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Section 1. Background

The City of Calabasas (City) will be modifying the intersection at West Calabasas Road and Mureau Road into a roundabout as part of the West Calabasas Road Improvements Project. The roundabout is intended to improve vehicle traffic flow, reduce vehicle collisions, improve multimodal access, support future development along the West Calabasas Road corridor, and serve as a gateway as travelers enter City limits. The intersection has three legs, with the east and west legs being West Calabasas Road, and the north leg being the Mureau Road as it immediately crosses US-101.

1.1. Design efforts to-date

The West Calabasas Road / Mureau Road intersection was originally scoped by the City as a single-lane roundabout in accordance with the City’s West Calabasas Road Planning Guidelines. Due to its location as a frontage road, the intersection requires accommodation of CA Legal truck movements. The single-lane roundabout was originally designed for a 120-foot inscribed circle diameter (ICD), and was downsized to a 110-foot ICD after the 60% single-lane roundabout peer review.

1.2. Purpose

After reviewing the 90% single-lane roundabout design, the City has requested MNS to explore the feasibility of using a mini-roundabout instead of the single-lane roundabout as a cost-saving measure. Mini-roundabouts in the United States are typically characterized by traversable central islands and smaller inscribed circle diameters compared to standard, modern roundabouts. This allows larger vehicles to make turns or through movements over the traversable elements.

Section 2. Basis of Design

2.1. Design Standards

The mini-roundabout will conform to the following design standards:

- City Design Standards
- FHWA National Cooperative Highway Research Program (NCHRP) 1043 – Roundabouts: An Informational Guide
- West Calabasas Road Design Guidelines (2006)
- Caltrans Highway Design Manual

2.2. Design Parameters

Operational Analysis

Operational analysis is included in the original roundabout design memorandum, dated November 13, 2023.

Design Vehicle

The mini-roundabout was designed for the following design vehicles and turning movements and:

- 40-foot Bus (design)
 - All movements
- CA Legal truck (accommodated)
 - Right Turn (West Calabasas Road westbound to Mureau Road northbound)
 - Left Turn (Mureau Road southbound to West Calabasas Road eastbound)

The 40-foot bus design wheel tracking should stay within the circulatory roadway, without need for use of the truck apron. The CA Legal accommodation will require use of the traversable central island for the left turn.

Turning movements for design vehicles are shown in Appendix 1. Turning movements were evaluated using the Autodesk® Vehicle Tracking module within AutoCAD.

Sizing

The original sing-lane roundabout design had a 120-foot inscribed circle diameter to accommodate a CA Legal truck design vehicle; the inscribed circle diameter was updated to be 110 feet after 60% peer review.

If the central island is fully traversable for CA Legal truck design vehicles, the mini-roundabout needs to accommodate SU-40 trucks and be fully designed for 40-foot buses, especially due to the nearby Round Meadow Elementary School. Buses should stay within the circulatory roadway as traversing the central island will cause

uncomfortable load/passenger shifting. These design vehicles have maximum outside turning radii of 42 feet, meaning that mini-roundabout designs should have inscribed circle diameters of 84-foot minimum. A 90-foot inscribed circle diameter was chosen for the design. CA Legal truck design vehicles will not be able to make a U-turn from westbound to eastbound on West Calabasas Road.

Performance Checks

The mini-roundabout was checked for conformance with the following standards as outlined in NCHRP 1043 Chapter 8:

- Fastest Path and Speed Differential (Speed Consistency)
- Stopping Sight Distance
- Intersection Sight Distance
- Visibility Angles

Performance checks are shown in Appendix 2.

Due to the three-legged nature of the roundabout, some performance checks were not required.

Stopping Sight Distance

The existing bridge railing will be a stopping sight distance obstruction for the approach looking to the yield point. This can be mitigated with a warning sign on the other side of the bridge.

Intersection Sight Distance

There will likely be a sight distance obstruction of Midwest guardrail system (MGS) for intersection sight distance in advance of the entry of Approach A, looking toward the Approach C incoming traffic. Approach B entry looking toward the Approach A incoming traffic will have a similar, but less significant problem.

Also, landscaping will need to be low-profile if the central island is to be partially landscaped due to the intersection sight distance at the entry of Approach A, looking into the circulatory roadway.

Pedestrian and bicycle design

Discussion on pedestrian and bicycle design is included in the original roundabout design memorandum, dated November 13, 2023. The City has agreed that a crosswalk is only needed on the east leg, and bicycle separation is not necessary due to the suburban-to-rural nature and mountainous terrain of the roundabout.

2.3. Modular mini-roundabout applicability

The City has requested MNS to investigate the possibility of retrofitting the existing intersection geometry with a mini-roundabout using modular tiles. As a sample reference, pre- and post-retrofit conditions of the Lincoln Boulevard and Girard Road intersection (San Francisco, CA) is shown in the following Google Earth satellite imagery:



Pre-project intersection geometry (3-4 lanes)

Post-project modular roundabout.

This roundabout uses modular polymer “tiles” to serve as curbing throughout the intersection.

The existing intersection could support a 58.5-foot inscribed circle diameter. While retrofit would be a cost-sensitive solution, it presents the following challenges for the West Calabasas Road / Mureau Road intersection:

- Speed differential
 - Circulatory roadway speeds for left turns would be limited to 9mph, while most entries would be well above 20 mph. Speed differentials should be limited to 10 mph.
- There is a significant vertical curvature on the westbound approach that hinders visibility and may also make the installation and maintenance of modular tiles difficult.

Section 3. Magnitude of Cost

A magnitude of cost was developed based on the previous project design efforts. It should be noted that this magnitude of cost is for the whole scope of the project, and is not isolated to just the roundabout. Major changes for a mini-roundabout include: moderately decreased curbs, asphalt paving, truck apron, etc.; elimination of the soil nail wall; decreased landscaping and irrigation. Whereas the roundabout estimate was \$3.9M, the mini-roundabout has a magnitude of cost of \$3.4M, which is an approximately \$450,000 in savings. Appendix 3 presents calculations for the rough order of magnitude for the mini-roundabout.

Section 4. Design Comparison

The mini-roundabout design was compared to the original single-lane roundabout design.

Parameter	Mini-roundabout	Single-lane roundabout
Visibility	Low	High
Central island landscaping	Low to none	Medium

Gateway monument in central island	No	Yes
CA Legal U-turns	No	Yes
Magnitude of Cost	\$3.4M	\$3.9M

Visibility

One of the key elements that makes roundabouts effective traffic control devices is their visibility. The central island plays a key role in providing the visual cue to drivers to reduce their speed upon approach. For this reason, vertical objects (such as trees and other crashworthy features) increase the roundabout’s efficacy as highly visible objects. A mini-roundabout would not be able to accommodate pronounced vertical features in the central island.

While speeds are limited by the narrow Mureau Road overcrossing bridge, the West Calabasas Road geometry is more conducive to higher approach speeds. With the primary approach movement on West Calabasas Road being westbound, the vertical crest curve on approach further decreases visibility.

Central island landscaping opportunities

An approximately 350 square foot area in the central island could be used for landscaping; however, it would need to be low-profile due to stopping and intersection sight distance triangles.

Gateway monument

The original vision of the roundabout included a gateway monument in the central island. A mini-roundabout would not be able to accommodate this feature; however, there may be some opportunity to build one into the southern slope.

Mobility

The mini-roundabout will not be able to accommodate U-turns for CA Legal trucks. Additionally, 40-foot buses and trucks will require maximum wheel turning in the mini-roundabout.

Magnitude of Cost

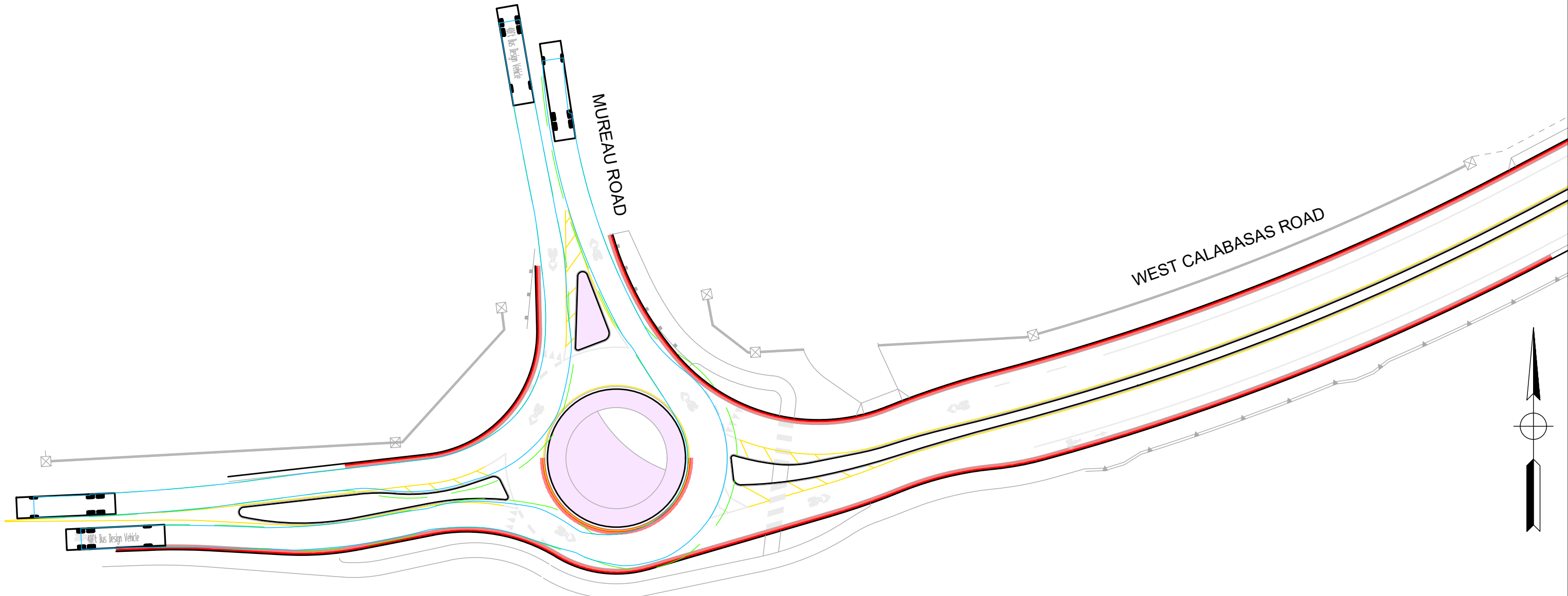
Section 3 compares the single-lane and the mini-roundabouts in terms of magnitude of cost, \$3.9 million and \$3.4 million, respectively.

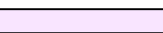
Section 5. Peer Review

Kittelson & Associates, Inc. (Kittelson) will be performing a peer review of this draft technical memorandum.

Appendix 1. Design Vehicle Turning Movements

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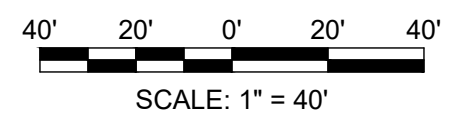


-  WHEEL EDGE PATH
-  BODY OUTLINE
-  2' CLEARANCE TO CURB
-  1' CLEARANCE TO CURB
-  TRAVERSABLE APRON

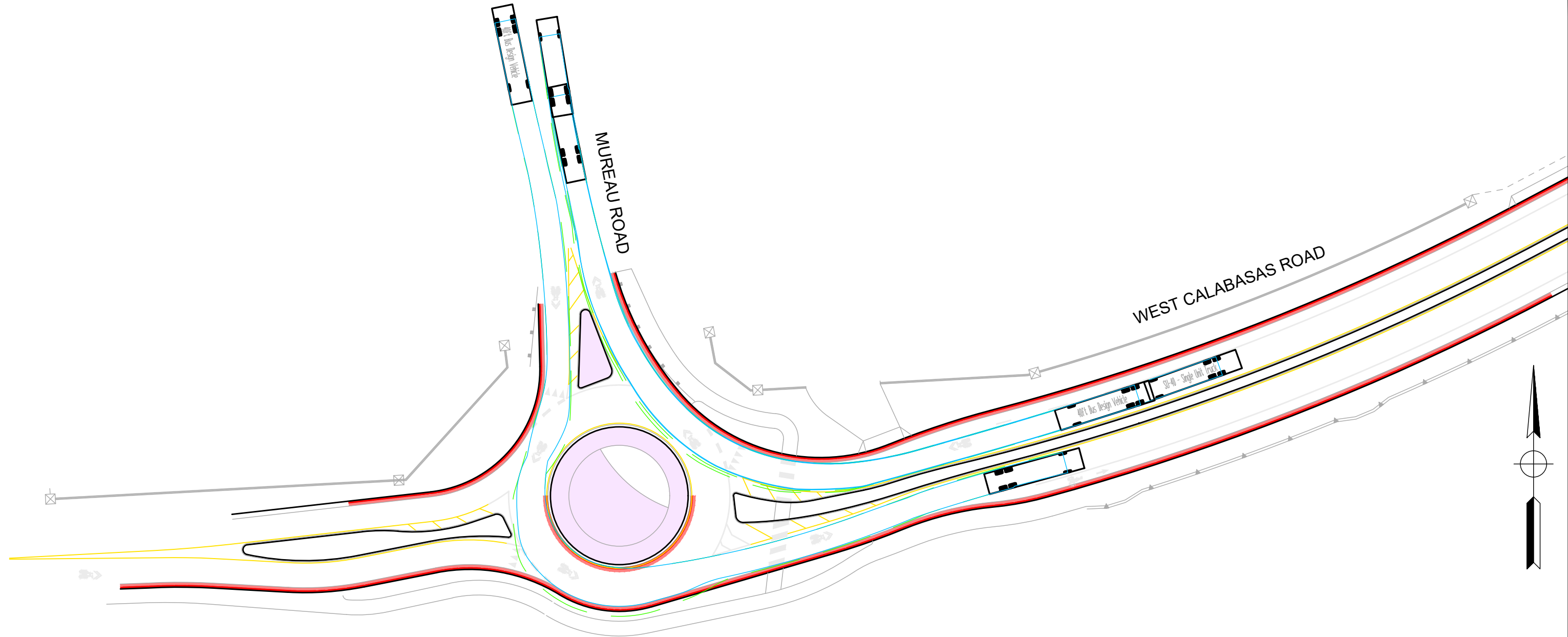


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CITY OF CALABASAS
WEST CALABASAS ROAD IMPROVEMENTS PROJECT
MINI-ROUNDBOUT TURN ANALYSIS (40-FOOT BUS TURN - WEST)



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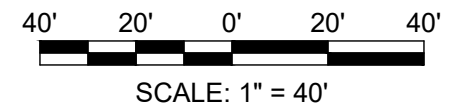


- WHEEL EDGE PATH
- BODY OUTLINE
- 2' CLEARANCE TO CURB
- 1' CLEARANCE TO CURB
- TRAVERSABLE APRON

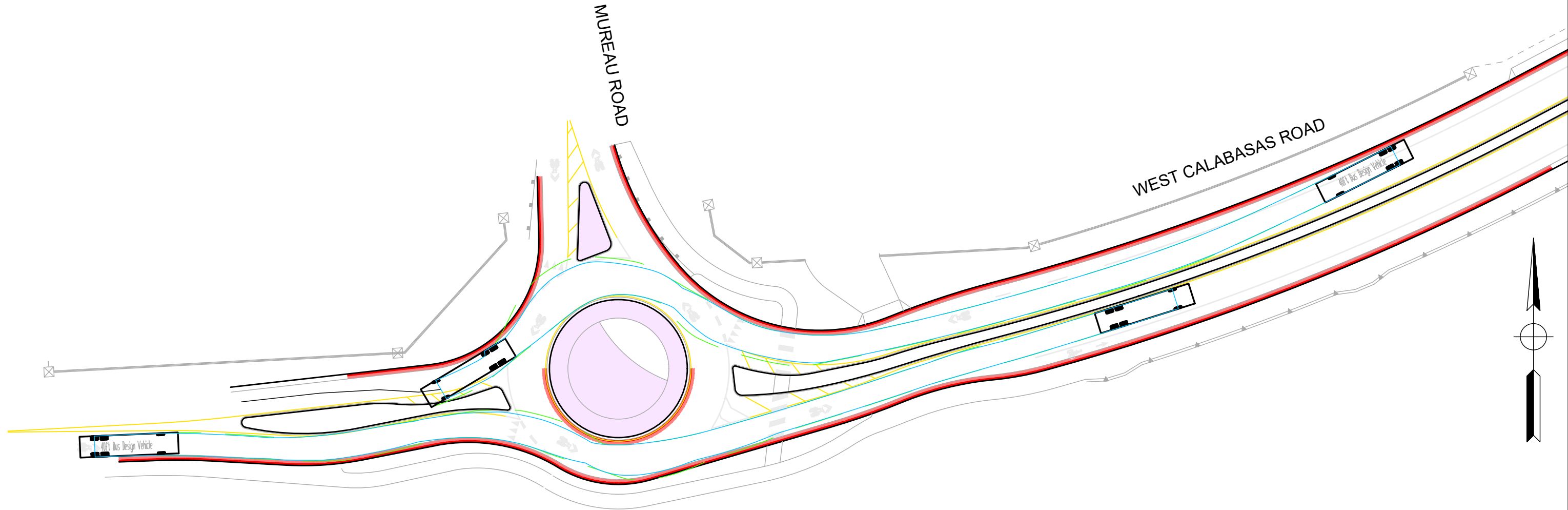


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MINI-ROUNDBOUT TURN ANALYSIS (40-FOOT BUS TURN - EAST)



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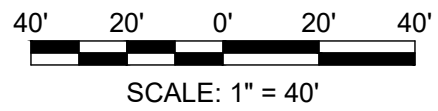


- WHEEL EDGE PATH
- BODY OUTLINE
- 2' CLEARANCE TO CURB
- 1' CLEARANCE TO CURB
- TRAVERSABLE APRON



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CITY OF CALABASAS
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MINI-ROUNDBOUT TURN ANALYSIS (40-FOOT BUS THROUGH)

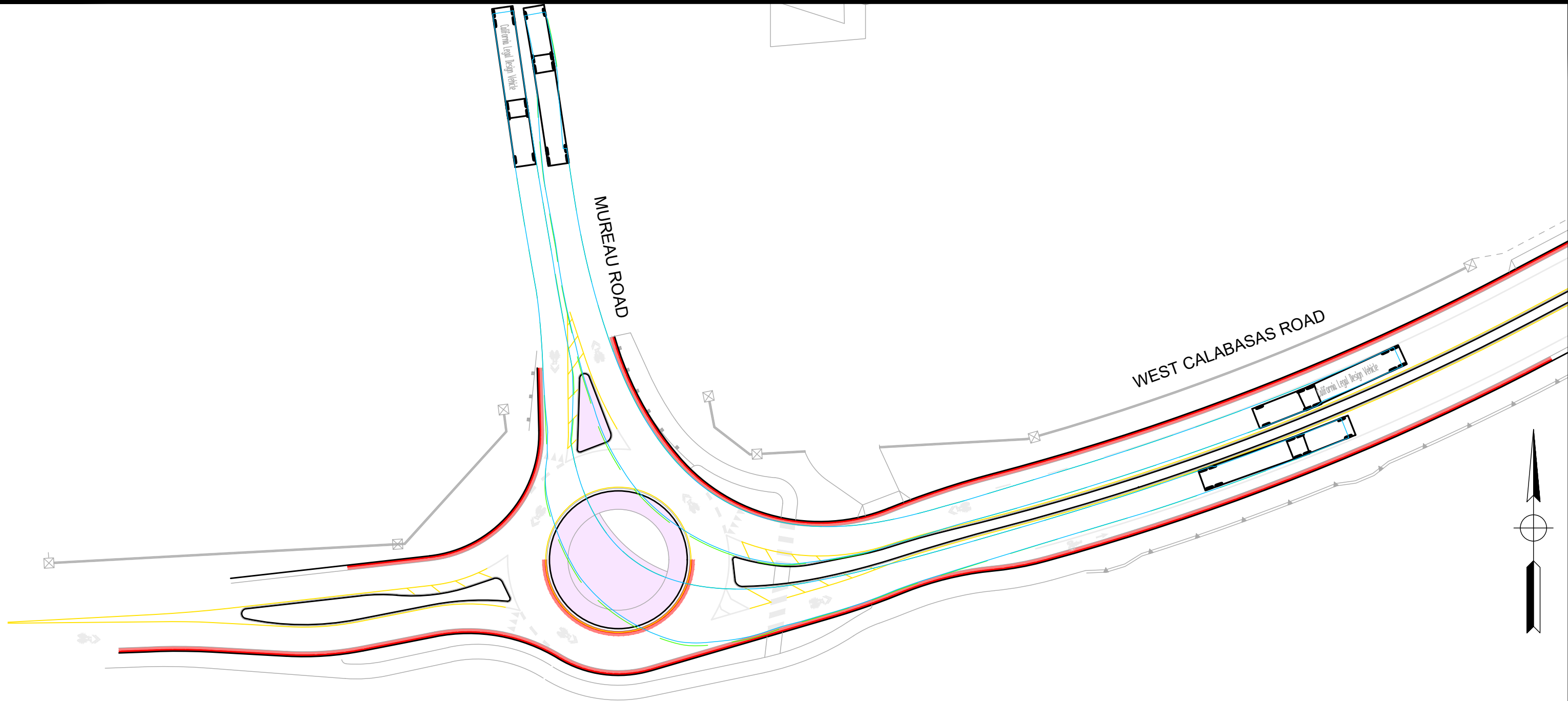


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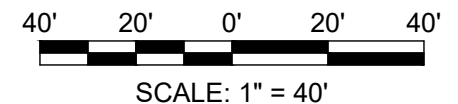


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CITY OF CALABASAS
WEST CALABASAS ROAD IMPROVEMENTS PROJECT
MINI-ROUNDBOUT TURN ANALYSIS (CA LEGAL TURN)

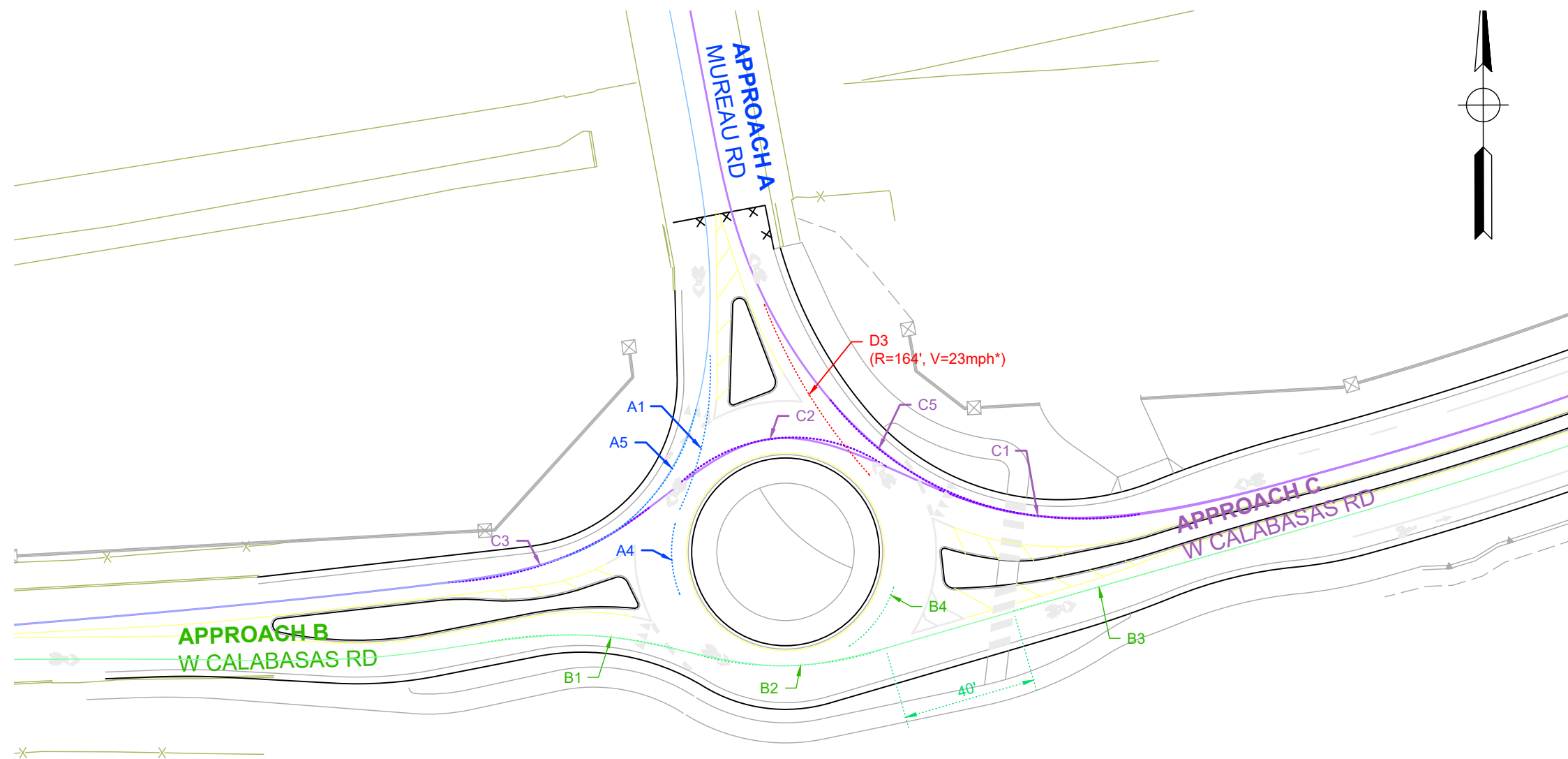


- WHEEL EDGE PATH
- BODY OUTLINE
- 2' CLEARANCE TO CURB
- 1' CLEARANCE TO CURB
- TRAVERSABLE APRON



Appendix 2. Performance Checks

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Fastest paths were calculated using a spline-based method developed by the Wisconsin Department of Transportation. See Wisconsin DOT Facilities Development Manual 11-26, Attachment 5.1: Roundabout Critical Design Parameters Document
<https://wisconsindot.gov/rdwy/fdm/fd-11-26-att.pdf#fd11-26a50.1>

Speeds were calculated from the following:
 $V = 3.4415 R^{0.3861}$ for $e = +0.02$ (NCHRP 1043 Equation 9.3)
 $V = 3.4614 R^{0.3673}$ for $e = -0.02$ (NCHRP 1043 Equation 9.4)

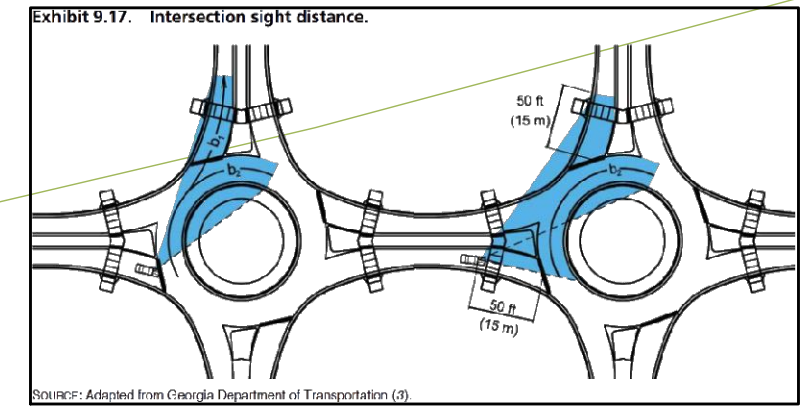
Approach A		
ID	R (ft)	V (mph)
A1	98.0	20
A2	-	-
A3	-	-
A4	34.0	13
A5	60.7	17

Approach B		
ID	R (ft)	V (mph)
B1	130.5	23
B2	95.0	18
B3*	9804.7	24
B4	34.0	13
B5	-	-

Approach C		
ID	R (ft)	V (mph)
C1	110.2	21
C2	48.5	14
C3	64.8	17
C4	-	-
C5	93.1	20

*Uses NCHRP 1043 Equation 9.7 methodology

Speed Consistency					
				differential	
A (Left)	A1	A4	B3*		
	20	13	20	-8	ok
B (Thru)	B1	B2	B3*		
	23	18	24	-6	ok
B (Left)	B1	B4	D3*		
	23	13	23	-10	ok
C (Thru)	C1	C2	C3		
	21	14	17	-7	ok



MGS will obstruct sight line (minor)

MGS will obstruct sight line

APPROACH B
W CALABASAS RD

APPROACH A
MUREAU RD

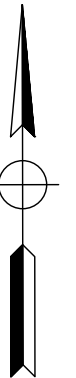
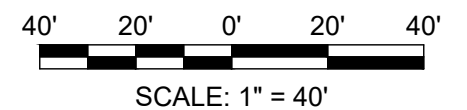
APPROACH C
W CALABASAS RD

Intersection Sight Distance							
Approach	$t_{critical}$	Reference Approach	V_1	$V_{m, circ}$	$V_{m, enter}$	b_1	b_2
A	5.0	C	21	13	16.8	123.5	92.8
B	5.0	A	15	13	13.8	101.4	92.8
C	5.0	-	-	13	-	-	92.8

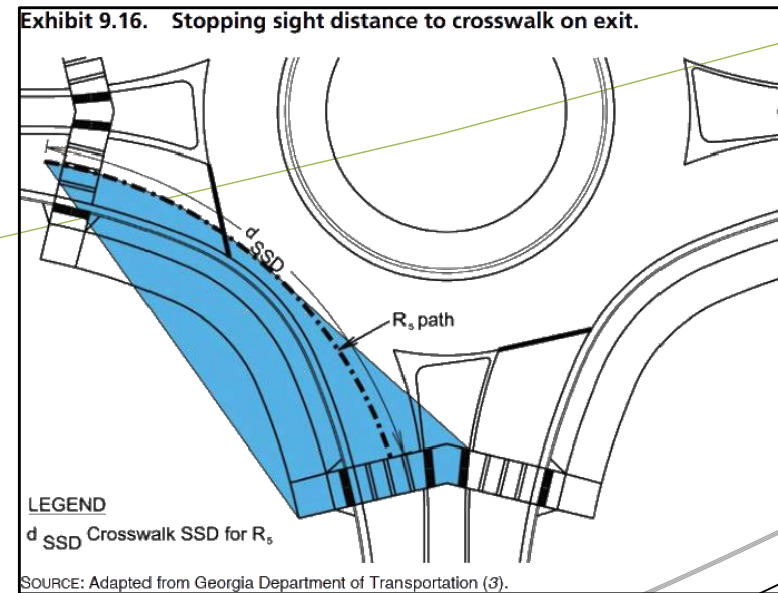
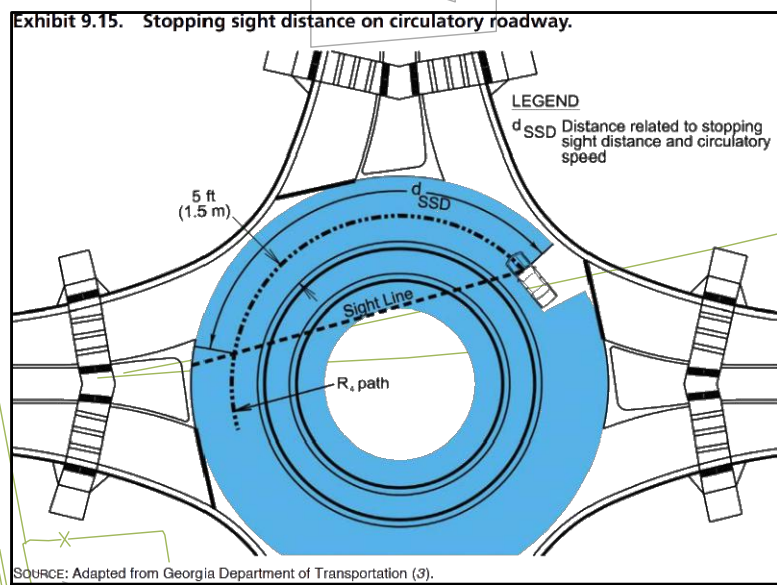
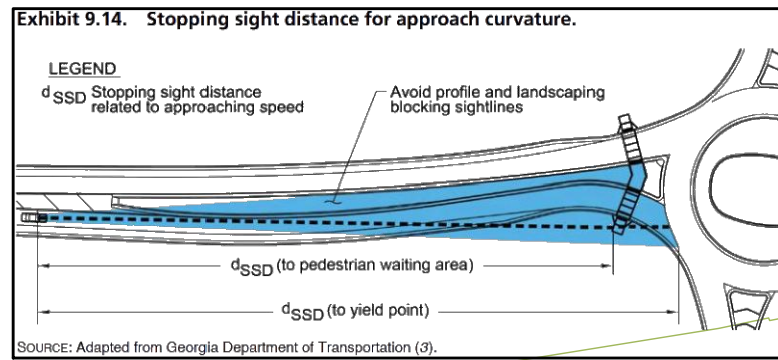


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CITY OF CALABASAS
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ROUNDBOUT INTERSECTION SIGHT DISTANCE ANALYSIS



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(no cases this roundabout)

Existing Bridge Railing will obstruct this sight line
 d (with obstruction) = 116' ~ 20mph

APPROACH B
W CALABASAS RD (25 MPH)

APPROACH C
W CALABASAS RD
40 MPH

APPROACH A
MUREAU RD (25 MPH)

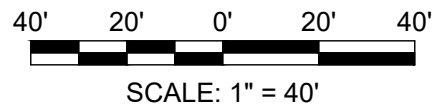
Stopping Sight Distance						
Approach	SSD on Approach		SSD on Circulatory Roadway		SSD to Exit Crosswalk*	
	V (mph)	d (ft)	V (mph)	d (ft)	V (mph)	d (ft)
A	25	152	13	62	-	-
B	25	152	13	62	-	-
C	40	302	13	62	-	-

*No right turns to crosswalks this roundabout



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CITY OF CALABASAS
WEST CALABASAS ROAD IMPROVEMENTS PROJECT
ROUNDBOUT STOPPING SIGHT DISTANCE ANALYSIS



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Appendix 3. Magnitude of Cost



Rough Magnitude of Cost - Mini-Roundabout

Item #	Description	Unit	Quantity	Unit Cost	Cost	Notes
General						
1	Mobilization and Demobilization	LS	1	\$ 251,000	\$ 251,000	
2	Temporary Water Pollution Control	LS	1	\$ 28,000	\$ 28,000	
3	Traffic Control	LS	1	\$ 100,000	\$ 100,000	
4	Signing and Striping	LS	1	\$ 25,000	\$ 25,000	
Existing Facilities						
5	Preserve Existing Survey Monuments	EA	12	\$ 10,000	\$ 120,000	V
6	Clearing and Grubbing	LS	1	\$ 20,000	\$ 20,000	
7	Remove Existing Tree	EA	6	\$ 1,500	\$ 9,000	3
8	Remove Asphalt Concrete Pavement	SF	18,850	\$ 3.00	\$ 56,550	
9	Remove Concrete Facility	SF	4,600	\$ 4.50	\$ 20,700	
10	Remove Existing Fence	LF	1,390	\$ 3.00	\$ 4,170	7
11	Remove Existing Guardrail	LF	120	\$ 3.00	\$ 360	6
12	Remove Existing Bollard	EA	5	\$ 300	\$ 1,500	8
13	Remove Existing CMU Headwall	EA	1	\$ 1,000	\$ 1,000	
14	Remove Existing Catch Basin	EA	1	\$ 1,000	\$ 1,000	
15	Relocate Existing LVMWD Water Meter	EA	1	\$ 1,500	\$ 1,500	5M
16	Adjust to Grade Existing Manhole Cover	EA	1	\$ 1,500	\$ 1,500	A1
17	Adjust to Grade Existing Water Valve Cover	EA	3	\$ 800	\$ 2,400	A2
18	Adjust to Grade Existing Water Meter Box	EA	1	\$ 500	\$ 500	A3
19	Adjust to Grade Existing Caltrans Pull Box	EA	1	\$ 500	\$ 500	A4
Roadway Improvements						
20	Unclassified Excavation	CY	2,370	\$ 60	\$ 142,200	
21	Crushed Miscellaneous Base	CY	840	\$ 100	\$ 84,000	
22	Asphalt Concrete	TN	440	\$ 140	\$ 61,600	2A, 4D
23	Asphalt Rubber Hot Mix	TN	280	\$ 160	\$ 44,800	2A
24	Jointed Plain Concrete Pavement Truck Apron	SF	1,300	\$ 55	\$ 71,500	3A
25	Concrete Sidewalk	SF	5,860	\$ 16	\$ 93,760	4S
26	Curb Ramp	SF	120	\$ 30	\$ 3,600	4R
27	Curb and Gutter (various types)	LS	1	\$ 130,000	\$ 130,000	
28	Driveway Approach	SF	200	\$ 25	\$ 5,000	4D
29	Guardrail	LF	125	\$ 80	\$ 10,000	5
30	Chain Link Fence	LF	40	\$ 60	\$ 2,400	6A
31	Chain Link Fence Gate (W=4')	EA	1	\$ 3,000	\$ 3,000	6G
32	Curb Opening Catch Basin (W=7') per SPPWC 300-4	EA	1	\$ 10,000	\$ 10,000	2A
33	Curb Opening Catch Basin with Manhole (W=10') per SPPWC 307-3	EA	1	\$ 15,000	\$ 15,000	2B
34	Grating Catch Basin	EA	1	\$ 8,000	\$ 8,000	6
35	Manhole per SPPWC 300-4	EA	2	\$ 12,000	\$ 24,000	3
36	Manhole Collar	EA	1	\$ 6,000	\$ 6,000	7
37	Junction Structure per SPPWC 331-3	EA	1	\$ 7,500	\$ 7,500	3J
38	Pipe Riser	LF	10	\$ 1,000	\$ 10,000	4
39	Bollards	EA	17	\$ 200	\$ 3,400	5
40	2" Water Lateral and Meter	EA	1	\$ 4,000	\$ 4,000	5N
41	18" Reinforced Concrete Pipe	LF	220	\$ 250	\$ 55,000	1
42	24" Reinforced Concrete Pipe	LF	50	\$ 300	\$ 15,000	1
43	24" Corrugated Steel Pipe	LF	10	\$ 300	\$ 3,000	1
44	PCC Swale	LF	590	\$ 60	\$ 35,400	D
45	Headwall	EA	1	\$ 15,000	\$ 15,000	5
46	Gravity Wall	LF	17	\$ 300	\$ 5,190	8
47	Caisson Wall Facing	SF	1,880	\$ 180	\$ 338,400	
48	Caisson (Cast-in-Drilled-Hole)	LF	1,230	\$ 250	\$ 307,500	
49	Monitoring (Caisson)	LS	1	\$ 5,000	\$ 5,000	
50	Cable Railing	LF	440	\$ 150	\$ 66,000	
Street Lighting Improvements						
51	Street Light LED Head	EA	9	\$ 4,000	\$ 36,000	
52	Street Light Concrete Pole, Arm, and Foundation	EA	9	\$ 3,500	\$ 31,500	
53	Street Light Pull Box	EA	12	\$ 1,000	\$ 12,000	
54	Street Light Service and Pedestal	LS	1	\$ 18,000	\$ 18,000	
55	Street Light Conduit	LF	1,350	\$ 50	\$ 67,500	
56	Street Light Conductors	LF	8,000	\$ 3	\$ 24,000	



Rough Magnitude of Cost - Mini-Roundabout

Item #	Description	Unit	Quantity	Unit Cost	Cost	Notes
Landscaping Improvements						
57	Reinforced Concrete Masonry Wall (8' Height)	LF	260	\$ 400	\$ 104,000	
58	Reinforced Concrete Masonry Wall (3' Height)	LF	248	\$ 150	\$ 37,200	
59	Stone Pilaster (Reinforced Concrete Masonry Wall)	EA	7	\$ 4,800	\$ 33,600	
60	Stucco Finishing (Reinforced Concrete Masonry Wall)	SF	5,340	\$ 6	\$ 32,040	
61	Precast Cap on Walls	LF	587	\$ 30	\$ 17,610	
62	Tubular Steel Fence @ 2'-0" Wall	LF	190	\$ 60	\$ 11,400	
63	Rolling Tubular Steel Gate	LS	1	\$ 18,000	\$ 18,000	Manual gate
64	Pavers on Base - Raised Medians	SF	390	\$ 20	\$ 7,800	
65	Planting and Irrigation	LS	1	\$ 350,000	\$ 350,000	
					<i>Construction Subtotal</i>	\$ 3,030,580
				<i>Contingency</i>	<i>15%</i>	\$ 454,587
					Construction Total with Contingency	\$ 3,485,167