Technical Memorandum

February 05, 2026

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From	Kamesh Vedula, GHD Zach Stinger, GHD	**Project No.**	12658096
Project Name	DOWNTOWN GRASS VALLEY ROUNDABOUT PROJECT		
Subject	Downtown Grass Valley Roundabout Right-In Right-Out Alternative Analysis Memorandum		

1. Introduction

In 2019, GHD was retained by the Nevada County Transportation Commission to complete an intersection analysis for the intersection of State Route (SR) 174 and SR 20 / SR 49 that will replace three existing signalized intersections. In 2025, a review and update of the analysis results presented within the *SR 174 / SR 20 Intersection Analysis* report (May 2020) were performed to revalidate the projected performance of the proposed design. Current conditions and functionality were reviewed, and new 2050 growth projections were compared with the previous study's 2045 forecast Design Year volumes to verify the proposed roundabout would be able to accommodate future demand. The update reflected current traffic characteristics and growth patterns within the project area.

The Downtown Grass Valley Roundabout Project is currently in the Project Approval Environmental Document phase, and an update to the control type and access at the intersection of S Auburn Street and Neal Street is proposed. This alternative analysis memorandum has been prepared to present the following:

- Updated intersection operations for the roundabout
- Intersection operations for the conversion of the S Auburn Street and Neal Street intersection southbound stop-controlled approach to a right-in/right-out access

2. S Auburn Street / Neal Street Right-In/Right-Out Access

Exhibit 1 presents the proposed right-in/right-out access at the intersection of S Auburn Street and Neal Street. Additionally, the westbound approach on Neal Street is reduced to a single through/right-turn lane, the eastbound approach is reduced to a single right-turn lane, and the westbound departure onto the SR 20 / SR 49 ramp is reduced to a single lane.

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
03	Nev	20/49, 174	R12.7/R13.0, R10.1/R10.2		--

REGISTERED CIVIL ENGINEER DATE

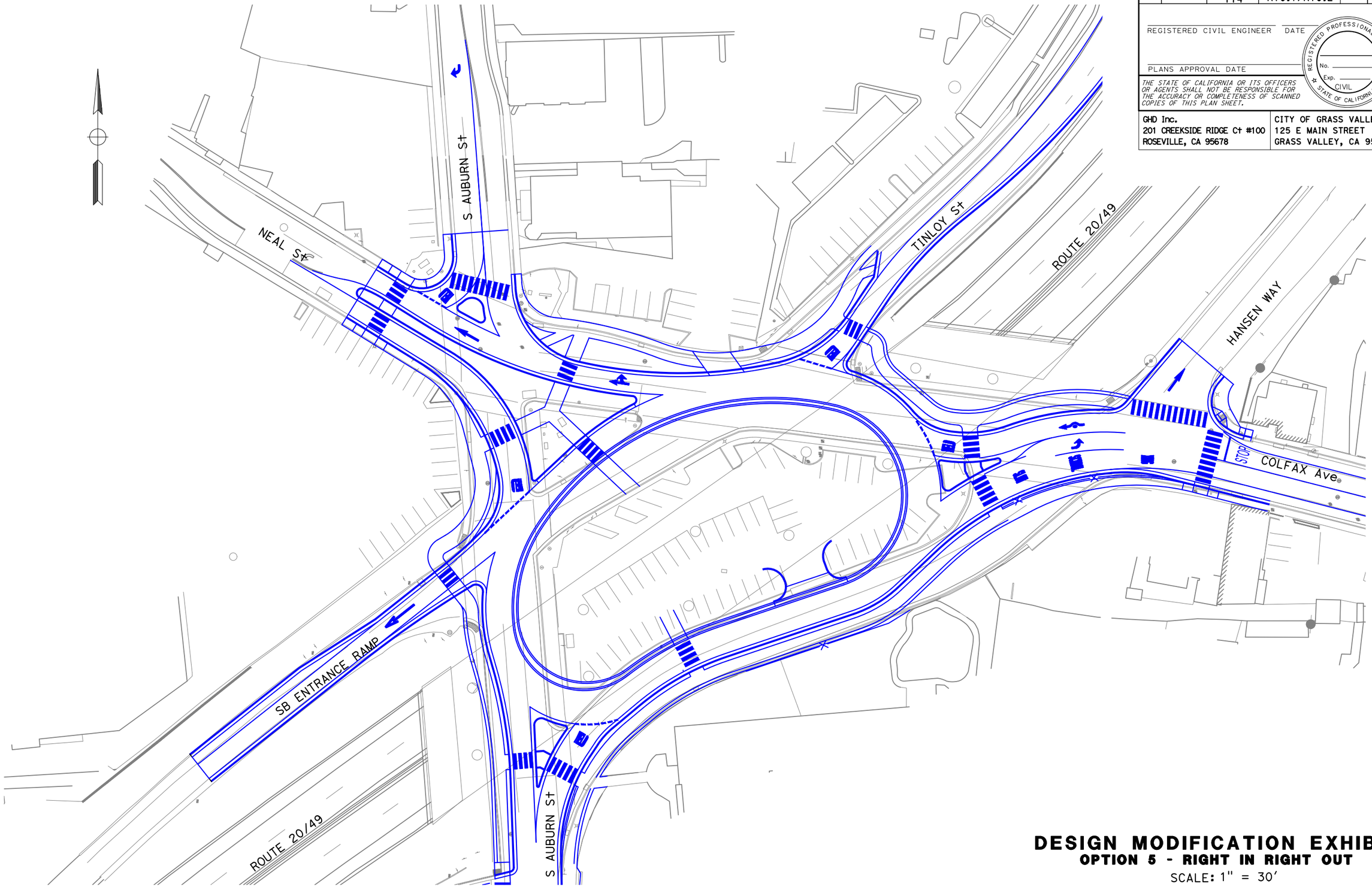
REGISTERED PROFESSIONAL ENGINEER
No.
Exp.
CIVIL
STATE OF CALIFORNIA

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

GHD Inc.
201 CREEKSIDE RIDGE Ct #100
ROSEVILLE, CA 95678

CITY OF GRASS VALLEY
125 E MAIN STREET
GRASS VALLEY, CA 95945



DESIGN MODIFICATION EXHIBIT

OPTION 5 - RIGHT IN RIGHT OUT

SCALE: 1" = 30'

EX-1

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans

CONSULTANT FUNCTIONAL SUPERVISOR: KAMESH VEDULA

CALCULATED-DESIGNED BY: CHRISTOPHER DOUD

CHECKED BY: AMANDA HIGHT

REVISED BY	DATE REVISED

LAST REVISION: 06-30-23

DATE PLOTTED = 1/27/2026
TIME PLOTTED = 12:27 PM

BORDER LAST REVISED 7/2/2010

USERNAME = CHRIS DOUD
DGN FILE = 0324000193EX09-POTENTIAL DESIGN MODIFICATION.DWG

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT XXXX

PROJECT NUMBER & PHASE XXXXXXXXXXX

3. Analysis Parameters and Assumptions

The following analysis assumptions and parameters were utilized for the analysis of the proposed right-in/right-out access at the intersection of S Auburn Street and Neal Street and the Downtown Grass Valley roundabout.

3.1 Traffic Volumes

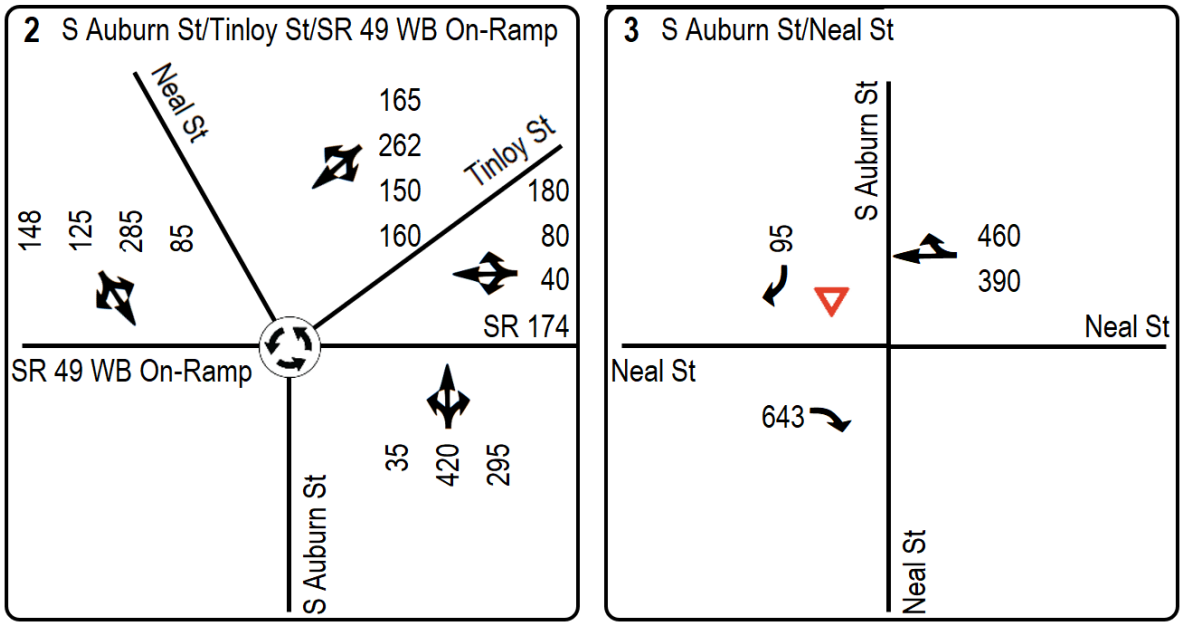
2050 Design Year PM peak hour traffic forecasts presented in the 2025 revalidation were used for this updated analysis to remain consistent with previous assumptions. Refer to the “Downtown Grass Valley Roundabout Traffic Operations Memorandum – Revalidation” for 2050 Design Year PM peak hour traffic forecasts.

3.2 Alternate Traffic Reroutes

The intersection of S Auburn Street and Neal Street was reanalyzed with restricted southbound access from S Auburn Street onto Neal Street. Southbound through volumes from S Auburn Street were rerouted to enter the roundabout on Neal Street and Tinloy Street due to the restricted access.

Figure 3.1 presents updated traffic assignments at the intersections of S Auburn Street / Neal Street and the roundabout with Design Year 2050 PM peak hour volumes.

Figure 3.1 Design Year 2050 Intersection Volumes – Right-In Right-Out with Traffic Rerouting



3.3 Level of Service Methodologies

To remain consistent with the level of service assumptions and methodologies used in the 2025 revalidation analysis, Transportation Research Board Publication Highway Capacity Manual, Sixth Edition (HCM 6) methodologies were used for this analysis. Refer to the “Downtown Grass Valley Roundabout Traffic Operations Memorandum – Revalidation” for additional information on the assumptions used.

4. Design Year 2050 Build Conditions

Table 4.1 presents Design Year 2050 Build Conditions intersection operations for all intersections assuming a right-in/right-out access at the intersection of S Auburn Street and Neal Street and geometry modifications between S Auburn Street / Neal Street and the roundabout. All intersections are projected to operate acceptably. All Synchro and SimTraffic reports are provided in Appendix A, and all Sidra reports are provided in Appendix B.

Table 4.1 Design Year 2050 Build Conditions Intersection Operations – Right-In/Right-Out

#	Intersection	Control Type[1]	Target LOS	PM Peak Hour	
				Delay	LOS
1	Auburn Street & EB Off-Ramp	TWSC	D	12.3	B
2	Auburn Street/WB On-Ramp/Tinloy Street/Neal Street/SR 174	RNDBT	D	15.2	B
3	Auburn Street & Neal Street	TWSC	D	4.8	A
4	Hansen Way & Colfax Avenue/SR 174	TWSC	D	10.6	B

Notes:
1. TWSC = Two Way Stop Control, RNDBT = Roundabout
2. LOS = Delay based on worst minor street approach for TWSC intersections, average of all approaches for RNDBT
3. **Bold** = Unacceptable Conditions
4. OVR = Delay over 300 seconds

Table 4.2 presents Design Year 2050 Build Conditions 95th percentile queue results for all intersections in the network.

Table 4.2 Design Year 2050 Build Conditions 95th percentile Queue Results – Right-In/Right-Out

Int. #	Intersection/Approach	Control Type	2050 Design Year 95th Percentile Queue (ft)	
			PM Peak Hour	Available Storage
1	***Auburn Street & EB Off-Ramp***			
	Eastbound Left	TWSC	145	
	Eastbound Right		45	140
	Northbound Thu		195	
	Southbound Thru		5	100
2	***Auburn Street/WB On-Ramp/Tinloy Street/Neal Street/SR 174***			
	Westbound Left/Thru/Right	RNDBT	45	125
	Southwestbound Left/Thru/Right		295	
	Northbound Left/Thru/Right		***150***	100
	Southbound Left/Thru/Right		355	

Table 4.2 Design Year 2050 Build Conditions 95th percentile Queue Results – Right-In Right-Out (Continued)

Int. #	Intersection/Approach	Control Type	2050 Design Year 95th Percentile Queue (ft) PM Peak Hour	Available Storage
3	***Auburn Street & Neal Street***			
	Eastbound Right	TWSC	55	
	Westbound Thru/Right		75	
	Southbound Right		60	
4	***Hansen Way & Colfax Avenue/SR 174***			
	Eastbound Left	TWSC	10	40
	Eastbound Thru		5	125
	Westbound Thru/Right		215	

Note: **Bold** text indicates queues that exceed available storage

Storage is projected to be exceeded on the northbound approach of the roundabout by approximately two vehicles (assuming 25 ft per vehicle). The approximate 100 ft storage represents the distance from the stop sign next to Grass Valley Charter School along S Auburn Street to the northbound yield line of the roundabout.

An approximate 15 vehicle queue is projected for the southbound approach to the roundabout with rerouted traffic. Due to the increased number of vehicles entering the roundabout from the southbound Neal Street approach and the reduced number of lanes, queuing is expected to spill back past the Safeway driveway.

Compared to the 2025 “Downtown Grass Valley Roundabout Traffic Operations Memorandum – Revalidation” queue for the roundabouts’ southbound movement, the projected southbound approach 95th percentile queue of 355 ft for the alternative with rerouted traffic is approximately 12 vehicles longer. This is primarily due to the number of southbound roundabout lanes being reduced and causing southbound right-turning traffic at the roundabout (that could previously use the free right lane to avoid the roundabout) to enter the roundabout with the rest of the through traffic.

5. Conclusions

With the conversion of the S Auburn Street and Neal Street intersection to a right-in/right-out access and modifications to intersection geometries, the network is projected to operate with acceptable LOS and with projected queuing past the Safeway driveway.

Appendix A

Synchro and SimTraffic Reports

1: S Auburn St & EB Off Ramp Performance by movement

Movement	EBL	EBR	NBT	SBT	All
Denied Del/Veh (s)	0.5	3.4	0.4	0.3	0.6
Total Del/Veh (s)	14.7	2.5	14.0	0.3	9.7
Vehicles Entered	331	79	432	313	1155
Vehicles Exited	331	79	431	314	1155
Hourly Exit Rate	331	79	431	314	1155
Input Volume	330	80	420	315	1145
% of Volume	100	98	103	100	101

Total Network Performance

Denied Del/Veh (s)	0.6
Total Del/Veh (s)	11.5
Vehicles Entered	1155
Vehicles Exited	1157
Hourly Exit Rate	1157
Input Volume	2290
% of Volume	51

Intersection: 1: S Auburn St & EB Off Ramp

Movement	EB	EB	NB	SB
Directions Served	L	R	T	T
Maximum Queue (ft)	170	56	255	4
Average Queue (ft)	88	12	106	0
95th Queue (ft)	145	46	194	4
Link Distance (ft)	825		757	461
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)		140		
Storage Blk Time (%)	1			
Queuing Penalty (veh)	1			

Network Summary

Network wide Queuing Penalty: 1

3: S Auburn St & Neal St Performance by movement

Movement	EBR	WBT	WBR	SBR	All
Denied Del/Veh (s)	0.5	0.9	0.9	0.2	0.7
Total Del/Veh (s)	1.8	4.1	2.7	4.8	2.8
Vehicles Entered	639	395	452	95	1581
Vehicles Exited	638	397	453	95	1583
Hourly Exit Rate	638	397	453	95	1583
Input Volume	643	390	460	95	1588
% of Volume	99	102	98	100	100

Total Network Performance

Denied Del/Veh (s)	0.7
Total Del/Veh (s)	3.4
Vehicles Entered	1581
Vehicles Exited	1585
Hourly Exit Rate	1585
Input Volume	3176
% of Volume	50

Intersection: 3: S Auburn St & Neal St

Movement	EB	WB	SB
Directions Served	R	TR	R
Maximum Queue (ft)	106	129	71
Average Queue (ft)	11	20	28
95th Queue (ft)	54	77	59
Link Distance (ft)	525	484	525
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Network Summary

Network wide Queuing Penalty: 0

Intersection	
Int Delay, s/veh	6.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	370	370	300	100	0	0
Future Vol, veh/h	370	370	300	100	0	0
Conflicting Peds, #/hr	2	0	0	2	2	0
Sign Control	Free	Free	Stop	Stop	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	40	-	-	-	-	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	402	402	326	109	0	0

Major/Minor	Major1		Minor2	
Conflicting Flow All	2	0	1208	4
Stage 1	-	-	2	-
Stage 2	-	-	1206	-
Critical Hdwy	4.12	-	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	-	-	5.52	-
Follow-up Hdwy	2.218	-	4.018	3.318
Pot Cap-1 Maneuver	1620	-	~ 183	1080
Stage 1	-	-	-	-
Stage 2	-	-	~ 257	-
Platoon blocked, %		-		
Mov Cap-1 Maneuver	1617	-	0	1076
Mov Cap-2 Maneuver	-	-	0	-
Stage 1	-	-	0	-
Stage 2	-	-	0	-

Approach	EB	WB
HCM Control Delay, s	4	10.6
HCM LOS		B

Minor Lane/Major Mvmt	EBL	EBT	WBLn1
Capacity (veh/h)	1617	-	1076
HCM Lane V/C Ratio	0.249	-	0.404
HCM Control Delay (s)	8	-	10.6
HCM Lane LOS	A	-	B
HCM 95th %tile Q(veh)	1	-	2

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

4: Hansen Way & SR 174 Performance by movement

Movement	EBL	EBT	WBT	WBR	All
Denied Del/Veh (s)	3.3	1.3	0.4	0.4	1.6
Total Del/Veh (s)	1.0	1.6	17.2	14.1	6.6
Vehicles Entered	359	369	292	102	1122
Vehicles Exited	358	369	291	102	1120
Hourly Exit Rate	358	369	291	102	1120
Input Volume	370	370	300	100	1139
% of Volume	97	100	97	102	98

Total Network Performance

Denied Del/Veh (s)	1.6
Total Del/Veh (s)	7.4
Vehicles Entered	1122
Vehicles Exited	1120
Hourly Exit Rate	1120
Input Volume	2278
% of Volume	49

Intersection: 4: Hansen Way & SR 174

Movement	EB	EB	WB
Directions Served	L	T	TR
Maximum Queue (ft)	16	8	280
Average Queue (ft)	1	0	113
95th Queue (ft)	8	6	216
Link Distance (ft)		358	573
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	40		
Storage Blk Time (%)	0	0	
Queuing Penalty (veh)	0	0	

Network Summary

Network wide Queuing Penalty: 0

Appendix B

Sidra Report

LANE SUMMARY

Site: [2 (2)] RNDBT - Right-In Right-Out w/ Rerouted Traffic (Network)

Network: [N101 (6)] Network - Right-In Right-Out w/ Rerouted Traffic (General)

Output produced by SIDRA INTERSECTION Version: 10.0.5.217

New Site
Site Category: (None)
Roundabout
Network Scenario: 1 | Local Volumes **Site Scenario: 1 | Local Volumes**

Lane Use and Performance

	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	95% Back Of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	[Total veh/h	HV] %	[Total veh/h	HV] %	veh/h	v/c	%	sec		[Veh	Dist] ft		ft	%	%
South: S Auburn St - NB															
Lane 1[d]	789	2.0	726	2.0	1257	0.578	100	9.5	LOS A	5.8	148.2	Full	100	0.0	18.2
Approach	789	2.0	726	2.0		0.578		9.5	LOS A	5.8	148.2				
East: Hwy 174 - WB															
Lane 1[d]	316	2.0	316	2.0	1242	0.254	100	5.1	LOS A	1.8	45.1	Full	125	0.0	0.0
Approach	316	2.0	316	2.0		0.254		5.1	LOS A	1.8	45.1				
NorthEast: Tinloy St - SWB															
Lane 1[d]	776	2.0	776	2.0	1039	0.746	100	16.3	LOS B	11.5	293.2	Full	1600	0.0	0.0
Approach	776	2.0	776	2.0		0.746		16.3	LOS B	11.5	293.2				
NorthWest: S Auburn St - SB															
Lane 1[d]	677	2.0	677	2.0	820	0.825	100	24.8	LOS C	14.1[N8]	357.0[N8]	Full	80	0.0	49.9
Approach	677	2.0	677	2.0		0.825		24.8	LOS C	14.1	357.0				
All Vehicles	2558	2.0	2495	2.1		0.825		15.2	LOS B	14.1	357.0				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c >1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).
Roundabout Capacity Model: SIDRA HCM.
Delay Model: HCM Delay Formula (Stopline Delay: Geometric Delay is not included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

d Dominant lane on roundabout approach
N4 Average Back of Queue has been restricted to the available queue storage space as it extends to lanes at upstream Sites.
N8 The Percentile Back of Queue extends to upstream Site lanes.

Approach Lane Flows (veh/h)

South: S Auburn St - NB

Mov. From S To Exit:	L2 W	T1 N	R2 E	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	34	407	286	726	2.0	1257	0.578	100	NA	NA
Approach	34	407	286	726	2.0		0.578			

East: Hwy 174 - WB

Mov. From E To Exit:	L2 S	T1 W	R2 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	42	84	189	316	2.0	1242	0.254	100	NA	NA
Approach	42	84	189	316	2.0		0.254			

NorthEast: Tinloy St - SWB

Mov. From NE To Exit:	L3 E	L1 S	R1 W	R3 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	168	158	276	174	776	2.0	1039	0.746	100	NA	NA
Approach	168	158	276	174	776	2.0		0.746			

NorthWest: S Auburn St - SB

Mov. From NW To Exit:	L3 N	L1 E	R1 S	R3 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	89	300	132	156	677	2.0	820	0.825	100	NA	NA
Approach	89	300	132	156	677	2.0		0.825			

	Total	%HV	Deg.Satn (v/c)
All Vehicles	2495	2.1	0.825

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis

	Exit Lane Number	Short Lane Length ft	Percent Opng in Lane %	Opposing Flow Rate veh/h	Critical Gap pcu/h	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec	Merge Queue [Veh	Dist] ft

There are no Exit Short Lanes for Merge Analysis at this Site.

Variable Demand Analysis

	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
South: S Auburn St - NB				
Lane 1	0.0	0.0	0.0	0.0
East: Hwy 174 - WB				
Lane 1	0.0	0.0	0.0	0.0

NorthEast: Tinloy St - SWB				
Lane 1	0.0	0.0	0.0	0.0
NorthWest: S Auburn St - SB				
Lane 1	0.0	0.0	0.0	0.0