

# APPENDIX D



## 2015 Airport Drive Couplet Traffic Study

# Airport Drive Couplet at Spotted Road

## Traffic Study

April 2015

Prepared for:

Spokane International Airport



Prepared by:



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# Airport Drive Couplet at Spotted Road

## Traffic Study

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## Introduction

The intersection of the Airport Drive Couplet at Spotted Road serving the Spokane International Airport (SIA) has a history of collisions, many of which have involved serious injuries and some fatalities due to the high speeds on Airport Drive. With the high accident severity, the Spokane International Airport applied for and received funding from the Surface Transportation Program to study the intersection to determine appropriate solutions.

Several improvements have been made at these intersections as a result of previous studies which have reduced the crash frequency and severity, however collisions continue. As a result, this current study was commissioned to re-evaluate the intersections of Spotted Road at Inbound and Outbound Airport Drive to determine appropriate short, medium and long-range safety improvements, evaluate potential capacity improvements and identify potential triggers for the implementation of improvements.

This report documents the following study processes and methodologies:

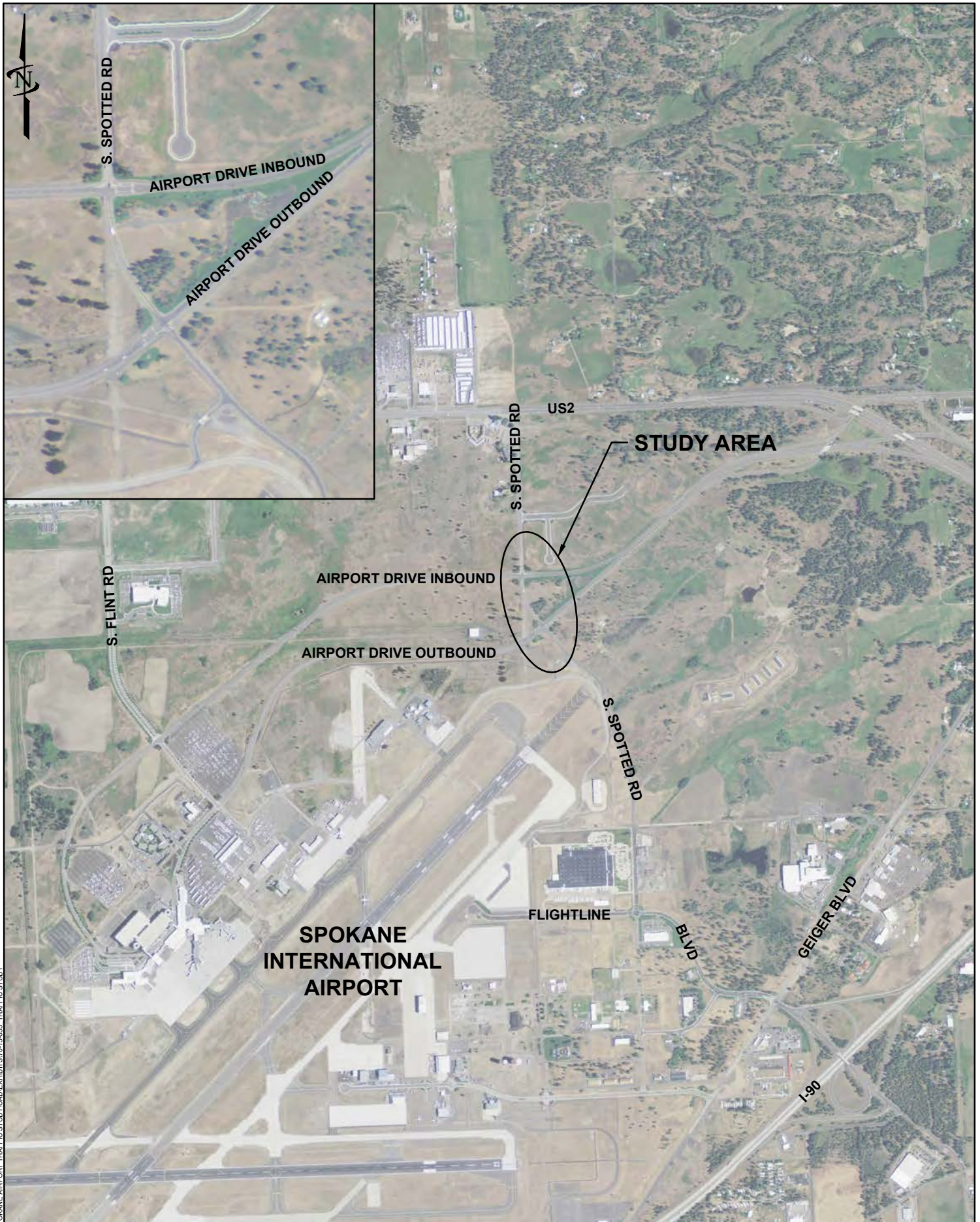
- Background and recent improvements
- Technical Advisory Committee
- Existing conditions
- 20 year forecasted traffic volumes
- Alternatives developed
- Stakeholder and public involvement
- Evaluation of alternatives
- Recommendations

## Background

The intersections of Spotted Road at Inbound and Outbound Airport Drive (“Inbound” and “Outbound” for the purposes of this report) have been included in several previous studies at varying levels of detail. A Vicinity Map is shown in Figure 1. It is appropriate to consider the findings, thought processes and recommendations of these studies. A brief summary of pertinent aspects of these studies is provided in Appendix A, while a synopsis is included below:

- **SIA Technology Park Transportation Impact Analysis (2004)**  
This study evaluated the transportation impacts of the Technology Park near Spotted Road. It included 7 approved developments near the airport in background growth and indicated that, based on the assumptions of the study, that traffic signals would be needed at the three study intersections (Spotted Road at Airport Drive Inbound, Outbound and US 2) by year 2018. It identified a high accident rate at Spotted Road/Airport Drive.
- **SIA Spotted Road and Airport Drive Safety Improvement Project (2006)**  
This study was performed as a result of the high accident rates identified in the 2004 study. An initial list of 26 alternatives to address safety and capacity issues was developed and combined into 5 categories for evaluation. As a result, several short-term low-cost improvements were recommended to address sight distance and other safety issues. A preferred long range alternative to address capacity issues was also recommended that included the relocation of Airport Drive Outbound next to Inbound and a partial cloverleaf interchange constructed at Spotted Road. (See Appendix A for a graphic showing the short-term improvements recommended and the long-range recommendation.)





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VICINTY MAP

FIGURE  
**1**

AIRPORT DRIVE COUPLET AT  
 SPOTTED ROAD INTERSECTION STUDY



- **West Plains – SIA Transportation Study (2011)**

The Spokane Regional Transportation Council undertook a two year process of preparing a multi-modal transportation study. This study involved the Washington State Department of Transportation, City of Spokane, City of Airway Heights and Spokane County and Spokane International Airport as stakeholders. It included significant effort to evaluate the forecasted development in the West Plains area and fine tune the regional model. Nine alternative capacity improvements were considered, with the recommendation being a new minor arterial roadway connecting to and paralleling US 2 along the 21<sup>st</sup> Avenue alignment from west of the City of Airway Heights to the vicinity of the Airport Drive/US 2 interchange. (See Appendix A for a graphic showing this new roadway alignment.)

- **SIA Master Plan (2013)**

This comprehensive plan for SIA recognized the safety issues at the Spotted Road intersections, with a recommendation that both directions of Airport Drive be co-located so that an interchange could be built with a single bridge structure instead of two.

- **Horizon 2040 Transportation Plan (2013)**

The Regional Transportation Plan (RTP) forecasted growth in the region and updated the regional model. Although the proposed 21<sup>st</sup> Avenue minor arterial identified in the West Plains Study is identified as a needed improvement, it is not included in the fiscally constrained RTP.

In addition to analyzing the couplet intersections, another segment of Spotted Road was analyzed and included with this study. Since the 2006 study, the Federal Aviation Administration (FAA) has updated guidelines on land uses within Runway Protection Zones (RPZ). Essentially, in order to protect both the airport and ground activities, FAA has stated that “it is desirable to clear all objects from the RPZ”. Included in Appendix B is a Technical Memorandum that summarizes the FAA regulations pertaining to land uses within the RPZ and what events would trigger the preparation of an RPZ evaluation.

This study accounts for the fact that Spotted Road passes through the RPZ of Runway 21 perpendicular to the runway approximately 1,200 feet from the end of the runway. See Figure 1.

## **Recent Improvements**

Primarily as a result of the 2006 study mentioned above, several improvements have been implemented to reduce accidents at Spotted Road/Airport Drive. These improvements include the following:

- Stop bars on Spotted Road were moved closer to Airport Drive to improve sight distance.
- Painted arrows for lane use were added.
- Stop Ahead Signs with flashing lights were added.
- Overhead flashing beacons were added.
- Landscaping was removed to improve sight distance.
- Rumble strips on all Spotted Road approaches were added to warn traffic to stop.
- Real Time speed notification signs have been placed on Inbound east of Spotted Road and east of Flint Road and on Outbound east of Flint Road.

As discussed below in the existing conditions section, these improvements have had some success in decreasing the accident history.

## **Technical Advisory Committee**

A Technical Advisory Committee (TAC) was put together to assist in the study process and provide important historical perspective, technical review and recommendations. The TAC consisted of members representing the agencies:

- Spokane International Airport
- City of Spokane Public Works
- City of Spokane Fire Department
- Spokane Regional Transportation Council
- Washington State Department of Transportation

The TAC met three times during the course of the Study at key times to review the history and background, review traffic forecasting, identify meaningful alternatives for evaluation and appropriate evaluation criteria, and review the evaluation of alternatives.

## Existing Conditions

This section will document existing conditions with respect to roadway characteristics, traffic volumes, traffic operations at study intersections, transit, and summarize collision history.

In the vicinity of Spotted Road near Airport Drive the land use is primarily undeveloped. The City of Spokane has recently annexed the area and a fire station has been constructed on Spotted Road north of Airport Drive. SIA has constructed access roads and provided utilities to the Technology Park north of Airport Drive and east of Spotted Road

### Roadway Characteristics

**Airport Drive** is an east-west principal arterial roadway with a speed limit of 50 MPH that extends from an interchange with US 2 east of Spotted Road to the Spokane International Airport Terminal to the west. In the vicinity of Spotted Road the two directions of travel are separated by nearly 700' as the roadway provides a loop to and from the airport. Known as Airport Drive Inbound (Inbound) and Airport Drive Outbound (Outbound). Each direction of travel has two 12' lanes with 8' shoulders on both sides and street lights are provided. There is no curb, gutter or sidewalk, except immediately adjacent to the airport terminal. At Spotted Road there are short deceleration lanes for both directions of travel. There are real time speed indicator devices provided at two locations for Inbound, east of Spotted Road and east of Flint Road and one for Outbound as well east of Flint Road.

**Spotted Road** is a north-south major collector roadway north of Outbound with a single lane in each direction. South of Outbound it is a local roadway. The speed limit is 30 MPH south of Inbound and 45 MPH north of Inbound. It provides access from US 2 to the north and to industrial properties to the southeast including a United States Postal Service regional facility. There are approximately 4' shoulders used by pedestrians on each side, with curb and gutter only on the east side between Inbound and Outbound, while the shoulders on both sides north of Inbound and South of Outbound are typically less than 2'. North of Airport Drive Spotted Road is identified as a T-3 facility on the Washington State Freight and Goods Transportation System (FGTS) meaning that freight weighing between 300,000 tons to 4 million tons are carried on it annually.



*Spotted Road looking south at Airport Drive Inbound*

**US 2** is an east-west principal arterial roadway that connects to Interstate 90 to the east. To the west it passes through the City of Airway Heights and continues west to Lincoln County and across the state. It has 5 lanes including a two-way left-turn lane as well as six foot shoulders and roadside ditches, with a speed limit of 55 MPH. US 2 is identified on the FGTS as a T-2 facility, carrying 4 – 10 million tons of freight annually.

A number of collisions have also occurred at the intersection of US 2/Spotted Road and the Washington State Department of Transportation has identified that a potential solution to this challenge is to restrict the northbound left turns. The feasibility of a traffic signal at this location is questionable and would be costly due to the vertical curve east of the intersection that restricts sight distance and a signal would likely cause rear end crashes due to the queues that would result for westbound traffic with a traffic signal and the limited sight distance. A traffic signal was recently installed at the intersection of Flint Road/US 2. It is felt that this new traffic signal may have an influence on reducing the northbound left turns at US2/Spotted Road and may reduce the number of crashes.

**Flint Road** is a north-south collector roadway. North of Inbound it has a landscaped median that separates 4 lanes of travel. It has curb and gutter and streetlights on both sides with a sidewalk on the east side. The speed limit is 35 MPH. South of Inbound Flint Road is a three lane section including a two-way left-turn lane. Design will begin soon for this section to be realigned to improve the southbound flow of traffic since the section north of Inbound to south currently has offset lanes.

## Transit

The Spokane Transit Authority provides fixed route transit service to SIA. Route 60 traverses Airport Drive every 30 minutes with a stop west of Spotted Road on Inbound and east of Spotted Road on Outbound. No pedestrian facilities are provided in the area other than roadway shoulders. Due to the fact that Route 60 dwells at the airport for 10 – 15 minutes during each trip it was noted by transit staff that many travelers that work south of the airport choose to get off the bus at Spotted Road and Inbound and walk across both directions of Spotted Road to their place of work, sometimes late at night.

## Traffic Volumes

At the outset of the study airport officials were interested in knowing how the mid-day traffic volumes compared to the typical PM peak hour traffic volumes. On May 7 and May 8, 2014 all-day bi-directional traffic volumes on all legs of the two study intersections as well as traffic volumes on US 2 at Spotted Road were collected. These counts were collected for multiple reasons, including determining when the mid-day peak was so that more detailed data could be collected later, to compare the hourly volumes on airport drive, and to perform traffic signal warrant analysis.

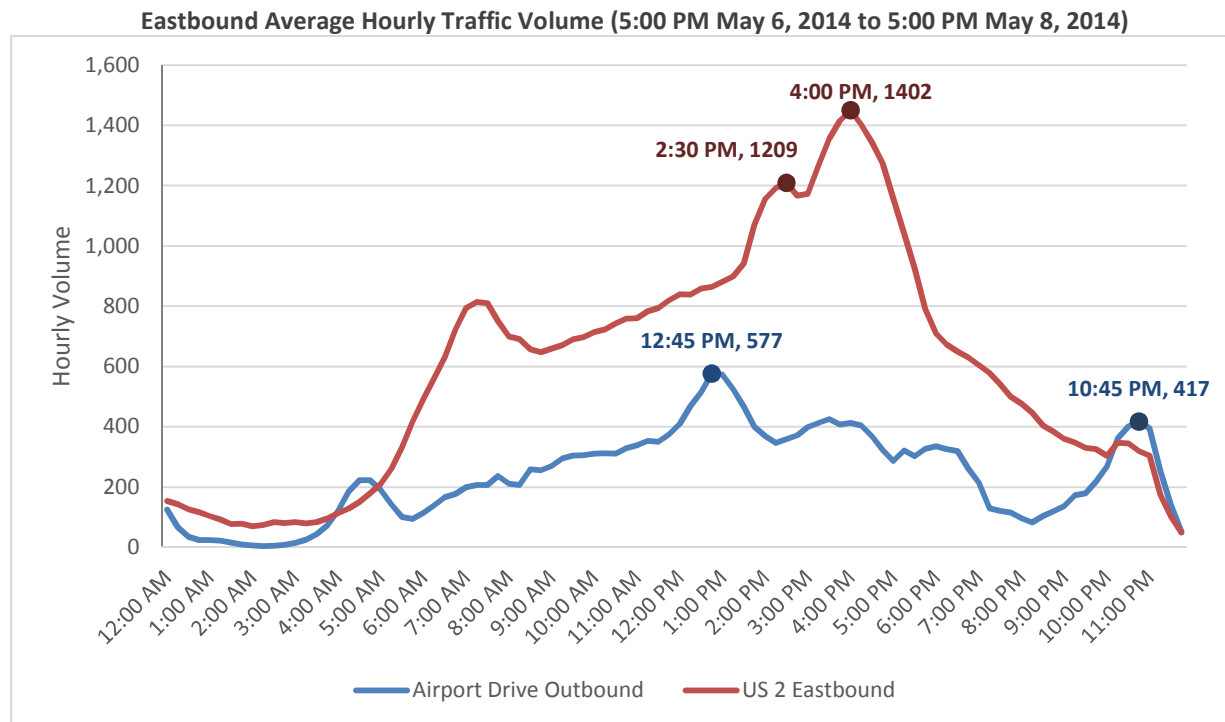
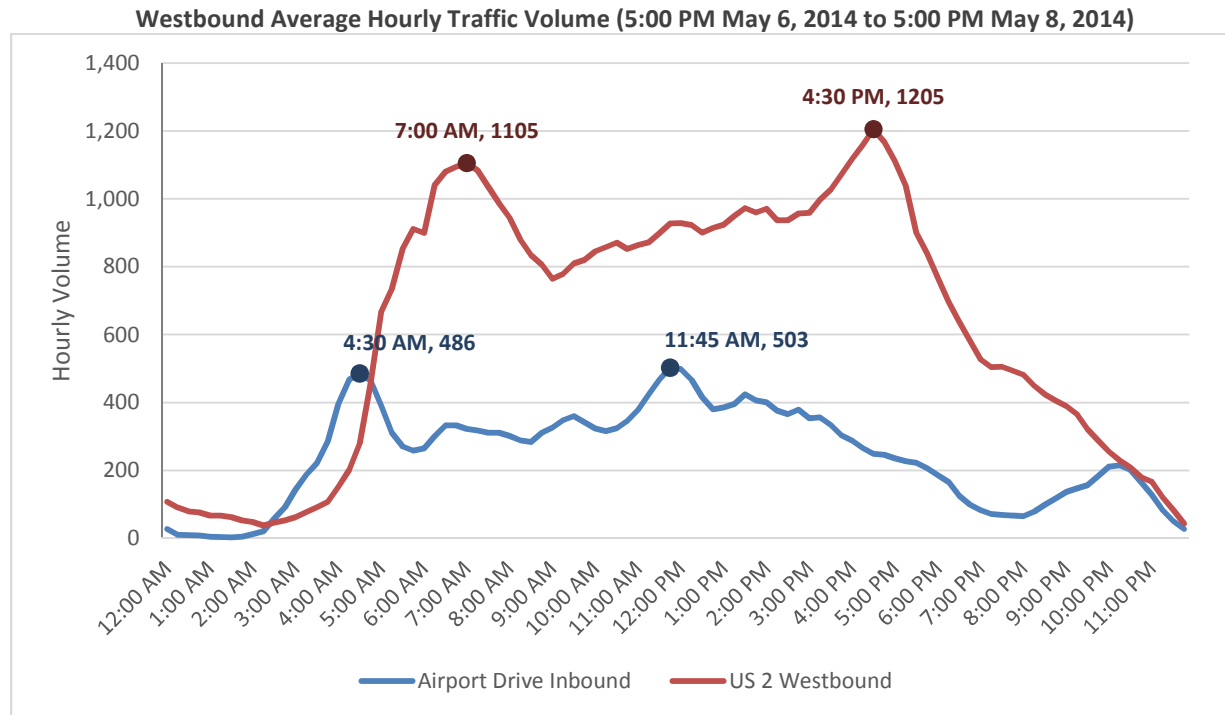
Average all-day traffic volumes (ADT) on Airport Drive are 5,950 in each direction west of Spotted Road and 5,580 in each direction east of Spotted Road. On Spotted Road the ADT ranges from 2,920 both directions combined south of Outbound to 2,020 north of Inbound. The ADT on US 2 is considerably higher at 29,950 for both directions combined.

In order to identify when the peak hour of traffic occurs on Airport Drive and US-2, the average hourly traffic volumes at US-2 and Spotted Road, Inbound west of Spotted Road, and Outbound east of Spotted Road were compared. Figure 2 illustrates the average hourly traffic volumes that were observed on Airport Drive and US-2 during the traffic counts. The eastbound traffic on US-2 experiences two afternoon peak hours at 2:30 PM and 4:00 PM while westbound traffic had a typical urban traffic



pattern with an AM peak hour at 7:00 AM and PM peak hour at 4:30 PM. The peak hours on Airport Drive do not occur during the typical peak hours nor during those of US-2. The eastbound peak hours on Airport Drive were at 12:45 PM and 10:45 PM while the westbound were at 4:30 AM and 11:15 AM.

Figure 2. Comparison of Hourly Traffic Volumes on Airport Drive and US 2



Based on the evaluation of the all-day counts, manual turning movement counts were also collected in 15 minute increments at the two study intersections as well as the intersections of Inbound/Flint Road and US2/Spotted Road on May 15, 2014 from 12:00 – 2:00 PM and 4:00 – 5:00 PM. The other two intersections were counted for informational purposes, to reevaluate past studies and to potentially assist with the traffic forecasting as well. Mid-day Peak Hour turning movement volumes are shown in Figure 3 while PM Peak Hour Turning Movement volumes are shown in Figure 4. Traffic volumes collected are included in Appendix C.

## Operational Analysis

The analysis of Level-of-Service (LOS) is a means of quantitatively describing the quality of operational conditions of a roadway segment or intersection and the perception by motorists and passengers. Service levels are identified by letter designation, A – F, with LOS “A” representing the best operating conditions and LOS “F” the worst. Each LOS represents a range of operating conditions and one or more measures of effectiveness (MOE’s) are used to quantify the LOS of a roadway element. For intersections the MOE used is average control delay (seconds) per vehicle. While there are several methodologies for estimating the LOS of intersections, the most commonly used is presented in the Highway Capacity Manual and is the methodology used in this study (HCM 2010). The Highway Capacity Manual LOS criteria for unsignalized intersections are summarized in Table 1.

Table 1. Level of Service Criteria for Signalized and Unsignalized Intersections

Level of Service (LOS)	Average Control Delay (seconds/vehicle)	
	Signalized Intersections	Unsignalized Intersections
A	< =10	< =10
B	>10 - < 20	>10 - < 15
C	>20 - < 35	>15 - < 25
D	>35 - < 55	>25 - < 35
E	>55 - < 80	>35 - < 50
F	>80	>50

Source: *Highway Capacity Manual 2010*, Transportation Research Board, National Research Council, Washington, D.C., 2010.

For unsignalized intersections “delay” is based on the availability of gaps in the major street to allow minor street movements to occur. As traffic volumes increase, the availability of gaps decrease and greater delay tends to result in driver frustration and anxiety, loss of time, unnecessary fuel consumption, and contributes to unnecessary air pollution. The City of Spokane standard for Level of Service is LOS “D”, meaning the overall intersection LOS must be “D” or better.

Peak hour traffic volumes and existing intersection geometry and traffic control were evaluated to determine the delay and Level of Service at the study intersections. The results of the capacity analysis and intersection delay for existing conditions are shown in Table 2 with LOS worksheet calculations included in Appendix D.

# LEGEND



Study Intersection

000

Peak Hour Volumes

LT TH RT  
Left Thru Right

Volume Turn Movement



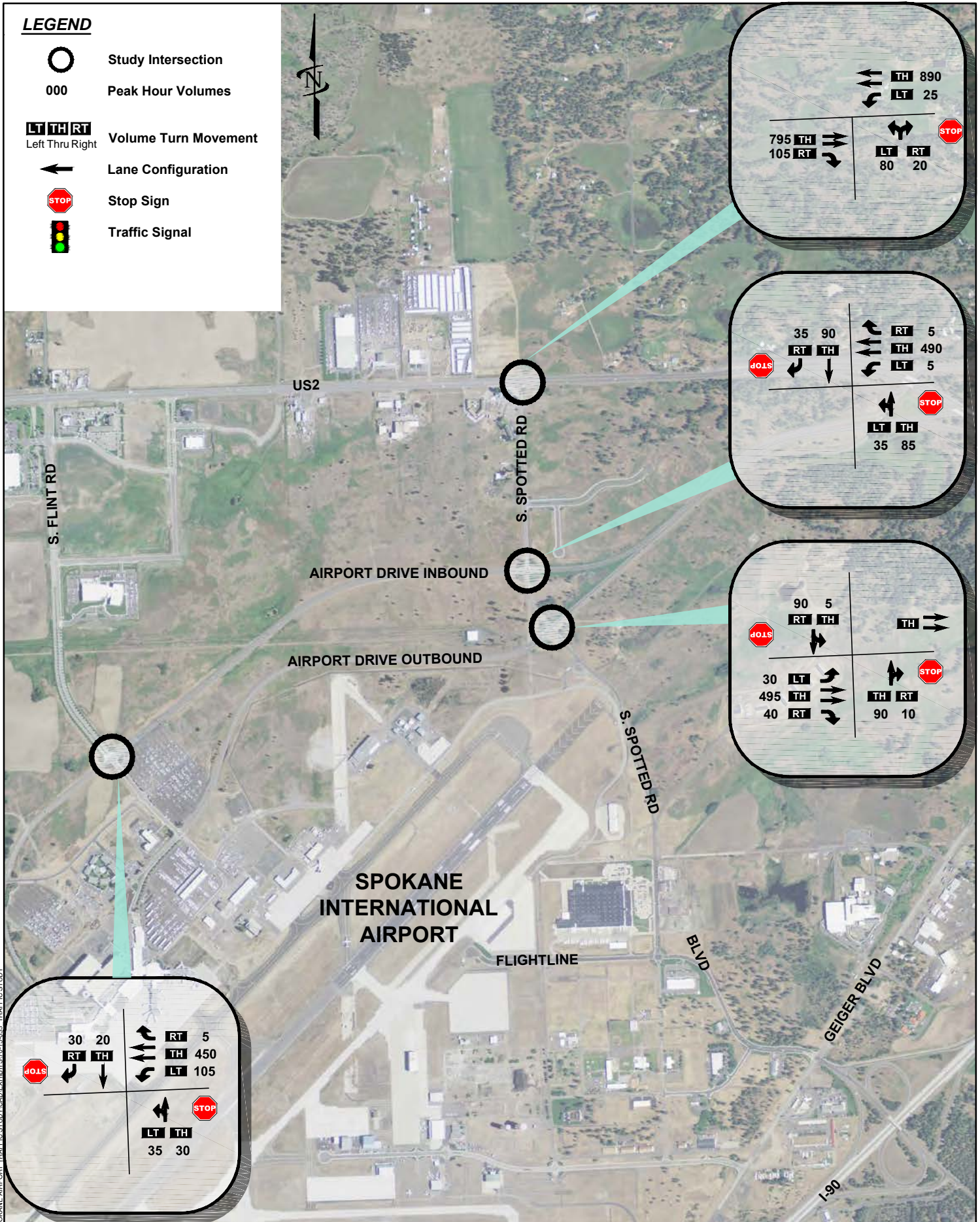
Lane Configuration



Stop Sign



Traffic Signal



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2014 MID-DAY  
PEAK TRAFFIC  
VOLUMES

FIGURE  
3

AIRPORT DRIVE COUPLET AT  
SPOTTED ROAD INTERSECTION STUDY



# LEGEND



Study Intersection

000

Peak Hour Volumes

LT TH RT  
Left Thru Right

Volume Turn Movement



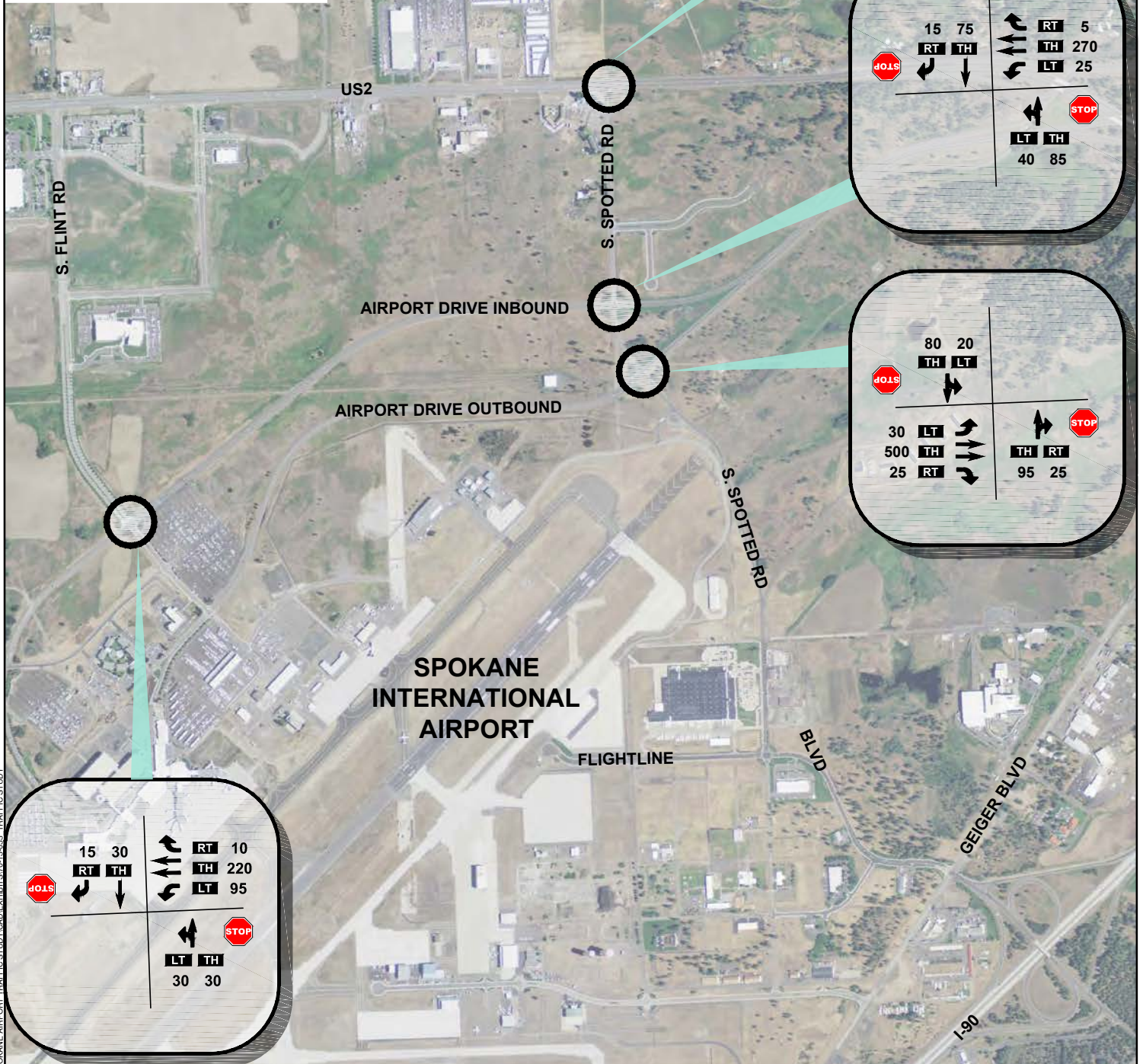
Lane Configuration



Stop Sign



Traffic Signal



2014 PM PEAK  
TRAFFIC  
VOLUMES

FIGURE  
4

AIRPORT DRIVE COUPLET AT  
SPOTTED ROAD INTERSECTION STUDY





Table 2. Summary of Existing Mid-day and PM Peak Hour Intersection Delay (sec) and Level of Service

Intersection	Mid-Day Peak		Evening Peak	
	North bound	South bound	North bound	South bound
US 2/Spotted Road	26.8/D	--	58/F	--
Inbound Airport Drive/Spotted Road	16.8/C	14.8/B	13.6/B	12.2/B
Outbound Airport Drive/Spotted Road	16.6/C	20/C	17.8/C	19.3/C
Inbound Airport Drive/Flint Road	18.3/C	13.1/B	10.9/B	10.4/B

**LEGEND**

22.8/C      Delay in average seconds per vehicle/Level of Service

NB = northbound, SB = southbound, WB = westbound, EB = eastbound

As shown in Table 2 the overall delay and LOS for the two study intersections of Airport Drive at Spotted Road are good during both peaks evaluated with LOS of “B” or “C”. The mid-day peak actually has higher delay experienced than the PM peak at both Inbound/Spotted Road and Inbound /Flint Road. The intersection of US2/Spotted Road functions acceptably during the mid-day with LOS “D”, however, during the PM peak the LOS is “F” with 58 seconds of average vehicle delay.

### Collision History

A significant amount of research was performed to identify the crash history for the two study intersections. Crashes for years prior to improvements were identified for the years 2002 – 2008 and are summarized in Table 3, while crashes after improvements were made for years 2009 – 2013 are summarized in Table 4. More detailed information was available for the 2009 – 2013 time period and it was feasible to determine which of the two intersections and the directions of travel for the vehicles involved. These crashes are also shown with more detailed information graphically in Figures 5 and 6 below.

Examination and comparison of Tables 3 and 4 shows that there were 41 total crashes during the 7 years (5.85/year) prior to improvements with 1 fatality and 9 injuries. During the 5 years for which crash data is available after intersection improvements were installed there had been 27 crashes (5.4/year) with 1 fatality and 8 injuries. More crashes have typically occurred at the intersection of Spotted Road/Outbound than at Inbound. The vast majority of crashes are the result of a vehicle entering at an angle.

As shown in Figure 5, nearly all of the crashes at Spotted Road/Inbound involve a northbound vehicle, whereas at Outbound there are crashes involving southbound vehicles as well.

Table 3. Airport Drive/Spotted Road Crash Summary 2002 - 2008

**Total Accidents at Airport Drive/Spotted Road**

Intersection	2002	2003	2004	2005	2006	2007	2008	Total
Spotted Road at Inbound/Outbound Airport Drive Combined	7	3	3	6	8	7	7	41

**Most Severe Injury Type**

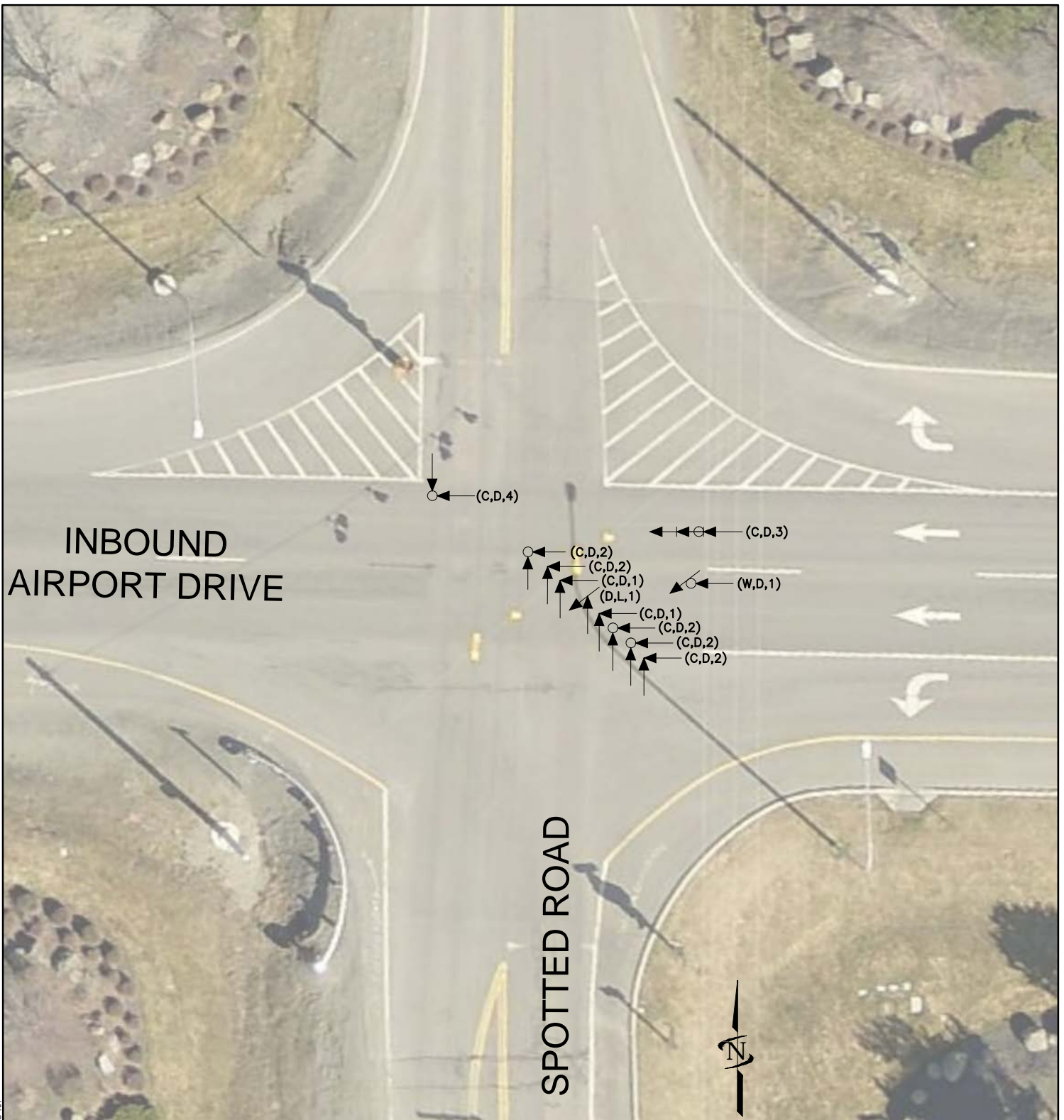
Injury Type	2002	2003	2004	2005	2006	2007	2008	Total
Fatality					1			1
Disabling	3		1					4
Serious							1	1
Evident Injury	1				3			4
Possible Injury	1	1		2		4	2	10
No Injury	1	2	2	4	4	3	4	20
Unknown	1							1
<b>TOTAL</b>	<b>7</b>	<b>3</b>	<b>3</b>	<b>6</b>	<b>8</b>	<b>7</b>	<b>7</b>	<b>41</b>

Table 4. Airport Drive/Spotted Road Crash Summary 2009 - 2013

Total Accidents by Location						
Intersection	2009	2010	2011	2012	2013	Total
Inbound/Spotted	2	3	1	3	2	11
Outbound/Spotted	3	2	5	2	4	16
<b>TOTAL</b>	<b>5</b>	<b>5</b>	<b>6</b>	<b>5</b>	<b>6</b>	<b>27</b>

Most Severe Injury Type		
Injury Type	Inbound Airport Dr/ Spotted Rd	Outbound Airport Dr/ Spotted Rd
	Number of Accidents	
Fatality	0	1
Serious	1	1
Evident Injury	4	2
Possible Injury	2	3
No Injury	4	9
<b>TOTAL</b>	<b>11</b>	<b>16</b>

Most Common First Collision Type				
Collision Type	Inbound Airport Drive/Spotted Road		Outbound Airport Drive/ Spotted Road	
	Total	Percent	Total	Percent
Entering at angle	9	81.8%	14	87.5%
Same direction - rear end	1	9.1%	0	0.0%
Over Embankment - no guardrail	1	9.1%	0	0.0%
Fixed Object	0	0.0%	1	6.3%
Same direction - sideswipe	0	0.0%	1	6.3%
<b>TOTAL</b>	<b>11</b>	<b>100.0%</b>	<b>16</b>	<b>100.0%</b>



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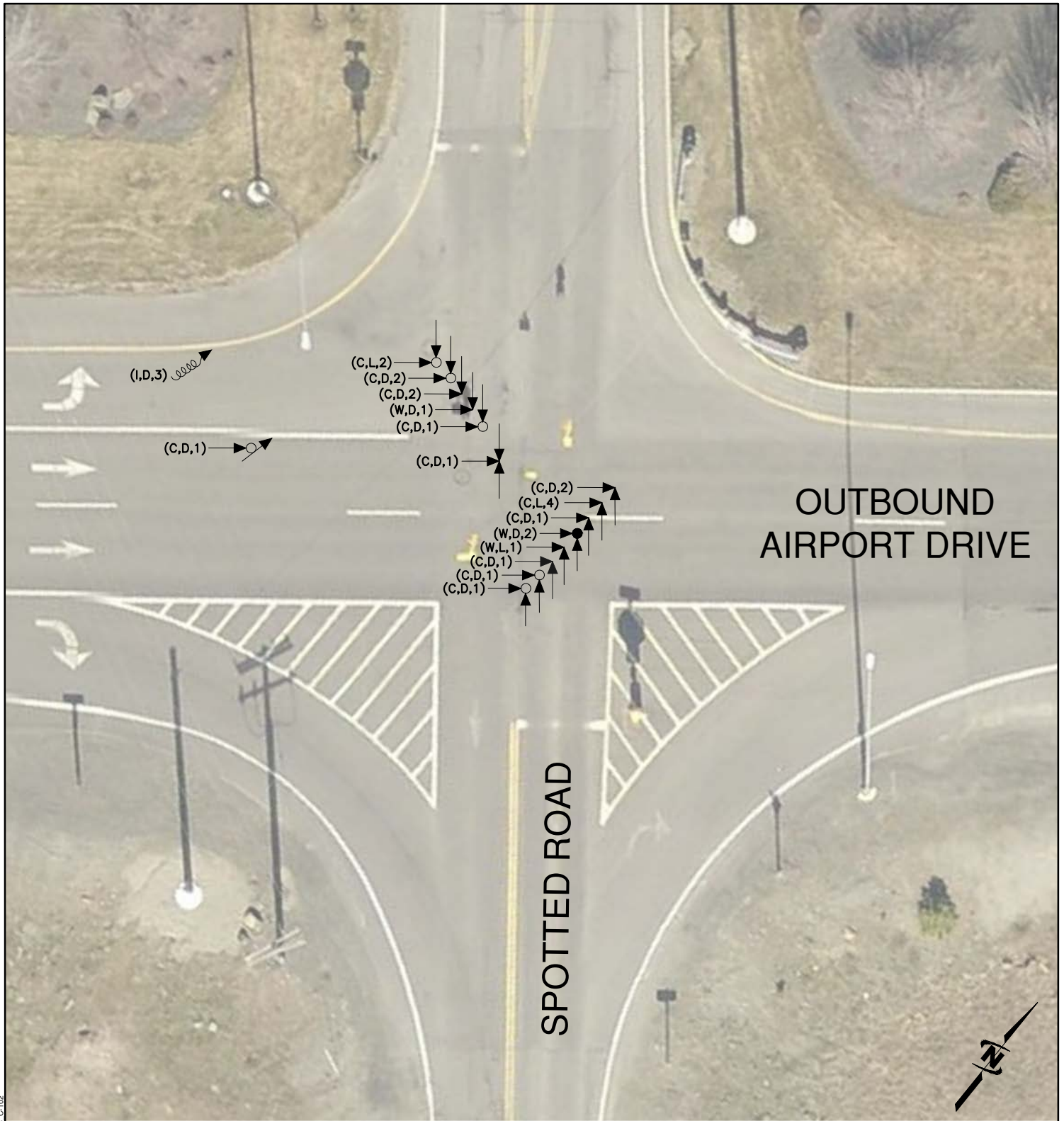


**INBOUND AIRPORT  
DRIVE AND  
SPOTTED ROAD  
CRASHES 2009-2013**

**FIGURE  
5**

**AIRPORT DRIVE COUPLET  
AT SPOTTED ROAD  
INTERSECTION STUDY**





### ACCIDENT LEGEND

SYMBOLS	TYPE OF COLLISION
◁	NON MOVING VEHICLE
←	MOVING VEHICLE
↶	BACKING VEHICLE
□	FIXED OBJECT
●	FATAL ACCIDENT
○	INJURY ACCIDENT
↹	REAR-END
↱	HEAD ON

SYMBOLS	TYPE OF COLLISION
↯	SIDE SWIPE
↯	OUT OF CONTROL
↯	AT ANGLE
↯	RIGHT ANGLE
↯	LEFT TURN
C	DRY, CLEAR
W	WET
S	SNOW/SLUSH

SYMBOLS	TYPE OF COLLISION
I	ICE
D	DAYLIGHT
N	DARK, NO LIGHTS
L	DARK WITH LIGHTS
1	FAILED TO YIELD (DIDN'T GRANT ROW)
2	FAILED TO OBEY STOP
3	EXCEEDING REASONABLE SAFE SPEED
4	INATTENTION

Given the types of collisions, and the geometry of the study intersections it was felt that the speeds of vehicles on Airport Drive and sight distance from the stop signs on Spotted Road could be contributing factors to the number of crashes at the intersections. If Spotted Road traffic either can not see approaching Airport Drive Traffic with adequate time to judge whether there is enough time to safely cross Airport Drive, or if Airport Drive traffic is traveling faster than the posted speed making it harder for Spotted Road traffic to identify adequate gaps in the traffic to safely cross, then drivers may take risks to cross traffic.

Speeds were evaluated from the traffic data collected for each of the legs of the two study intersections and is summarized in Table 5. The most critical data is the Airport Drive speed approaching the study intersections. As the data shows, 9.6% of the Inbound traffic is going more than 5 MPH over the 50 MPH speed limit, however 8% of the total is between 5 and 10%. Although the percentage of traffic going faster than 60 MPH is low (1.6% of the two day total), it was over 200 vehicles and some were going faster than 70 MPH. This could contribute somewhat to reducing the ability of Spotted Road traffic to identify adequate gaps in traffic. Only 0.3% of the Outbound traffic was going faster than 10 MPH above the 50 MPH posted speed. The 85 percentile speeds westbound on Inbound Airport Drive east of Spotted Road approaching the intersection was 54 MPH and west of Spotted Road was 51 MPH. The 85 percentile speeds eastbound on Outbound Airport Drive west of Spotted Road approaching the intersection was 51 MPH and east of Spotted Road was 55 MPH.

The time from when approaching vehicles on Inbound and Outbound can be seen, to when they arrive at Spotted Road was also evaluated. It was found that Inbound traffic can be seen by northbound Spotted Road vehicles about 14 seconds prior to arriving at the intersection. Outbound traffic can be seen by southbound Spotted Road traffic 9 seconds prior to arrival at the intersection. These times far exceed the time required to make a safe crossing.

Examination of the accident data reveals that a significant number of the crashes were the result of “Disregard Stop Sign” or “Did not Grant Right-of-Way. “ Even with all of the signage, flashing lights, rumble strips and other safety improvements, drivers for some reason are making poor decisions to cross Airport Drive.

Table 5. All-day Vehicle Speeds

Airport Drive Speed Limit 50 MPH																	% >5MPH Over Speed Limit
		Speed															
		1-35	36-40	41-45	46-50	51-55	56-60	61-65	66-70	71-75	76-80	81-85	86-90	TOTAL			
Inbound Airport Dr East of Spotted Rd	Direction	Total	218	262	3624	4944	4841	1048	187	19	7	0	0	0	13150	1261	
	WB Percent		1.7%	2.0%	12.3%	37.6%	36.8%	8.0%	1.4%	0.1%	0.1%	0.0%	0.0%	0.0%	100.0%	9.6%	
Inbound Airport Dr West of Spotted Rd	Direction	Total	594	1122	2644	6053	3406	524	63	14	1	0	0	0	14421	602	
	WB Percent		4.1%	7.8%	18.3%	42.0%	23.6%	3.6%	0.4%	0.1%	0.0%	0.0%	0.0%	0.0%	100.0%	4.2%	
Outbound Airport Dr West of Spotted Rd	Direction	Total	173	392	2957	7456	3123	371	41	5	3	0	0	1	14522	421	
	EB Percent		1.2%	2.7%	20.4%	51.3%	21.5%	2.6%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	2.9%	
Outbound Airport Dr East of Spotted Rd	Direction	Total	186	258	1363	4337	5610	1998	221	28	1	4	2	1	13609	1855	
	EB Percent		1.4%	1.9%	10.0%	31.9%	41.2%	1.7%	1.6%	0.2%	0.0%	0.0%	0.0%	0.0%	100.0%	13.6%	

Spotted Road  
Speed Limit 45 MPH north of Inbound Airport Drive, 30 MPH south of Inbound Airport Drive

Location	Direction	Speed															% >5 MPH Over Speed Limit	
		Speed																
		1-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65	66-70	71-75	76-80	TOTAL		
Spotted Road North of Airport Dr	Total	29	5	20	196	727	944	314	50	4	0	0	0	0	0	2298	63	
	Percent	1.3%	0.2%	0.9%	8.5%	31.6%	41.1%	13.7%	2.4%	0.2%	0.1%	0.0%	0.0%	0.0%	0.0%	100.0%	2.7%	
Spotted Road between Airport Dr	Total	28	6	77	354	933	744	244	37	3	0	0	0	0	0	2426	40	
	Percent	1.2%	0.2%	3.2%	14.6%	38.5%	30.7%	10.1%	1.5%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	1.6%	
Spotted Road between Airport Dr	Total	87	76	518	1782	883	109	14	1	0	0	0	0	0	0	3470	1007	
	Percent	2.5%	2.2%	14.9%	51.4%	25.4%	3.1%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	29.0%	
Spotted Road South of Airport Dr	Total	132	93	481	1239	619	91	9	0	0	0	0	0	0	0	2643	708	
	Percent	5.0%	3.5%	18.2%	46.5%	23.4%	3.1%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	26.8%	
Spotted Road South of Airport Dr	Total	274	481	1507	1029	88	8	0	0	0	0	0	0	0	0	3387	96	
	Percent	8.1%	14.2%	44.5%	30.4%	2.6%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	2.8%	
Spotted Road South of Airport Dr	Total	147	149	988	1594	445	42	4	0	0	0	0	0	0	0	3369	491	
	Percent	4.4%	4.4%	29.5%	47.2%	13.2%	1.2%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	14.6%	

Speeds that exceed the Posted Speed Limit  
Intersection Approach

## 2034 No-Build Traffic Volumes

This section describes the methodology used to develop traffic volumes for the 5, 10 and 20 year scenarios and evaluates No-Build traffic volumes for traffic operations.

### Forecast Methodology

There were two components of the preparation of the future 20 year traffic forecasts for this study effort: 1) Historical Growth, and 2) Regional Model forecasted growth.

#### Historical Traffic Growth

PM peak hour traffic volumes from 2003 were available from the previous study at the intersections of Spotted Road at Inbound and Outbound Airport Drive as well as at US 2. These volumes were compared with the volumes collected as part of this study effort for 2014. It was found that the annual growth rates by approach at the Outbound/Spotted Road intersection ranged from 1.8% per year to 3.3% per year. (The regional model showed a range of 0.9% to 2.2% annual growth rate by approach.) The historical annual growth rates for each approach were applied to the 2014 traffic volumes collected as part of this study to determine future traffic volumes for year 2019, 2024 and 2034. These volumes are shown for the two study intersections in Figure 6.

#### Regional Model

As a tool in preparing the Regional Transportation Plan, the Spokane Regional Transportation Council (SRTC) maintains a set of regional computerized transportation models. The model is developed using current transportation network features and existing land uses in the region (representing year 2010) using Transportation Analysis Zones (TAZs). Each TAZ is defined with various attributes describing the number and type of households and employees as well as other land uses within each zone. Using existing traffic data, the model is calibrated for existing conditions using Federal Highway Administration procedures and methods. Once calibrated, changes in assumptions for future land uses and roadway networks can be made to determine the potential impacts of developments and/or roadway scenarios. Land use assumptions representing future conditions are developed to determine various impacts on the roadway network at a regional level. The future year model representing the year 2030 developed by SRTC represents the best land use and roadway assumptions at the time it was created.





It must be recognized that although traffic models are calibrated within acceptable ranges, the model is a tool in transportation planning and traffic forecasting. The SRTC model is a PM peak hour model. Professional judgment should be used in interpreting model outputs. To arrive at reasonable estimates of traffic volumes for the year 2034, the following steps were taken.

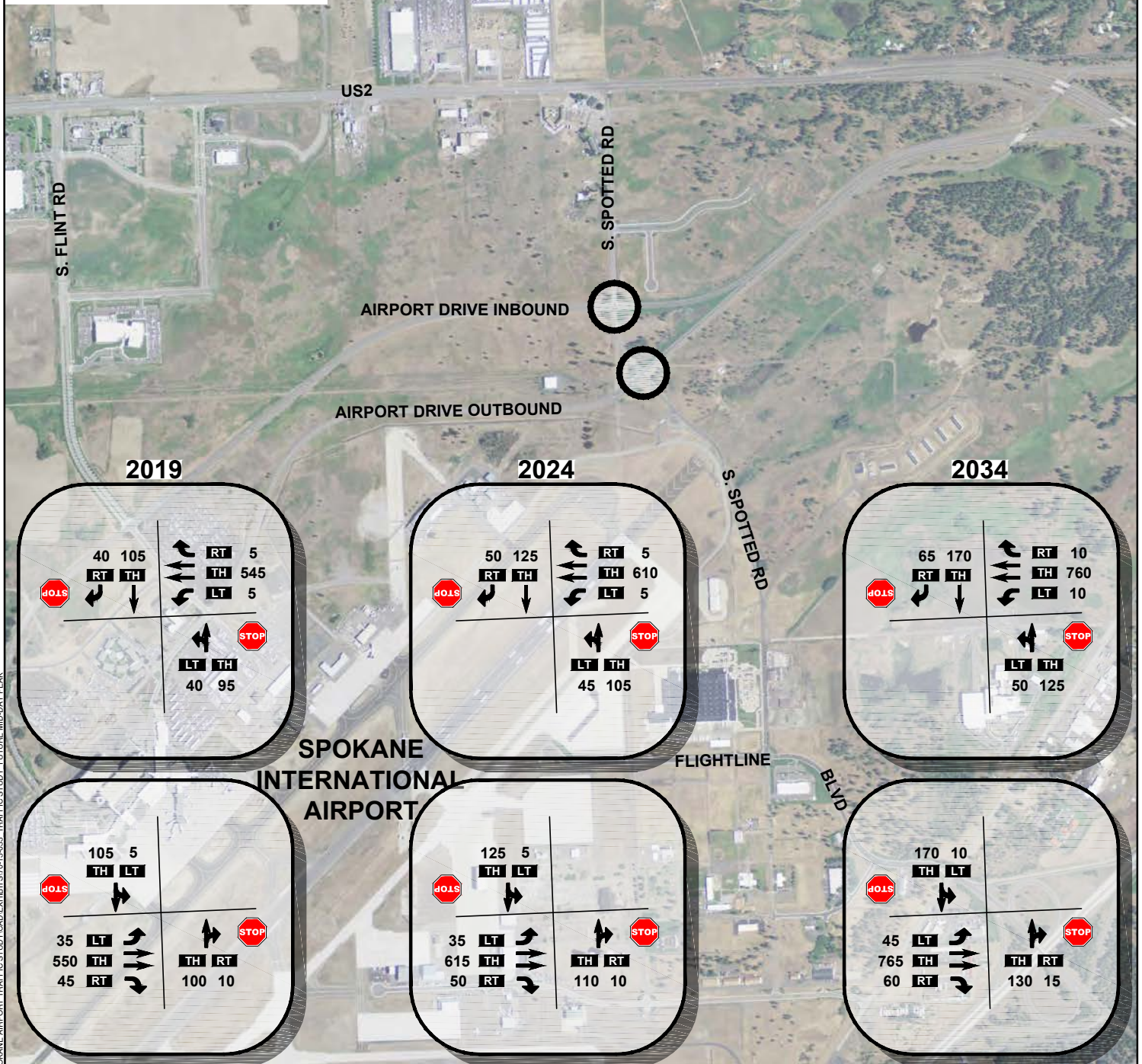
After the alternatives for evaluation were developed, as described later in this report, the regional model was used to forecast traffic volumes with the following features:

- The same demographic features as the 2030 regional model were reviewed and deemed appropriate. It was assumed that even though the existing mid-day volumes are higher than the traditional PM peak hour, that with the growth in the area around the airport the PM peak would exceed the mid-day in the future and that no adjustment to the regional model would be necessary for that purpose.



# LEGEND

-  Study Intersection
- 000** Peak Hour Volumes
- LT TH RT**  
Left Thru Right Volume Turn Movement
-  Lane Configuration
-  Stop Sign
-  Traffic Signal



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FUTURE NO-BUILD  
PEAK HOUR  
TRAFFIC  
VOLUMES

FIGURE  
7

AIRPORT DRIVE COUPLET AT  
SPOTTED ROAD INTERSECTION STUDY

- 21<sup>st</sup> Avenue Extension from Hayford Road to Airport Drive was added
- Spotted Road was realigned southeast of Airport Drive to connect with 21<sup>st</sup> Avenue at Airport Drive.

The consultant team worked closely with SRTC staff and the City of Spokane traffic engineer to obtain outputs from the model with adjustments described above and to prepare turning movement volumes at the new intersection of Airport Drive/21<sup>st</sup> Avenue/Spotted Road. The historical growth rates in the No-Build Scenario were used to corroborate future forecasts with the modified roadway network.

Once traffic volumes for the initial alternative were complete, traffic volumes for all of the alternatives were developed by tracking each movement through the study area such that the total volume entering and exiting the study intersections for each alternative were equal.

### Traffic Operations Analysis

The traffic volumes from Figure 7 were evaluated for delay and Level of Service using the existing lane configurations and traffic control using the Highway Capacity Manual procedures. The results of the analysis are shown in Table 6 with LOS worksheet calculations included in Appendix D.

Table 6. Summary of Future Delay (sec) and Level of Service

Scenario	Inbound Airport Drive/ Spotted Road		Outbound Airport Drive/ Spotted Road	
	Northbound	Southbound	Northbound	Southbound
Existing	16.8/C	14.8/B	16.6/C	20/C
2019	19.6/C	16.6/C	18.8/C	25.0/C
2024	24.7/C	19.9/C	21.6/C	34.5/D
2034	65.3/F	40.1/E	34.9/D	147.8/F
	31.6/D (1)	29.6/D (1)	32.9/D (2)	122.2/F (2)

#### LEGEND

22.8/C      Delay in average seconds per vehicle/Level of Service

NB = northbound, SB = southbound, WB = westbound, EB = eastbound

#### Notes

(1) Includes exclusive NB left turn lane and SB right turn lane for Spotted Road.

(2) Includes exclusive NB right turn lane and SB left turn lane for Spotted Road.

As shown in the table, the LOS at the study intersections will gradually increase in delay in each future year which will lower the LOS. Traffic operations are expected to remain above the City of Spokane standard for the next 10 years. In 20 years however, the delay will fall below acceptable LOS. Exclusive turn lanes can provide some relief at Inbound/Spotted Road, however the Outbound intersection will experience LOS "F" even with exclusive turn lanes without some improvements in traffic control.

A traffic signal warrant analysis was conducted. This was performed recognizing that a traffic signal is not the airports preferred method of traffic control on Airport Drive, but rather in an effort to identify when major improvements might be necessary in order to achieve acceptable LOS. Based on the historic growth rates and assuming similar hourly distributions of traffic, it is anticipated that the intersection of Outbound/Spotted Road would meet the 8 hour signal warrant in year 2030.



## Development of Alternatives

This section will discuss the alternatives that were developed for consideration by the Technical Advisory Committee (TAC) and for public review.

### Considerations for the Alternatives

The consultant team reviewed previous studies and brainstormed new alternatives for consideration by the TAC and airport staff. These alternatives were discussed with the TAC. During the review, the short-listed alternatives from the previous study were briefly reviewed as well as some innovative solutions as well.

The TAC narrowed the alternatives to move forward for evaluation and for public review to five. The discussion included the following elements:

- Include the preferred alternative from the earlier study for comparative purposes.
- Roundabouts generally are safer than traditional intersections are more widely accepted than they were at the time of the 2006 study which considered several variations of roundabouts but were dismissed. It is recognized that roundabouts may not be the airports preferred form of traffic control since they slow Inbound traffic and free-flow conditions are preferred.
- Each of the 5 alternatives to move forward should include the 21<sup>st</sup> Avenue Extension from Hayford Road east to Spotted Road. In those alternatives where a connection to Airport Drive is feasible it should be included as well.
- Removal of Spotted Road from the Runway Protection Zone (RPZ) should be included as part of each alternative.
- Minimizing delay on Inbound Airport Drive is a priority.

### Description of the Alternatives

A description of the key components of each of the 5 alternatives is provided below. Graphics of these alternatives are shown in the following 12 Figures, including enlarged graphics of the key intersections.

#### Alternative A: Partial Cloverleaf Interchange

This alternative is the preferred alternative from the 2006 study, however, it also incorporates the 21<sup>st</sup> Avenue Extension and the realignment of Spotted Road outside of the RPZ. Outbound Airport Drive is relocated next to Inbound beginning west of Spotted Road so as to require a single structure to carry Spotted Road over Airport Drive. Existing Spotted Road would be closed south of Outbound in favor of the realigned roadway.

Interchange ramps for Outbound are situated on Spotted Road while Inbound ramps are situated on 21<sup>st</sup> Avenue west of Spotted Road. In this particular case 21<sup>st</sup> Avenue would terminate at Spotted Road, which seemed more meaningful and less costly than including a second interchange for 21<sup>st</sup> Avenue at Airport Drive. There are many options with respect to the phasing of this particular alternative.

#### Alternative B: Two Roundabouts with Continuous Green-T Intersection

This alternative places a new roundabout at each of the existing intersections of Spotted Road at Inbound Airport Drive and Outbound Airport Drive. Inbound and Outbound would each retain 2 lanes while Spotted Road would continue to have a single lane in each direction. 21<sup>st</sup> Avenue could be extended independently east of Flint Road to Connect with Spotted Road. Spotted Road south of

Outbound Airport Drive could also be realigned independently to connect with Airport Drive. At the new intersection of Spotted Road at Airport Drive, a continuous Green-T intersection would be constructed that would allow Inbound to function as a free-flow movement. All other movements at the intersection would be controlled by a traffic signal which would allow westbound left turns from Inbound to southbound Spotted Road as well as northbound left turns from Spotted Road to Inbound to occur while Outbound traffic is stopped.

Alternative C: Interchange at Airport Drive/21<sup>st</sup> Avenue Extension/Spotted Road

This alternative would create a new interchange near the existing westbound off ramp to Tech Park Drive. The future 21<sup>st</sup> Avenue Extension would connect with the realigned Spotted Road and together would go over Airport Drive (existing Tech Park Drive would become 21<sup>st</sup> Avenue). Inbound Airport Drive off-ramps would be in the traditional diamond configuration. However the Outbound ramps would need to also accommodate the existing ramps to Sunset Boulevard (I-90 Business route) in order to meet the length requirements of the ramps. This would function like a collector-distributor system with the off-ramp to Spotted Road/21<sup>st</sup> Avenue and Sunset Boulevard exiting together, with the Sunset Boulevard off continuing separately under the new structure. It would then be joined by the on-ramp from Spotted Road and then after appropriate merge length a diverge to allow the on-ramp from Spotted Road to connect to Outbound Airport Drive while Sunset Boulevard would continue on it's existing path. Existing Spotted Road would be closed south of Inbound.

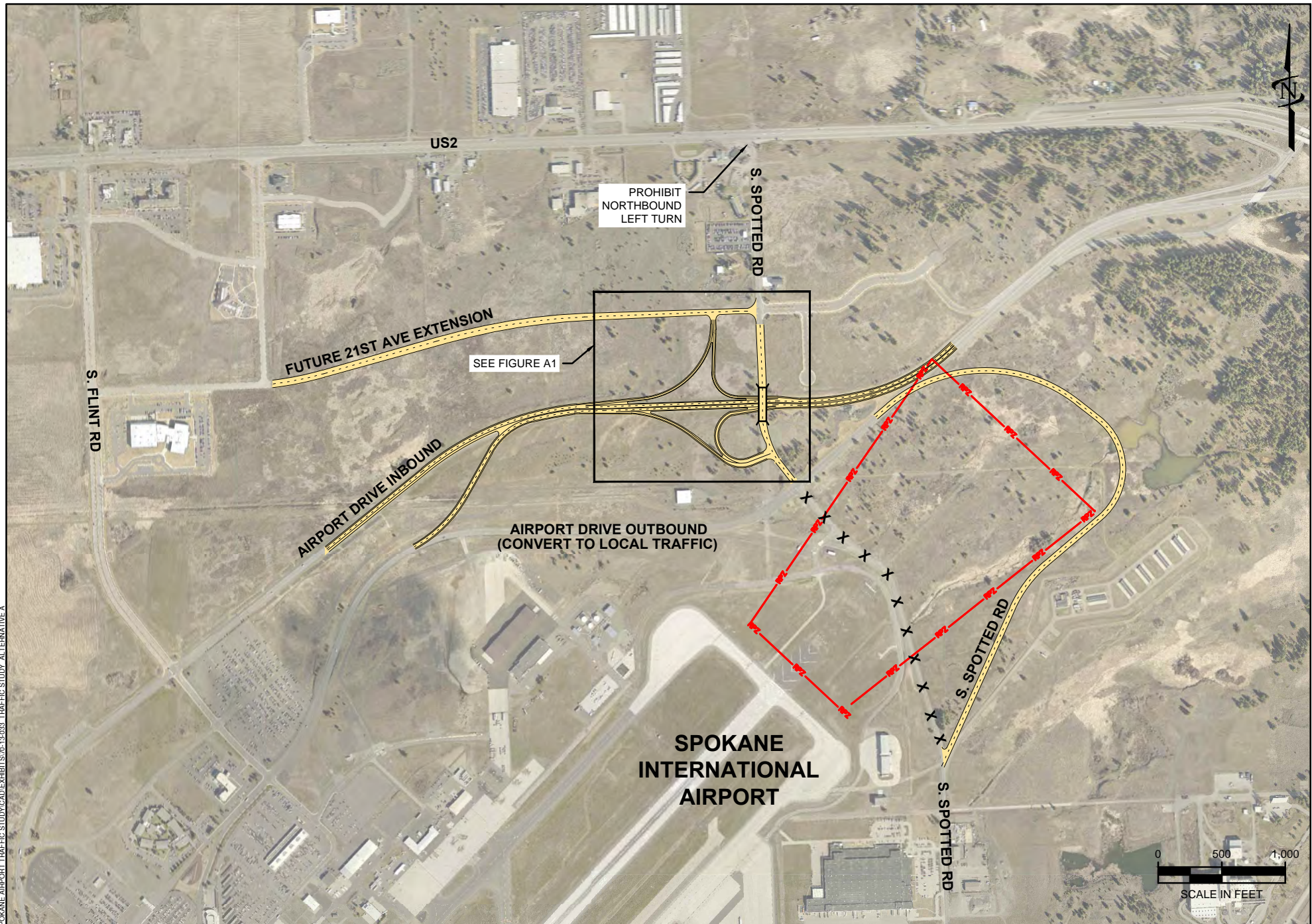
Alternative D: Roundabout at Airport Drive/21<sup>st</sup> Avenue Extension/Spotted Road

This alternative is very similar to Alternative C except that instead of grade separating 21<sup>st</sup> Avenue and Spotted Road both would meet Airport Drive at an at-grade intersection controlled by a roundabout. The roundabout would have two entry lanes for both Inbound and Outbound and a single entry lane for both 21<sup>st</sup> Avenue and Spotted Road. No issues would exist for existing Sunset Boulevard ramps.

Alternative E: Continuous Green-T Intersection and Overpass for Spotted Road at Inbound Airport Drive

This alternative was created in an attempt to retain Inbound Airport Drive as a free flow facility. It includes the Continuous Green-T intersection concept from Alternative B, but instead of a roundabout at the existing Inbound/Spotted Road intersection it would grade separate Spotted Road over Inbound. In an effort to also eliminate the weave of northbound Spotted Road traffic from south of Outbound to go to US 2, this movement would go west parallel to and north of Outbound to the existing Spotted Road and then proceed north over Inbound.





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ALTA A: PARTIAL CLOVERLEAF INTERCHANGE

FIGURE

8

AIRPORT DRIVE COUPLET AT  
SPOTTED ROAD INTERSECTION STUDY



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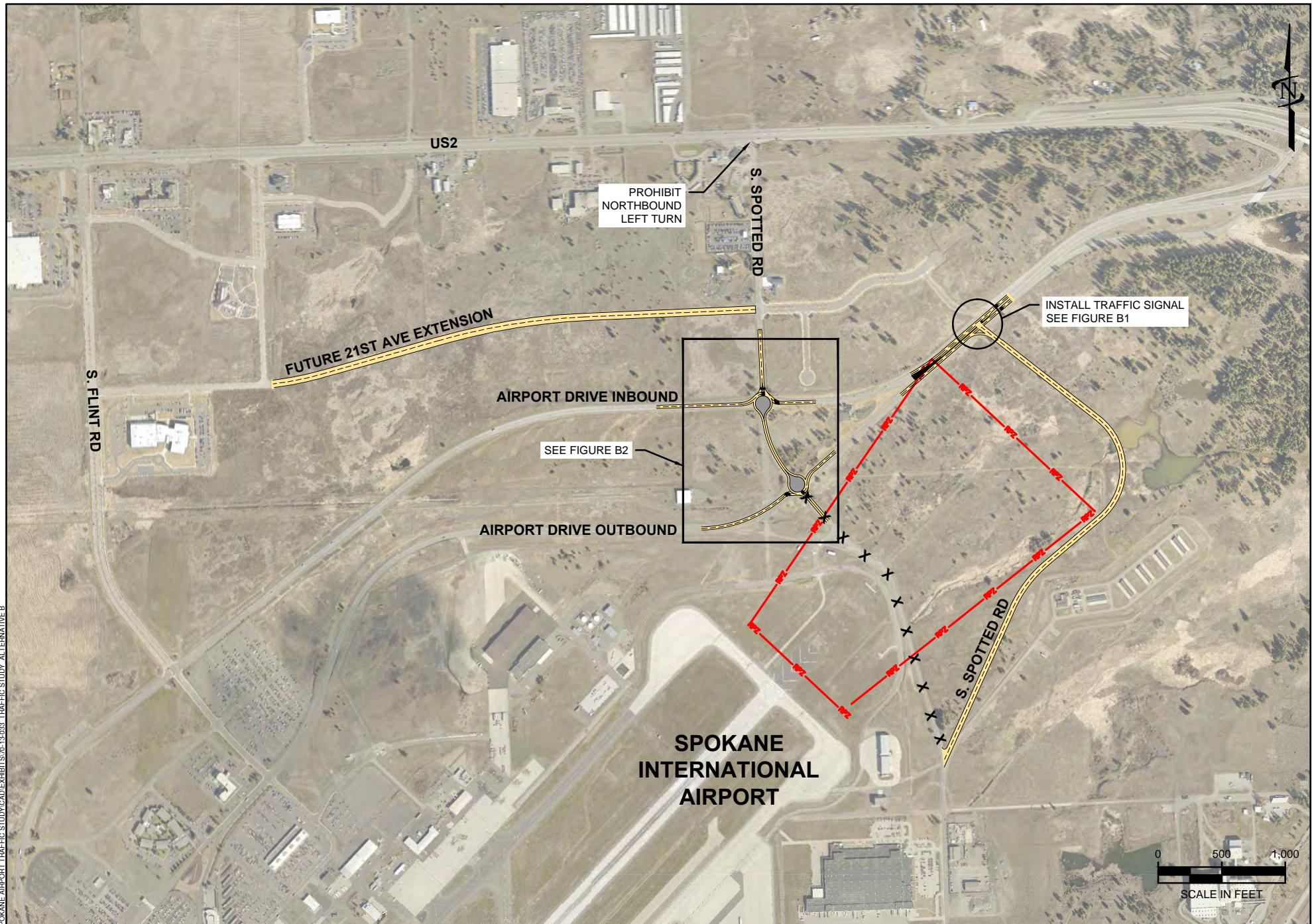
ALT A: PARTIAL CLOVERLEAF INTERCHANGE  
INSET

FIGURE  
**8.1**

AIRPORT DRIVE COUPLET AT  
SPOTTED ROAD INTERSECTION STUDY

LAST UPDATE: 2/5/2015
PLOT DATE: 2/5/2015
FILE





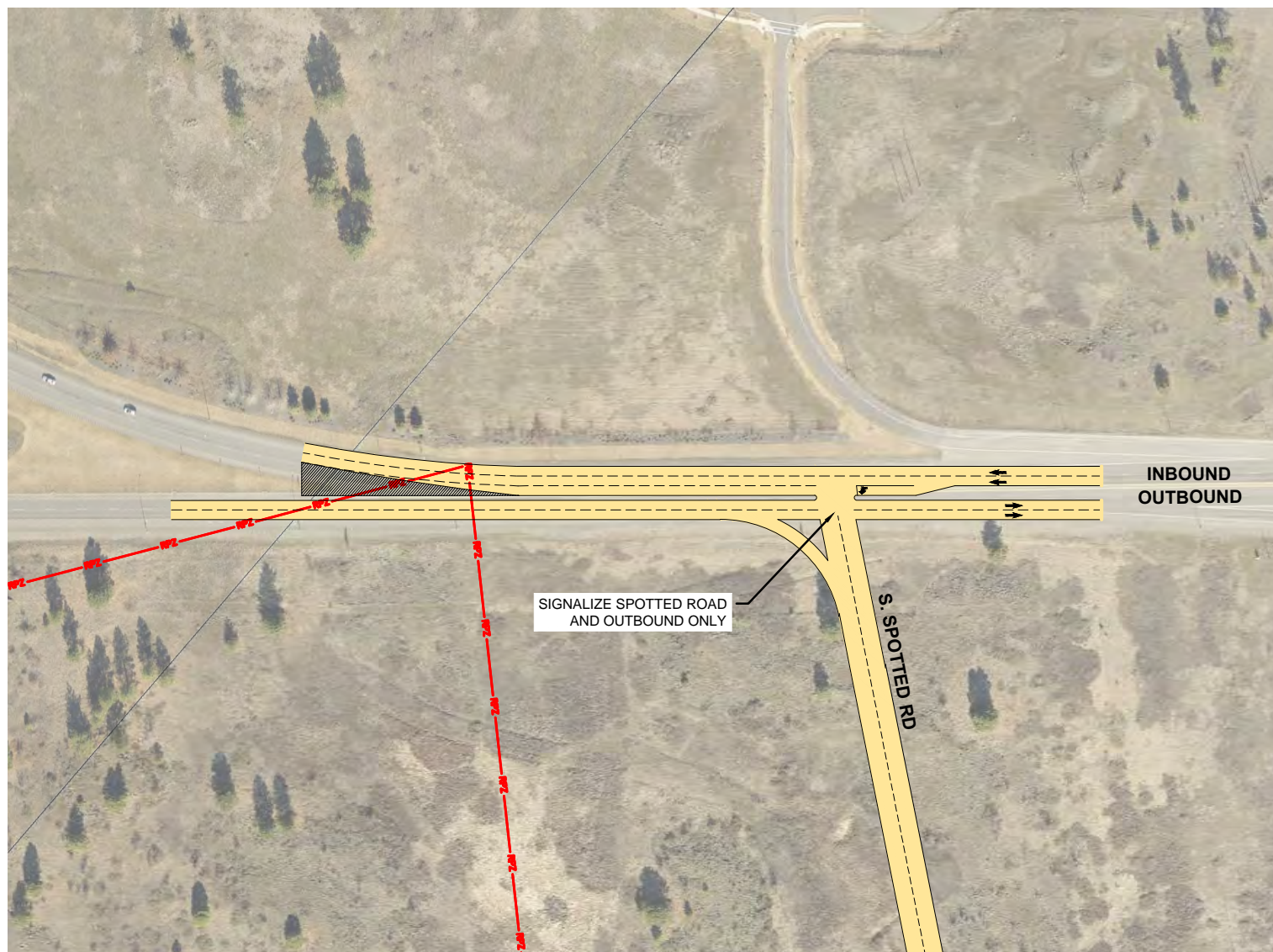
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ALT B: TWO ROUNDABOUTS WITH  
CONTINUOUS GREEN-T INTERSECTION

FIGURE  
9

AIRPORT DRIVE COUPLET AT  
SPOTTED ROAD INTERSECTION STUDY





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ALT B: TWO ROUNDABOUTS WITH  
CONTINUOUS GREEN-T INTERSECTION  
INSET 1

FIGURE  
9.1

AIRPORT DRIVE COUPLET AT  
SPOTTED ROAD INTERSECTION STUDY

LAST UPDATE: 1/8/2015  
PLOT DATE: 2/5/2015  
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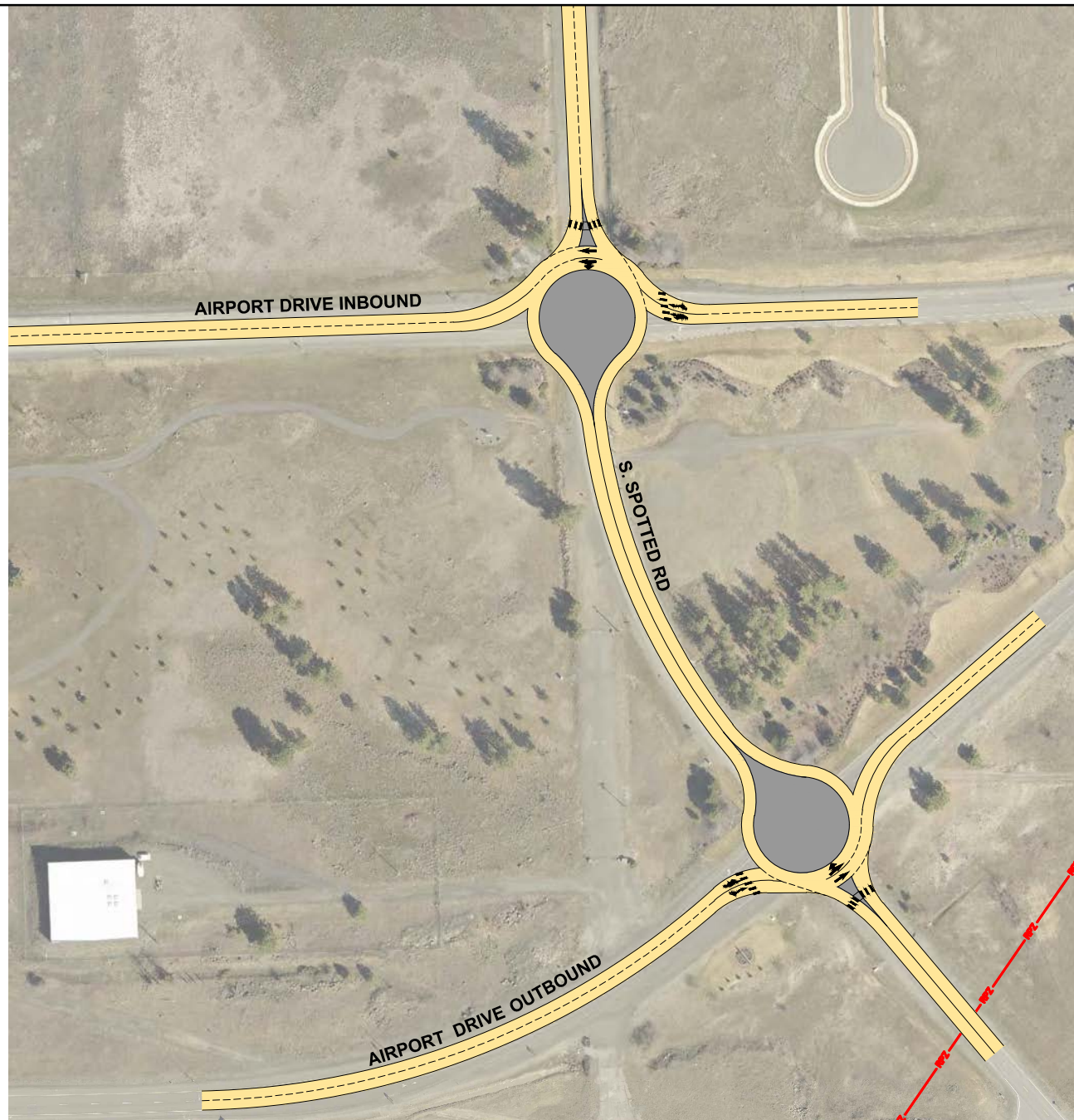


LAST UPDATE: 1/8/2015  
PLOT DATE: 2/5/2015  
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ALT B: TWO ROUNDABOUTS WITH  
CONTINUOUS GREEN-T INTERSECTION  
INSET 2

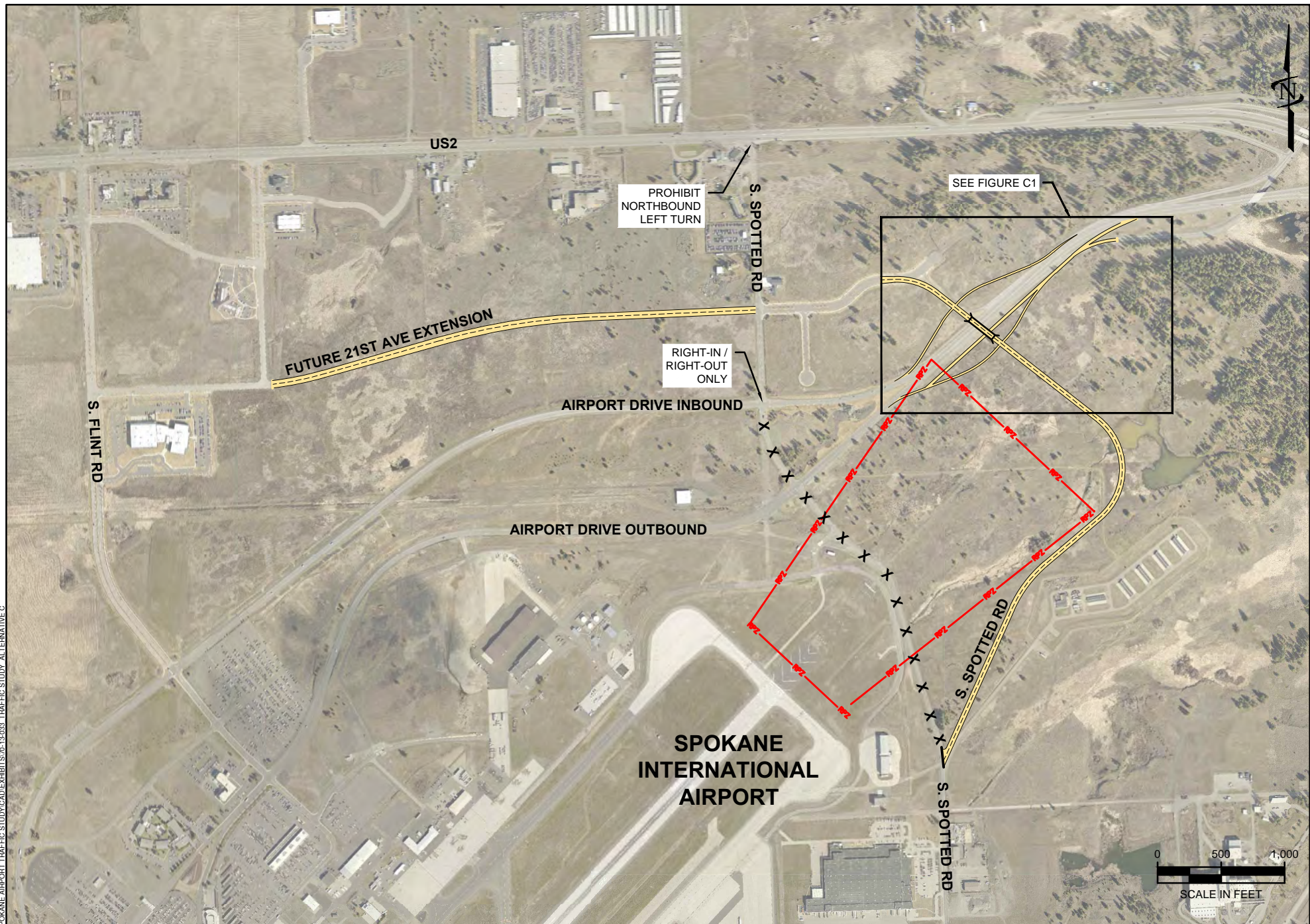
FIGURE  
9.2

AIRPORT DRIVE COUPLET AT  
SPOTTED ROAD INTERSECTION STUDY



0 200 400  
SCALE IN FEET





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ALT C: INTERCHANGE AT AIRPORT DRIVE/  
21ST AVE EXTENSION/ SPOTTED ROAD

FIGURE  
10

AIRPORT DRIVE COUPLET AT  
SPOTTED ROAD INTERSECTION STUDY





\\KWEFILES\PUBLIC\PROJECT\JUB\70-13-033 SPOKANE AIRPORT TRAFFIC STUDY\CADEXHIBITS\70-13-033 TRAFFIC STUDY ALTERNATIVE C

LAST UPDATE: 3/25/2015  
PLOT DATE: 4/30/2015  
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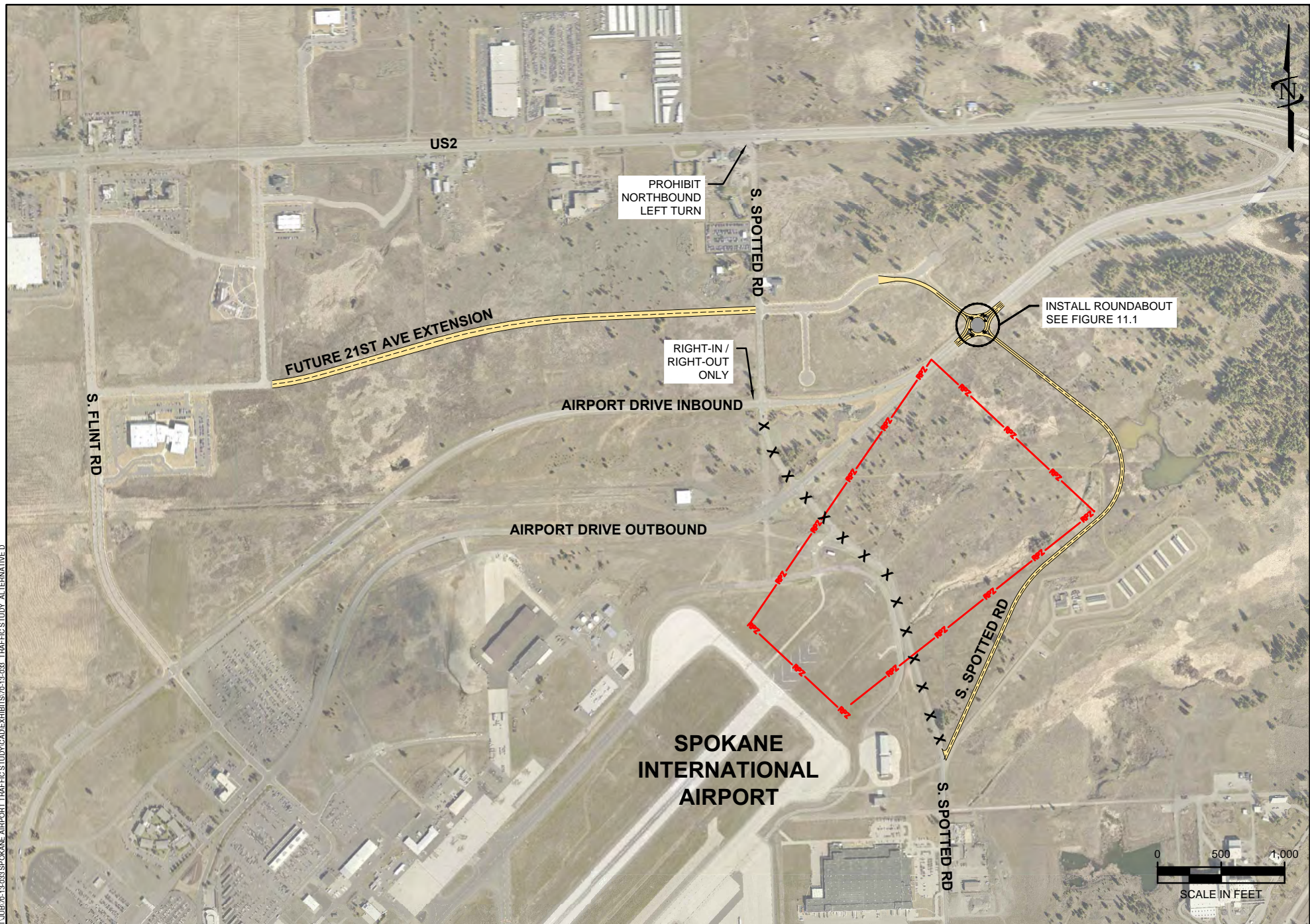


ALT C: INTERCHANGE AT AIRPORT DRIVE/  
21ST AVE EXTENSION/ SPOTTED ROAD  
INSET

FIGURE  
10.1

AIRPORT DRIVE COUPLET AT  
SPOTTED ROAD INTERSECTION STUDY





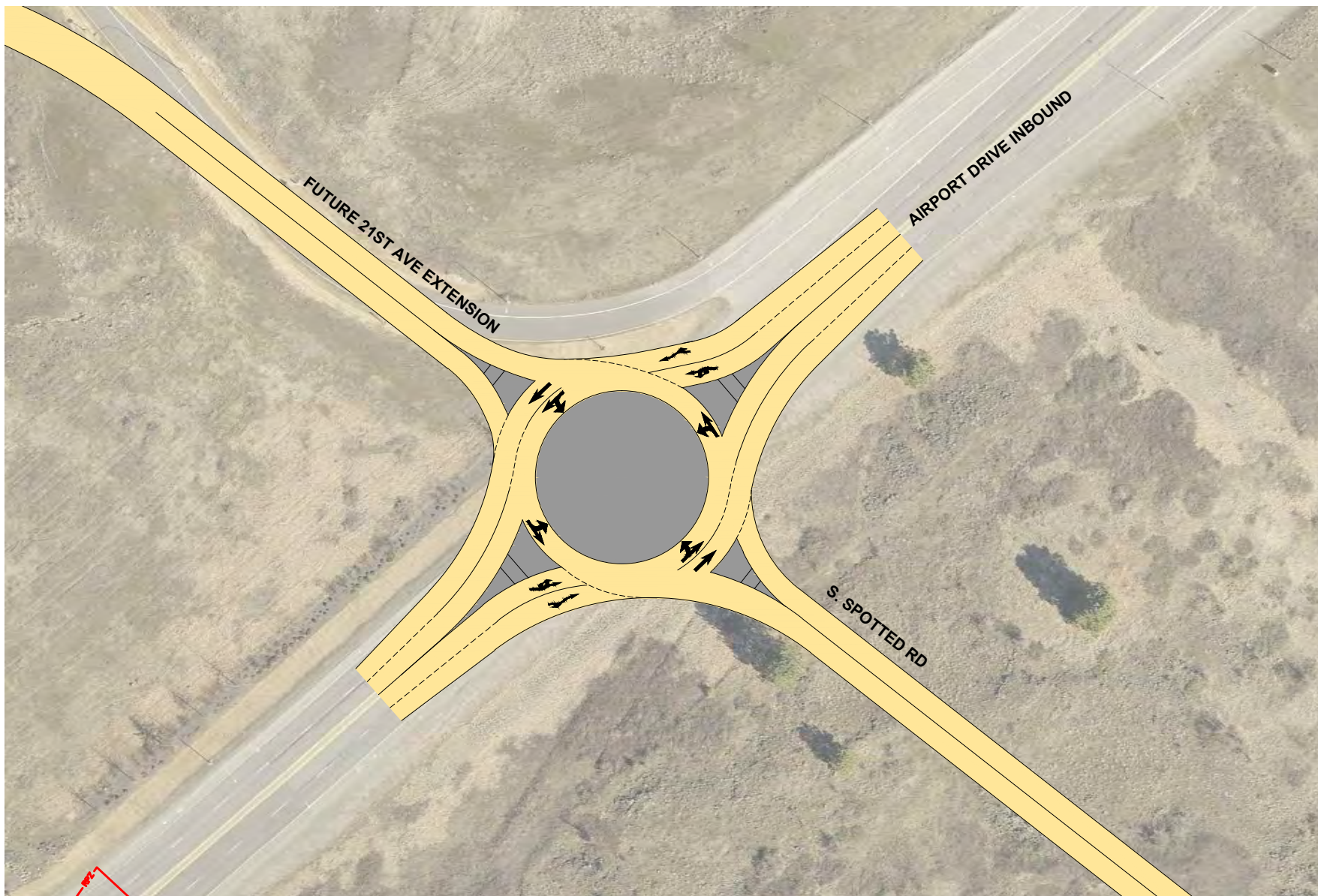
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ALT D: ROUNDABOUT AT AIRPORT DRIVE/  
21ST AVE EXTENSION/ SPOTTED ROAD

FIGURE  
11

AIRPORT DRIVE COUPLET AT  
SPOTTED ROAD INTERSECTION STUDY



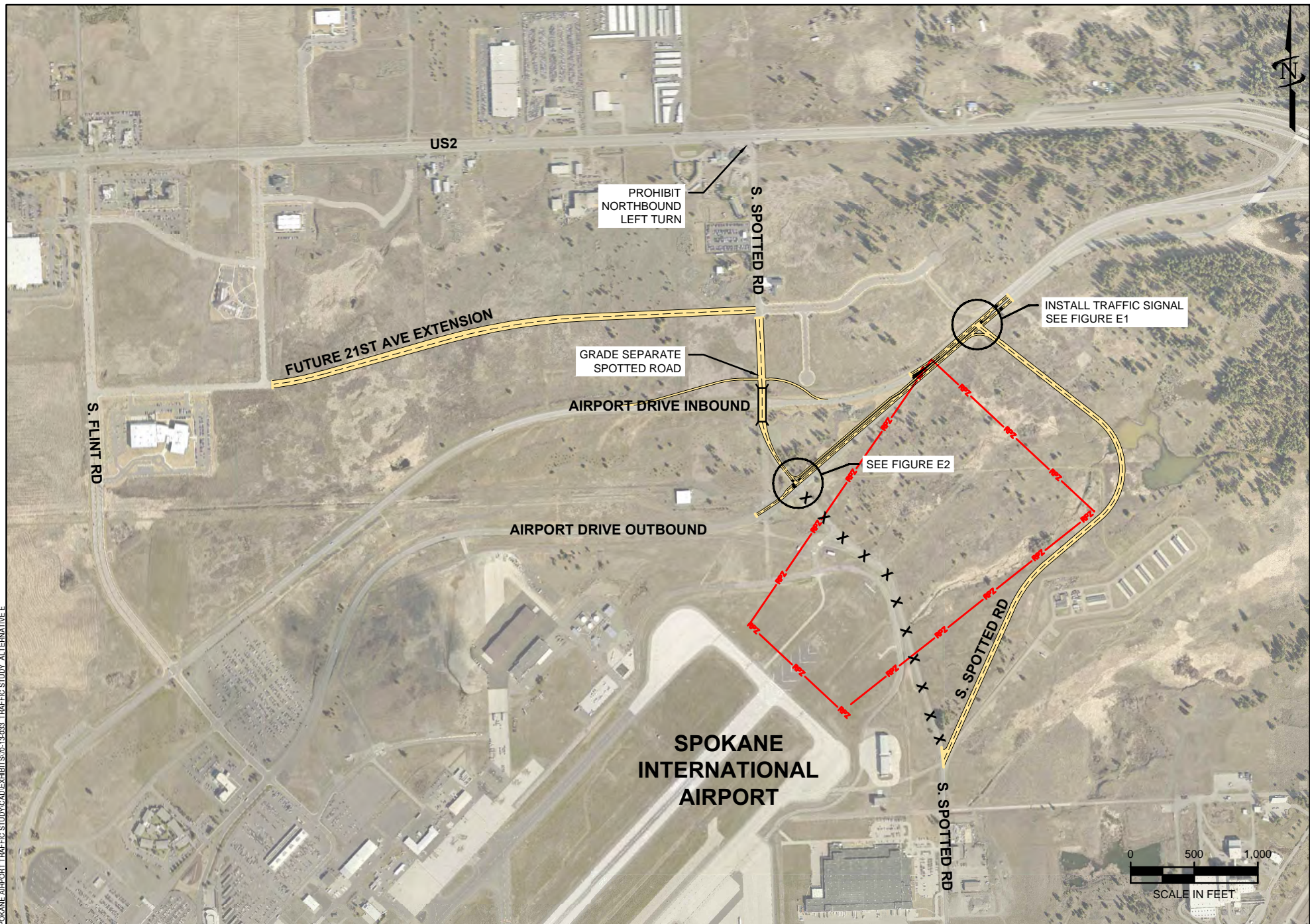


ALT D: ROUNDABOUT AT AIRPORT DRIVE/  
21ST AVE EXTENSION/ SPOTTED ROAD  
INSET

FIGURE  
**11.1**

AIRPORT DRIVE COUPLET AT  
SPOTTED ROAD INTERSECTION STUDY





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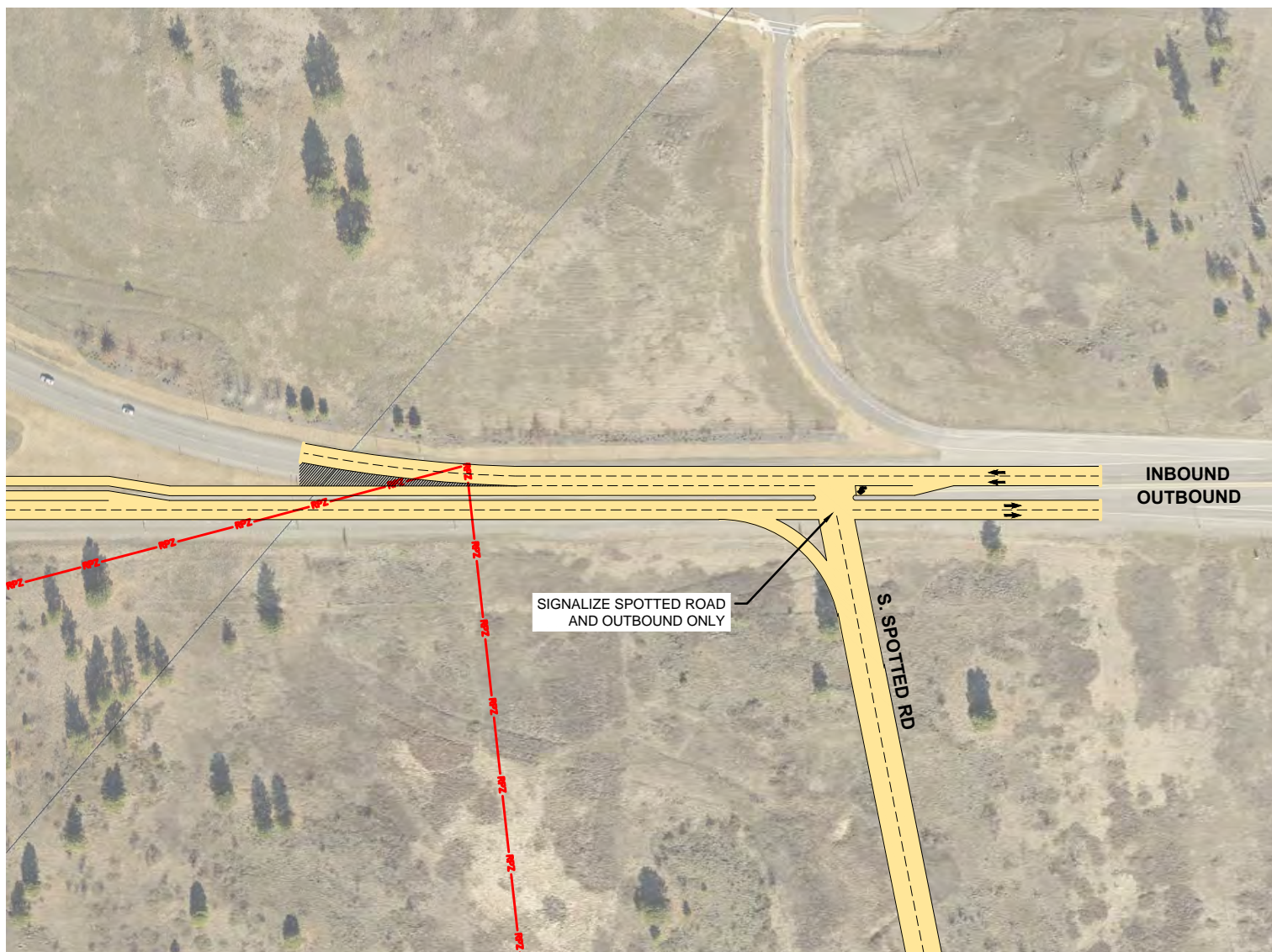
ALT E: CONTINUOUS GREEN-T INTERSECTION  
AND OVERPASS FOR SPOTTED ROAD AT  
INBOUND AIRPORT DRIVE

FIGURE  
12

AIRPORT DRIVE COUPLET AT  
SPOTTED ROAD INTERSECTION STUDY

LAST UPDATE: 1/9/2015  
PLOT DATE: 2/5/2015  
FILE





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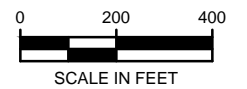
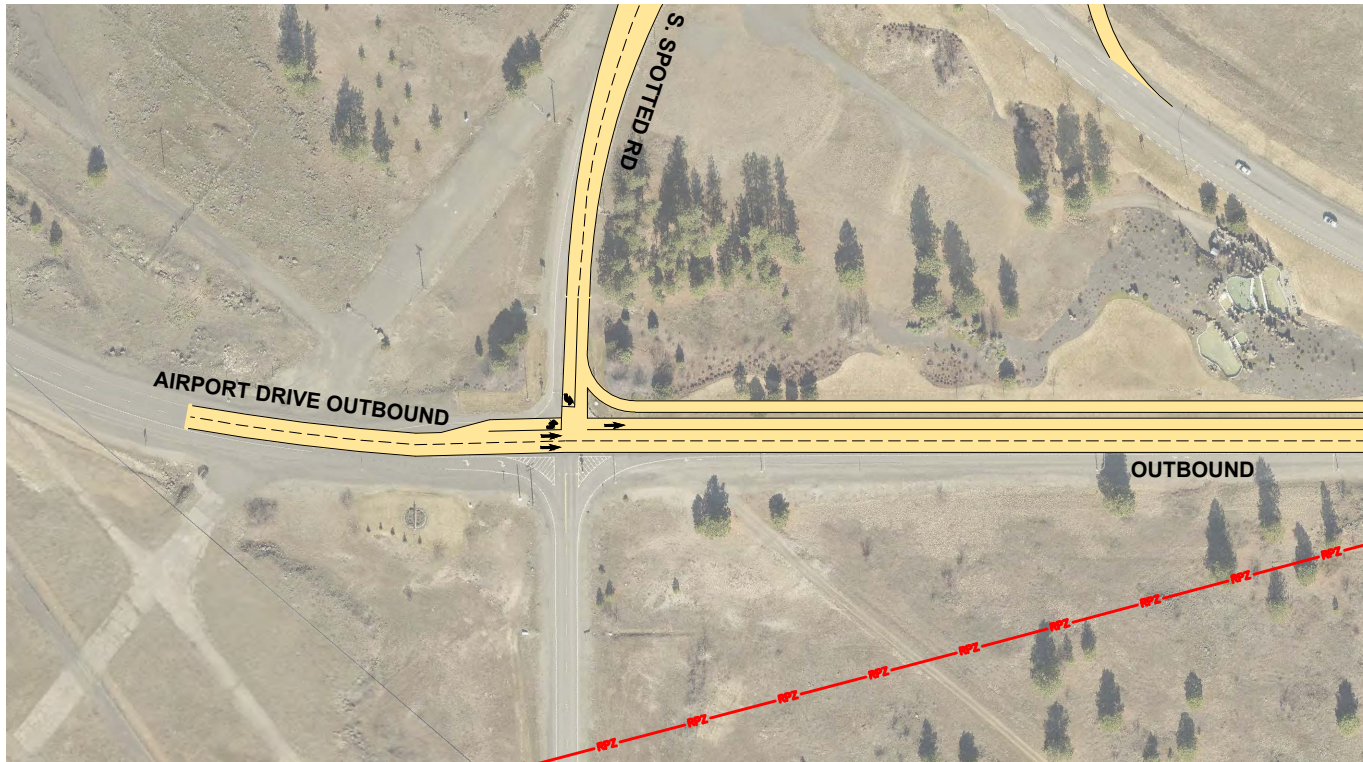


ALT E: CONTINUOUS GREEN-T INTERSECTION  
AND OVERPASS FOR SPOTTED ROAD AT  
INBOUND AIRPORT DRIVE  
INSET 1

FIGURE  
12.1

AIRPORT DRIVE COUPLET AT  
SPOTTED ROAD INTERSECTION STUDY

LAST UPDATE: 1/9/2015  
PLOT DATE: 2/5/2015  
FILE



ALT E: CONTINUOUS GREEN-T INTERSECTION  
AND OVERPASS FOR SPOTTED ROAD AT  
INBOUND AIRPORT DRIVE  
INSET 2

FIGURE  
12.2

AIRPORT DRIVE COUPLET AT  
SPOTTED ROAD INTERSECTION STUDY