



LSC TRANSPORTATION CONSULTANTS, INC.

1889 York Street  
Denver, CO 80206  
(303) 333-1105  
FAX (303) 333-1107  
E-mail: [lsc@lscdenver.com](mailto:lsc@lscdenver.com)

December 2, 2019

Mr. Steve C. Meier  
Hummel Investments, LLC  
8117 Preston Road, Suite 120  
Dallas, TX 75225

Re: Falcon Marketplace South-  
west Roundabout Report  
El Paso County, CO  
LSC #164350

Dear Mr. Meier:

We are pleased to submit this design report for the proposed southwest roundabout in the Falcon Marketplace development in El Paso County, Colorado.

### **Roundabout Layout**

Figure 1 and the Roundabout Critical Design Parameters form show the proposed design parameters. The inscribed diameter is 150 feet with a 20-foot wide circulatory roadway.

### **Design Vehicle**

Figures 2, 4 and 5 show WB-62 truck paths through the proposed roundabout for three of the four approaches. Figure 3 shows the SU-30 box truck paths for the fourth approach. A minimum of one foot of clearance is maintained between all wheel paths and vertical curbs. Figures 6 through 8 show WB-67 trucks can be accommodated with minimal impact on three of the four approaches.

### **Design Speeds**

Figures 9 through 12 show the estimated fastest path radii for each of the approaches to the proposed roundabout. The fastest entry path should generally be no more than about 25 mph for single-lane approaches and 30 mph for two-lane approaches. The fastest entry path for each of the three approaches meets this criteria.

### **Sight Distance**

Figure 13 shows the sight triangles for the proposed roundabout.

**Level of Service**

The attached Rodel capacity analysis reports show the proposed roundabout is expected to operate at LOS "A" during both weekday morning and afternoon peak-hours through 2040.

**Pedestrian Safety and Accessibility**

Pedestrian crossings with pedestrian refuge areas within the splitter islands have been provided on the north approach. Pedestrian crossings are generally set back 25 feet from the yield line. In addition, detached sidewalks should be provided on the corners of the roundabout that provide pedestrian crossings.

**Vertical Design Guidance**

The following recommendations are given when designing the vertical aspects of the proposed roundabout:

1. Pedestrian refuge areas should be designed at street level rather than elevated to the height of the splitter island;
2. Ramps should be provided and designed in accordance with ADA standards on each end of the crosswalk;
3. Detectable warning surfaces in accordance with ADA standards should be provided at ramps and the pedestrian refuge area of the splitter islands.
4. The truck apron should be textured and raised above the circulating roadway. The specific design will be determined as part of the construction plans.
5. The cross slope of the proposed circulating roadway should generally be two percent or less.

\* \* \* \* \*

We trust that our findings and recommendations will assist in the planning and design of the proposed roundabout. Please call if we can be of further assistance.

Respectfully submitted,

LSC Transportation Consultants, Inc.

By:

Christopher S. McGranahan, P.E., PTOE  
Principal



CSM/wc

12-2-19

Enclosures: Roundabout Control Design Parameters  
Figures 1 - 13  
Rodel Capacity Analysis Worksheets

**Southwest Roundabout  
Falcon Marketplace  
El Paso County, CO**

## ROUNDABOUT CRITICAL DESIGN PARAMETERS

DESIGN PARAMETERS	LEG 1	LEG 2	LEG 3	LEG 4	LEG 5	LEG 6
Approach Width, FT	16.0	18.0	16.0	18.0		
Entry Width, FT	16.0	18.0	16.0	18.0		
Entry Angle, PHI $\Phi$ , DEG	16.0	37.0	17.0	16.0		
Inscribed Circle Diameter, FT	150.0	150.0	150.0	150.0		
Exit Width, FT	20.0		20.0			
Circulating Roadway Width Upstream of Entry, FT	20.0	20.0	20.0	20.0		

### FASTEST SPEED PATH

$R_1$ , Radius/Speed, FT/MPH	132	22	184	25	120	22	90	20		
$R_2$ , Radius/Speed, FT/MPH	115	21			65	17				
$R_3$ , Radius/Speed, FT/MPH	155	24	70	18	70	18	160	24		
$R_4$ , Radius/Speed, FT/MPH			60	17			63	17		
$R_5$ , Radius/Speed, FT/MPH			100	20			96	20		
Bypass $R_5$ , Radius/Speed, FT/MPH										

### MINIMUM SIGHT PARAMETERS

Approach Design Speed, MPH						
Horizontal Stopping Sight Distance, FT						
Circulating Intersection Sight Distance, FT/MPH						
Entering Intersection Sight Distance, FT/MPH						

Design Vehicle: WB-62 for Approaches 1, 3, & 4; SU-30 for Approach 2

Truck Apron Width: 15'

OSOW Accommodations: A WB-67 vehicle can be accommodated with minimal impacts on three of the four approaches.

Circulating Roadway Cross-Slope: 2% or less

Access Control:

Parking Control: No parking on any of the approaches

Bicycle & Pedestrian Accommodations: East/West Bicycle & Pedestrian movements are accommodated on the North Approach

Designer: SMR  
Reviewer: CSM

SIGNATURE: \_\_\_\_\_

DATE: 12/2/2019

NAME: Christopher S. McGranahan, PE, PTOE

*The reviewer's signature on this document indicates that the design has been reviewed and is in general compliance with good roundabout principals. The critical design elements have been addressed. The project design engineer in responsible charge of final plan development will stamp the plans when applicable.*

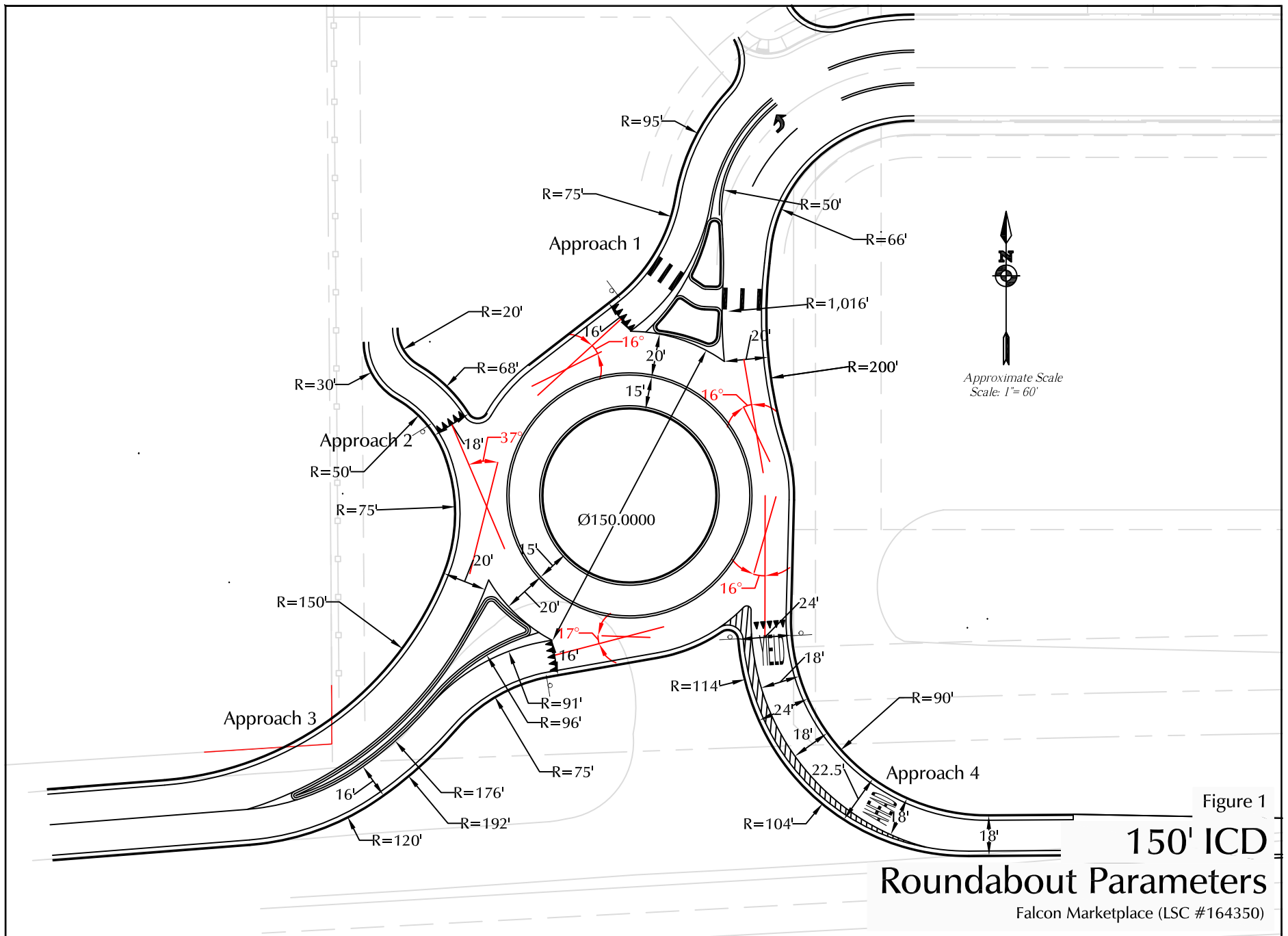


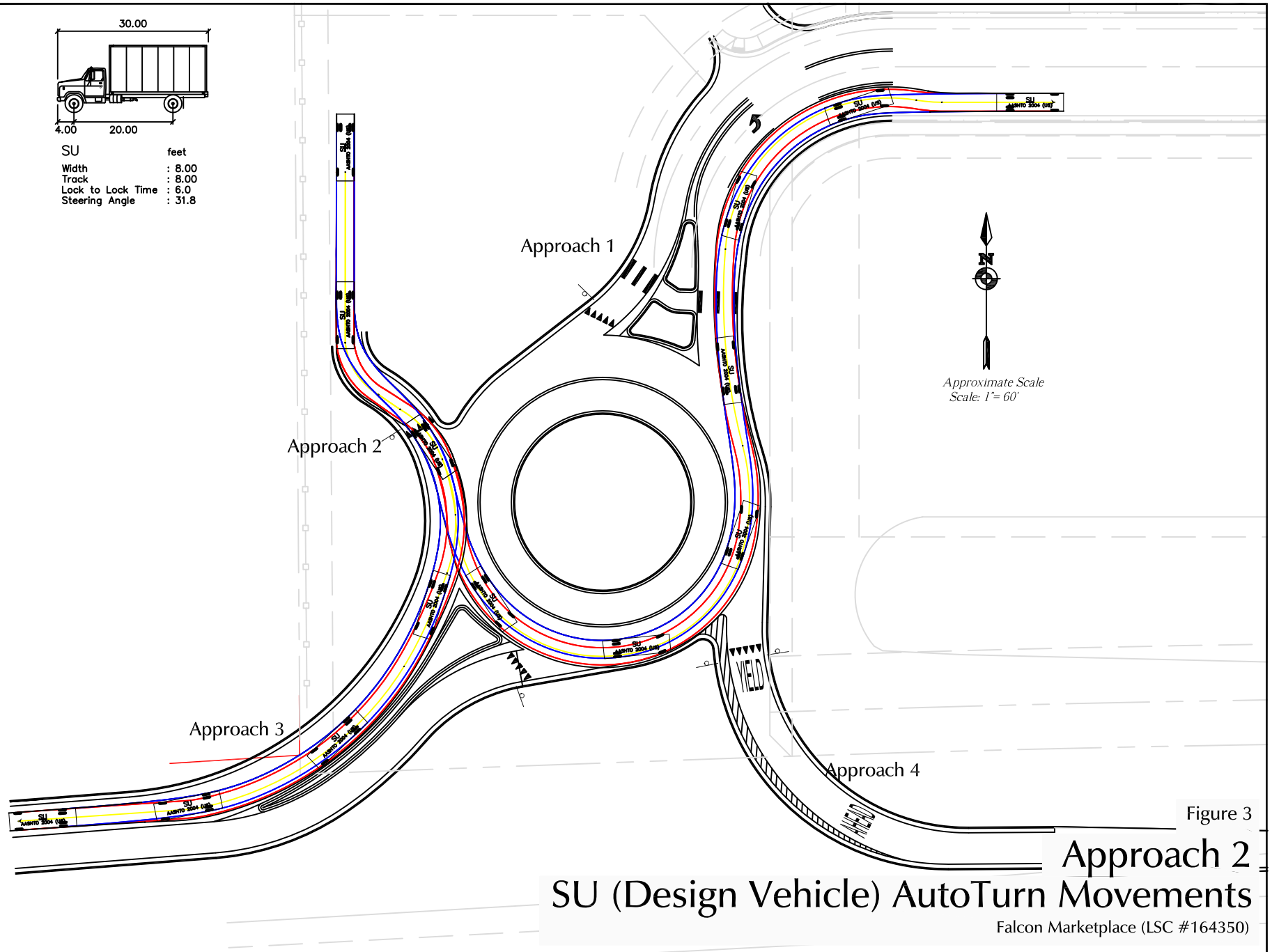
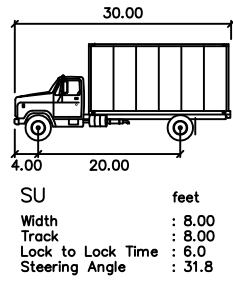
Figure 1

150' ICD

Roundabout Parameters

Falcon Marketplace (LSC #164350)



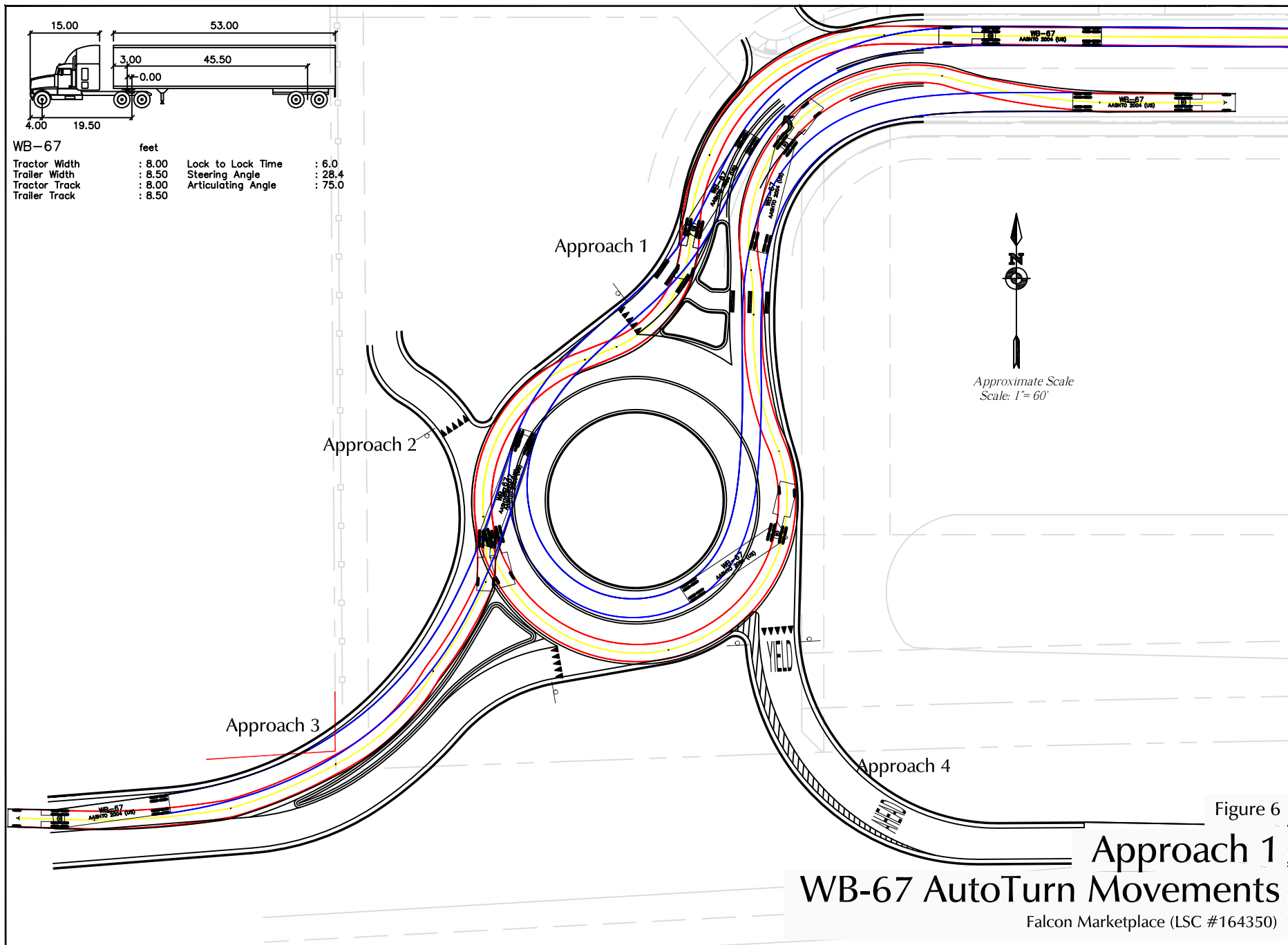


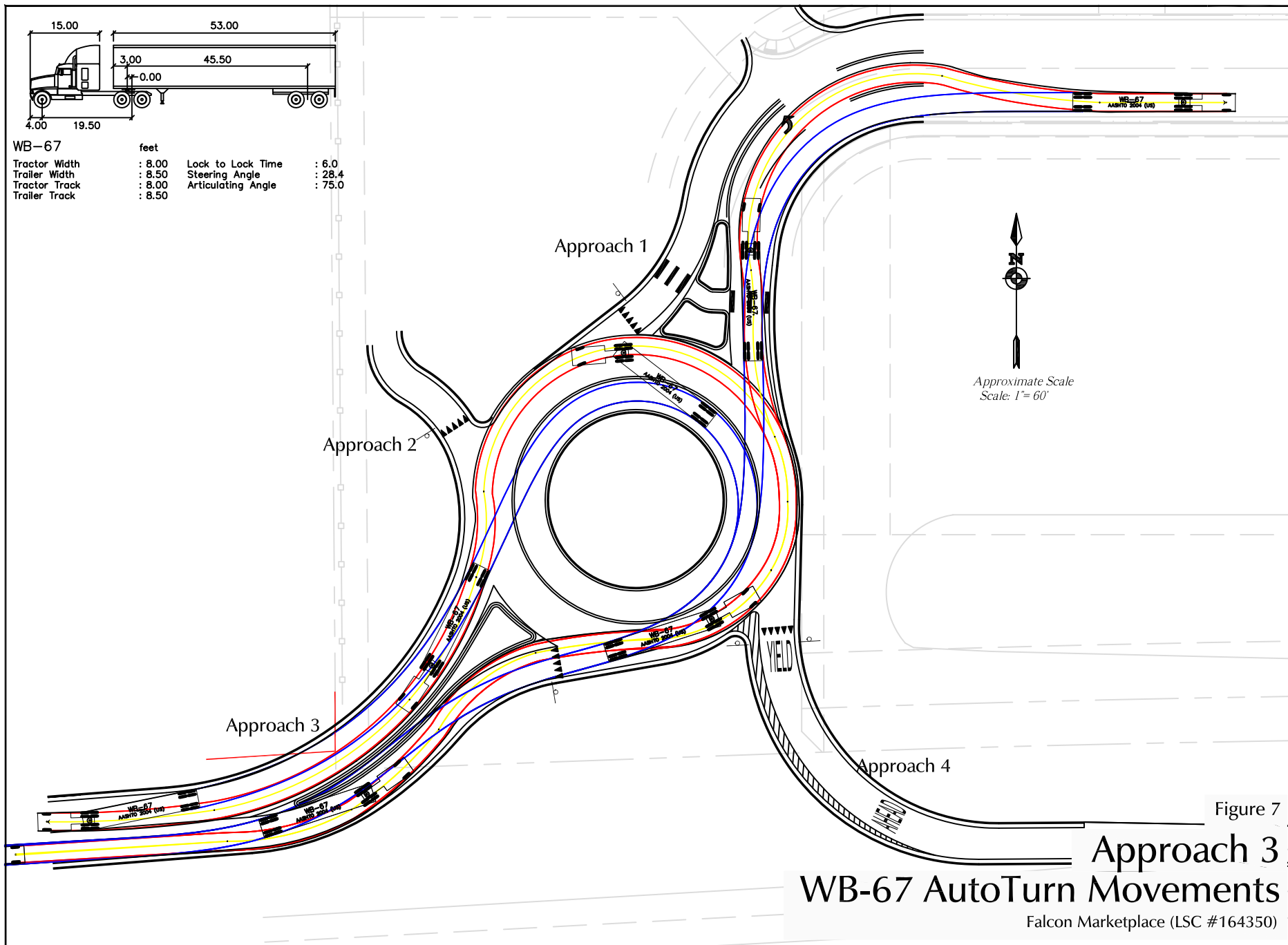




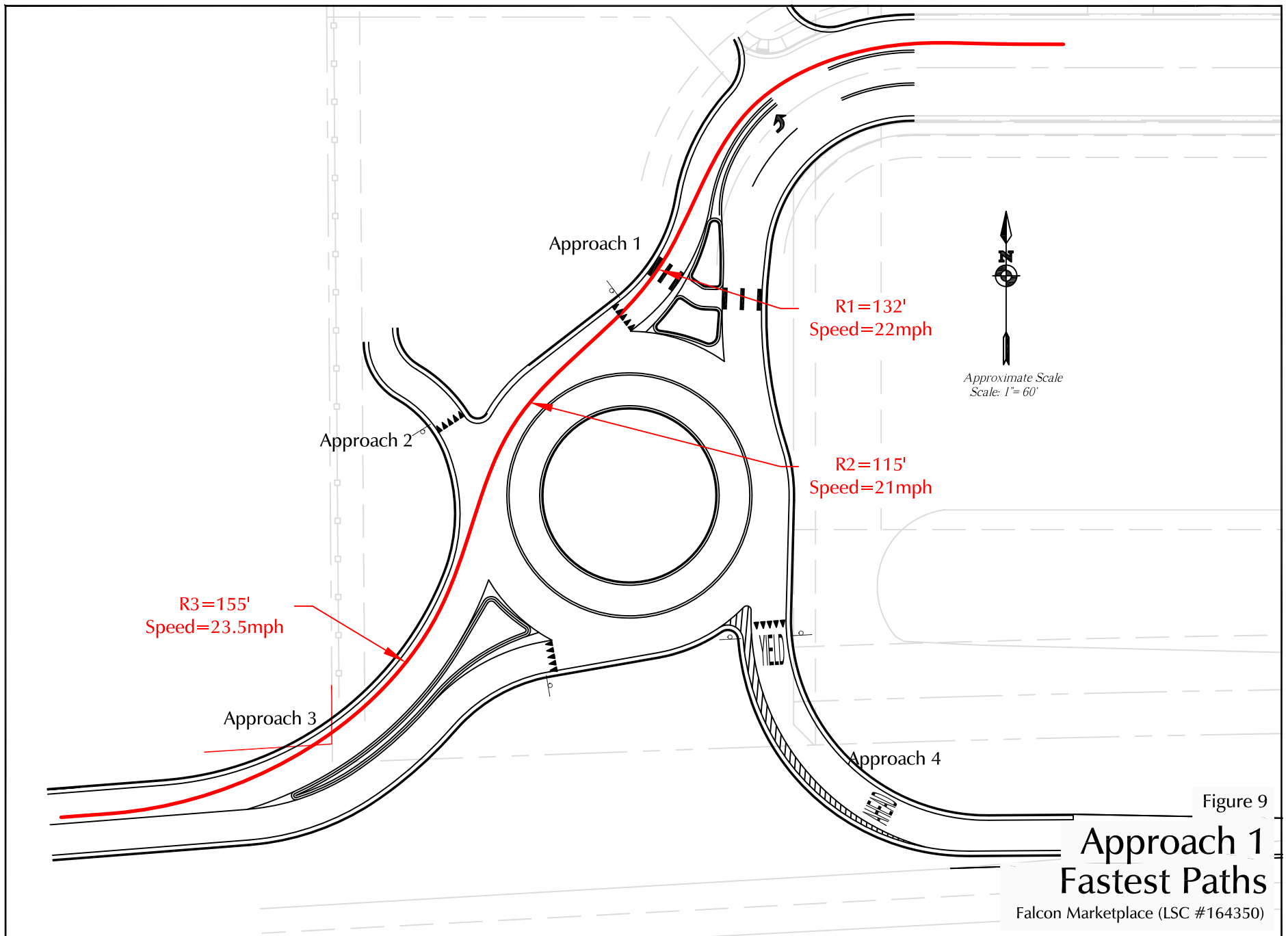


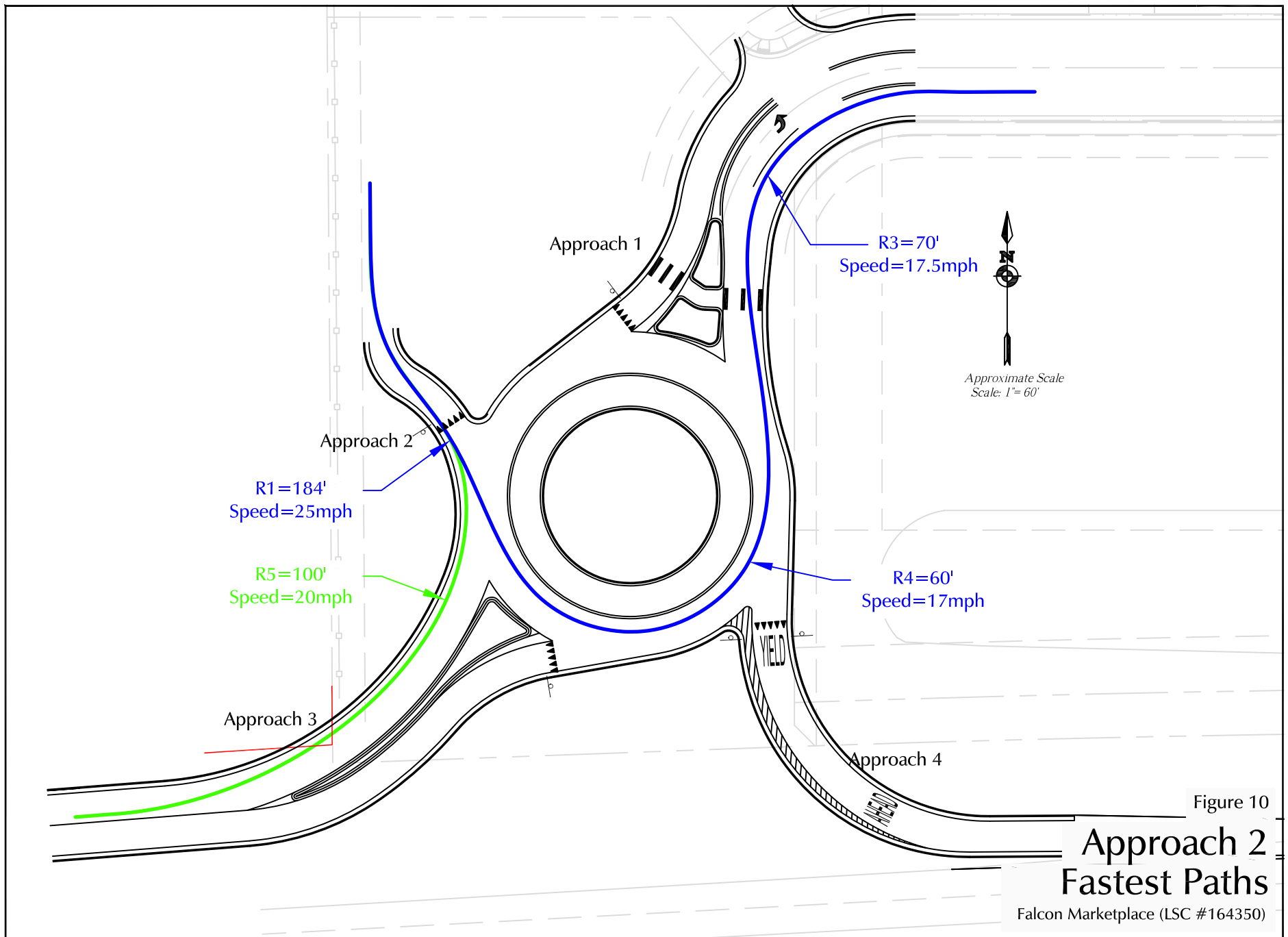


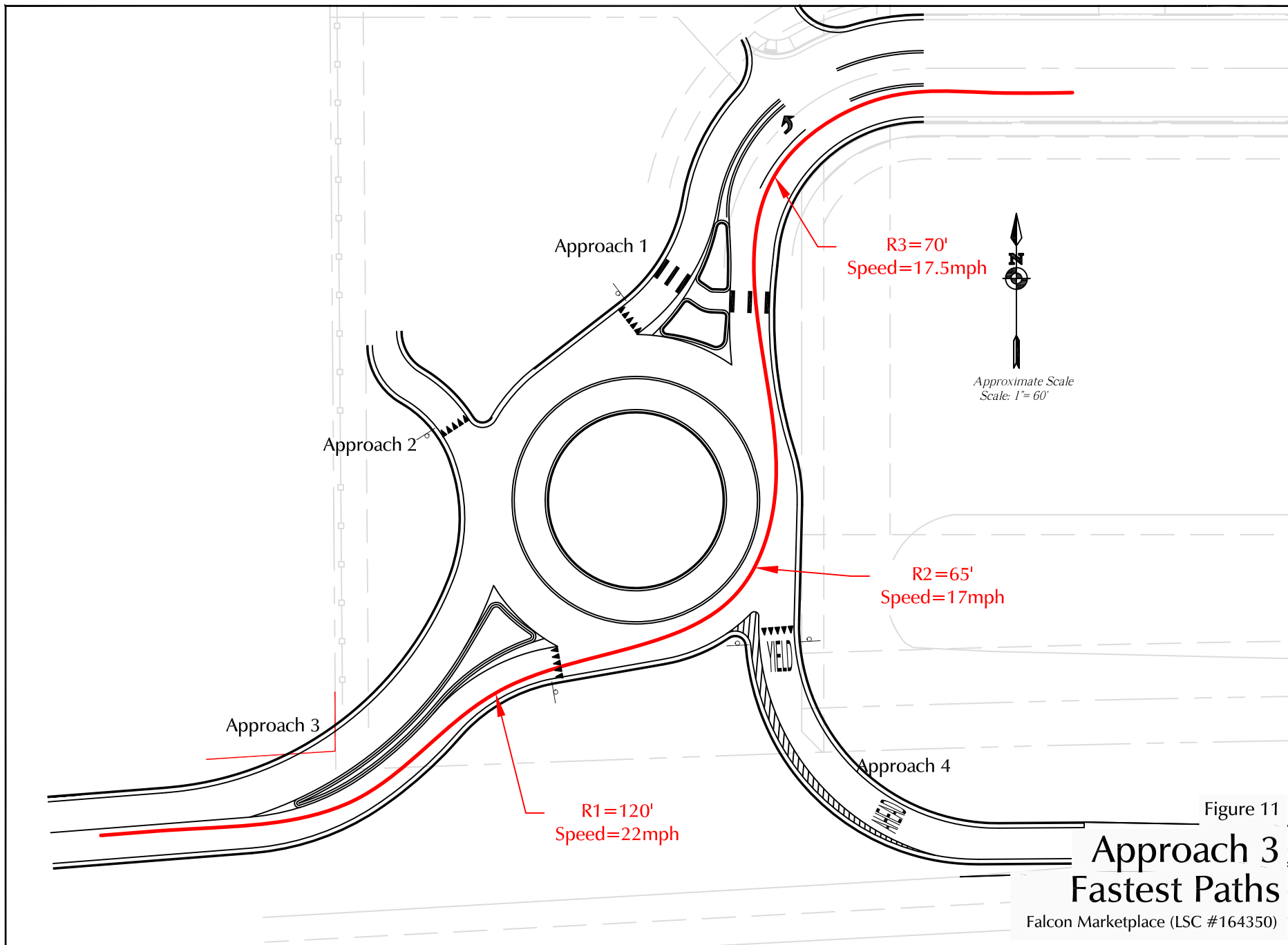




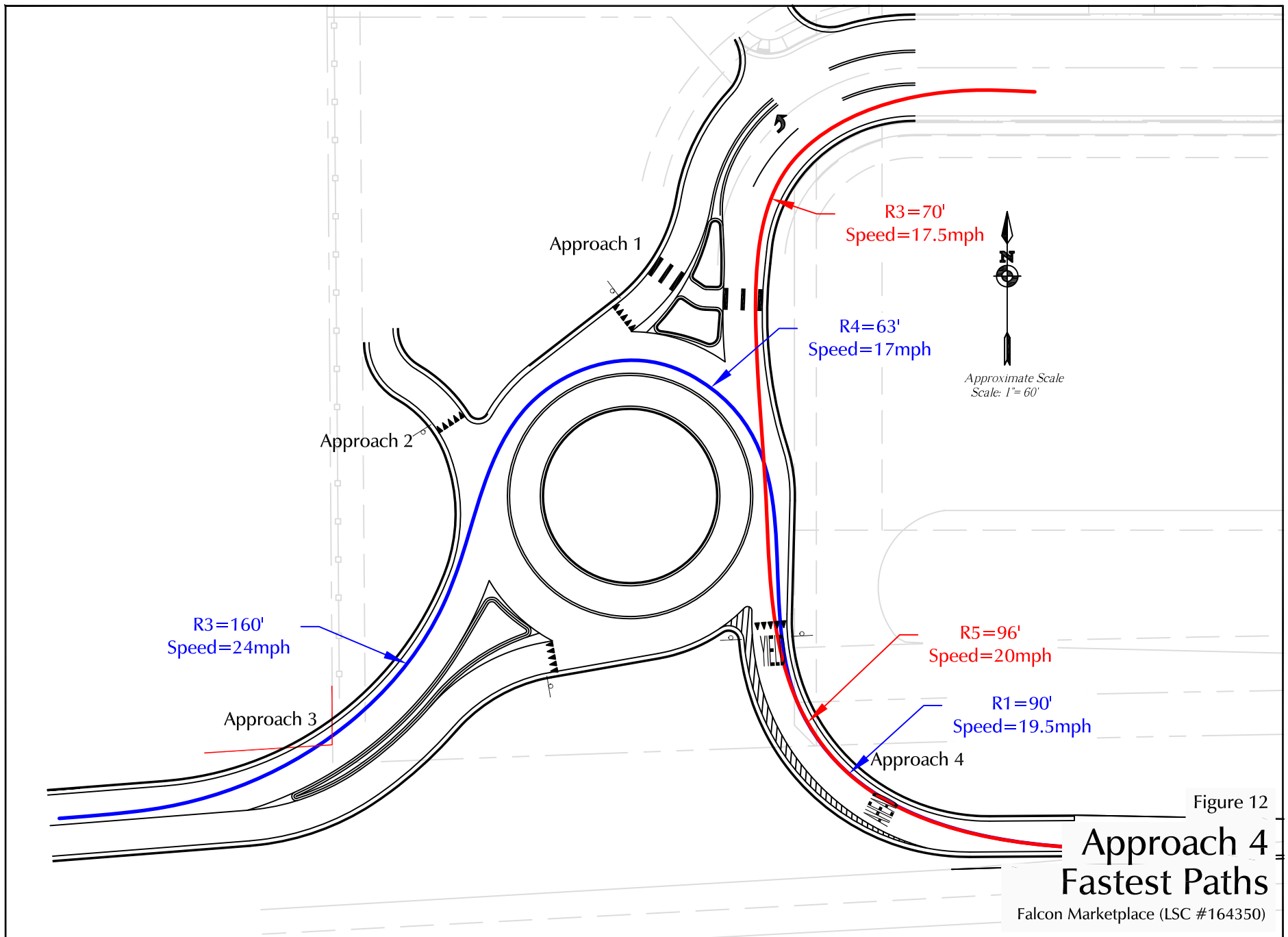


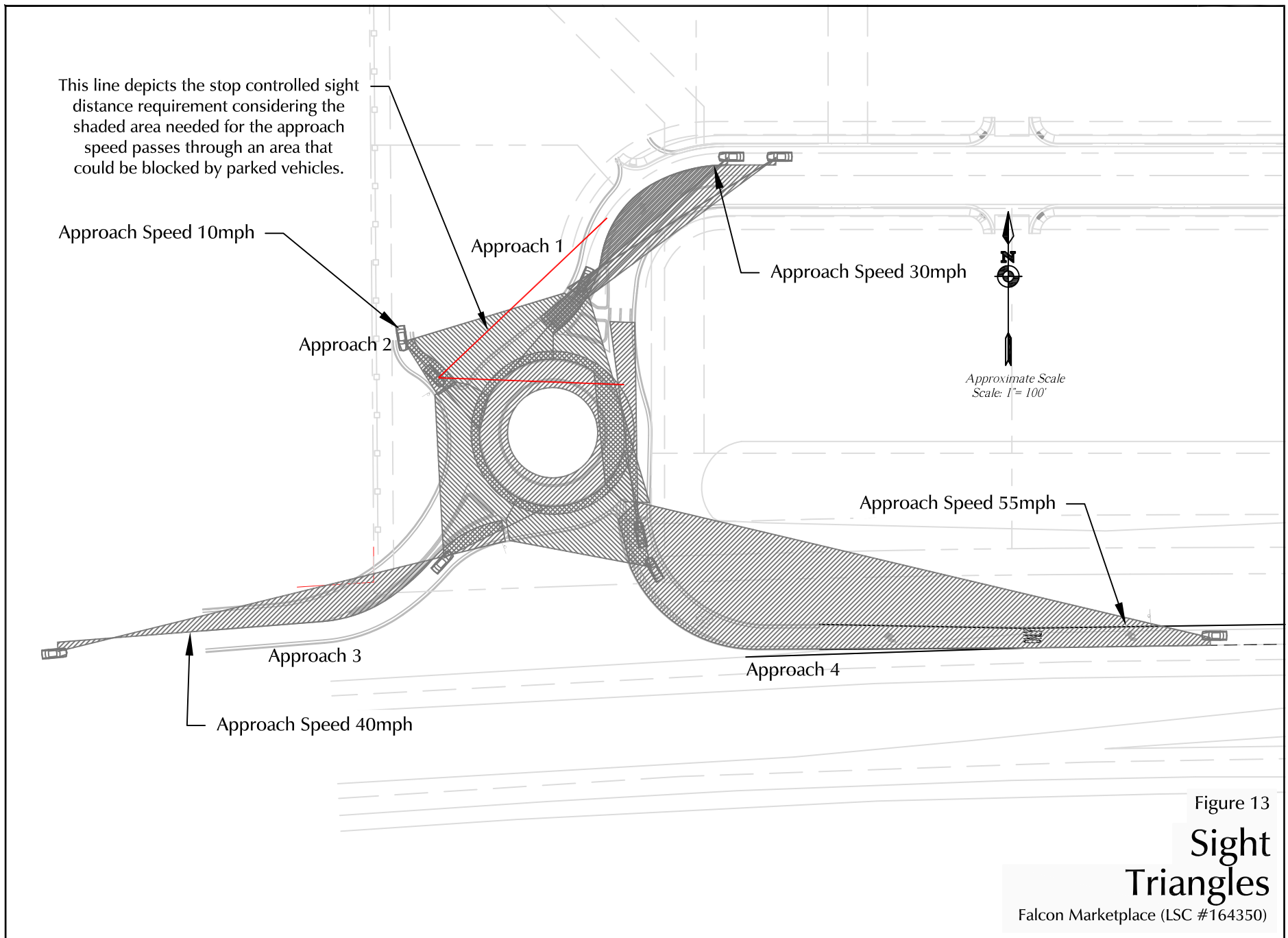












## Operational Data

### Traffic Flow Data (veh/hr)

#### 2040 AM Peak Peak Hour Flows

Leg	Leg Names	Turning Flows					Flow Modifiers		
		U-Turn	Exit-3	Exit-2	Exit-1	Bypass	Trucks %	Flow Factor	Peak Hour Factor
1	Approach 1	0	0	60	0	0	2.0	1.00	0.9
2	Approach 4	0	199	0	151	0	2.0	1.00	0.9
3	Approach 3	0	0	151	0	0	2.0	1.00	0.9
4	Approach 2	0	16	0	21	0	2.0	1.00	0.9

## Operational Results

### 2040 AM Peak - 15 minutes

#### Flows and Capacity

Leg	Leg Names	Bypass Type	Flows (veh/hr)					Capacity (veh/hr)			
			Arrival Flow		Opposing Flow		Exit Flow	Capacity		Average VCR	
			Entry	Bypass	Entry	Bypass		Entry	Bypass	Entry	Bypass
1	Approach 1	None	65		17		403	1242		0.0528	
2	Approach 4	None	380		83		0	1399		0.2739	
3	Approach 3	None	164		216		247	1118		0.1479	
4	Approach 2	None	40		380		0	936		0.0433	

#### Delays, Queues and Level of Service

Leg	Leg Names	Bypass Type	Average Delay (sec)			95% Queue (veh)		Level of Service		
			Entry	Bypass	Leg	Entry	Bypass	Entry	Bypass	Leg
1	Approach 1	None	3.16		3.16	0.14		A		A
2	Approach 4	None	4.29		4.29	0.95		A		A
3	Approach 3	None	4.28		4.28	0.44		A		A
4	Approach 2	None	4.00		4.00	0.12		A		A

# Global Results

## Performance and Accidents

### 2040 AM Peak Global Performance

Parameter	Units	Entries	Bypasses	Total
Arrive Flows	veh/hr	598		598
Capacity	veh/hr	4728		4728
Average Delay	sec/veh	4.28		4.28
L.O.S. (Signal)	A – F	A		A
L.O.S. (Unsig)	A – F	A		A
Total Delay	veh.hrs	0.71		0.71

# Operational Data

## Traffic Flow Data (veh/hr)

### 2040 PM Peak Peak Hour Flows

Leg	Leg Names	Turning Flows					Flow Modifiers		
		U-Turn	Exit-3	Exit-2	Exit-1	Bypass	Trucks %	Flow Factor	Peak Hour Factor
1	Approach 1	0	0	65	0	0	2.0	1.00	0.9
2	Approach 4	0	157	0	179	0	2.0	1.00	0.9
3	Approach 3	0	0	251	0	0	2.0	1.00	0.9
4	Approach 2	0	5	0	4	0	2.0	1.00	0.9



## Operational Results

### 2040 PM Peak - 15 minutes

#### Flows and Capacity

Leg	Leg Names	Bypass Type	Flows (veh/hr)					Capacity (veh/hr)			
			Arrival Flow		Opposing Flow		Exit Flow	Capacity		Average VCR	
			Entry	Bypass	Entry	Bypass		Entry	Bypass	Entry	Bypass
1	Approach 1	None	71		5		448	1250		0.0569	
2	Approach 4	None	365		76		0	1403		0.2622	
3	Approach 3	None	273		171		271	1146		0.2401	
4	Approach 2	None	10		443		0	901		0.0109	

#### Delays, Queues and Level of Service

Leg	Leg Names	Bypass Type	Average Delay (sec)			95% Queue (veh)		Level of Service		
			Entry	Bypass	Leg	Entry	Bypass	Entry	Bypass	Leg
1	Approach 1	None	3.18		3.18	0.15		A		A
2	Approach 4	None	4.24		4.24	0.89		A		A
3	Approach 3	None	4.84		4.84	0.79		A		A
4	Approach 2	None	3.00		3.00	0.03		A		A

## Global Results

### Performance and Accidents

#### 2040 PM Peak Global Performance

Parameter	Units	Entries	Bypasses	Total
Arrive Flows	veh/hr	661		661
Capacity	veh/hr	4731		4731
Average Delay	sec/veh	4.44		4.44
L.O.S. (Signal)	A – F	A		A
L.O.S. (Unsig)	A – F	A		A
Total Delay	veh.hrs	0.82		0.82



LSC TRANSPORTATION CONSULTANTS, INC.

1889 York Street  
Denver, CO 80206  
(303) 333-1105  
FAX (303) 333-1107  
E-mail: [lsc@lscdenver.com](mailto:lsc@lscdenver.com)

December 2, 2019

Mr. Steve C. Meier  
Hummel Investments, LLC  
8117 Preston Road, Suite 120  
Dallas, TX 75225

Re: Falcon Marketplace North-  
east Roundabout Report  
El Paso County, CO  
LSC #164350

Dear Mr. Meier:

We are pleased to submit this design report for the proposed northeast roundabout in the Falcon Marketplace development in El Paso County, Colorado.

### **Roundabout Layout**

Figures 1a and 1b and the Roundabout Critical Design Parameters form show the proposed design parameters. The inscribed diameter is 135 feet with a 20-foot wide circulatory roadway.

### **Design Vehicle**

Figures 2a through 4 show WB-62 truck paths through the proposed roundabout for the various approaches. A minimum of one foot of clearance is maintained between all wheel paths and vertical curbs. Figures 5a through 7 show WB-67 trucks can be accommodated with minimal impact on each of the approaches.

### **Design Speeds**

Figures 8 through 10 show the estimated fastest path radii for each of the approaches to the proposed roundabout. The fastest entry path should generally be no more than about 25 mph for single-lane approaches and 30 mph for two-lane approaches. The fastest entry path for each of the three approaches meets this criteria with the following exception: The Approach 1 fastest path in the interim condition is expected to be about 27 mph prior to construction of the north leg. The entry phi angle is proposed to be 21 degrees and the conflicting volumes for this movement are minimal, so the 27 mph fastest path is considered acceptable.

### **Sight Distance**

Figure 13 shows the sight triangles for the proposed roundabout.

**Level of Service**

The attached Rodel capacity analysis reports show the proposed roundabout is expected to operate at LOS "A" during both weekday morning and afternoon peak-hours through 2040.

**Pedestrian Safety and Accessibility**

Pedestrian crossings with pedestrian refuge areas within the splitter islands have been provided on the north and south approaches. Pedestrian crossings are generally set back 25 feet from the yield line. In addition, detached sidewalks should be provided on the corners of the roundabout that provide pedestrian crossings.

**Vertical Design Guidance**

The following recommendations are given when designing the vertical aspects of the proposed roundabout:

1. Pedestrian refuge areas should be designed at street level rather than elevated to the height of the splitter island;
2. Ramps should be provided and designed in accordance with ADA standards on each end of the crosswalk;
3. Detectable warning surfaces in accordance with ADA standards should be provided at ramps and the pedestrian refuge area of the splitter islands.
4. The truck apron should be textured and raised above the circulating roadway. The specific design will be determined as part of the construction plans.
5. The cross slope of the proposed circulating roadway should generally be two percent or less.

\* \* \* \* \*

We trust that our findings and recommendations will assist in the planning and design of the proposed roundabout. Please call if we can be of further assistance.

Respectfully submitted,

LSC Transportation Consultants, Inc.

By:

Christopher S. McGranahan, P.E.  
Principal



12-2-19

CSM/wc

Enclosures: Roundabout Control Design Parameters  
Figures 1 - 13  
Rodel Capacity Analysis Worksheets

**Northeast Roundabout  
Falcon Marketplace  
El Paso County**

## ROUNDBOUT CRITICAL DESIGN PARAMETERS

DESIGN PARAMETERS	LEG 1	LEG 2	LEG 3	LEG 4	LEG 5	LEG 6
Approach Width, FT	17.0	21.0	21.0			
Entry Width, FT	18.0	16.0	16.0			
Entry Angle, PHI $\phi$ , DEG	21.0	24.0	21.0			
Inscribed Circle Diameter, FT	135.0	135.0	135.0			
Exit Width, FT	35.0	20.0	20.0			
Circulating Roadway Width Upstream of Entry, FT	20.0	20.0	20.0			

### FASTEST SPEED PATH

$R_1$ , Radius/Speed, FT/MPH	225	27	165	24	165	24			
$R_2$ , Radius/Speed, FT/MPH			85	19	85	19			
$R_3$ , Radius/Speed, FT/MPH	834	46	620	39	620	39			
$R_4$ , Radius/Speed, FT/MPH	57	17			57	17			
$R_5$ , Radius/Speed, FT/MPH			160	24					
Bypass $R_5$ , Radius/Speed, FT/MPH									

### MINIMUM SIGHT PARAMETERS

Approach Design Speed, MPH						
Horizontal Stopping Sight Distance, FT						
Circulating Intersection Sight Distance, FT/MPH						
Entering Intersection Sight Distance, FT/MPH						

Design Vehicle: WB-62

Truck Apron Width: 18'

OSOW Accommodations: WB-67 can be accommodated with minimal impacts

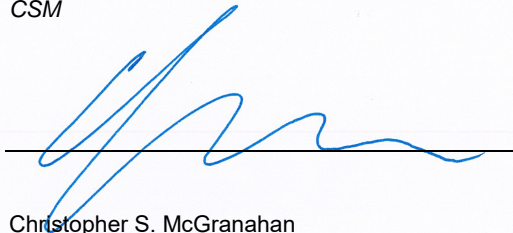
Circulating Roadway Cross-Slope: 2% or less

Access Control:

Parking Control: No parking on any of the three approaches

Bicycle & Pedestrian Accommodations: East/West Bicycle and Pedestrians movements are accommodated on the North and South Approaches

Designer: SMR  
Reviewer: CSM

SIGNATURE: 

NAME: Christopher S. McGranahan

DATE: 12/2/2019

*The reviewer's signature on this document indicates that the design has been reviewed and is in general compliance with good roundabout principals. The critical design elements have been addressed. The project design engineer in responsible charge of final plan development will stamp the plans when applicable.*

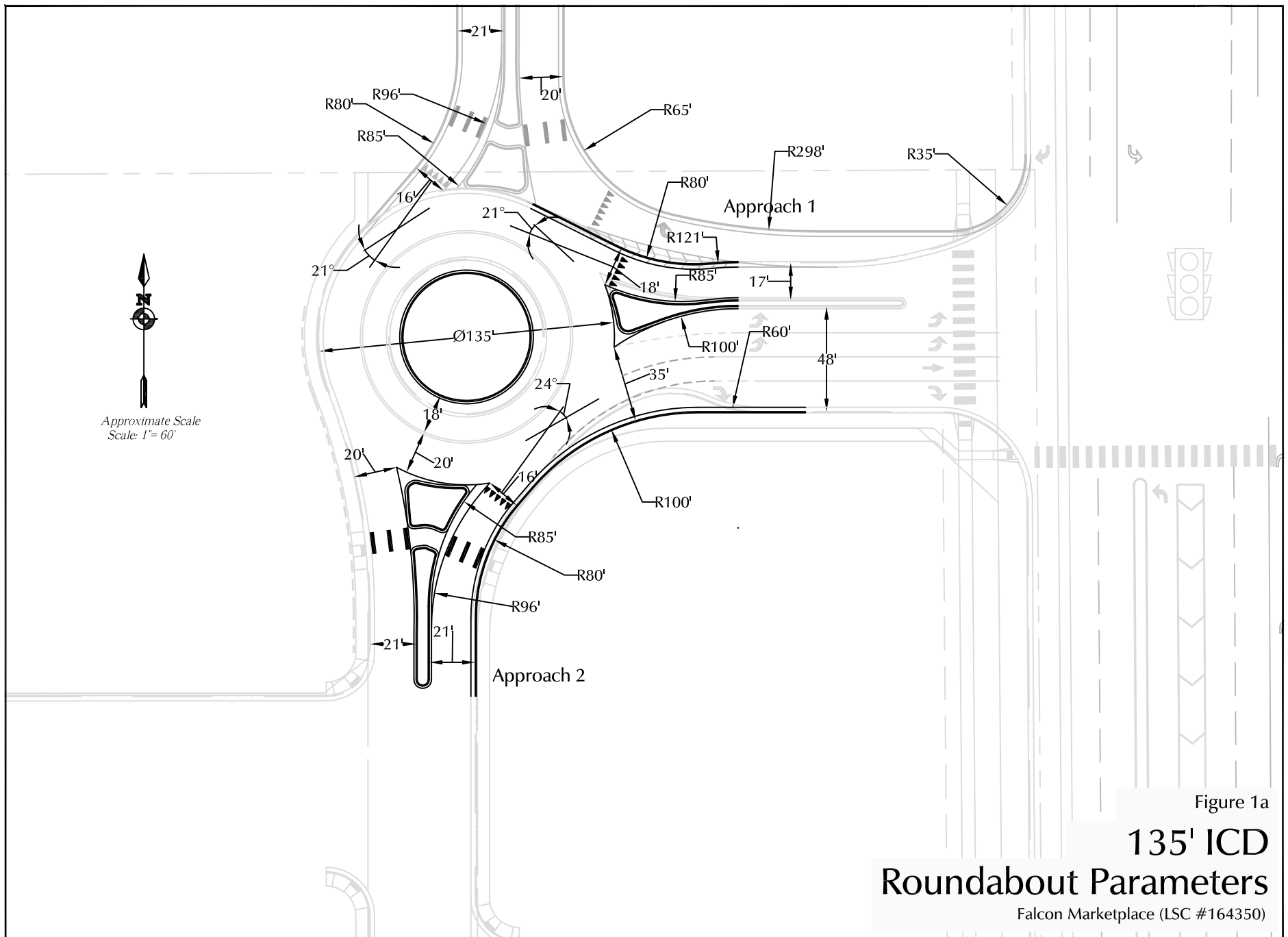


Figure 1a

# 135' ICD Roundabout Parameters

Falcon Marketplace (LSC #164350)



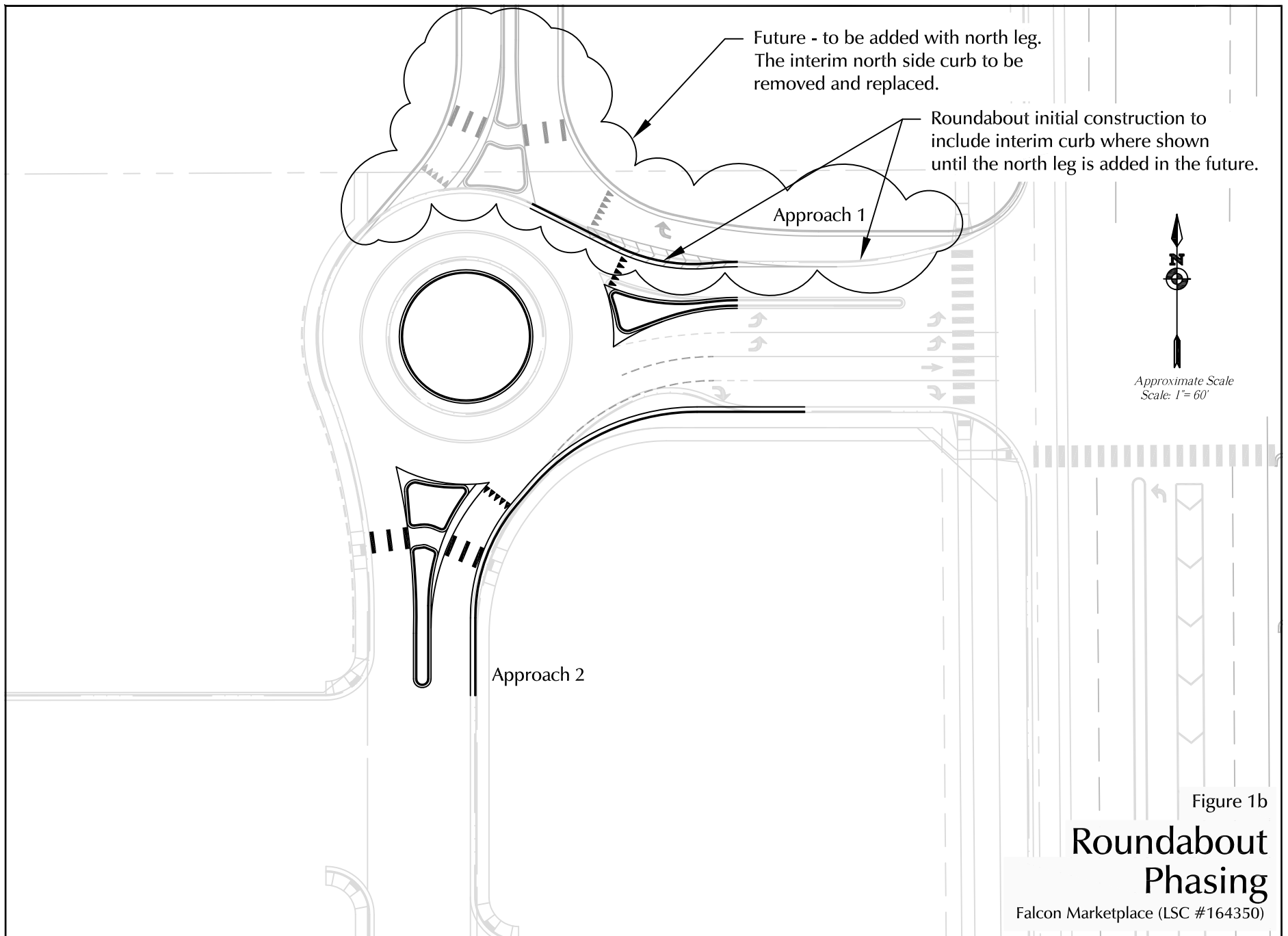
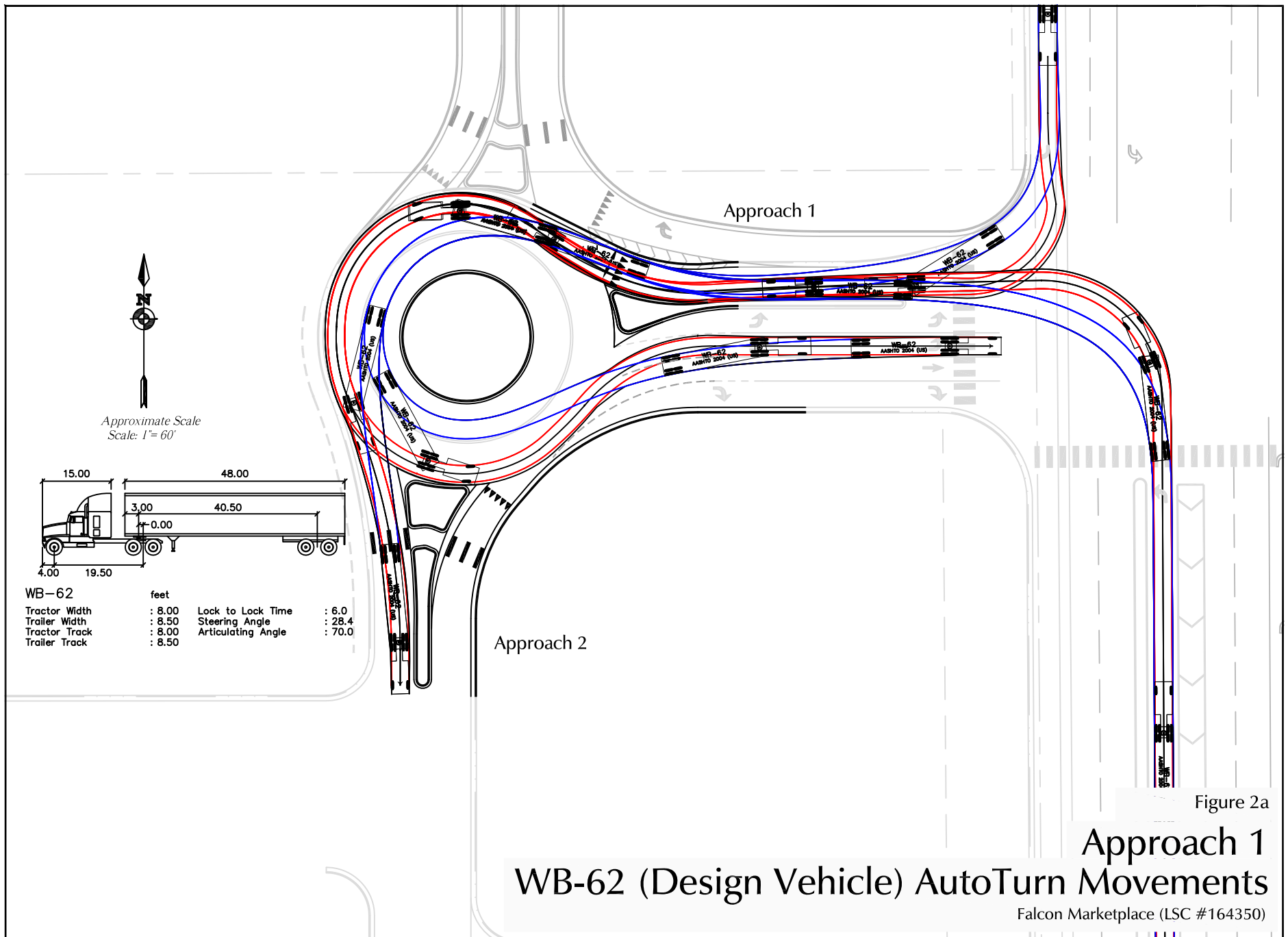
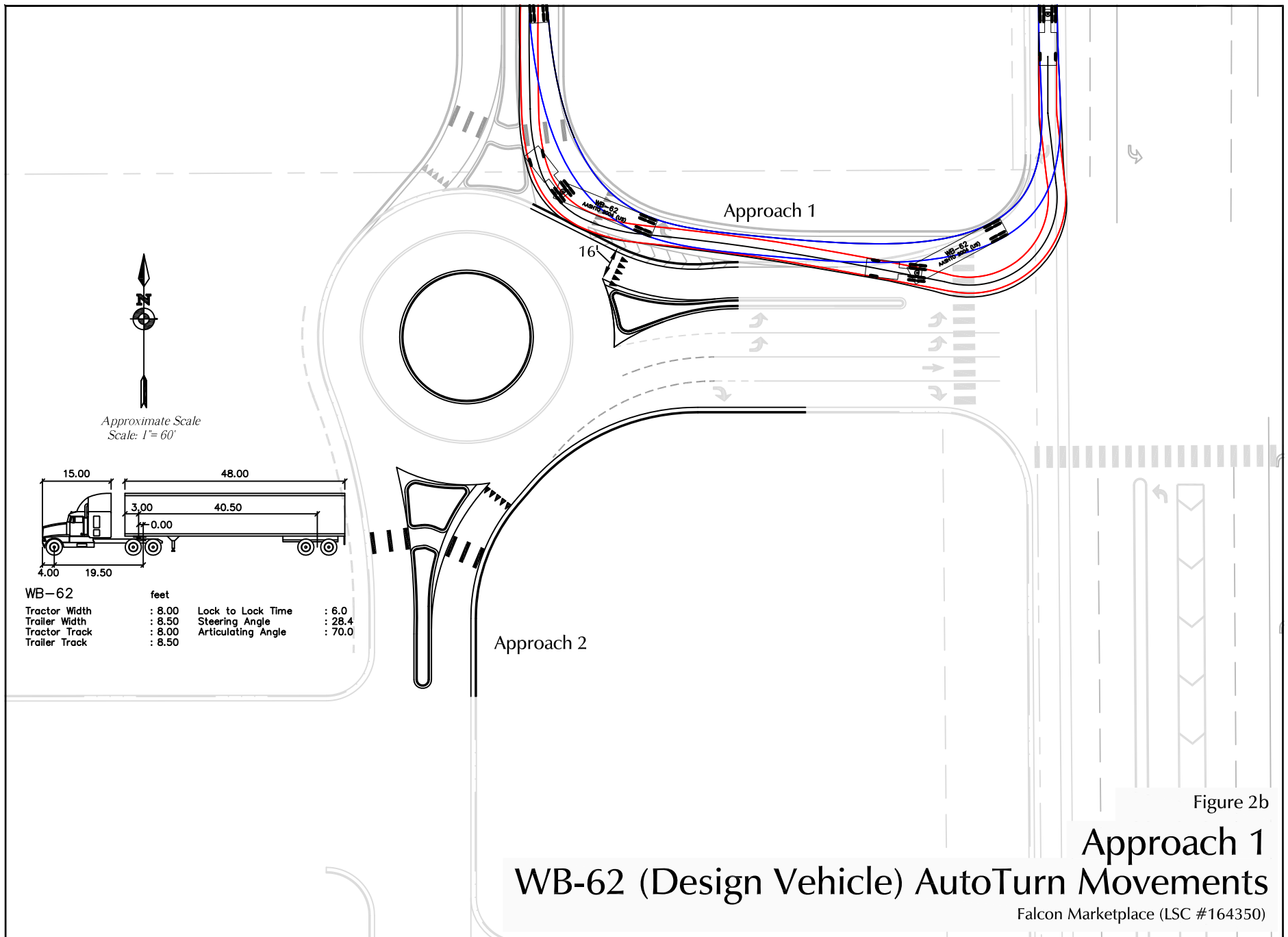


Figure 1b

## Roundabout Phasing

Falcon Marketplace (LSC #164350)





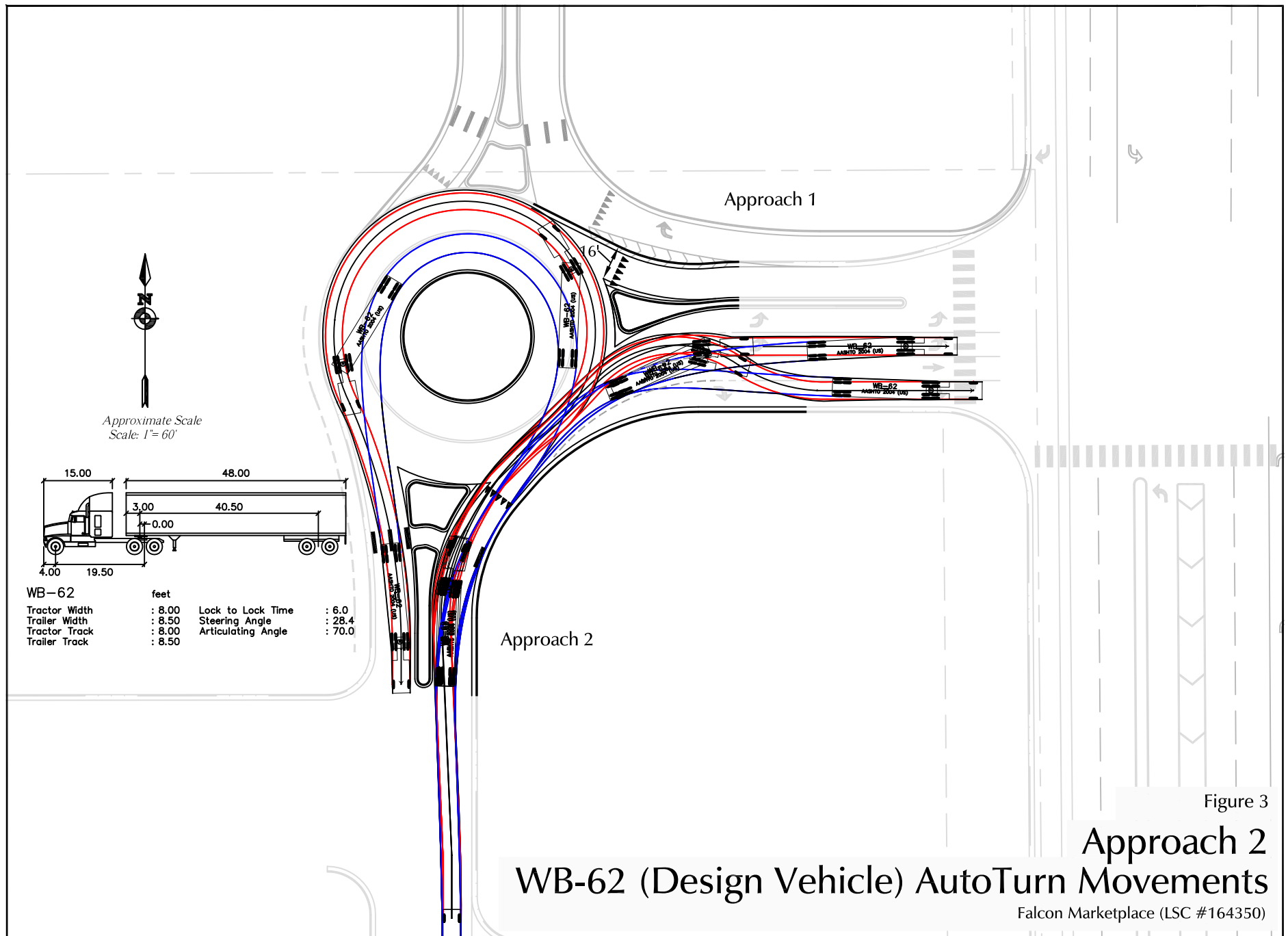


Figure 3

## Approach 2

# WB-62 (Design Vehicle) AutoTurn Movements

Falcon Marketplace (LSC #164350)

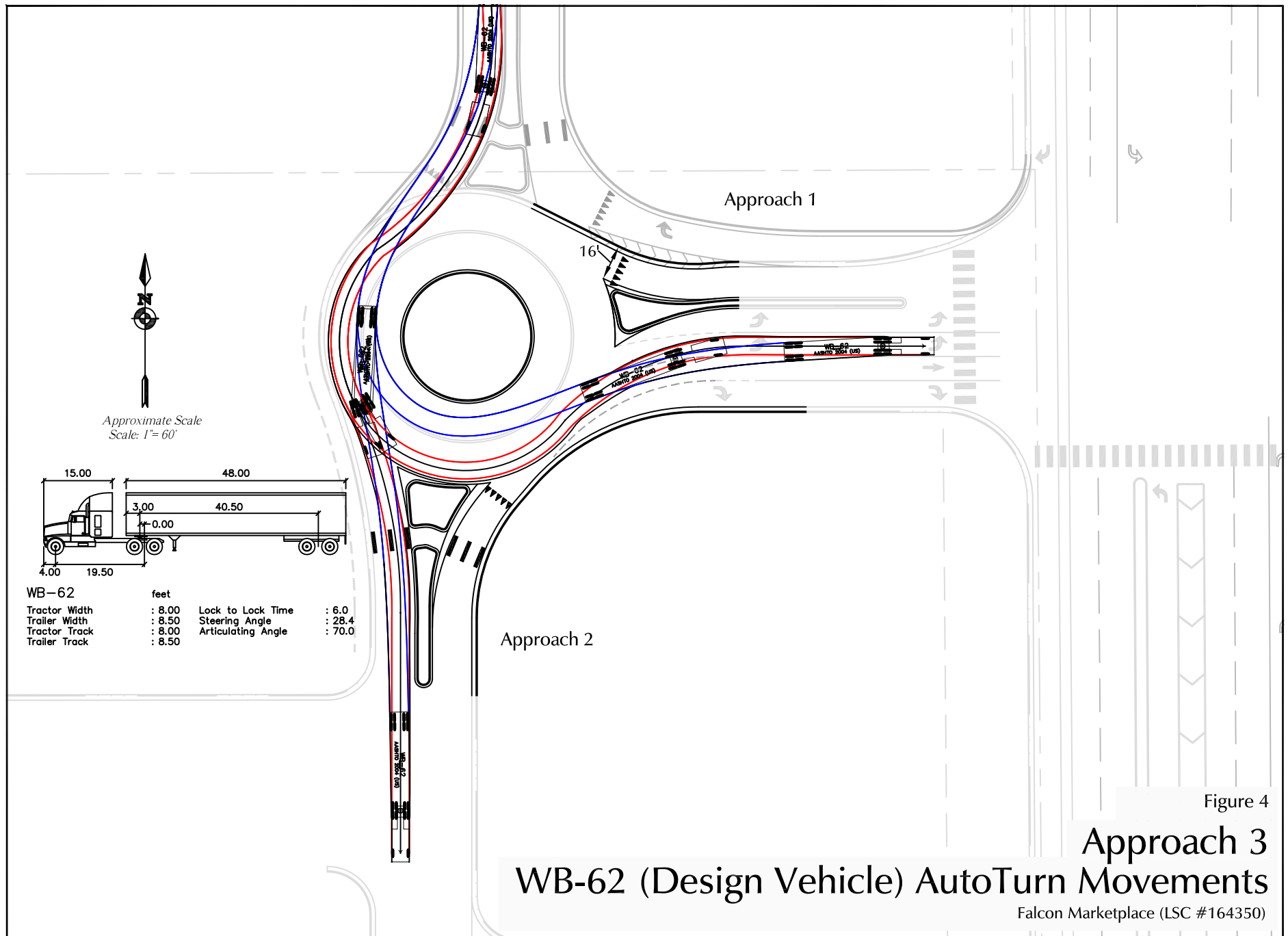
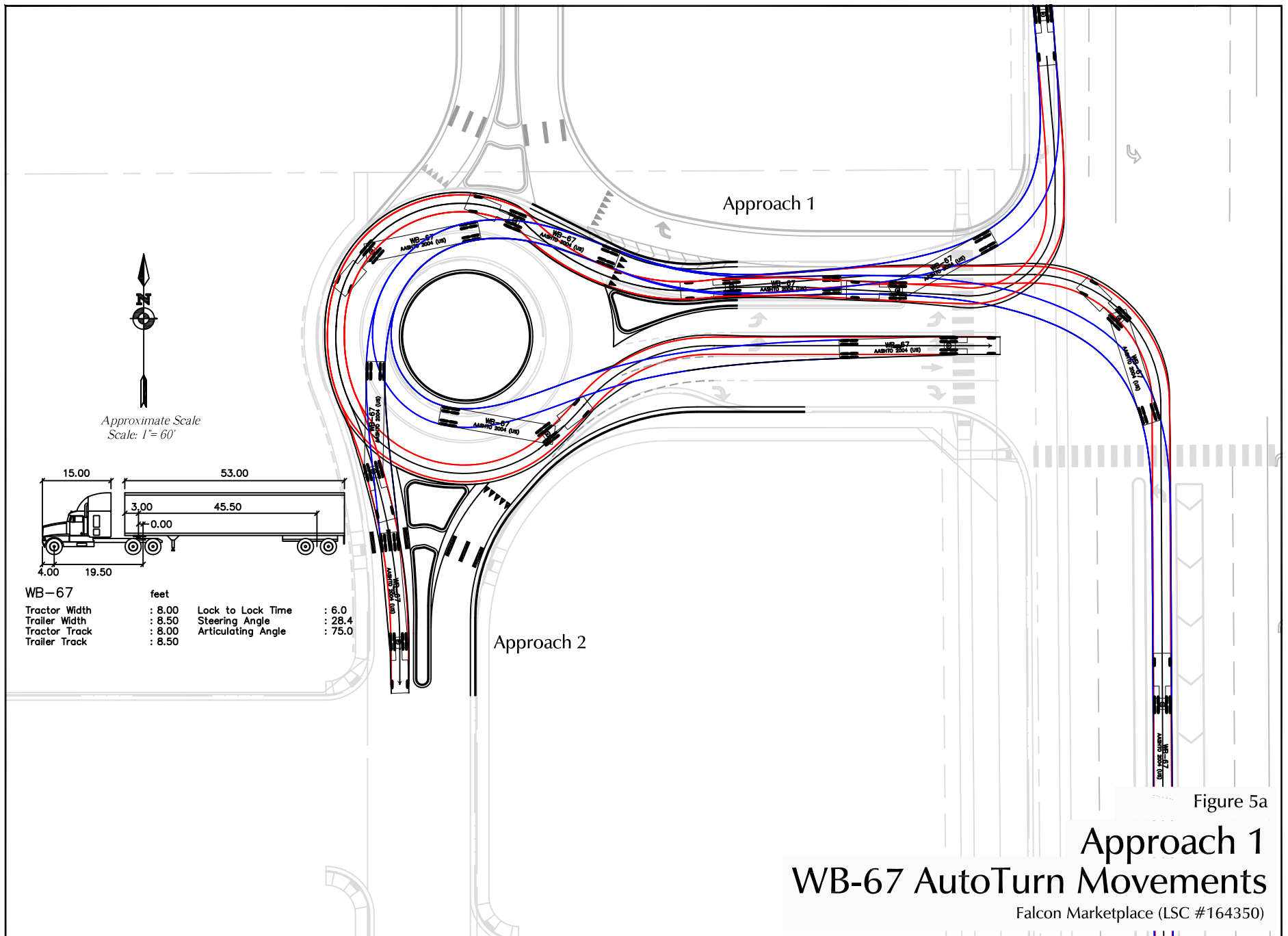


Figure 4

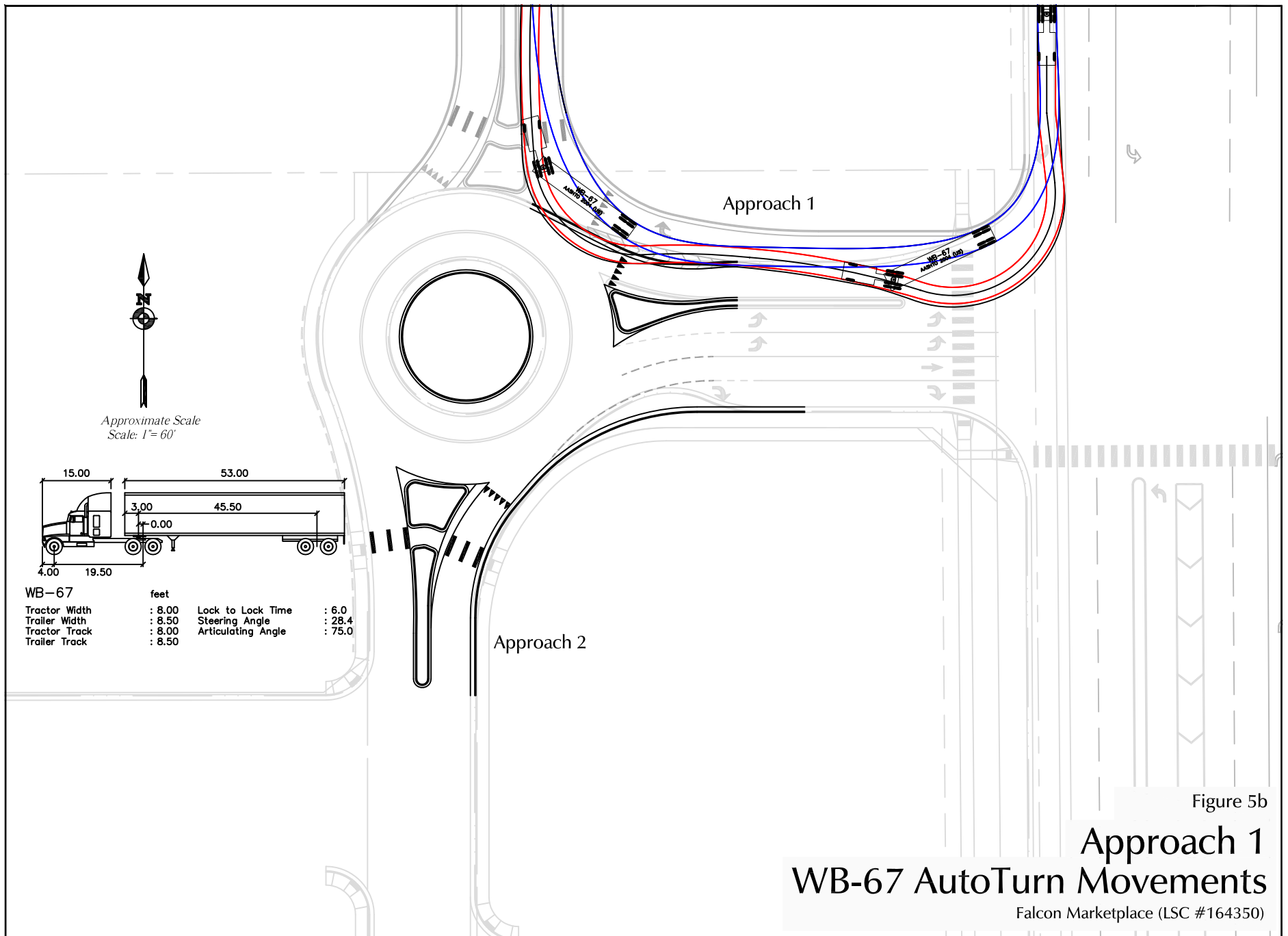
## Approach 3

# WB-62 (Design Vehicle) AutoTurn Movements

Falcon Marketplace (LSC #164350)







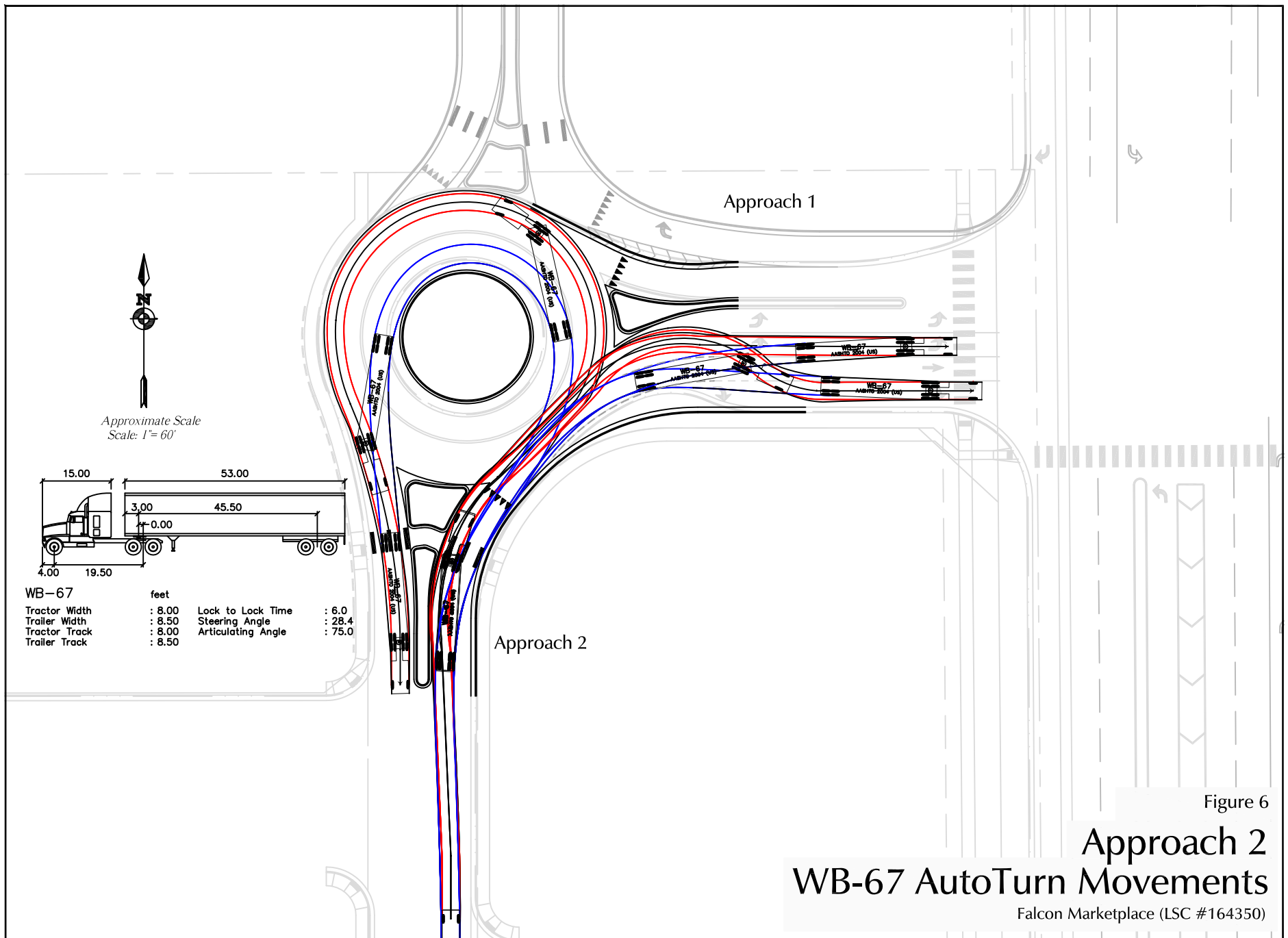
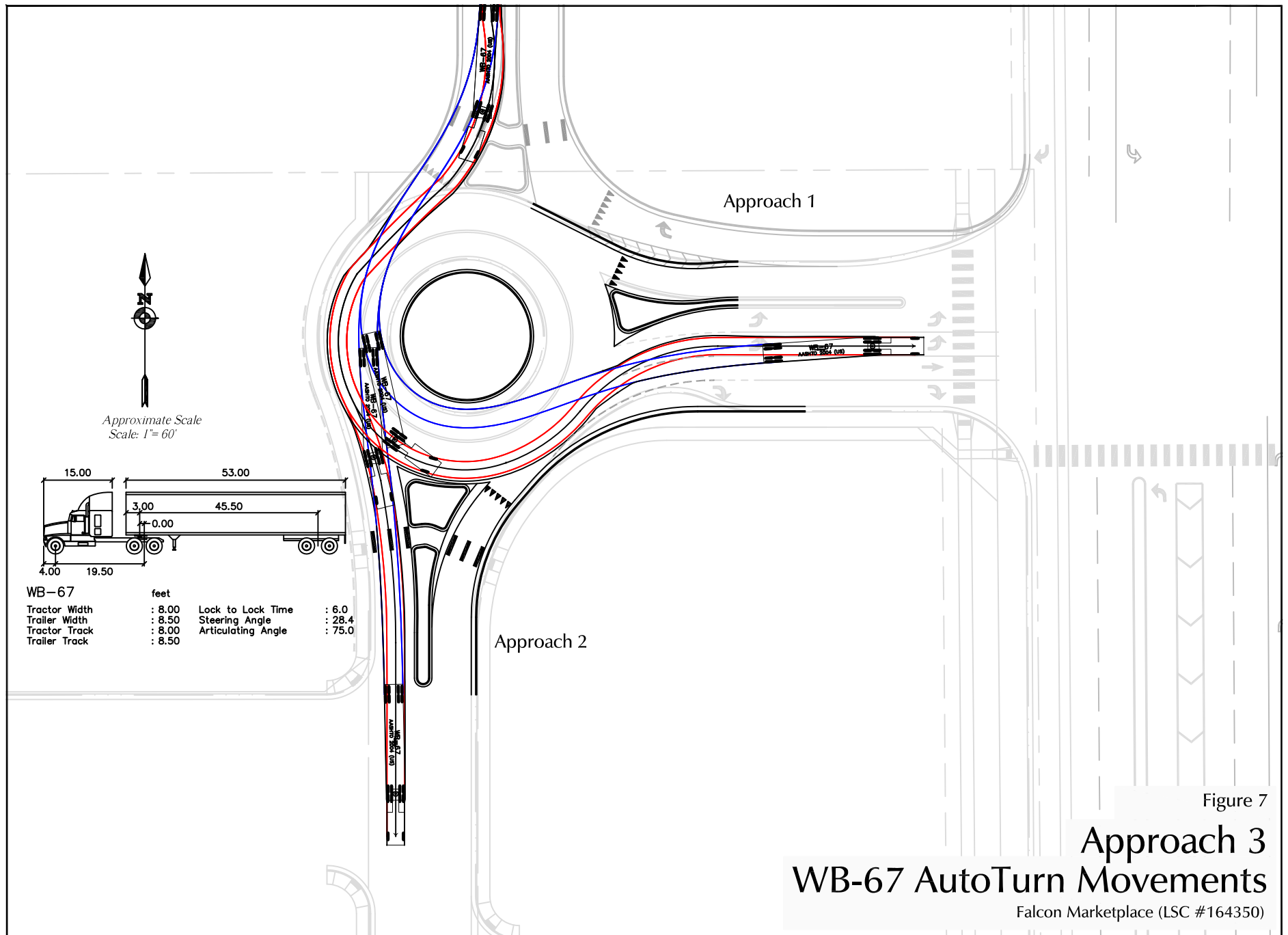


Figure 6

## Approach 2 WB-67 AutoTurn Movements

Falcon Marketplace (LSC #164350)



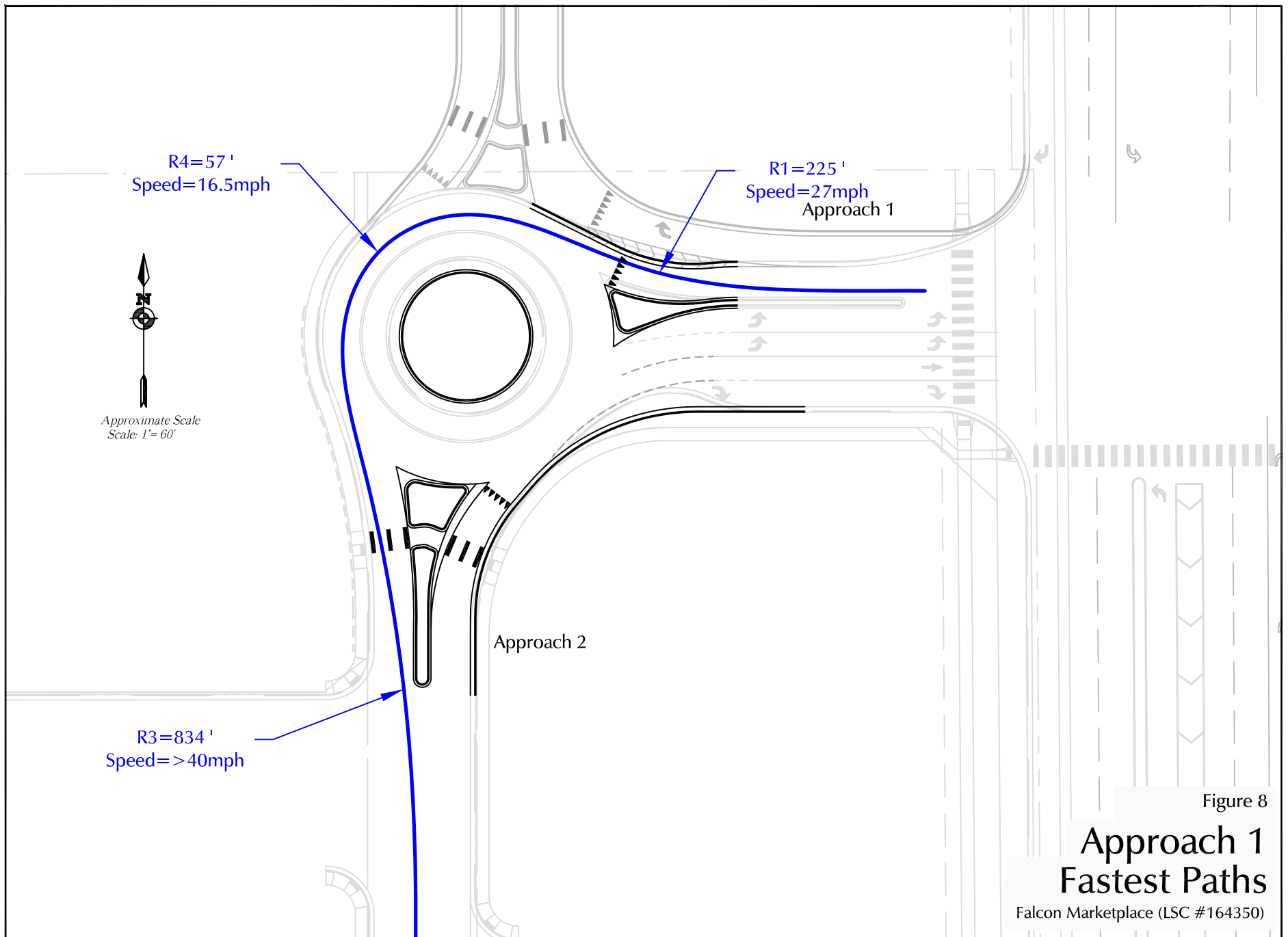
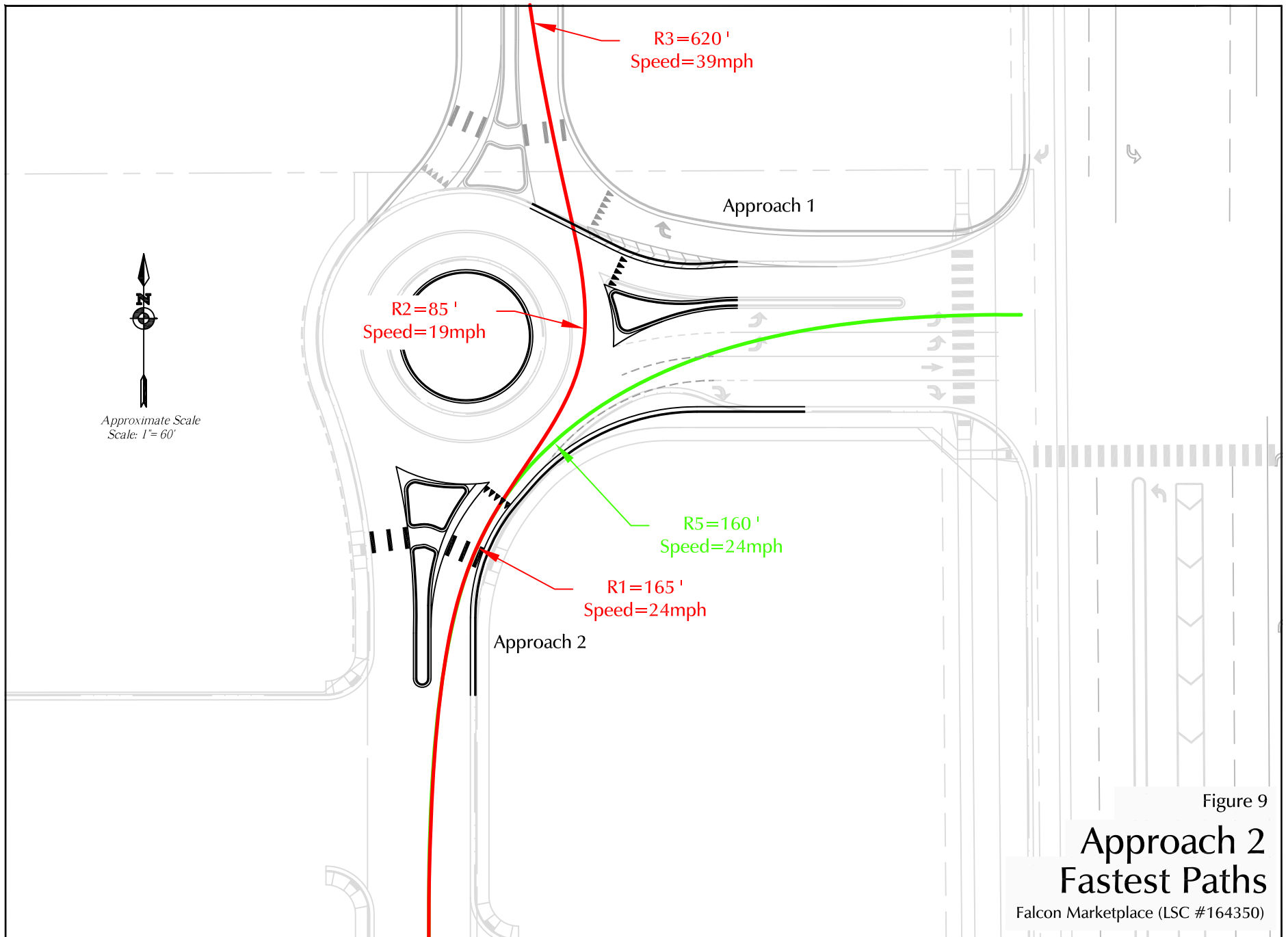
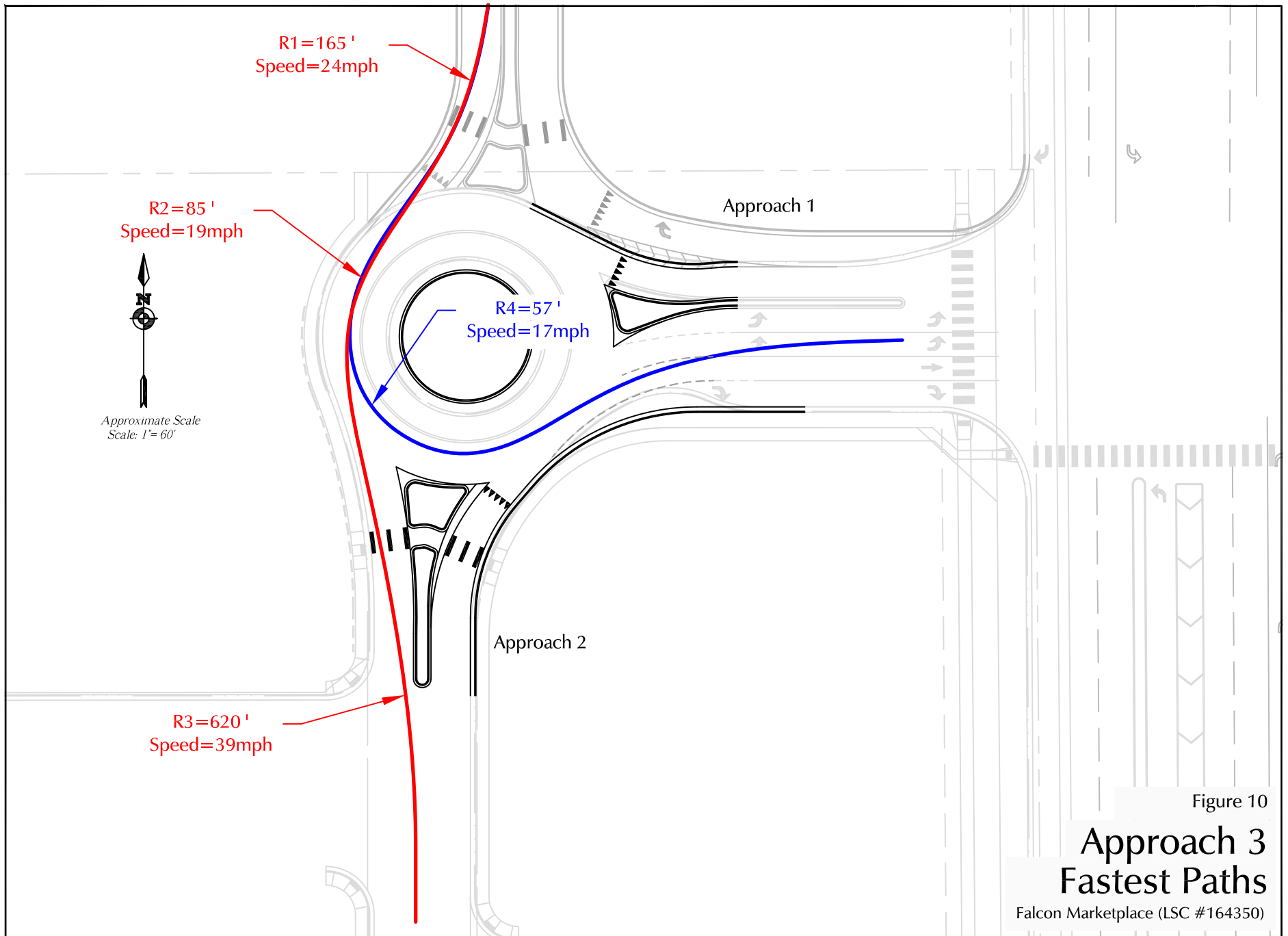


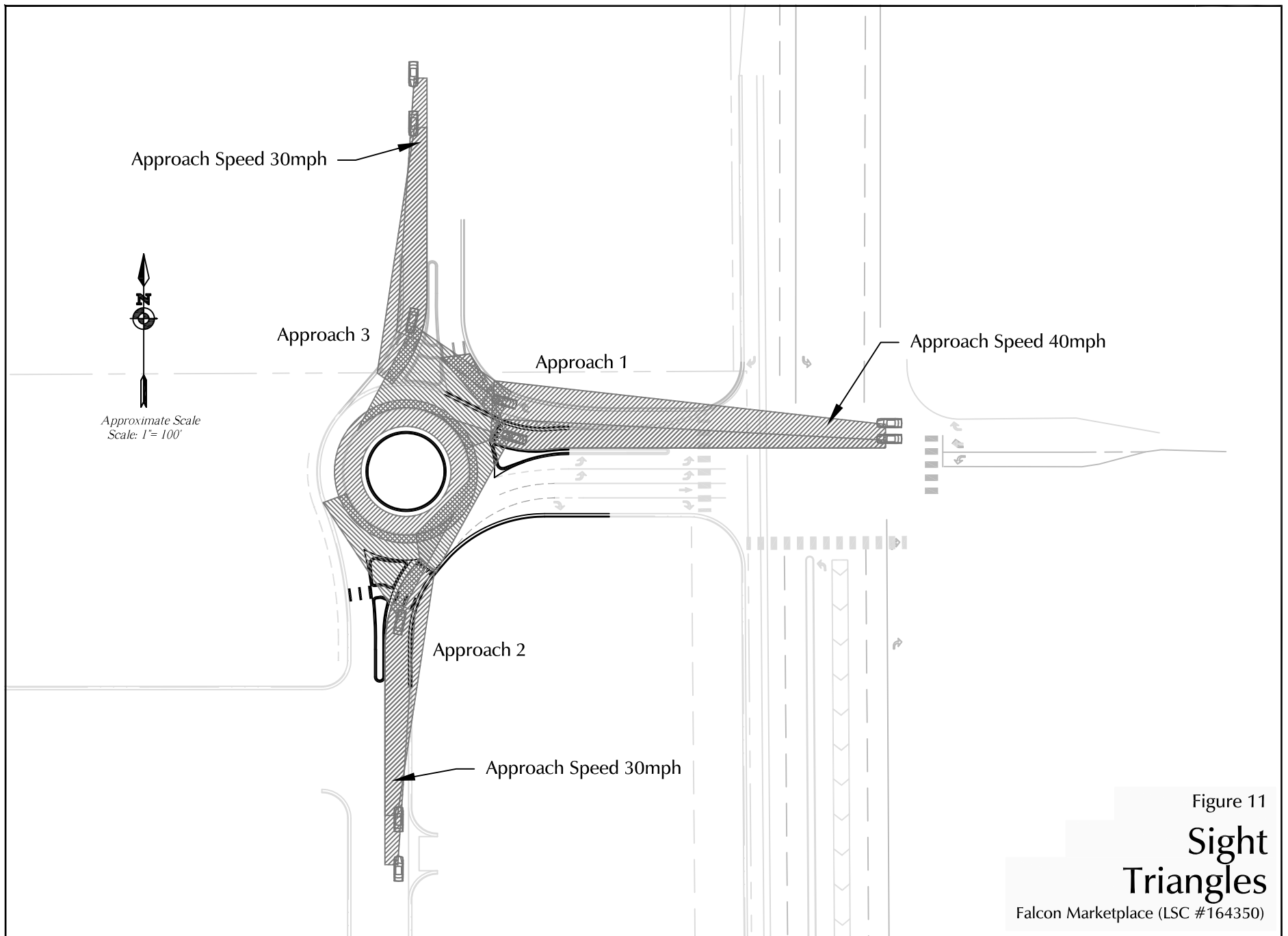
Figure 8

## Approach 1 Fastest Paths

Falcon Marketplace (LSC #164350)







## Operational Data

### Traffic Flow Data (veh/hr)

#### 2040 AM Peak Peak Hour Flows

Leg	Leg Names	Turning Flows				Flow Modifiers		
		U-Turn	Exit-2	Exit-1	Bypass	Trucks %	Flow Factor	Peak Hour Factor
1	Approach 3	0	246	0	0	2.0	1.00	0.9
2	Approach 1	0	3	261	176	2.0	1.00	0.9
3	Approach 2	0	73	5	0	2.0	1.00	0.9



## Operational Results

### 2040 AM Peak - 15 minutes

#### Flows and Capacity

Leg	Leg Names	Bypass Type	Flows (veh/hr)					Capacity (veh/hr)			
			Arrival Flow		Opposing Flow		Exit Flow	Capacity		Average VCR	
			Entry	Bypass	Entry	Bypass		Entry	Bypass	Entry	Bypass
1	Approach 3	None	267		79		9	1500		0.1793	
2	Approach 1	Yield	287	191	267	551	79	807	1161	0.3603	0.1660
3	Approach 2	None	85		3		742	1551		0.0549	

#### Delays, Queues and Level of Service

Leg	Leg Names	Bypass Type	Average Delay (sec)			95% Queue (veh)		Level of Service		
			Entry	Bypass	Leg	Entry	Bypass	Entry	Bypass	Leg
1	Approach 3	None	2.74		2.74	0.56		A		A
2	Approach 1	Yield	6.32	3.54	5.21	1.38	0.52	A	A	A
3	Approach 2	None	2.33		2.33	0.15		A		A

## Global Results

### Performance and Accidents

#### 2040 AM Peak Global Performance

Parameter	Units	Entries	Bypasses	Total
Arrive Flows	veh/hr	588	176	764
Capacity	veh/hr	3874	1192	5066
Average Delay	sec/veh	4.27	3.51	4.10
L.O.S. (Signal)	A – F	A	A	A
L.O.S. (Unsig)	A – F	A	A	A
Total Delay	veh.hrs	0.70	0.17	0.87

## Operational Data

### Traffic Flow Data (veh/hr)

#### 2040 PM Peak Peak Hour Flows

Leg	Leg Names	Turning Flows				Flow Modifiers		
		U-Turn	Exit-2	Exit-1	Bypass	Trucks %	Flow Factor	Peak Hour Factor
1	Approach 3	0	206	9	0	2.0	1.00	0.9
2	Approach 1	0	371	0	314	2.0	1.00	0.9
3	Approach 2	0	8	558	0	2.0	1.00	0.9

## Operational Results

### 2040 PM Peak - 15 minutes

#### Flows and Capacity

Leg	Leg Names	Bypass Type	Flows (veh/hr)					Capacity (veh/hr)			
			Arrival Flow		Opposing Flow		Exit Flow	Capacity		Average VCR	
			Entry	Bypass	Entry	Bypass		Entry	Bypass	Entry	Bypass
1	Approach 3	None	234		9		1009	1793		0.1309	
2	Approach 1	Yield	403	341	224	224	18	1077	1640	0.3783	0.2093
3	Approach 2	None	615		403		565	1528		0.4056	

#### Delays, Queues and Level of Service

Leg	Leg Names	Bypass Type	Average Delay (sec)			95% Queue (veh)		Level of Service		
			Entry	Bypass	Leg	Entry	Bypass	Entry	Bypass	Leg
1	Approach 3	None	2.18		2.18	0.39		A		A
2	Approach 1	Yield	4.89	2.66	3.87	1.50	0.69	A	A	A
3	Approach 2	None	3.60		3.60	1.68		A		A

## Global Results

### Performance and Accidents

#### 2040 PM Peak Global Performance

Parameter	Units	Entries	Bypasses	Total
Arrive Flows	veh/hr	1152	314	1466
Capacity	veh/hr	4430	1652	6082
Average Delay	sec/veh	3.69	2.67	3.47
L.O.S. (Signal)	A – F	A	A	A
L.O.S. (Unsig)	A – F	A	A	A
Total Delay	veh.hrs	1.18	0.23	1.41