. Tight Diamond with two NB/SB through lanes & two EBL turn lanes

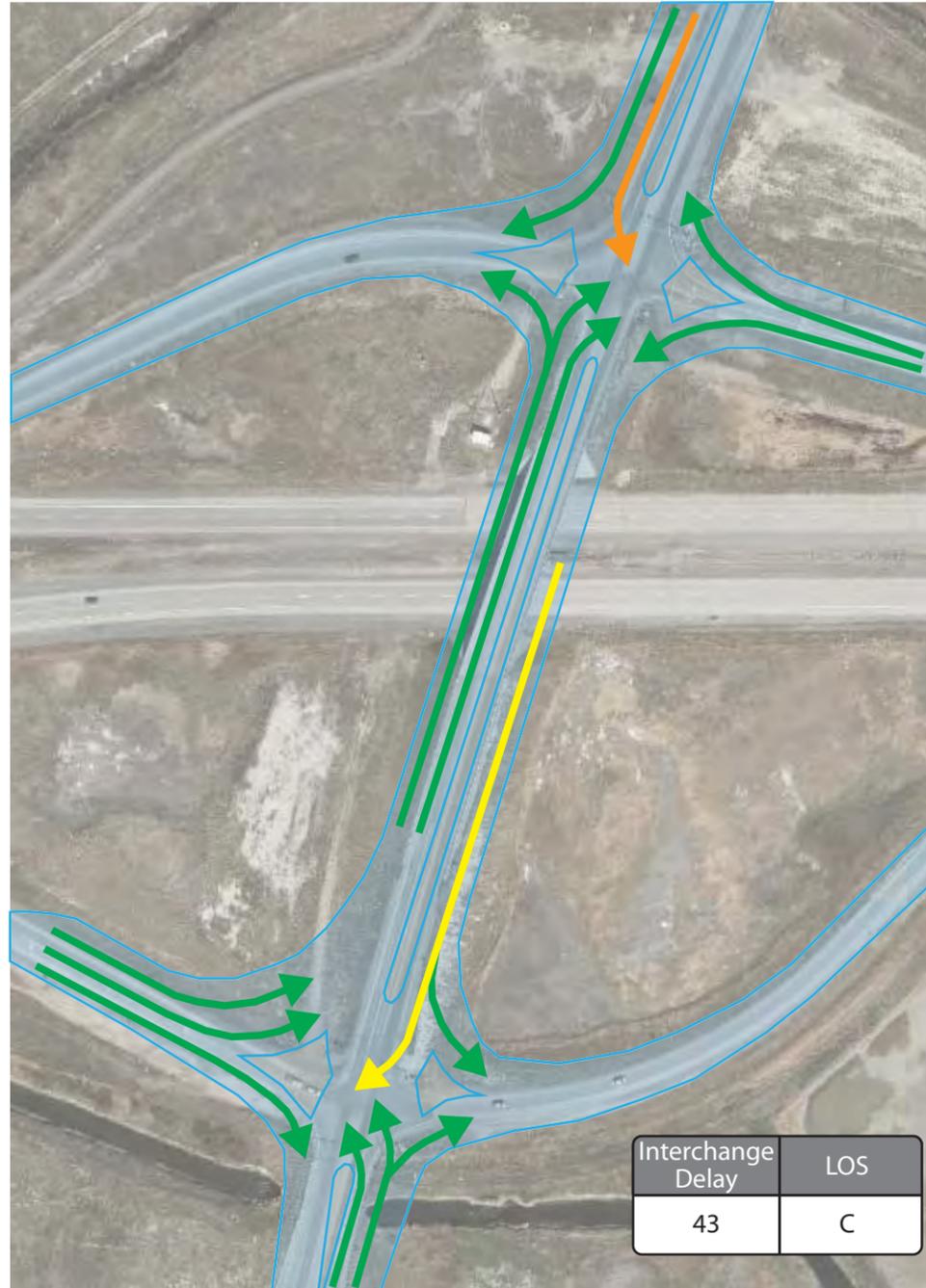


Level of Service Color Legend			
	LOS F (80 Seconds of delay or more)		LOS D (Between 35 and 55 seconds of delay)
	LOS E (Between 55 and 80 seconds of delay)		LOS C to A (35 seconds of delay or less)

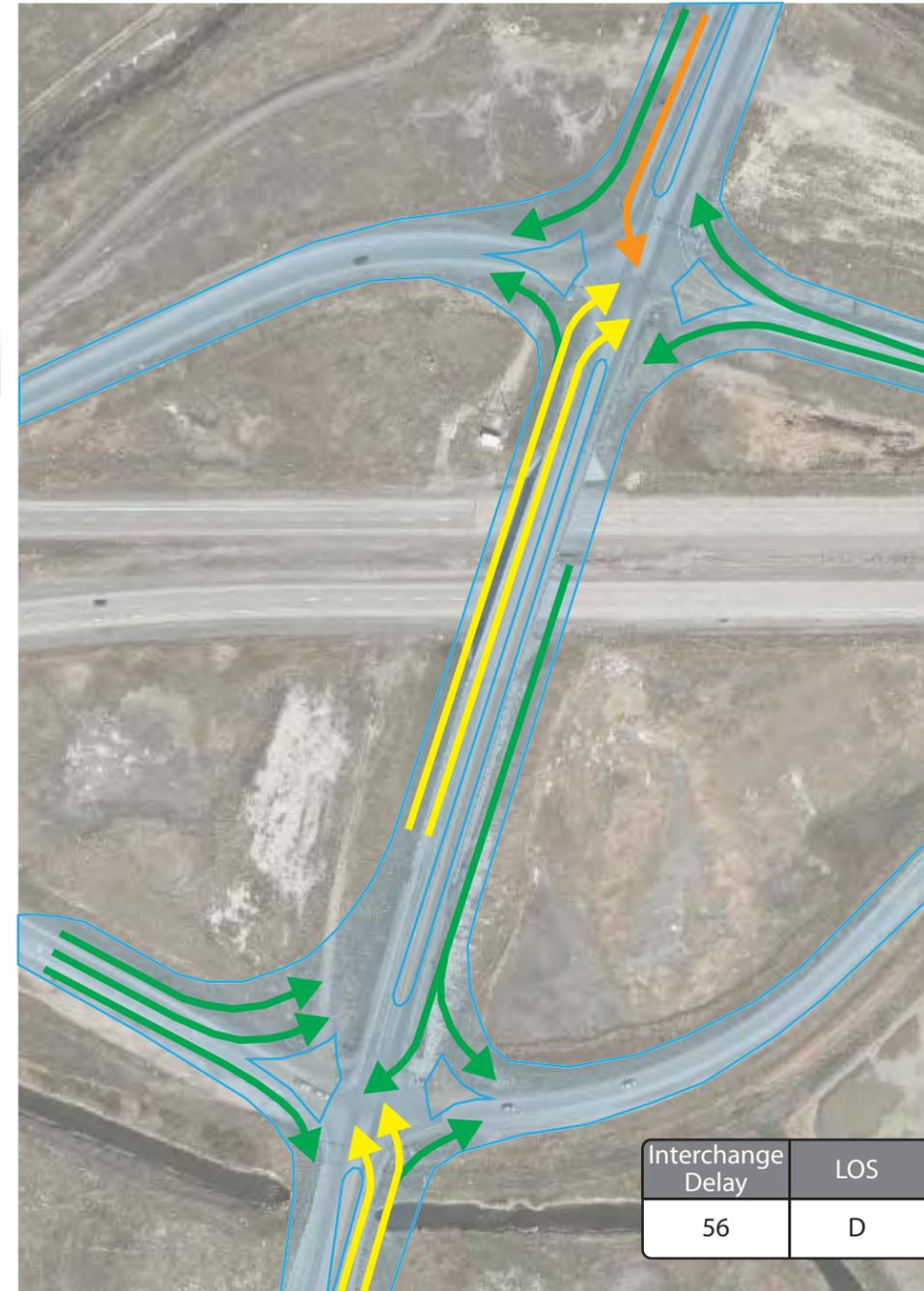
Redwood Road & I-215 Interchange

Interim Solution Concepts Performance

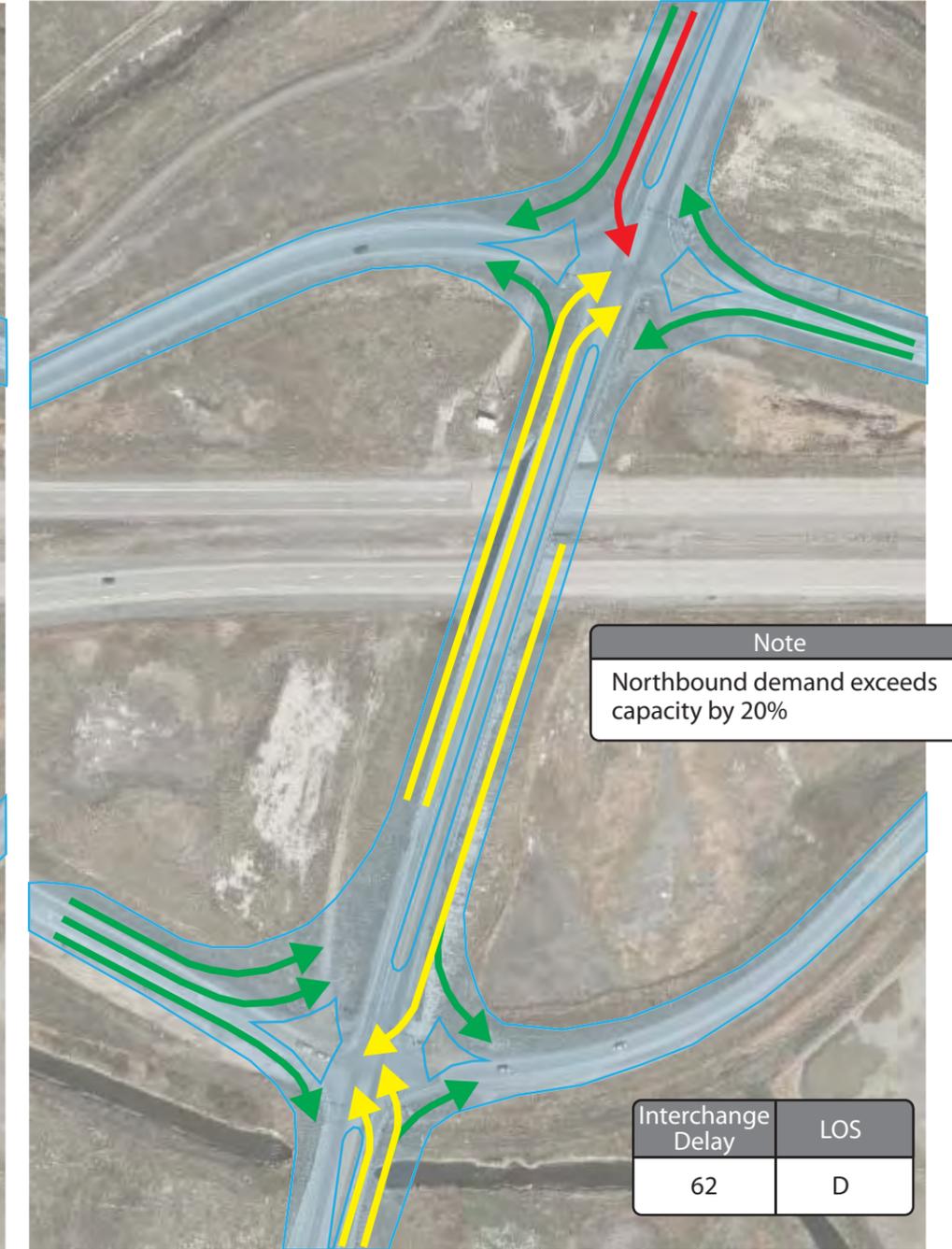
1. 2025 PM Peak Hour Conditions



2. 2030 PM Peak Hour Conditions



3. 2035 PM Peak Hour Conditions



Level of Service Color Legend			
	LOS F (80 Seconds of delay or more)		LOS D (Between 35 and 55 seconds of delay)
	LOS E (Between 55 and 80 seconds of delay)		LOS C to A (35 seconds of delay or less)