



Dillon Brent Turner
February 8, 2023

TECHNICAL MEMORANDUM

To: Kevin Icard, AICP and Dan Frazier, AICP
Town of Bluffton

From: Dillon Turner, PE, PTOE
Kimley-Horn

Date: February 8, 2023

RE: **Alston Park Phase 3 – Traffic Impact Analysis**
Bluffton, South Carolina

The purpose of this technical memorandum is to document a turn lane warrant analysis conducted for the Alston Park Phase 3 residential development, located along New Riverside Road south of the May River at New Riverside Road roundabout in Bluffton, South Carolina. The development is planned to consist of up to 76 single family homes.

As proposed, the site will be accessed via one full-movement, stop-controlled approach. Based on the results of this analysis, no improvements to the proposed development are recommended. The site plan is attached in **Appendix A**.

PROJECT TRAFFIC

The trip generation potential of the proposed development was estimated based on data contained within the Institute of Transportation Engineers (ITE) *Trip Generation Manual*, 11th Edition.

The trip generation estimate is summarized in **Table 1**. It is estimated that the residential development will generate 58 total (15 in/43 out) net new external trips during the AM peak hour and 77 total (49 in/28 out) net new external trips during the PM peak hour.

Table 1 – Trip Generation Summary

Alston Park Phase 3 Trip Generation									
Land Use	Intensity	Units	Daily	AM Peak Hour			PM Peak Hour		
				Total	In	Out	Total	In	Out
210 - Single-Family Detached Housing	76	DU	784	58	15	43	77	49	28
Total Net New External Trips			784	58	15	43	77	49	28
Note: Trip generation was calculated using the following data:									
<u>Daily Traffic Generation</u>									
210 - Single-Family Detached Housing			ITE 210 = LN (T) = 0.92 * LN (X) + (2.68); (50 % In; 50 % Out)						
<u>AM Peak-Hour Traffic Generation</u>									
210 - Single-Family Detached Housing			ITE 210 = LN (T) = 0.91 * LN (X) + (0.12); (26 % In; 74 % Out)						
<u>PM Peak-Hour Traffic Generation</u>									
210 - Single-Family Detached Housing			ITE 210 = LN (T) = 0.94 * LN (X) + (0.27); (63 % In; 37 % Out)						

TRIP DISTRIBUTION & ASSIGNMENT

New external trips generated by the proposed development were distributed and assigned to the surrounding roadway network based on existing travel patterns, surrounding land uses, and the proposed site layout. The trip distribution percentages used in this analysis are as follows:

- 70% to/from the North via New Riverside Road
- 30% to/from the South via New Riverside Road

The existing traffic counts and volume development worksheets are attached in **Appendix B**.

CAPACITY ANALYSIS

Capacity/level-of-Service (LOS) analyses were conducted using the *Highway Capacity Manual (HCM)*, 6th Edition, methodologies of the *Synchro*, Version 11, traffic analysis software. Capacity analyses were conducted for the AM and PM peak hours of the 2027 build condition. The capacity analysis worksheets are included in **Appendix C**.

It should be noted the existing traffic at the intersection of Benton Circle at Grovewood Drive was redistributed under 2027 build conditions due to the proposed connection of Benton Circle to Holly Hill Lane. The redistributed northbound traffic at Benton Circle at Grovewood Drive was also considered at the intersection New Riverside Road at Holly Hill Lane.

The capacity analysis results for the intersections of New Riverside Road at Holly Hill Lane and Benton Circle at Grovewood Drive are summarized in **Table 2** and **Table 3**, respectively.

Table 2 – New Riverside Road at Holly Hill Lane Analysis Results

New Riverside Road at Holly Hill Lane LOS (Delay)			
Condition	Measure	EB (Holly Hill Lane)	NBL (New Riverside Road) ¹
AM Peak Hour			
2027 Build	LOS (Delay)	C (20.1)	B (10.0)
PM Peak Hour			
2027 Build	LOS (Delay)	B (12.3)	A (8.2)
¹ For unsignalized major street approaches, only left-turn delay is reported.			

Table 3 - Benton Circle at Grovewood Drive Analysis Results

Benton Circle at Grovewood Drive LOS (Delay)					
Condition	Measure	EBL (Grovewood Drive) ¹	WBL (Grovewood Drive) ¹	NB (Benton Circle)	SB (Benton Circle)
AM Peak Hour					
2027 Build	LOS (Delay)	A (0.0)	A (0.0)	A (9.1)	A (9.2)
PM Peak Hour					
2027 Build	LOS (Delay)	A (0.0)	A (0.0)	A (9.1)	A (9.1)
¹ For unsignalized major street approaches, only left-turn delay is reported.					

The results of the capacity analysis indicated all approaches are anticipated to operate at LOS C or better during the AM and PM peak hours. During the AM peak hour, the eastbound approach at the intersection of New Riverside Road at Holly Hill Lane is expected to operate at LOS C.

AUXILIARY TURN LANE WARRANTS

A turn lane warrant for the southbound right movement accessing the proposed Alston Park Phase 3 was determined based on Figure 2-6 from the *National Cooperative Highway Research Program* (NCHRP) Report 457.

Based on the results of the turn lane warrant analysis, an exclusive southbound right-turn lane into the proposed development at the intersection of New Riverside Road at Holly Hill Lane *is not warranted*.

The right-turn lane warrant worksheet for New Riverside Road at Holly Hill Lane is provided in **Attachment D**.

It should be noted there is an existing northbound left-turn lane already constructed along New Riverside Road at Holly Hill Lane; therefore, a left-turn lane warrant was not analyzed.

SIGHT DISTANCE

At the intersection of New Riverside Road at Holly Hill Lane, the site distance appears to be for left or right-turning traffic due off Holly Hill Lane due to existing trees and vegetation located along the curve of New Riverside Road. The sight distance for left-turning traffic onto Holly Hill Lane also appear limited due to the curvature of New Riverside Road. The intersection sight distance and stopping sight distance for the Holly Hill Lane at New Riverside Road should be confirmed per SCDOT and AASHTO guidelines.

CONCLUSION

Based on the trip generation potential of the development and guidance published in the NCHRP Report 457, a southbound right-turn lane into the proposed Alston Park Phase 3 at the intersection of New Riverside Road at Holly hill Lane *is not warranted*. Based on the Synchro capacity analysis all approaches are anticipated to operate at an acceptable LOS during the AM and PM peak hours. The intersection sight distance and stopping sight distance for the Holly Hill Lane at New Riverside Road should be confirmed per SCDOT and AASHTO guidelines.

Attachments:

Attachment A – Conceptual Site Plan

Attachment B – Traffic Counts and Volume Development Worksheet

Attachment C – Capacity Analysis Worksheets

Attachment D – NCHRP Report 457 Right-Turn Warrant for New Riverside Road at Holly Hill Lane

Attachment A

Conceptual Site Plan



Winters Jones Keefe
landscape architecture
land planning

CAROLINA
ENGINEERING
CONSULTANTS

BEAUFORT, SC
843-322-0553

28 Promenade Street, Suite 201 | Bluffton, South Carolina 29910 | ph 843.797.7411
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WRITTEN MATERIAL SHALL NOT BE USED
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IN ANY FORM WITHOUT PRIOR WRITTEN
CONSENT OF WJK LTD.
THIS SHEET TO SCALE AT: 24"X36"

SITE DEVELOPMENT PLANS
FOR
ALSTON PARK
PHASE 3
BLUFFTON, SOUTH CAROLINA

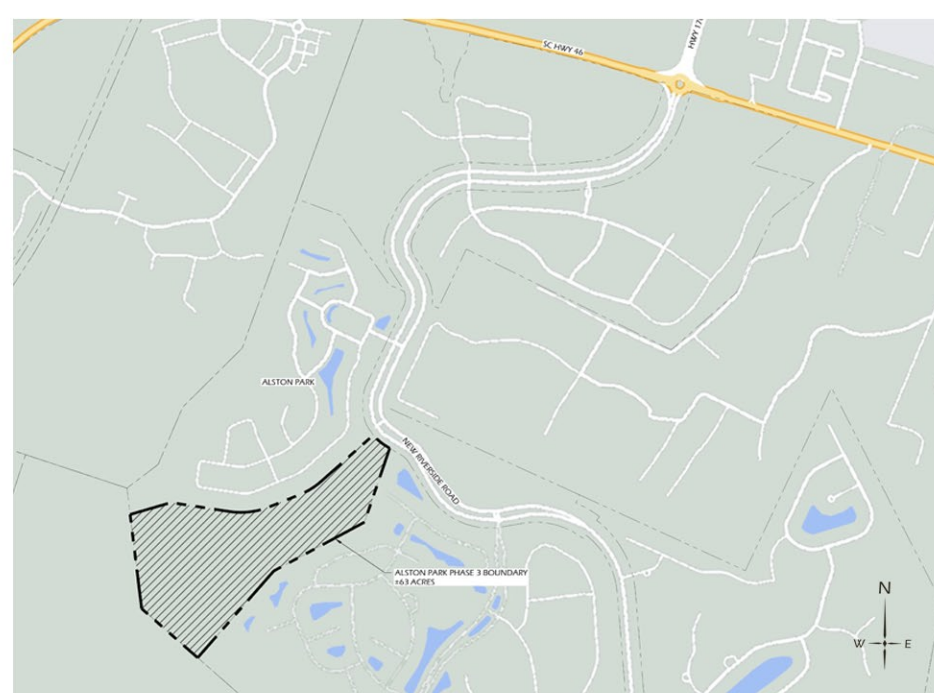
DATE: 7 FEB 2023
PROJECT NO.: 20011.01
DRAWN BY: KH
CHECKED BY: DK

PRELIMINARY
SUBMITTAL PLAN,
NOT FOR
CONSTRUCTION

REVISIONS:

DRAWING TITLE
**INITIAL MASTER
PLAN**

DRAWING NUMBER
EX B



LOCATION MAP

SITE DATE TABLE

- PROJECT AREA: 63.4 ACRES
- OPEN SPACE : 25.31 ACRES
- NUMBER OF LOTS: 76
- RESIDENTIAL DENSITY ALLOWED (RU/UPLAND AC): 1.66

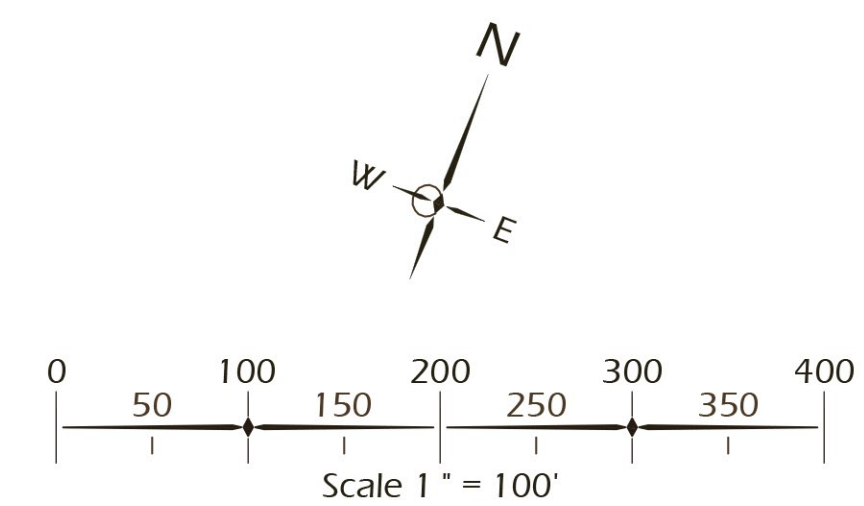
LAND USE KEY

	ACREAGE
RESIDENTIAL (70' MIN. X 120' MIN.)	16.38
PONDS	2.94
RAINGARDENS	1.25
GREENS	3.62
RIGHT OF WAY	5.5
WETLAND BUFFER	4.0
WETLAND	17.5
COMMUNITY COMMON AREA /OPEN SPACE	12.2

TOTAL 63.4 ACRES

SITE INFORMATION

NEW RIVERSIDE PARCEL 5A SOUTH
SOUTHWEST OF THE INTERSECTION OF NEW RIVER-
SIDE RD AND S.C. HWY 46, SOUTH OF PARCEL 4A.
TAX MAP ID NO.: R610 035 000 0019 0000 AND
R610 035 000 0846 0000
CURRENT ZONING: PUD (NEW RIVERSIDE CONCEPT
PLAN)



Attachment B

Traffic Counts and Volume Development Worksheet



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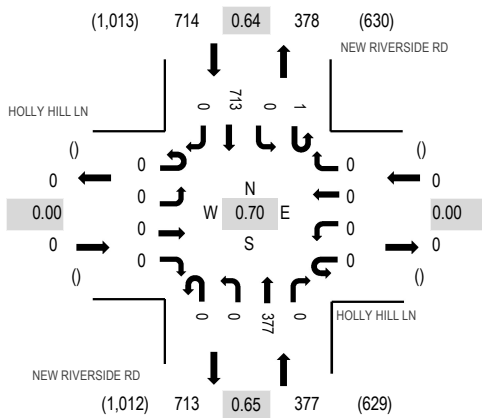
Location: 1 NEW RIVERSIDE RD & HOLLY HILL LN AM

Date: Tuesday, January 10, 2023

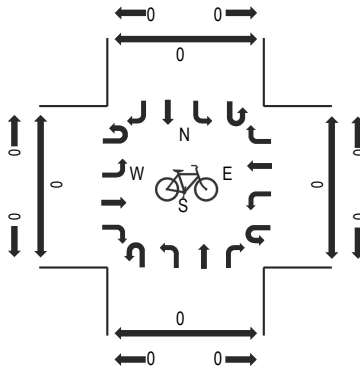
Peak Hour: 07:45 AM - 08:45 AM

Peak 15-Minutes: 08:15 AM - 08:30 AM

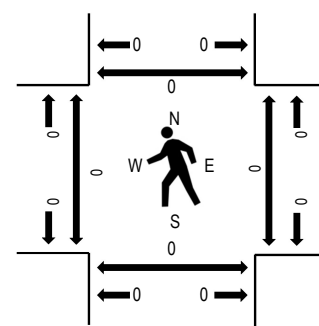
Peak Hour - Motorized Vehicles



Peak Hour - Bicycles



Peak Hour - Pedestrians



Note: Total study counts contained in parentheses.

Traffic Counts - Motorized Vehicles

Interval Start Time	HOLLY HILL LN Eastbound				HOLLY HILL LN Westbound				NEW RIVERSIDE RD Northbound				NEW RIVERSIDE RD Southbound				Total	Rolling Hour	Pedestrian Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right			West	East	South	North
7:00 AM	0	0	0	0	0	0	0	0	0	0	47	0	0	0	70	0	117	593	0	0	0	0
7:15 AM	0	0	0	0	0	0	0	0	0	0	62	0	0	0	86	0	148	680	0	0	0	0
7:30 AM	0	0	0	0	0	0	0	0	0	0	69	0	0	0	86	0	155	920	0	0	0	0
7:45 AM	0	0	0	0	0	0	0	0	0	0	57	0	0	0	116	0	173	1,091	0	0	0	0
8:00 AM	0	0	0	0	0	0	0	0	0	0	59	0	1	0	144	0	204	1,049	0	0	0	0
8:15 AM	0	0	0	0	0	0	0	0	0	0	110	0	0	0	278	0	388		0	0	0	0
8:30 AM	0	0	0	0	0	0	0	0	0	0	151	0	0	0	175	0	326		0	0	0	0
8:45 AM	0	0	0	0	0	0	0	0	0	0	74	0	0	0	57	0	131		0	0	0	0

Peak Rolling Hour Flow Rates

Vehicle Type	Eastbound				Westbound				Northbound				Southbound				Total
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	3	0	0	0	6	0	9
Lights	0	0	0	0	0	0	0	0	0	0	354	0	1	0	670	0	1,025
Mediums	0	0	0	0	0	0	0	0	0	0	20	0	0	0	37	0	57
Total	0	0	0	0	0	0	0	0	0	0	377	0	1	0	713	0	1,091

Heavy Vehicle Percentage and Peak Hour Factor

	Eastbound				Westbound				Northbound				Southbound				Total
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	
Heavy Vehicle %	0.0%				0.0%				0.8%				0.8%				0.8%
Heavy Vehicle %	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.8%	0.0%	0.0%	0.0%	0.8%	0.0%	0.8%
Peak Hour Factor	0.00				0.00				0.65				0.64				0.70
Peak Hour Factor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.25	0.00	0.64	0.00	0.70



ALL TRAFFIC DATA SERVICES

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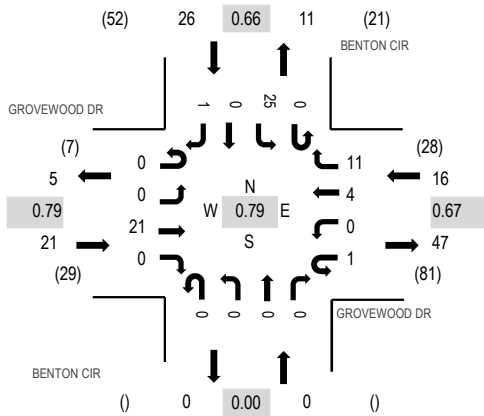
Location: 2 BENTON CIR & GROVEWOOD DR AM

Date: Tuesday, January 10, 2023

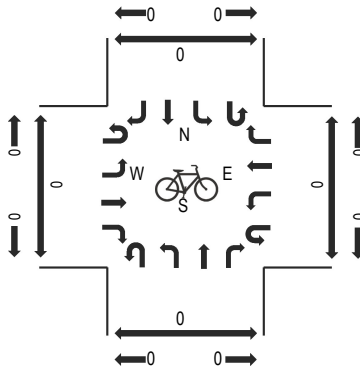
Peak Hour: 07:45 AM - 08:45 AM

Peak 15-Minutes: 07:45 AM - 08:00 AM

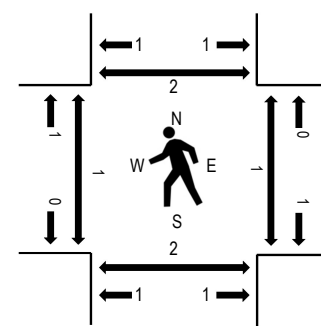
Peak Hour - Motorized Vehicles



Peak Hour - Bicycles



Peak Hour - Pedestrians



Note: Total study counts contained in parentheses.

Traffic Counts - Motorized Vehicles

Interval Start Time	GROVEWOOD DR Eastbound				GROVEWOOD DR Westbound				BENTON CIR Northbound				BENTON CIR Southbound				Total	Rolling Hour	Pedestrian Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right			West	East	South	North
7:00 AM	0	0	1	0	0	0	0	1	0	0	0	0	0	6	0	0	8	55	0	0	0	0
7:15 AM	0	0	1	0	0	0	0	2	0	0	0	0	0	11	0	0	14	58	0	0	1	1
7:30 AM	0	0	5	0	0	0	1	3	0	0	0	0	0	4	0	0	13	61	0	0	0	0
7:45 AM	0	0	7	0	1	0	1	3	0	0	0	0	0	7	0	1	20	63	1	0	1	0
8:00 AM	0	0	4	0	0	0	1	1	0	0	0	0	0	5	0	0	11	54	0	1	0	1
8:15 AM	0	0	6	0	0	0	0	3	0	0	0	0	0	8	0	0	17		0	0	0	1
8:30 AM	0	0	4	0	0	0	2	4	0	0	0	0	0	5	0	0	15		0	0	1	0
8:45 AM	0	0	1	0	0	0	1	4	0	0	0	0	0	5	0	0	11		0	0	0	0

Peak Rolling Hour Flow Rates

Vehicle Type	Eastbound				Westbound				Northbound				Southbound				Total
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lights	0	0	19	0	1	0	3	10	0	0	0	0	0	22	0	1	56
Mediums	0	0	2	0	0	0	1	1	0	0	0	0	0	3	0	0	7
Total	0	0	21	0	1	0	4	11	0	0	0	0	0	25	0	1	63

Heavy Vehicle Percentage and Peak Hour Factor

	Eastbound				Westbound				Northbound				Southbound				Total
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	
Heavy Vehicle %	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Heavy Vehicle %	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Peak Hour Factor	0.79	0.79	0.79	0.79	0.67	0.67	0.67	0.67	0.00	0.00	0.00	0.00	0.66	0.66	0.66	0.66	0.79
Peak Hour Factor	0.00	0.00	0.79	0.00	0.25	0.00	0.50	0.75	0.00	0.00	0.00	0.00	0.00	0.64	0.00	0.25	0.79



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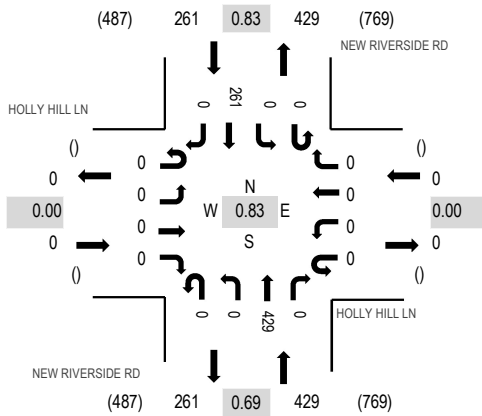
Location: 1 NEW RIVERSIDE RD & HOLLY HILL LN PM

Date: Tuesday, January 10, 2023

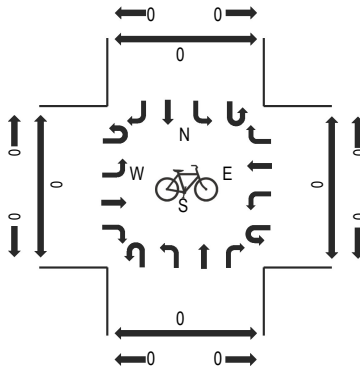
Peak Hour: 04:00 PM - 05:00 PM

Peak 15-Minutes: 04:00 PM - 04:15 PM

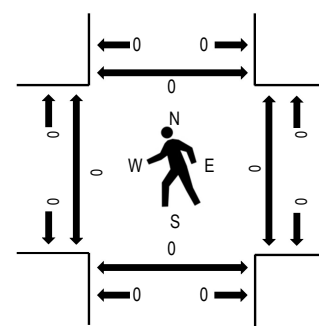
Peak Hour - Motorized Vehicles



Peak Hour - Bicycles



Peak Hour - Pedestrians



Note: Total study counts contained in parentheses.

Traffic Counts - Motorized Vehicles

Interval Start Time	HOLLY HILL LN Eastbound				HOLLY HILL LN Westbound				NEW RIVERSIDE RD Northbound				NEW RIVERSIDE RD Southbound				Total	Rolling Hour	Pedestrian Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right			West	East	South	North
4:00 PM	0	0	0	0	0	0	0	0	0	0	155	0	0	0	54	0	209	690	0	0	0	0
4:15 PM	0	0	0	0	0	0	0	0	0	0	99	0	0	0	63	0	162	645	0	0	0	0
4:30 PM	0	0	0	0	0	0	0	0	0	0	86	0	0	0	81	0	167	613	0	0	0	0
4:45 PM	0	0	0	0	0	0	0	0	0	0	89	0	0	0	63	0	152	591	0	0	0	0
5:00 PM	0	0	0	0	0	0	0	0	0	0	102	0	0	0	62	0	164	566	0	0	0	0
5:15 PM	0	0	0	0	0	0	0	0	0	0	78	0	0	0	52	0	130		0	0	0	0
5:30 PM	0	0	0	0	0	0	0	0	0	0	81	0	0	0	64	0	145		0	0	0	0
5:45 PM	0	0	0	0	0	0	0	0	0	0	79	0	0	0	48	0	127		0	0	0	0

Peak Rolling Hour Flow Rates

Vehicle Type	Eastbound				Westbound				Northbound				Southbound				Total
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	8
Lights	0	0	0	0	0	0	0	0	0	0	395	0	0	0	250	0	645
Mediums	0	0	0	0	0	0	0	0	0	0	26	0	0	0	11	0	37
Total	0	0	0	0	0	0	0	0	0	0	429	0	0	0	261	0	690

Heavy Vehicle Percentage and Peak Hour Factor

	Eastbound				Westbound				Northbound				Southbound				Total
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	
Heavy Vehicle %	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.9%	0.0%	0.0%	0.0%	0.0%	0.0%	1.2%
Heavy Vehicle %	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.9%	0.0%	0.0%	0.0%	0.0%	0.0%	1.2%
Peak Hour Factor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.69	0.00	0.00	0.00	0.83	0.00	0.83
Peak Hour Factor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.69	0.00	0.00	0.00	0.83	0.00	0.83



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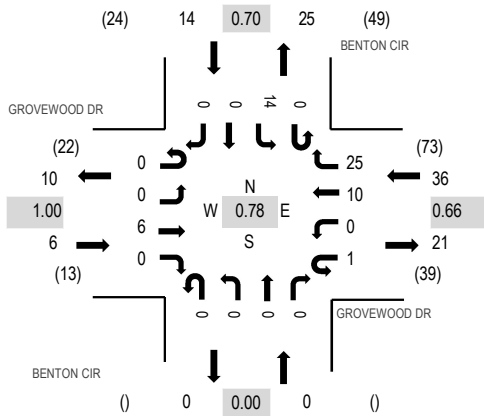
Location: 2 BENTON CIR & GROVEWOOD DR PM

Date: Tuesday, January 10, 2023

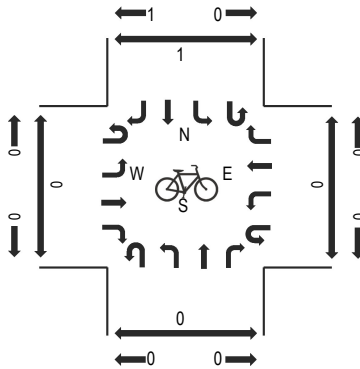
Peak Hour: 05:00 PM - 06:00 PM

Peak 15-Minutes: 05:00 PM - 05:15 PM

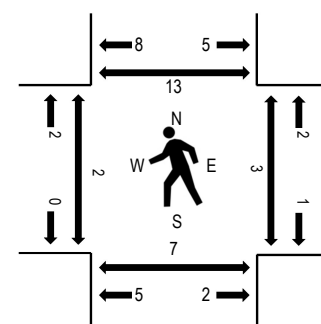
Peak Hour - Motorized Vehicles



Peak Hour - Bicycles



Peak Hour - Pedestrians



Note: Total study counts contained in parentheses.

Traffic Counts - Motorized Vehicles

Interval Start Time	GROVEWOOD DR Eastbound				GROVEWOOD DR Westbound				BENTON CIR Northbound				BENTON CIR Southbound				Total	Rolling Hour	Pedestrian Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right			West	East	South	North
4:00 PM	0	0	2	0	0	0	4	10	0	0	0	0	0	4	0	0	20	54	0	0	0	0
4:15 PM	0	0	1	0	0	0	4	4	0	0	0	0	0	5	0	0	14	52	0	0	0	0
4:30 PM	0	0	2	0	0	0	4	5	0	0	0	0	0	0	0	0	11	48	0	0	0	1
4:45 PM	0	0	2	0	1	0	0	5	0	0	0	0	0	1	0	0	9	47	0	0	0	3
5:00 PM	0	0	2	0	0	0	1	11	0	0	0	0	0	4	0	0	18	56	0	0	2	2
5:15 PM	0	0	2	0	1	0	1	4	0	0	0	0	0	2	0	0	10		0	2	0	4
5:30 PM	0	0	1	0	0	0	2	2	0	0	0	0	0	5	0	0	10		2	0	2	5
5:45 PM	0	0	1	0	0	0	6	8	0	0	0	0	0	3	0	0	18		0	1	3	2

Peak Rolling Hour Flow Rates

Vehicle Type	Eastbound				Westbound				Northbound				Southbound				Total
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lights	0	0	6	0	1	0	10	24	0	0	0	0	0	14	0	0	55
Mediums	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Total	0	0	6	0	1	0	10	25	0	0	0	0	0	14	0	0	56

Heavy Vehicle Percentage and Peak Hour Factor

	Eastbound				Westbound				Northbound				Southbound				Total
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	
Heavy Vehicle %	0.0%				0.0%				0.0%				0.0%				0.0%
Heavy Vehicle %	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Peak Hour Factor	1.00				0.66				0.00				0.70				0.78
Peak Hour Factor	0.00	0.00	1.00	0.00	0.50	0.00	0.75	0.57	0.00	0.00	0.00	0.00	0.00	0.70	0.00	0.00	0.78

INTERSECTION TRAFFIC VOLUME DEVELOPMENT																	
INTERSECTION:		New Riverside Road at Holly Hill Lane															
COUNT DATE:		January 10, 2023															
AM PEAK HOUR FACTOR:		0.70				AM FUTURE PEAK HOUR FACTOR: 0.90											
PM PEAK HOUR FACTOR:		0.83				PM FUTURE PEAK HOUR FACTOR: 0.90											

AM Peak Hour																	
AM 2022 EXISTING TRAFFIC		EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR
AM Adjusted Turning Movement Counts ¹		0	0	0	0	0	0	0	0	0	0	378	0	0	0	713	0
AM 2022 EXISTING TRAFFIC		0	0	0	0	0	0	0	0	0	0	378	0	0	0	713	0
AM Heavy Vehicle Percentage		2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	6%	2%	2%	2%	6%	2%
AM 2027 NO-BUILD TRAFFIC		EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Annual Growth Rate		3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
AM 2027 NO-BUILD TRAFFIC GROWTH		0	0	0	0	0	0	0	0	0	0	60	0	0	0	114	0
AM 2027 NO-BUILD TRAFFIC		0	0	0	0	0	0	0	0	0	0	438	0	0	0	827	0
Redistributed Benton Circle at Grovewood Drive			25		10						3					8	
"SITE TRAFFIC DISTRUBUTION"																	
LAND USE	TYPE	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Net New Distribution	Entering										30%					70%	
	Exiting		70%		30%												
"AM PROJECT TRIPS"																	
LAND USE	TYPE	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Project Trip	Net New	0	30	0	13	0	0	0	0	0	5	0	0	0	0	0	10
AM TOTAL PROJECT TRIPS		0	30	0	13	0	0	0	0	0	5	0	0	0	0	0	10
AM 2027 BUILD-OUT TRAFFIC		0	55	0	23	0	0	0	0	0	8	438	0	0	0	827	18

PM Peak Hour																	
PM 2022 EXISTING TRAFFIC		EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR
PM Adjusted Turning Movement Counts ¹		0	0	0	0	0	0	0	0	0	0	429	0	0	0	261	0
PM 2022 EXISTING TRAFFIC		0	0	0	0	0	0	0	0	0	0	429	0	0	0	261	0
PM Heavy Vehicle Percentage		2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	8%	2%	2%	2%	4%	2%
PM 2027 NO-BUILD TRAFFIC		EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Annual Growth Rate		3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
PM 2027 NO-BUILD TRAFFIC GROWTH		0	0	0	0	0	0	0	0	0	0	68	0	0	0	42	0
PM 2027 NO-BUILD TRAFFIC		0	0	0	0	0	0	0	0	0	0	497	0	0	0	303	0
Redistribution Benton Circle at Grovewood Drive			11		5						8					19	
"SITE TRAFFIC DISTRUBUTION"																	
LAND USE	TYPE	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Net New Distribution	Entering										30%					70%	
	Exiting		70%		30%												
"PM PROJECT TRIPS"																	
LAND USE	TYPE	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Project Trip	Net New	0	20	0	8	0	0	0	0	0	15	0	0	0	0	0	34
PM TOTAL PROJECT TRIPS		0	20	0	8	0	0	0	0	0	15	0	0	0	0	0	34
PM 2027 BUILD-OUT TRAFFIC		0	31	0	13	0	0	0	0	0	23	497	0	0	0	303	53

INTERSECTION TRAFFIC VOLUME DEVELOPMENT																
INTERSECTION:		Groveswood Drive at Benton Circle														
COUNT DATE:		January 10, 2023														
AM PEAK HOUR FACTOR:		0.79					AM FUTURE PEAK HOUR FACTOR: 0.90									
PM PEAK HOUR FACTOR:		0.78					PM FUTURE PEAK HOUR FACTOR: 0.90									

AM Peak Hour																	
AM 2022 EXISTING TRAFFIC	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	
AM Adjusted Turning Movement Counts ¹	0	0	21	0	0	1	4	11	0	0	0	0	0	25	0	1	
AM 2022 EXISTING TRAFFIC	0	0	21	0	0	1	4	11	0	0	0	0	0	25	0	1	
AM Heavy Vehicle Percentage	2%	2%	10%	2%	2%	2%	25%	9%	2%	2%	2%	2%	2%	12%	2%	2%	
AM 2027 NO-BUILD TRAFFIC	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	
Annual Growth Rate	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	
AM 2027 NO-BUILD TRAFFIC GROWTH	0	0	3	0	0	0	1	2	0	0	0	0	0	4	0	0	
AM 2027 NO-BUILD TRAFFIC	0	0	24	0	0	1	5	13	0	0	0	0	0	29	0	1	
Redistributed Benton Circle at Grovewood Drive			-16	16			-3	-8		3	8			-19	19		
"SITE TRAFFIC DISTRUBUTION"																	
LAND USE	TYPE	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Net New Distribution	Entering																
	Exiting																
"AM PROJECT TRIPS"																	
LAND USE	TYPE	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Project Trip	Net New	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AM TOTAL PROJECT TRIPS		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AM 2027 BUILD-OUT TRAFFIC		0	0	8	16	0	1	2	5	0	3	8	0	0	10	19	1

PM Peak Hour																	
PM 2022 EXISTING TRAFFIC	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	
PM Adjusted Turning Movement Counts ¹	0	0	6	0	0	1	10	25	0	0	0	0	0	14	0	0	
PM 2022 EXISTING TRAFFIC	0	0	6	0	0	1	10	25	0	0	0	0	0	14	0	0	
PM Heavy Vehicle Percentage	2%	2%	2%	2%	2%	2%	2%	4%	2%	2%	2%	2%	2%	2%	2%	2%	
PM 2027 NO-BUILD TRAFFIC	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	
Annual Growth Rate	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	
PM 2027 NO-BUILD TRAFFIC GROWTH	0	0	1	0	0	0	2	4	0	0	0	0	0	2	0	0	
PM 2027 NO-BUILD TRAFFIC	0	0	7	0	0	1	12	29	0	0	0	0	0	16	0	0	
Redistribution Benton Circle at Grovewood Drive			-5	5			-8	-19		8	19			-11	11		
"SITE TRAFFIC DISTRUBUTION"																	
LAND USE	TYPE	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Net New Distribution	Entering																
	Exiting																
"PM PROJECT TRIPS"																	
LAND USE	TYPE	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Project Trip	Net New	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PM TOTAL PROJECT TRIPS		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PM 2027 BUILD-OUT TRAFFIC		0	0	2	5	0	1	4	10	0	8	19	0	0	5	11	0

Attachment C

Capacity Analysis Worksheets

HCM 6th TWSC
1: New Riverside Road & Holly Hill Lane

Alston Park Phase 3
2027 Build AM

Intersection								
Int Delay, s/veh	1.2							
Movement	EBL	EBR	NBL	NBT	SBU	SBT	SBR	
Lane Configurations								
Traffic Vol, veh/h	55	23	8	438	0	827	18	
Future Vol, veh/h	55	23	8	438	0	827	18	
Conflicting Peds, #/hr	0	0	0	0	0	0	0	
Sign Control	Stop	Stop	Free	Free	Free	Free	Free	
RT Channelized	-	None	-	None	-	-	None	
Storage Length	0	-	230	-	230	-	-	
Veh in Median Storage, #	1	-	-	0	-	0	-	
Grade, %	0	-	-	0	-	0	-	
Peak Hour Factor	90	90	90	90	90	90	90	
Heavy Vehicles, %	2	2	2	6	2	6	2	
Mvmt Flow	61	26	9	487	0	919	20	
Major/Minor	Minor2	Major1		Major2				
Conflicting Flow All	1191	470	939	0	487	-	0	
Stage 1	929	-	-	-	-	-	-	
Stage 2	262	-	-	-	-	-	-	
Critical Hdwy	6.84	6.94	4.14	-	6.44	-	-	
Critical Hdwy Stg 1	5.84	-	-	-	-	-	-	
Critical Hdwy Stg 2	5.84	-	-	-	-	-	-	
Follow-up Hdwy	3.52	3.32	2.22	-	2.52	-	-	
Pot Cap-1 Maneuver	180	540	726	-	705	-	-	
Stage 1	345	-	-	-	-	-	-	
Stage 2	758	-	-	-	-	-	-	
Platoon blocked, %				-		-	-	
Mov Cap-1 Maneuver	178	540	726	-	705	-	-	
Mov Cap-2 Maneuver	279	-	-	-	-	-	-	
Stage 1	341	-	-	-	-	-	-	
Stage 2	758	-	-	-	-	-	-	
Approach	EB	NB		SB				
HCM Control Delay, s	20.1	0.2		0				
HCM LOS	C							
Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBU	SBT	SBR		
Capacity (veh/h)	726	-	325	705	-	-		
HCM Lane V/C Ratio	0.012	-	0.267	-	-	-		
HCM Control Delay (s)	10	-	20.1	0	-	-		
HCM Lane LOS	B	-	C	A	-	-		
HCM 95th %tile Q(veh)	0	-	1.1	0	-	-		

HCM 6th TWSC
2: Grovewood Drive & Benton Circle

Alston Park Phase 3
2027 Build AM

Intersection												
Int Delay, s/veh	5.3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	8	16	1	2	5	3	8	0	10	19	1
Future Vol, veh/h	0	8	16	1	2	5	3	8	0	10	19	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	10	2	2	25	9	2	2	2	12	2	2
Mvmt Flow	0	9	18	1	2	6	3	9	0	11	21	1
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	8	0	0	27	0	0	36	28	18	30	34	5
Stage 1	-	-	-	-	-	-	18	18	-	7	7	-
Stage 2	-	-	-	-	-	-	18	10	-	23	27	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.22	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.22	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.22	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.608	4.018	3.318
Pot Cap-1 Maneuver	1612	-	-	1587	-	-	970	865	1061	954	859	1078
Stage 1	-	-	-	-	-	-	1001	880	-	989	890	-
Stage 2	-	-	-	-	-	-	1001	887	-	970	873	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1612	-	-	1587	-	-	950	864	1061	945	858	1078
Mov Cap-2 Maneuver	-	-	-	-	-	-	950	864	-	945	858	-
Stage 1	-	-	-	-	-	-	1001	880	-	989	889	-
Stage 2	-	-	-	-	-	-	975	886	-	960	873	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0			0.9			9.1			9.2		
HCM LOS							A			A		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	886	1612	-	-	1587	-	-	891				
HCM Lane V/C Ratio	0.014	-	-	-	0.001	-	-	0.037				
HCM Control Delay (s)	9.1	0	-	-	7.3	0	-	9.2				
HCM Lane LOS	A	A	-	-	A	A	-	A				
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0.1				

HCM 6th TWSC
1: New Riverside Road & Holly Hill Lane

Alston Park Phase 3
2027 Build PM

Intersection								
Int Delay, s/veh	0.8							
Movement	EBL	EBR	NBL	NBT	SBU	SBT	SBR	
Lane Configurations								
Traffic Vol, veh/h	31	13	23	497	0	303	53	
Future Vol, veh/h	31	13	23	497	0	303	53	
Conflicting Peds, #/hr	0	0	0	0	0	0	0	
Sign Control	Stop	Stop	Free	Free	Free	Free	Free	
RT Channelized	-	None	-	None	-	-	None	
Storage Length	0	-	230	-	230	-	-	
Veh in Median Storage, #	1	-	-	0	-	0	-	
Grade, %	0	-	-	0	-	0	-	
Peak Hour Factor	90	90	90	90	90	90	90	
Heavy Vehicles, %	2	2	2	8	2	4	2	
Mvmt Flow	34	14	26	552	0	337	59	
Major/Minor	Minor2	Major1		Major2				
Conflicting Flow All	695	198	396	0	552	-	0	
Stage 1	367	-	-	-	-	-	-	
Stage 2	328	-	-	-	-	-	-	
Critical Hdwy	6.84	6.94	4.14	-	6.44	-	-	
Critical Hdwy Stg 1	5.84	-	-	-	-	-	-	
Critical Hdwy Stg 2	5.84	-	-	-	-	-	-	
Follow-up Hdwy	3.52	3.32	2.22	-	2.52	-	-	
Pot Cap-1 Maneuver	376	810	1159	-	642	-	-	
Stage 1	671	-	-	-	-	-	-	
Stage 2	702	-	-	-	-	-	-	
Platoon blocked, %				-		-	-	
Mov Cap-1 Maneuver	368	810	1159	-	642	-	-	
Mov Cap-2 Maneuver	477	-	-	-	-	-	-	
Stage 1	656	-	-	-	-	-	-	
Stage 2	702	-	-	-	-	-	-	
Approach	EB	NB		SB				
HCM Control Delay, s	12.3	0.4		0				
HCM LOS	B							
Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBU	SBT	SBR		
Capacity (veh/h)	1159	-	543	642	-	-		
HCM Lane V/C Ratio	0.022	-	0.09	-	-	-		
HCM Control Delay (s)	8.2	-	12.3	0	-	-		
HCM Lane LOS	A	-	B	A	-	-		
HCM 95th %tile Q(veh)	0.1	-	0.3	0	-	-		

HCM 6th TWSC
2: Grovewood Drive & Benton Circle

Alston Park Phase 3
2027 Build PM

Intersection												
Int Delay, s/veh	6.1											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	2	5	1	4	10	8	19	0	5	11	0
Future Vol, veh/h	0	2	5	1	4	10	8	19	0	5	11	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	4	2	2	2	2	2	2
Mvmt Flow	0	2	6	1	4	11	9	21	0	6	12	0
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	15	0	0	8	0	0	23	22	5	28	20	10
Stage 1	-	-	-	-	-	-	5	5	-	12	12	-
Stage 2	-	-	-	-	-	-	18	17	-	16	8	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1603	-	-	1612	-	-	989	872	1078	981	874	1071
Stage 1	-	-	-	-	-	-	1017	892	-	1009	886	-
Stage 2	-	-	-	-	-	-	1001	881	-	1004	889	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1603	-	-	1612	-	-	978	871	1078	962	873	1071
Mov Cap-2 Maneuver	-	-	-	-	-	-	978	871	-	962	873	-
Stage 1	-	-	-	-	-	-	1017	892	-	1009	885	-
Stage 2	-	-	-	-	-	-	986	880	-	980	889	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0			0.5			9.1			9.1		
HCM LOS							A			A		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	900	1603	-	-	1612	-	-	899				
HCM Lane V/C Ratio	0.033	-	-	-	0.001	-	-	0.02				
HCM Control Delay (s)	9.1	0	-	-	7.2	0	-	9.1				
HCM Lane LOS	A	A	-	-	A	A	-	A				
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	0.1				

Attachment D

NCHRP Report 457 Right-Turn Warrant for New Riverside Road at Holly Hill Lane

2027 Build AM

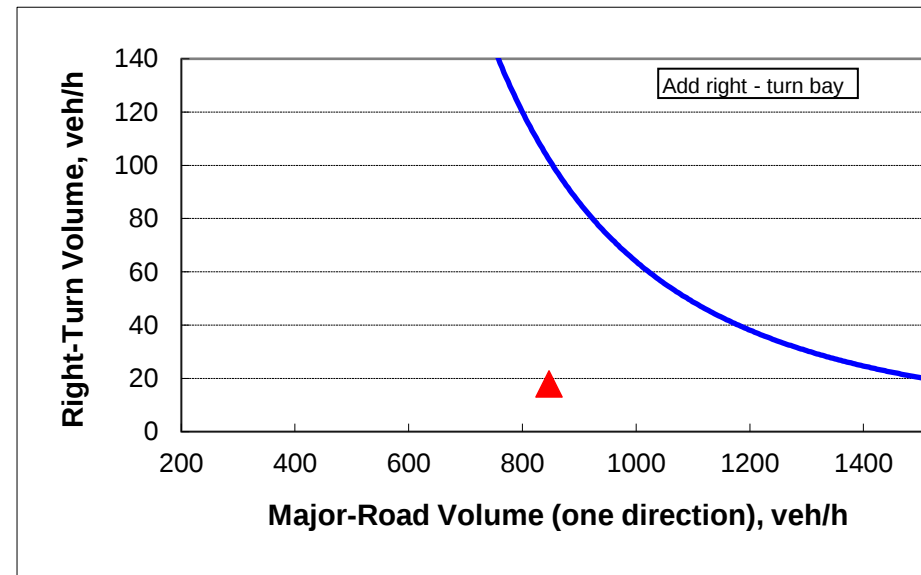
Figure 2 - 6. Guideline for determining the need for a major-road right-turn bay at a two-way stop-controlled intersection.

INPUT

Roadway geometry:	4-lane roadway
Variable	Value
Major-road speed, mph:	35
Major-road volume (one direction), veh/h:	847
Right-turn volume, veh/h:	18

OUTPUT

Variable	Value
Limiting right-turn volume, veh/h:	102
Guidance for determining the need for a major-road right-turn bay for a 4-lane roadway:	
Do NOT add right-turn bay.	



2027 Build PM

Figure 2 - 6. Guideline for determining the need for a major-road right-turn bay at a two-way stop-controlled intersection.

INPUT

Roadway geometry:	4-lane roadway
Variable	Value
Major-road speed, mph:	35
Major-road volume (one direction), veh/h:	356
Right-turn volume, veh/h:	53

OUTPUT

Variable	Value
Limiting right-turn volume, veh/h:	1185
Guidance for determining the need for a major-road right-turn bay for a 4-lane roadway:	
Do NOT add right-turn bay.	

