

TRAFFIC IMPACT STUDY

Chick-fil-A # 04959 Tucker
4431 Hugh Howell Rd,
Tucker, Georgia

May 2, 2022

Prepared for:
Chick-fil-A, Inc.

RECEIVED
CITY OF TUCKER

05/03/2022

PLANNING & ZONING
DEPARTMENT

Bowman

Traffic Impact Study

Chick-fil-A # 04959 Tucker

4431 Hugh Howell Rd,
Tucker, Georgia

Prepared May 2, 2022

Prepared for:
Chick-fil-A, Inc.
5200 Buffington Road
Atlanta, GA 30349
Phone: 404.214.9934

Prepared by:

The logo for Bowman Consulting Group, featuring the word "Bowman" in a bold, green, sans-serif font.

Bowman Consulting Group
Certificate of Authorization License No. 30462
4450 W. Eau Gallie Blvd., Suite 144
Melbourne, FL 32934
Phone: (321) 255-5434
Fax: (321) 255-7751

Analysts: Daniela Jurado
Rodrigo Meirelles

Project Manager: Andrew Petersen, PE

05/02/2022
Bowman Job # 120005-01-049

Table of Contents

Executive Summary	ii
1.Introduction	1
2.Background Information	1
Traffic Impact Analysis Methodology	2
3.Roadway Network	2
Intersection Characteristics	2
4.Data Collection	4
5.Traffic Forecast and Background Traffic	4
6.Trip Generation	5
7.Trip Distribution	5
8.Turn Lane Warrant Analysis	6
9.Capacity Analysis	7
Capacity Analysis Comparison – No Build vs Build Conditions (Year 2023).....	8
Proposed Improvements	10
Capacity Analysis Comparison – No Build vs Build Improved Conditions.....	10
Queueing Analysis	11
10.Conclusions and Recommendations	14

List of Figures

Figure 1. Site location.	1
Figure 2. Trip Distribution.....	6

List of Tables

Table 1 Historical AADT and Annual Growth Rates	4
Table 2 Site Trip Generation	5
Table 3 Right Turn Lane Warrant Criteria.....	6
Table 4 HCM Level of Service Criteria.....	7
Table 5 2023 AM Peak Hour Capacity Analysis	8
Table 6 2023 PM Peak Hour Capacity Analysis	9
Table 7 2023 morning Peak Hour Capacity Analysis Comparison No Build vs Improved Conditions	11
Table 7 2023 Evening Peak Hour Capacity Analysis Comparison No Build vs Improved Conditions	11
Table 8 Queueing Analysis Comparison.....	12

Appendices

Appendix A: Site Plan
Appendix B: Scope/Methodology
Appendix C: Traffic Counts
Appendix D: Traffic Volume and Traffic Distribution Exhibits
Appendix E: Chick-Fil-A Trip Generation Assessment
Appendix F: Capacity Analysis Reports

Executive Summary

This report summarizes the findings of the Traffic Impact Study performed by Bowman Consulting (Bowman) for the proposed 4,989 SF Chick-fil-A development with 40 Car Stack Chick-fil-A development to be located at the Southwest corner of the intersection of Hugh Howell Rd and Rosser Terrace in the City of Tucker, Georgia.

Access to the site will be provided by (1) one right-in/left-out driveway along Rosser Terrace and (2) one full-access driveway along Dillard St.

The purpose of this study is threefold: (i) to determine the number of expected trips generated by the proposed site; (ii) to determine the potential impact, if any, of the proposed development on the surrounding roadway network; and (iii) to propose improvements to mitigate the impact of the proposed development, if required.

A Traffic Impact Analysis Methodology Statement was prepared and shared with representatives from the City of Tucker and the Georgia Department of Transportation.

Turning movement counts were collected for the morning and evening peak hours at the intersections of Hugh Howell Rd & Cowan Rd, Hugh Howell Rd & Rosser Terrace, Hugh Howell Rd & Tucker Industrial Rd, and Cowan Rd & Dillard St.

Based on the results of the trip generation assessment prepared by Bowman Consulting, the proposed development is expected to generate a total of 261 trips during the morning peak hour and 285 trips during the evening peak hour. It is anticipated that during the morning peak hour 128 of these are existing trips, the remaining 133 are expected to be primary trips. During the evening peak hour, it is anticipated that 143 are existing trips and 142 are new trips.

For the purposes of this analysis, it is anticipated that the proposed development will be constructed and fully operational by the year 2023.

The following scenarios were evaluated as part of this study: 2023 No Build, 2023 Build and 2023 Build with Improvements.

A Turn Lane Warrant Analysis was conducted based on the City of Tucker Code of Ordinances Sec. 22-284 - *Access Management*. The results show a right turn lane is warranted at the eastbound approach of the intersection of Hugh Howell Rd and Rosser Terrace under Existing, No Build and Build conditions. Based on discussion with the City of Tucker Traffic Review Staff, a southbound right turn lane on Rosser Terrace to access the site via Site Driveway 1 was requested to be included with the development of the project.

Capacity Analyses comparison No Build Vs Build conditions were conducted for the analysis intersections to identify areas impacted by the proposed development. The results indicate the following:

- During the morning peak hour: all intersections are projected to operate at an acceptable overall LOS B or better during the No Build and Build conditions. No changes in LOS and minimal increases in delays are expected on all approaches of the analysis intersections.
- During the evening peak hour: all intersections are projected to operate at an acceptable overall LOS C or better during the No Build and Build conditions. The intersection of Hugh Howell Rd with

Cowan Rd is expected to operate at LOS B under No Build conditions and LOS C under Build conditions, with an increase in delay of 3.7 seconds.

The following improvements for the signalized intersection of Cowan RD and Hugh Howell Rd were evaluated in order to verify the effectiveness of possible proposed improvements.

- **Improved Signal Optimization:** Optimize signal timings at Intersection of Hugh Howell Rd & Cowan Rd for evening Peak Hour.
- **Improved LT:** Provide a Northbound Left turn lane at the intersection of Hugh Howell Rd & Cowan Rd.
- **Improved RT CH:** Provide a channelized Northbound Right-turn Lane at the intersection of Hugh Howell Rd & Cowan Rd.

Capacity Analyses comparison No Build Vs Build Improved conditions were conducted to evaluate the proposed improvements. The results indicate the following:

- During the morning peak hour: The intersection of Hugh Howell Rd and Cowan Rd/The Centre Driveway is expected to experience acceptable overall LOS A under Build Improved conditions with minimal increase in the overall delay overall delay considering a northbound channelized right turn lane improvement. The northbound approach is anticipated to operate at LOS E under both No Build and Build Improved conditions with no increase in delay. All other approaches and turning movements are expected to maintain the existing LOS.
- During the evening peak hour: During the evening peak hour, the intersection of Hugh Howell Rd and Cowan Rd/The Centre Driveway is expected to experience acceptable overall LOS B under Build Improved conditions with minimal increase in the overall delay considering a northbound channelized right turn lane improvement. The northbound approach is anticipated to operate at LOS E under both No Build and Build Improved conditions with no increase in delay. All other approaches and turning movements are expected to maintain the existing LOS.

The 95th queue results show that, during the morning peak hour, no storage lengths are exceeded with the inclusion of the proposed development. During the evening peak hour, the storage length of the southbound left-turn lane of the intersection of Hugh Howell Rd & Cowan Rd/The Centre Driveway is expected to be exceeded under No Build, Build and Build Improved conditions. The westbound left-turn lane of the intersection of Hugh Howell Rd & Tucker Industrial Rd is expected to be exceeded under both No Build and Build conditions, with no increase in queue length under Build conditions.

Based on the results of the capacity, queuing and turn lane warrant analysis the following improvements are proposed:

- Provide a southbound right-turning lane at the intersection of Rosser Terrace & Site Driveway 1.
- Provide a northbound right-turn flare at the intersection of Hugh Howell Rd & Rosser Terrace.
- Provide a Northbound Right turn lane at the intersection of Hugh Howell Rd & Cowan Rd.

Based on the results of the capacity, turn lane, and queueing analysis, the proposed Chick-Fil-A at 4431 Hugh Howell Rd, Tucker, GA is not expected to adversely impact the surrounding roadway network provided the proposed improvements mentioned on this report.

1. Introduction

This report summarizes the findings of the Traffic Impact Study performed by Bowman Consulting (Bowman) for the proposed Chick-fil-A development to be located at the Southwest corner of the intersection of Hugh Howell Rd and Rosser Terrace in the City of Tucker, Georgia.

The purpose of this study is threefold: (i) to determine the number of expected trips generated by the proposed site; (ii) to determine the potential impact, if any, of the proposed development on the surrounding roadway network; and (iii) to propose improvements to mitigate the impact of the proposed development, if required.

2. Background Information

The proposed development entails a 4,989 SF Chick-fil-A development with 40-Car Stack to be constructed at 4431 Hugh Howell Rd, in the City of Tucker, Georgia. **Figure 1** depicts the site location.



Figure 1. Site location.

Access to the development will be provided by **(1)** one right-in/left-out driveway along Rosser Terrace and **(2)** one full-access driveway along Dillard St, no access driveways are proposed on Hugh Howell Rd. The latest Concept Plan is presented in **Appendix A**.

Traffic Impact Analysis Methodology

A Traffic Impact Analysis Methodology Statement was prepared and shared with representatives from the City of Tucker and the GDOT DeKalb County Division. A copy of the approved Traffic Impact Analysis Methodology Statement and proof of the coordination is contained in **Appendix B**.

To assess the traffic operation at the study Intersections, the following tasks were undertaken:

- Turning movement counts were collected during an average weekday for the morning (7:00 AM – 9:00 AM) and evening (4:00 PM – 6:00 PM) peak periods.
- Trip generation Assessment for Chick-Fil-a (CFA) facilities.
- Trip Distribution for the proposed development.
- Capacity and queuing analyses at study intersections.

3. Roadway Network

Hugh Howell Rd (GA 236): Within the identified study area is a State-maintained four-lane Minor Arterial according to the Georgia Department of Transportation State Functional Classification Map Online. Hugh Howell Rd has a continuous two-way left-turn lane (TWLTL), a southeast-northwest alignment and a posted speed limit of 45 miles per hour.

Rosser Terrace: Within the identified study area is a city-maintained two-lane undivided roadway identified as a Local Road according to the City of Tucker 2019, Strategic Transportation Master Plan. Rosser Terrace has a north-south alignment and a posted speed limit of 25 miles per hour.

Tucker Industrial Rd: Within the identified study area is a city-maintained two-lane undivided roadway identified as a Local Road according to the City of Tucker Strategic 2019, Transportation Master Plan. Tucker Industrial Rd has a north-south alignment with a posted speed limit of 35 miles per hour.

Cowan Rd: Within the identified study area is a city-maintained two-lane undivided roadway identified as a Local Road according to the City of Tucker 2019, Strategic Transportation Master Plan. Cowan Rd has a northeast-southwest alignment with a posted speed limit of 25 miles per hour.

Dillard St: Within the identified study area is a city-maintained two-lane undivided roadway identified as a Local Road according to the City of Tucker 2019, Strategic Transportation Master Plan. Dillard St has a north-south alignment with a posted speed limit of 25 miles per hour.

Intersection Characteristics

1. Intersection of Hugh Howell Rd and Rosser Terrace/Fuller Way

This intersection is currently a four-legged unsignalized intersection where Hugh Howell Rd has a southeast-northwest alignment and Rosser Terrace and Fuller way have a north-south alignment.

The northwest approach (Hugh Howell Road eastbound) consists of an exclusive through lane, one shared through/right-turn lane and a continuous TWLTL. The southeast approach (Hugh Howell Road westbound) consists of two exclusive through lanes, one exclusive right-turn lane and a continuous TWLTL. The northbound approach (Rosser Terrace) consists of one shared left-turn/through/right-turn lane. The southbound approach (Fuller Way) consists of one shared left-turn/through/right-turn lane.

2. Intersection of Hugh Howell Rd and Cowan Rd/The Centre Driveway

This intersection is currently a four-legged signalized intersection where Hugh Howell Rd has a southeast-northwest alignment and Cowan Rd has a northeast-southwest alignment.

The northwest approach (Hugh Howell Road eastbound) consists of one exclusive left-turn lane, one exclusive through lane, and one shared through/right-turn lane. The southeast approach (Hugh Howell Road westbound) consists of one exclusive left-turn lane, two exclusive through lanes, and one exclusive right-turn lane. The southwest approach (Cowan Road Northbound) consists of one shared left-turn/through/right-turn lane. The northeast approach (Publix Driveway southbound) consists of one exclusive left-turn lane, and one shared through/right-turn lane.

3. Intersection of Hugh Howell Rd and Tucker Industrial Rd

This intersection is currently a four-legged signalized intersection where Hugh Howell Rd has an east-west alignment and Tucker Industrial Rd has a north-south alignment.

The eastbound and westbound approaches consist of one exclusive left-turn lane, one exclusive through lane, and one shared through/right-turn lane. The northbound and southbound approaches have one shared left-turn/through/right-turn lane.

4. Intersection of Cowan Rd & Dillard St

This intersection is currently a three-legged unsignalized intersection where Hugh Howell Rd has a northeast-southwest alignment and Dillard St has a north-south alignment.

The northeast approach consists of a single lane with left-turn and through movements allowed. The southwest approach consists of a single lane with through and right-turn movements allowed. The northbound approach consists of a single lane with left-turn and right-turn movements allowed.

Proposed Conditions

As mentioned before, access to the development will be provided by (1) one right-in/left-out driveway along Rosser Terrace and (2) one full-access driveway along Dillard St. No access is proposed on Hugh Howell Road.

4. Data Collection

For the purposes of this study the following data was collected:

- Inspections were conducted to obtain an inventory of existing roadway geometry, traffic control devices, and location of existing and proposed driveways.
- Published GDOT AADT counts and functional classification information.
- Turning movement counts were collected at the following intersections:
 - Hugh Howell Rd and Cowan Rd
 - Hugh Howell Rd and Rosser Terrace
 - Hugh Howell Rd and Tucker Industrial Rd
 - Cowan Rd & Dillard St

The traffic counts were completed during an average weekday, Tuesday, June 15, 2021, for the intersections of Hugh Howell Rd with Cowan Rd, Rosser Terrace, and Tucker Industrial Rd, and on Tuesday, March 1, 2022, for the intersection of Cowan Rd with Dillard St for the morning (7:00 AM – 9:00 AM) and evening (4:00 PM – 6:00 PM) peak periods. The turning movement counts are presented in **Appendix C**.

5. Traffic Forecast and Background Traffic

For the purposes of this analysis, it is anticipated that the proposed development will be constructed and fully operational by the year 2023. The following scenarios were evaluated as part of this study:

- Future Conditions (2023) without the proposed development (No Build)
- Future Conditions (2023) with the proposed development (Build)
- Improved Future Conditions (2023) with the proposed development (Build with Improvements)

To develop the 2022 and the 2023 traffic volumes, the first step was to determine a background growth rate applicable for the study area roadway segments. For each roadway segment, the annual growth rate was calculated using the historical AADT information provided by the GDOT Average Annual Daily Traffic & Historical Counts 2015-2019 information. A 0.5% minimum average annual growth rate was used for all traffic in the study area.

The historical study area roadway AADT information, as well as the applied growth rates utilized for the analysis, are presented in **Table 1**.

Table 1 Historical AADT and Annual Growth Rates

Roadway	From	to	2015	2016	2017	2018	2019	2016	2017	2018	2019	Avg Growth rate	Applied Growth rate
Hugh Howell Rd	Lawrenceville Hwy	Mountain Industrial Blvd	21,700	22,400	25,600	25,600	24,400	3.2%	14.3%	0.0%	-4.7%	3.2%	3.2%
Rosser Terrace	N/A	N/A	-	-	-	-	-	-	-	-	-	No Data	0.5%
Tucker Industrial Rd	N/A	N/A	-	-	-	-	-	-	-	-	-	No Data	0.5%
Cowan Rd	N/A	N/A	-	-	-	-	-	-	-	-	-	No Data	0.5%
Dillard St	N/A	N/A	-	-	-	-	-	-	-	-	-	No Data	0.5%

Source: GDOT Average Annual Daily Traffic & Historical Counts 2015-2019

The growth rates presented in **Table 1** were applied to the 2021 Turning Movement Counts to develop the 2022 Existing Volumes. The 2022 Existing Traffic Volumes are presented in **Appendix D, Exhibit 1**.

The 2023 No Build Traffic Volumes were developed applying one year growth to the 2022 Existing Traffic Volumes, see **Exhibit 2** in **Appendix D**.

6. Trip Generation

The applicant is proposing to develop the site with the following land uses generating site traffic:

- 4,989 SF Chick-fil-A Restaurant with drive-thru window (Proposed)

Considering Chick-fil-A fast-food restaurants generate larger number of trips than ITE comparable land uses. Bowman conducted a Trip Generation Assessment based on trip generation data provided by the Atlanta Department of Transportation for three similar Chick-fil-A facilities. The trip generation assessment is presented **Appendix E**.

Table 2 displays the trip generation for the proposed development and includes the morning and evening peak hour.

Table 2 Site Trip Generation

Land Use	Land Use Code ⁽¹⁾	AADT of Adjacent Street	Period	Peak Hour Trips ⁽²⁾			Pass by ⁽³⁾			Primary		
				In	Out	Total	In	Out	Total	In	Out	Total
Fast Food restaurant with Drive thru	934	24,400	AM	133	128	261	65	63	128	68	65	133
			PM	148	137	285	74	69	143	74	68	142

(1) Based on the Institute of Transportation Engineers Trip Generation, 10th Edition

(2) Based on Bowman 2021 Trip Generation Assessment for Chick-Fil-A facilities

(3) Pass-By rates of 49% were extracted from the Institute of Transportation Engineers Trip Generation Handbook, 3rd Edition

The proposed development is expected to generate a total of 261 trips during the morning peak hour and 285 trips during the evening peak hour. It is anticipated that during the morning peak hour 128 of these are existing trips, the remaining 133 are expected to be primary trips. During the evening peak hour, it is anticipated that 143 are existing trips and 142 are new trips.

7. Trip Distribution

The proposed trip distribution for the site was developed based on the AADT information of the surrounding roadway network, the population and employment centers in the area, and the access conditions of the site. The trip distribution for this site is presented in **Figure 2**.



Figure 2. Trip Distribution

The Primary and Pass-By trip distributions are presented in **Exhibits 3** and **4** in **Appendix D**.

The Primary and Pass-By trips are presented in **Exhibits 5** and **6** in **Appendix D**.

The CFA Site Trips are presented in **Exhibits 7** in **Appendix D**.

The CFA Site Trips were added to the 2022 No Build Traffic Volumes to yield the 2022 Build Traffic Volumes presented in **Exhibit 8** in **Appendix D**.

8. Turn Lane Warrant Analysis

A Turn Lane Warrant Analysis was conducted based on the City of Tucker Code of Ordinances. Per Sec. 22-284 - *Access Management*, a deceleration lane shall be required at each project driveway or subdivision street entrance, as applicable, that meets either the average daily traffic (ADT) or right turning volumes shown in **Table 3**.

Table 3 Right Turn Lane Warrant Criteria

Main Road Speed Limit	2 Lanes on Main Road		>2 Lanes on Main Road	
	35-40 mph	>40 mph	35-40 mph	>40 mph
Main Road ADT	8000	4000	12000	10000
Daily Right Turning Volume	150	75	150	75
Peak Hour Right Turning Volumes	15	7	15	7

For driveways, right-turn lanes shall be required at all driveways where the right-turning volume exceeds 300 vehicles per day.

The following number of entering right turns are anticipated under 2023 Build Conditions:

- Hugh Howell Rd and Rosser Terrace
 - AM Peak Hour - 16
 - PM Peak Hour - 33
- Rosser Terrace and Site Driveway 1
 - AM Peak Hour - 76
 - PM Peak Hour - 85

Based on the thresholds for a right-turn lane provided on the City of Tucker Code of Ordinances, a right turn lane is warranted at the eastbound approach of the intersection of Hugh Howell Rd and Rosser Terrace. Note the 7 right-turning vehicle per hour threshold from the City of Tucker Code of Ordinances for a 40 mph or higher speed limit roadway is already exceeded under Existing and No Build conditions.

Based on the posted speed limit of Rosser Terrace (25 mph) a right-turn deceleration lane is not warranted as the threshold is not applicable for roads with speed limits smaller than 35 mph. Based on discussion with the City of Tucker Traffic Review Staff, a southbound right turn lane on Rosser Terrace to access the site via Site Driveway 1 was requested to be included with the development of the project.

9. Capacity Analysis

The study intersections were analyzed for each scenario following the Highway Capacity Manual (HCM 6th edition) methodologies using the computer software Synchro 10. The analysis uses capacity, Level of Service, and control delay as the criteria for the performance of the driveways and study intersections.

Capacity, as defined by the HCM, is a measure of the maximum number of vehicles in an hour that can travel through an intersection or section of roadway under typical conditions. Level of Service (LOS) is a marker of the driving conditions and perception of drivers while traveling during the given time period. LOS ranges from LOS A which represents free flow conditions, to LOS F which represents breakdown conditions.

Table 4 shows the LOS for unsignalized intersections as defined by the HCM.

Table 4 HCM Level of Service Criteria

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

Control delay is a measure of the total amount of delay experienced by an individual vehicle and includes delay related to deceleration, queue delay, stopped delay, and acceleration.

Table 4 displays the amount of control delay (in seconds per vehicle) that corresponds to the LOS for signalized and unsignalized intersections.

Capacity Analysis Comparison – No Build vs Build Conditions (2023)

Capacity Analyses comparison were conducted for the No Build Vs Build conditions (2023). The primary purpose for this approach was to compare the results to identify areas impacted by the proposed development. The capacity results are included in **Appendix F**.

The capacity results for morning peak hour are summarized in **Table 5**.

Table 5 2023 AM Peak Hour Capacity Analysis

2023 CONDITIONS - (AM)			No Build		Build		
Intersection		Approach	Movement	DELAY (S)	LOS	DELAY (S)	LOS
1	Hugh Howell Rd & Rosser Terrace/Fuller Way	EB	L	8.3	A	8.2	A
			T	0.0	A	0.0	A
			TR	0.0	A	0.0	A
			Approach	0.5	A	0.5	A
		WB	L	0.0	A	7.8	A
			T	0.0	A	0.0	A
			R	0.0	A	0.0	A
			Approach	0.0	A	0.6	A
		NB	LT	-	-	12.3	B
			R	-	-	9.1	A
		SB	Approach	10.7	B	10.0	A
			Approach	9.7	A	9.7	A
Intersection	-	0.6	A	1.3	A		
2	Hugh Howell Rd & Cowan Rd/The Centre Driveway	EB	L	4.4	A	6.2	A
			T	5.7	A	8.0	A
			TR	5.7	A	8.0	A
			Approach	5.6	A	7.8	A
		WB	L	4.9	A	6.8	A
			T	0.3	A	0.4	A
			R	0.0	A	0.1	A
			Approach	0.4	A	0.5	A
		NB	Approach	78.7	E	75.5	E
			L	68.2	E	61.7	E
		SB	TR	65.2	E	58.7	E
			Approach	66.3	E	59.8	E
Intersection	-	8.3	A	11.4	B		
3	Hugh Howell Rd & Tucker Industrial Rd	EB	L	100.8	F	96.0	F
			T	0.3	A	0.3	A
			TR	0.3	A	0.3	A
			Approach	1.6	A	2.1	A
		WB	L	102.5	F	102.5	F
			T	5.2	A	5.6	A
			TR	5.2	A	5.6	A
			Approach	9.7	A	9.9	A
		NB	Approach	74.8	E	74.6	E
		SB	Approach	67.0	E	66.7	E
Intersection	-	13.2	B	13.5	B		
4	Cowan Rd & Dillard St	EB	Approach	0.0	A	0.0	A
		WB	Approach	0.9	A	3.6	A
		NB	Approach	8.9	A	9.7	A
		Intersection	-	1.7	A	4.9	A

Extracted from Synchro HCM 6th Edition

Based on the results of the capacity analysis during the morning peak hour, all intersections are projected to operate at an acceptable overall LOS B or better during the No Build and Build conditions.

The northbound and southbound approaches of the intersection of Hugh Howell Rd and Cowan Rd are expected to operate at LOS E under both No Build and Build conditions. The northbound and southbound approaches of the intersection of Hugh Howell Rd and Tucker Industrial Rd are expected to operate at LOS E under both No Build and Build conditions. The eastbound and westbound left-turning movements of the intersection of Hugh Howell Rd with Tucker Industrial Rd are expected to operate at a LOS F during both No Build and Build conditions, minimal increases in delays are expected at the above-mentioned turning movements and approaches.

The capacity results for evening peak hour are summarized in **Table 6**.

Table 6 2023 PM Peak Hour Capacity Analysis

2023 CONDITIONS - (PM)			No Build		Build		
Intersection		Approach	Movement	DELAY (S)	LOS	DELAY (S)	LOS
1	Hugh Howell Rd & Rosser Terrace/Fuller Way	EB	L	8.3	A	8.2	A
			T	0.0	A	0.0	A
			TR	0.0	A	0.0	A
			Approach	0.2	A	0.2	A
		WB	L	9.1	A	9.5	A
			T	0.0	A	0.0	A
			R	0.0	A	0.0	A
			Approach	0.0	A	0.7	A
		NB	LT	-	-	17.9	C
			R	-	-	11.7	B
		SB	Approach	15.2	C	13.7	B
			Approach	10.2	B	10.1	B
Intersection	-	0.5	A	1.1	A		
2	Hugh Howell Rd & Cowan Rd/The Centre Driveway	EB	L	9.3	A	12.0	B
			T	16.7	B	21.6	C
			TR	16.7	B	21.5	C
			Approach	15.9	B	20.6	C
		WB	L	12.1	B	15.8	B
			T	0.4	A	0.5	A
			R	0.2	A	0.2	A
			Approach	1.1	A	1.4	A
		NB	Approach	74.2	E	78.1	E
			SB	L	57.6	E	51.5
		TR		56.1	E	49.9	D
		Approach		56.7	E	50.5	D
Intersection	-	17.6	B	21.3	C		
3	Hugh Howell Rd & Tucker Industrial Rd	EB	L	117.2	F	108.3	F
			T	1.7	A	1.8	A
			TR	1.7	A	1.8	A
			Approach	2.1	A	2.4	A
		WB	L	104.4	F	104.4	F
			T	8.0	A	8.4	A
			TR	8.0	A	8.4	A
		Approach	15.0	B	15.3	B	
		NB	Approach	77.6	E	77.9	E
		SB	Approach	59.6	E	59.2	E
Intersection	-	14.6	B	14.9	B		
4	Cowan Rd & Dillard St	EB	Approach	0.0	A	0.0	A
		WB	Approach	1.7	A	3.3	A
		NB	Approach	9.4	A	10.5	B
		Intersection	-	1.7	A	3.9	A

Extracted from Synchro HCM 6th Edition

Based on the results of the capacity analysis during the evening peak hour, all intersections are projected to operate at an acceptable overall LOS C or better during the No Build and Build conditions. An increase in delay of 3.7 seconds is expected at the intersection of Hugh Howell Rd with Cowan Rd under Build conditions.

The northbound and southbound approaches of the intersection of Hugh Howell Rd and Tucker Industrial Rd are expected to operate at LOS E under both No Build and Build conditions; the eastbound and westbound left-turning movements of the intersection of Hugh Howell Rd with Tucker Industrial Rd are expected to operate at LOS F during both No Build and Build conditions.

Proposed Improvements

Based on the results of the turn lane warrant analysis and the capacity analysis comparison between No Build and Build conditions, the following improvements are proposed:

- Provide a southbound right-turning lane at the intersection of Rosser Terrace & Site Driveway 1.
- Provide a northbound right-turn flare at the intersection of Hugh Howell Rd & Rosser Terrace.

Additionally, the following improvements for the signalized intersection of Cowan Rd and Hugh Howell Rd were evaluated in order to verify the effectiveness of possible proposed improvements.

- **Improved Opt:** Optimize signal timings at Intersection of Hugh Howell Rd & Cowan Rd for evening Peak Hour.
- **Improved LT:** Provide a Northbound Left-turn Lane at the intersection of Hugh Howell Rd & Cowan Rd.
- **Improved RT CH:** Provide a channelized Northbound Right-turn Lane at the intersection of Hugh Howell Rd & Cowan Rd.

Capacity Analysis Comparison – No Build vs Build Improved Conditions

A Capacity Analyses comparison was conducted for the No Build and Build Improved conditions (year 2023). The primary purpose for this approach was to compare the results in order to evaluate the effect of the proposed improvements. The capacity results are included in **Appendix F**.

The capacity results for morning peak hour are summarized in **Table 7**.

Table 7 2023 Morning Peak Hour Capacity Analysis Comparison No Build vs Improved Conditions

2023 CONDITIONS - (AM)			No Build		Build Improved LT		Build Improved RTch	
Intersection	Approach	Movement	DELAY (S)	LOS	DELAY (S)	LOS	DELAY (S)	LOS
2 Hugh Howell Rd & Cowan Rd/The Centre Driveway	EB	L	4.4	A	4.8	A	4.8	A
		T	5.7	A	6.3	A	6.5	A
		TR	5.7	A	6.3	A	6.4	A
		Approach	5.6	A	6.2	A	6.4	A
	WB	L	4.9	A	5.4	A	5.5	A
		T	0.3	A	0.3	A	0.3	A
		R	0.0	A	0.1	A	0.1	A
		Approach	0.4	A	0.4	A	0.4	A
	NB	L/TL*			76.7	E	76.9	E
		TR/R*			76.0	E	-	-
		Approach	78.7	E	76.4	E	76.9	E
	SB	L	68.2	E	67.0	E	65.9	E
		TR	65.2	E	63.5	E	63.0	E
		Approach	66.3	E	64.8	E	64.1	E
	Intersection	-	8.3	A	11.0	B	9.1	A

Extracted from Synchro HCM 6th Edition

During the morning peak hour, the intersection of Hugh Howell Rd and Cowan Rd/The Centre Driveway is expected to experience acceptable overall LOS A under Build Improved conditions with minimal increase in the overall delay considering a northbound channelized right turn lane improvement. The northbound approach is anticipated to operate at LOS E under both No Build and Build Improved conditions with no increase in delay. All other approaches and turning movements are expected to maintain the existing LOS.

The capacity results for evening peak hour are summarized in **Table 7**.

Table 8 2023 Evening Peak Hour Capacity Analysis Comparison No Build vs Improved Conditions

2023 CONDITIONS - (PM)			No Build		Build Improved Opt		Build Improved LT		Build Improved RTch	
Intersection	Approach	Movement	DELAY (S)	LOS	DELAY (S)	LOS	DELAY (S)	LOS	DELAY (S)	LOS
2 Hugh Howell Rd & Cowan Rd/The Centre Driveway	EB	L	9.3	A	11.1	B	8.7	A	9.5	A
		T	16.7	B	20.0	B	16.0	B	17.4	B
		TR	16.7	B	20.0	B	16.0	B	17.4	B
		Approach	15.9	B	19.1	B	15.3	B	16.6	B
	WB	L	12.1	B	14.6	B	11.6	B	12.6	B
		T	0.4	A	0.5	A	0.4	A	0.4	A
		R	0.2	A	0.2	A	0.2	A	0.2	A
		Approach	1.1	A	1.3	A	1.1	A	1.2	A
	NB	L/TL*					73.7	E	73.6	E
		TR/R*					72.5	E	-	-
		Approach	74.2	E	71.7	E	73.1	E	73.6	E
	SB	L	57.6	E	53.5	D	60.3	E	56.7	E
		TR	56.1	E	51.8	D	57.7	E	55.5	E
		Approach	56.7	E	52.5	D	58.7	E	56.0	E
	Intersection	-	17.6	B	20.2	C	18.7	B	17.8	B

Extracted from Synchro HCM 6th Edition

During the evening peak hour, the intersection of Hugh Howell Rd and Cowan Rd/The Centre Driveway is expected to experience acceptable overall LOS B under Build Improved conditions with minimal increase in the overall delay considering a northbound right turn lane improvement. The northbound approach is anticipated to operate at LOS E under both No Build and Build Improved conditions with no increase in delay. All other approaches and turning movements are expected to maintain the existing LOS.

Queueing Analysis

The queue lengths were evaluated to determine if the available storage length of the turn lanes was exceeded. The 95th Percentile queue lengths are presented in **Appendix F. Table 9** summarizes the queue results.

Table 9 Queueing Analysis Comparison

2023 PM PEAK HOUR CONDITIONS				Available Storage (ft)	No Build		Build		Build Imp - Signal Opt		Build Imp - Left Turn		Build Imp - Right Turn	
Intersection			Approach		Movement	AM	PM	AM	PM	AM	PM	AM	PM	AM
					Queue (ft)	Queue (ft)	Queue (ft)	Queue (ft)	Queue (ft)	Queue (ft)	Queue (ft)	Queue (ft)	Queue (ft)	Queue (ft)
1	Hugh Howell Rd & Rosser Terrace (Unsignalized)	EB	L	100	3	3	3	3						
		WB	L	100	0	0	5	8						
2	Hugh Howell Rd & Cowan Rd/The Centre Driveway (Signalized)	EB	L	125	25	85	33	89	N/A - No AM Signal Opt Required	98	29	83	30	89
		WB	L	115	12	m27	16	m28		m32	14	m26	15	m28
		NB	Approach	-	88	201	178	#323		276	125	167	135	207
		SB	L	100	48	127	44	125		119	46	129	45	125
3	Hugh Howell Rd & Tucker Industrial Rd (Signalized)	EB	L	150	20	m11	m26	m17						
		WB	L	100	79	#124	79	#124						
4	Cowan Rd & Dillard St (Unsignalized)	NB	Approach	-	3	3	13	15						

Extracted from Synchro10 HCM 6th Edition

Intersections 3 & 4 have Non-NEMA Phasing therefore were extracted from Synchro10 HCM 2000 Edition

95th percentile volume exceeds capacity, queue may be longer.

m Volume for 95th percentile queue is metered by upstream signal.

For queue given in terms of vehicles one vehicle was assumed equal to 25 ft (Including space in between vehicles).

Based on the 95th% queue results, during the morning peak hour, no storage lengths are exceeded with the inclusion of the proposed development.

Based on the 95th% queue results, during the evening peak hour the storage length of the southbound left-turn lane of the intersection of Hugh Howell Rd & Cowan Rd/The Centre Driveway is expected to be exceeded under No Build, Build and Build Improved conditions. The westbound left-turn lane of the intersection of Hugh Howell Rd & Tucker Industrial Rd is expected to be exceeded under both No Build and Build conditions, with no increase in queue length under Build conditions.

10. Conclusions and Recommendations

Based on the results of the trip generation assessment prepared by Bowman Consulting, the proposed development is expected to generate a total of 261 trips during the morning peak hour and 285 trips during the evening peak hour. It is anticipated that during the morning peak hour 128 of these are existing trips, the remaining 133 are expected to be primary trips. During the evening peak hour, it is anticipated that 143 are existing trips and 142 are new trips.

The study found that based on the City of Tucker Code of Ordinances, a right turn lane is warranted at the eastbound approach of the intersection of Hugh Howell Rd and Rosser Terrace under Existing, No Build and Build conditions. Based on discussion with the City of Tucker Traffic Review Staff, a southbound right turn lane on Rosser Terrace to access the site via Site Driveway 1 was requested to be included with the development of the project.

The results of the No Build Vs Build conditions capacity analysis comparison indicate the following:

- During the morning peak hour:
All intersections are projected to operate at an acceptable overall LOS B or better during the No Build and Build conditions. No changes in LOS and minimal increases in delays are expected on all approaches of the analysis intersection.
- During the evening peak hour:
All intersections are projected to operate at an acceptable overall LOS C or better during the No Build and Build conditions.

The intersection of Hugh Howell Rd with Cowan Rd is expected to operate at LOS B under No Build conditions and LOS C under Build conditions, with an increase in delay of 3.7 seconds.

The following improvements for the signalized intersection of Cowan RD and Hugh Howell Rd were evaluated in order to verify the effectiveness of possible proposed improvements.

- **Improved Signal Optimization:** Optimize signal timings at Intersection of Hugh Howell Rd & Cowan Rd for evening Peak Hour.
- **Improved LT:** Provide a Northbound Left turn lane at the intersection of Hugh Howell Rd & Cowan Rd.
- **Improved RT CH:** Provide a channelized Northbound Right-turn Lane at the intersection of Hugh Howell Rd & Cowan Rd.

Capacity Analyses comparison No Build Vs Build Improved conditions were conducted to evaluate the proposed improvements. The results indicate the following:

- During the morning peak hour: The intersection of Hugh Howell Rd and Cowan Rd/The Centre Driveway is expected to experience acceptable overall LOS A under Build Improved conditions with minimal increase in the overall delay considering a northbound channelized right turn lane improvement. The northbound approach is anticipated to operate at LOS E under both No Build and Build Improved conditions with no increase in delay. All other approaches and turning movements are expected to maintain the existing LOS.
- During the evening peak hour: During the evening peak hour, the intersection of Hugh Howell Rd and Cowan Rd/The Centre Driveway is expected to experience acceptable overall LOS B under Build Improved conditions with minimal increase in the overall delay overall delay considering a northbound channelized right turn lane improvement. The northbound approach is anticipated to

operate at LOS E under both No Build and Build Improved conditions with no increase in delay. All other approaches and turning movements are expected to maintain the existing LOS.

The 95th queue results show that, during the morning peak hour, no storage lengths are exceeded with the inclusion of the proposed development. During the evening peak hour, the storage length of the southbound left-turn lane of the intersection of Hugh Howell Rd & Cowan Rd/The Centre Driveway is expected to be exceeded under No Build, Build and Build Improved conditions. The westbound left-turn lane of the intersection of Hugh Howell Rd & Tucker Industrial Rd is expected to be exceeded under both No Build and Build conditions, with no increase in queue length under Build conditions.

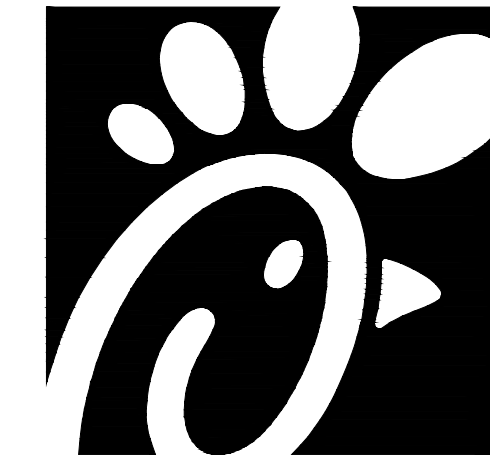
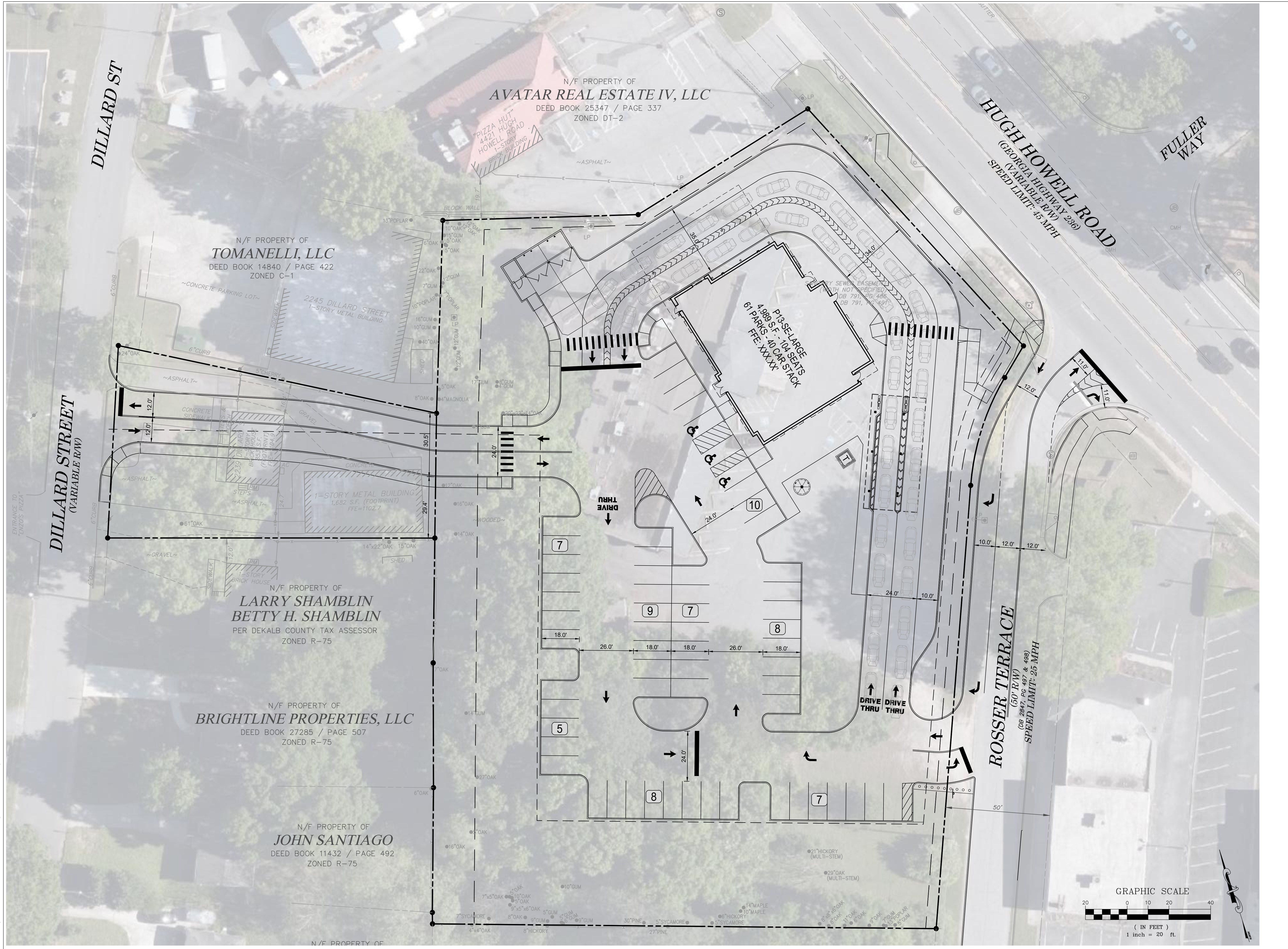
Based on the results of the capacity, queuing and turn lane warrant analysis the following improvements are proposed:

- Provide a southbound right-turning lane at the intersection of Rosser Terrace & Site Driveway 1.
- Provide a northbound right-turn flare at the intersection of Hugh Howell Rd & Rosser Terrace.
- Provide a northbound right turn lane at the intersection of Hugh Howell Rd & Cowan Rd.

Based on the results of the capacity, turn lane, and queueing analysis, the proposed Chick-Fil-A at 4431 Hugh Howell Rd, Tucker, GA is not expected to adversely impact the surrounding roadway network provided the proposed improvements mentioned on this report.

APPENDIX A

20 April 2022
120005-01-049 (ENG) - Chick-fil-A\120005-01-049 (ENG) - Tucker, GA (Hugh Howell Rd) (04095) Engineering\Engineering Plans\Exhibits\AT Entrance Exhibit\EX-1.3 - CFA, Tucker, GA (Hugh Howell Rd) - Rosser Terrace, Exhibit.dwg
THIS DOCUMENT, TOGETHER WITH THE CONCEPTS AND DESIGN PRESENTED HEREIN, IS AN INSTRUMENT OF SERVICE. IT IS LIMITED IN SCOPE AND INTENT TO THE SPECIFIC PURPOSE AND CLIENT FOR WHICH IT WAS PREPARED. NO OTHER PROJECTS OR APPLICATIONS OF THE INFORMATION CONTAINED HEREIN SHALL BE WITHOUT LIABILITY TO BOWMAN CONSULTING.



Chick-fil-A

Chick-fil-A
5200 BUFFINGTON RD
Atlanta, Georgia 30349-2998

Bowman

Certificate of Authorization License No. REF 095755
950 North Point Parkway Suite 200
Atlanta, GA 30005
Phone: (678) 374-6687
www.bowmanconsulting.com
© Bowman Consulting Group, Ltd.

CHICK-FIL-A
RELO TUCKER FSU
4435 HUGH HOWELL ROAD
TUCKER, GA 30084

FSU#04959
BUILDING TYPE / SIZE: P13-SE-LRG

REVISION SCHEDULE
NO. DATE DESCRIPTION

CONSULTANT PROJECT # 120005-01-049
ISSUED FOR PERMIT
DATE April 20, 2022
DRAWN BY BCG

Information contained on this drawing and in all digital files produced for above named project may not be reproduced in any manner without express written or verbal consent from authorized project representatives.

SHEET DILLARD ST
ACCESS EXHIBIT

SHEET NUMBER EX-1.3

APPENDIX B

TRAFFIC IMPACT STUDY CHICK-FIL-A, TUCKER, GA
SCOPING/METHODOLOGY STATEMENT

Scoping Meeting Date: Electronic Coordination

Applicant's Consultant: Bowman Consulting Group

Applicant's Contact information: Andrew J Petersen (321 -270 - 8987 / apetersen@bowman.com)

Daniela Jurado (321 -270 - 8977 / djurado@bowman.com)

(1) LOCATION OF PROPOSED PROJECT: **4431 Hugh Howell Rd, Tucker, GA 30084, See Figure 1.**

Municipality: City of Tucker, GA

County DeKalb County

(2) DESCRIPTION OF PROPOSED PROJECT:

The proposed development comprises a 4,989 square feet Fast-food restaurant with drive-thru window with 44 car stack, located at 4431 Hugh Howell Rd in the city of Tucker, Georgia. Access to the development will be provided by one (1) full-access driveway along Rosser Terrace.

Trip generation rates were extracted from the Institute of Transportation Engineers 10th Edition. The trip generation is presented in **Table 1**. The proposed Trip Distribution is presented in **Figure 2**.

(3) PURPOSE OF THE ASSESSMENT:

The purpose for the study is threefold: to determine the number of trips generated by the proposed site; to determine the potential impact, if any, of the proposed development on the roadway network; to propose improvements, if required.

Capacity analyses will be prepared for the No Build, Build conditions, and Build Conditions with Improvements (if required). Turn lane warrant analyses will be completed at the intersection of Hugh Howell Rd and Rosser Terrace. The results of the study will be summarized in a report document with graphics and back up data.

(4) DEVELOPMENT SCHEDULE:

Anticipated Opening Date: 2022

Analysis Date: 2022

(5) STUDY INTERSECTIONS (See Figure 2):

- Hugh Howell Rd and Rosser Terrace (Unsignalized Intersection)
- Hugh Howell Rd and Tucker Industrial Rd (Signalized Intersection)
- Hugh Howell Rd and Cowan Rd (Signalized Intersection)

(6) STUDY AREA TYPE: Urban: **x** Rural:

(7) ANALYSIS PERIODS AND TIMES:

AM Peak hour 7:00 AM - 09:00 AM
PM Peak hour 4:00 PM - 06:00 PM

(8) TRAFFIC ADJUSTMENT FACTORS:

(a) Seasonal Adjustment:	<u>To be determined upon coordination</u>	
(b) Annual Base Traffic Growth:	<u>See Table 2</u>	Source: Approximate Growth average from AADT's GDOT Traffic Count Data online

(9) OTHER PROJECTS WITHIN STUDY AREA TO BE ADDED TO BASE TRAFFIC:

To be determined upon coordination

(10) APPROVAL OF DATA COLLECTION ELEMENTS AND METHODOLOGIES:

<u>Proposed Location</u>	<u>Period (Avg Day)</u>	<u>Type</u>
-Hugh Howell Rd and Rosser Terrace	AM/PM	Turning Movement Counts
-Hugh Howell Rd and Tucker Industrial Rd	AM/PM	Turning Movement Counts
-Hugh Howell Rd and Cowan Rd	AM/PM	Turning Movement Counts

(11) CAPACITY/LOS ANALYSIS

<u>Location</u>	<u>Period (Avg Day)</u>	<u>Type</u>
-Hugh Howell Rd and Rosser Terrace	AM/PM	Synchro (HCS)
-Hugh Howell Rd and Tucker Industrial Rd	AM/PM	Synchro (HCS)
-Hugh Howell Rd and Cowan Rd	AM/PM	Synchro (HCS)

(12) ROADWAY IMPROVEMENTS/MODIFICATIONS BY OTHERS TO BE INCLUDED:

To be determine upon coordination

(13) OTHER NEEDED ANALYSES:

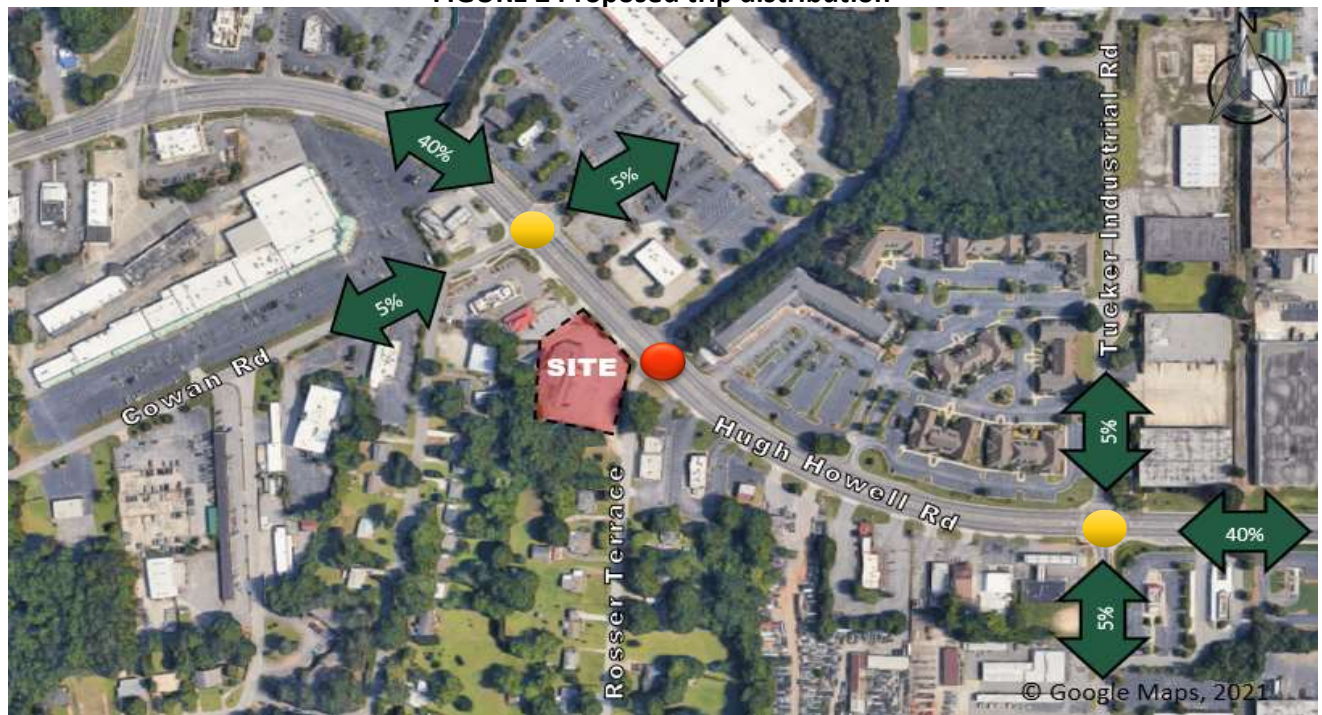
- (a) Signal Warrant Analysis:
No
- (b) Required Signal Phasing/Timing Modifications:
TBD
- (c) Analysis of the Need for Turning Lanes:
-Hugh Howell Rd and Rosser Terrace (Unsignalized Intersection)
- (d) Turning Lane Lengths:
95th Percentile Synchro Queue

(14) ADDITIONAL COMMENTS OR RECOMMENDATIONS RELATIVE TO THE SCOPE OF THIS PROJECT:

TRAFFIC IMPACT STUDY
SCOPING/METHODOLOGY STATEMENT



FIGURE 2 Proposed trip distribution



TRAFFIC IMPACT STUDY **SCOPING/METHODOLOGY STATEMENT**

TABLE 1

Land Use	Land Use Code ⁽¹⁾	Size	Daily Trips	Period	Peak Hour Trips			Pass by ⁽²⁾			Primary		
					In	Out	Total	In	Out	Total	In	Out	Total
Fast Food restaurant with Drive thru	934	4,989 SF	2,350	AM	102	99	201	50	49	99	52	50	102
				PM	85	78	163	43	39	82	42	39	81

(1) Based on the Institute of Transportation Engineers Trip Generation, 10th Edition

(1) Pass-By rates of 49% for the AM Peak Hour and 50% for the PM Peak Hour were extracted from the ITE Trip Generation Handbook, 3rd Edition

TABLE 2

Roadway	From	to	2015	2016	2017	2018	2019	2016	2017	2018	2019	Avg Growth rate	Applied Growth rate
Hugh Howell Rd	Lawrenceville Hwy	Mountain Industrial Blvd	21,700	22,400	25,600	25,600	24,400	3.2%	14.3%	0.0%	-4.7%	3.2%	3.2%
Rosser Terrace	N/A	N/A	-	-	-	-	-	-	-	-	-	No Data	0.5%
Tucker Industrial Rd	N/A	N/A	-	-	-	-	-	-	-	-	-	No Data	0.5%
Cowan Rd	N/A	N/A	-	-	-	-	-	-	-	-	-	No Data	0.5%

Source: Approximate Growth average from 2015-2019 AADT's GDOT Traffic Count Database System (TCDS).

<https://gdottrafficdata.drakewell.com/publicmultinodemap.asp>

A 0.5% minimum growth rate for the roads was assumed based on the City of Tucker population growth rate.

Rodrigo Meirelles

From: Ken Hildebrandt <KHildebrandt@Tuckerga.gov>
Sent: Wednesday, June 9, 2021 5:23 PM
To: Daniela Jurado
Cc: Andrew Petersen; Rodrigo Meirelles
Subject: [EXTERNAL] RE: [External]RE: [External]RE: Chick-fil-A Tucker Methodology Coordination

Yes, these will be a good representation.



**City of
Tucker**

KEN HILDEBRANDT, PE, PTOE
CITY ENGINEER

M: 770-865-5645

E: khildebrandt@tuckerga.gov W: tuckerga.gov



From: Daniela Jurado <djurado@bowman.com>
Sent: Wednesday, June 9, 2021 4:15 PM
To: Ken Hildebrandt <KHildebrandt@Tuckerga.gov>
Cc: Andrew Petersen <apetersen@bowman.com>; Rodrigo Meirelles <rmeirelles@bowman.com>
Subject: [External]RE: [External]RE: Chick-fil-A Tucker Methodology Coordination

Good Afternoon Ken,

We received some trip generation information today of some CFA locations in the Great Atlanta area, average weekday (M-Th) information from 2 months in 2019 and February 2021 when school was in session. The locations are the following:

- 1- 2580 Piedmont Rd
- 2- 2340 N Druid Hills Rd
- 3- 1100 Northside Dr

Sincerely,

DANIELA JURADO

Project Manager | **BOWMAN**

4450 W Eau Gallie Boulevard, Suite 144, Melbourne, FL 32934

O: (321) 270-8905 | D: (321) 270-8977 | M: (786) 370-2762

djurado@bowman.com | bowman.com



From: Ken Hildebrandt <KHildebrandt@Tuckerga.gov>
Sent: Wednesday, June 9, 2021 8:23 AM
To: Daniela Jurado <djurado@bowman.com>

Cc: Andrew Petersen <apetersen@bowman.com>; Rodrigo Meirelles <rmeirelles@bowman.com>

Subject: [EXTERNAL] RE: [External]RE: Chick-fil-A Tucker Methodology Coordination

What is the ADT on the street in Miami?

Is it a comparable site?



KEN HILDEBRANDT, PE, PTOE

CITY ENGINEER

M: 770-865-5645

E: khildebrandt@tuckerga.gov W: tuckerga.gov



From: Daniela Jurado <djurado@bowman.com>

Sent: Tuesday, June 8, 2021 2:21 PM

To: Ken Hildebrandt <KHildebrandt@Tuckerga.gov>

Cc: Andrew Petersen <apetersen@bowman.com>; Rodrigo Meirelles <rmeirelles@bowman.com>

Subject: [External]RE: Chick-fil-A Tucker Methodology Coordination

Good Afternoon Ken,

For the trip generation of the CFA we have conducted a trip generation study for a CFA in the Miami Dade area. Is it possible for us to use this trip generation study results to evaluate the trip generation for this site?

Thank you,

DANIELA JURADO

Project Manager | **BOWMAN**

4450 W Eau Gallie Boulevard, Suite 144, Melbourne, FL 32934

O: (321) 270-8905 | D: (321) 270-8977 | M: (786) 370-2762

djurado@bowman.com | bowman.com



From: Daniela Jurado

Sent: Tuesday, June 8, 2021 8:47 AM

To: Ken Hildebrandt <KHildebrandt@Tuckerga.gov>

Subject: RE: Chick-fil-A Tucker Methodology Coordination

Thank you,

DANIELA JURADO

Project Manager | **BOWMAN**

4450 W Eau Gallie Boulevard, Suite 144, Melbourne, FL 32934

O: (321) 270-8905 | D: (321) 270-8977 | M: (786) 370-2762

djurado@bowman.com | bowman.com



From: Ken Hildebrandt <KHildebrandt@Tuckerga.gov>
Sent: Tuesday, June 8, 2021 8:36 AM
To: Daniela Jurado <djurado@bowman.com>
Subject: [EXTERNAL] Chick-fil-A Tucker Methodology Coordination

DeKalb County maintains our traffic signals. You may be able to get this information from Demetria Allen.
dfchambliss@dekalbcountyga.gov



KEN HILDEBRANDT, PE, PTOE
CITY ENGINEER

M: 770-865-5645

E: khildebrandt@tuckerga.gov W: tuckerga.gov



From: Daniela Jurado <djurado@bowman.com>
Sent: Tuesday, June 8, 2021 8:28 AM
To: Ken Hildebrandt <KHildebrandt@Tuckerga.gov>; Rodrigo Meirelles <rmeirelles@bowman.com>; Courtney Smith <CSmith@Tuckerga.gov>; Kylie Thomas <kthomas@tuckerga.gov>
Cc: Andrew Petersen <apetersen@bowman.com>
Subject: [External]RE: [External]RE: [External]RE: Chick-fil-A Tucker Methodology Coordination

Good Morning Ken,

Is there a way we can get the signal phasing and timings for the intersections of Hugh Howell Rd and Tucker Industrial Rd and Hugh Howell Rd and Cowan Rd?

Thank you,

DANIELA JURADO

Project Manager | **BOWMAN**

4450 W Eau Gallie Boulevard, Suite 144, Melbourne, FL 32934

O: (321) 270-8905 | D: (321) 270-8977 | M: (786) 370-2762

djurado@bowman.com | bowman.com



From: Ken Hildebrandt <KHildebrandt@Tuckerga.gov>
Sent: Monday, June 7, 2021 3:21 PM
To: Daniela Jurado <djurado@bowman.com>; Rodrigo Meirelles <rmeirelles@bowman.com>; Courtney Smith <CSmith@Tuckerga.gov>; Kylie Thomas <kthomas@tuckerga.gov>
Cc: Andrew Petersen <apetersen@bowman.com>
Subject: [EXTERNAL] RE: [External]RE: [External]RE: Chick-fil-A Tucker Methodology Coordination

No further comments at this time.



KEN HILDEBRANDT, PE, PTOE
CITY ENGINEER

M: 770-865-5645

E: khildebrandt@tuckerga.gov W: tuckerga.gov



From: Daniela Jurado <djurado@bowman.com>

Sent: Monday, June 7, 2021 3:18 PM

To: Ken Hildebrandt <KHildebrandt@Tuckerga.gov>; Rodrigo Meirelles <rmeirelles@bowman.com>; Courtney Smith <CSmith@Tuckerga.gov>; Kylie Thomas <kthomas@tuckerga.gov>

Cc: Andrew Petersen <apetersen@bowman.com>

Subject: [External]RE: [External]RE: Chick-fil-A Tucker Methodology Coordination

Thank you Ken,

We will start working on the best locations to get this data collected. Besides the trip generation, is there any other comments on the proposed methodology?

Sincerely,

DANIELA JURADO

Project Manager | **BOWMAN**

4450 W Eau Gallie Boulevard, Suite 144, Melbourne, FL 32934

O: (321) 270-8905 | D: (321) 270-8977 | M: (786) 370-2762

djurado@bowman.com | bowman.com



From: Ken Hildebrandt <KHildebrandt@Tuckerga.gov>

Sent: Monday, June 7, 2021 12:46 PM

To: Daniela Jurado <djurado@bowman.com>; Rodrigo Meirelles <rmeirelles@bowman.com>; Courtney Smith <CSmith@Tuckerga.gov>; Kylie Thomas <kthomas@tuckerga.gov>

Cc: Andrew Petersen <apetersen@bowman.com>

Subject: [EXTERNAL] RE: [External]RE: Chick-fil-A Tucker Methodology Coordination

Again, I think that a Chick fil-A is a different animal and is not accurately represented in this trip generation category.



KEN HILDEBRANDT, PE, PTOE
CITY ENGINEER

M: 770-865-5645

E: khildebrandt@tuckerga.gov W: tuckerga.gov



From: Daniela Jurado <djurado@bowman.com>

Sent: Monday, June 7, 2021 9:53 AM

To: Ken Hildebrandt <KHildebrandt@Tuckerga.gov>; Rodrigo Meirelles <rmeirelles@bowman.com>; Courtney Smith <CSmith@Tuckerga.gov>; Kylie Thomas <kthomas@tuckerga.gov>

Cc: Andrew Petersen <apetersen@bowman.com>

Subject: [External]RE: Chick-fil-A Tucker Methodology Coordination

Good Morning Ken,

Would it be possible for us to use the ITE mean values plus one standard deviation. That would leave the following trip generation:

Mean

Land Use	Land Use Code ⁽¹⁾	Size	Daily Trips	Period	Peak Hour Trips			Pass. by ⁽²⁾		
					In	Out	Total	In	Out	Total
Fast Food restaurant with Drive thru	934	4,989	1,893	AM	103	98	201	50	48	99
				PM	85	78	163	42	38	80

(1) Based on the Institute of Transportation Engineers Trip Generation, 10th Edition

(1) Pass-By rates of 49% were extracted from the Institute of Transportation Engineers Trip Generation Handbook, 3rd Edition

Mean +1 std dev

Land Use	Land Use Code ⁽¹⁾	Size	Daily Trips	Period	Peak Hour Trips			Pass. by ⁽²⁾		
					In	Out	Total	In	Out	Total
Fast Food restaurant with Drive thru	934	4,989	1,893	AM	175	169	344	86	83	169
				PM	131	121	252	64	59	123

(1) Based on the Institute of Transportation Engineers Trip Generation, 10th Edition

(1) Pass-By rates of 49% were extracted from the Institute of Transportation Engineers Trip Generation Handbook, 3rd Edition

Would you agree with this approach?

Thank you,

DANIELA JURADO

Project Manager | **BOWMAN**

4450 W Eau Gallie Boulevard, Suite 144, Melbourne, FL 32934

O: (321) 270-8905 | D: (321) 270-8977 | M: (786) 370-2762

djurado@bowman.com | bowman.com



From: Ken Hildebrandt <KHildebrandt@Tuckerga.gov>

Sent: Monday, June 7, 2021 8:18 AM

To: Rodrigo Meirelles <rmeirelles@bowman.com>; Courtney Smith <CSmith@Tuckerga.gov>; Kylie Thomas <kthomas@tuckerga.gov>

Cc: Daniela Jurado <djurado@bowman.com>; Andrew Petersen <apetersen@bowman.com>

Subject: [EXTERNAL] Chick-fil-A Tucker Methodology Coordination

Rodrigo,

A Chick fil-A restaurant is rather unique and does not fit in the mold of Code 934 for a Fast Food Restaurant. Actual trip generation will be significantly higher. A more accurate estimate would be to provide counts at an existing comparably sized Chick fil-A.

You can call me at the number below with any questions.



KEN HILDEBRANDT, PE, PTOE
CITY ENGINEER

M: 770-865-5645

E: khildebrandt@tuckerga.gov W: tuckerga.gov



From: Rodrigo Meirelles <rmeirelles@bowman.com>

Sent: Thursday, June 3, 2021 10:18 AM

To: Ken Hildebrandt <KHildebrandt@Tuckerga.gov>; Courtney Smith <CSmith@Tuckerga.gov>; Kylie Thomas <kthomas@tuckerga.gov>

Cc: Daniela Jurado <djurado@bowman.com>; Andrew Petersen <apetersen@bowman.com>

Subject: [External]Chick-fil-A Tucker Methodology Coordination

Good Morning Ken, Courtney, and Kylie,

I am contacting you regarding a Chick-fil-A project at 4431 Hugh Howell Rd, Tucker, GA. The site will be replacing the existing Presbyterian Church. Attached you will find a Methodology Statement with the Trip Generation for this site and a Current Site Plan.

We want to schedule a meeting with the City of Tucker to verify that our methodology for this Traffic Impact Study is acceptable. Could you reply to this email with the best time for you to discuss this project?

Thank you in advance.

Sincerely,

RODRIGO MEIRELLES VAN VLIET

Engineer I | **BOWMAN**

4450 W Eau Gallie Boulevard, Suite 144, Melbourne, FL 32934

O: (321) 270-8905

rmeirelles@bowman.com | bowman.com



Rodrigo Meirelles

From: Rodrigo Meirelles
Sent: Wednesday, June 9, 2021 10:48 AM
To: Mathis, Renaldo M
Cc: Daniela Jurado; Andrew Petersen
Subject: RE: Chick-fil-A Tucker Methodology Coordination - GDOT

That will work, thank you very much Renaldo. Can you please include Daniela Jurado (djurado@bowman.com) and Andrew Petersen (apetersen@bowman.com) to the meeting invite as well?

Sincerely,

RODRIGO MEIRELLES VAN VLIET

Engineer I | **BOWMAN**

O: (321) 270-8905

rmeirelles@bowman.com

From: Mathis, Renaldo M <RMathis@dot.ga.gov>
Sent: Wednesday, June 9, 2021 10:35 AM
To: Rodrigo Meirelles <rmeirelles@bowman.com>
Subject: [EXTERNAL] RE: Chick-fil-A Tucker Methodology Coordination - GDOT

I will set the meeting on Microsoft teams for Tuesday at 1.

Thanks,

Renaldo M. Mathis

Civil Engineer II

Serving City of Atlanta & DeKalb County



District 7 Office of *Traffic Operations*
5025 New Peachtree Road
Chamblee, GA, 30341
770.216.3993 office
404.655.8946 mobile

From: Rodrigo Meirelles <rmeirelles@bowman.com>
Sent: Wednesday, June 9, 2021 10:20 AM
To: Mathis, Renaldo M <RMathis@dot.ga.gov>
Cc: Daniela Jurado <djurado@bowman.com>; Andrew Petersen <apetersen@bowman.com>
Subject: RE: Chick-fil-A Tucker Methodology Coordination - GDOT

Hello Renaldo,

Sorry for misspelling your name at first. Either one of these days will work for us. Let us know what time works best for you and your manager.

Thank you,

RODRIGO MEIRELLES VAN VLIET

Engineer I | **BOWMAN**

O: (321) 270-8905

rmeirelles@bowman.com

From: Mathis, Renaldo M <RMathis@dot.ga.gov>

Sent: Wednesday, June 9, 2021 9:35 AM

To: Rodrigo Meirelles <rmeirelles@bowman.com>

Subject: [EXTERNAL] RE: Chick-fil-A Tucker Methodology Coordination - GDOT

Good morning Rodrigo,

I can set a meeting for sometime early next week if that works for you. I m going to speak with my manager to see what times work best based on the day you prefer. I'm thinking sometime Monday or Tuesday. How does these dates sound to you?

Thanks,

Renaldo M. Mathis

Civil Engineer II

Serving City of Atlanta & DeKalb County



District 7 Office of *Traffic Operations*

5025 New Peachtree Road

Chamblee, GA, 30341

770.216.3993 office

404.655.8946 mobile

From: Rodrigo Meirelles <rmeirelles@bowman.com>

Sent: Wednesday, June 9, 2021 9:12 AM

To: Mathis, Renaldo M <RMathis@dot.ga.gov>

Cc: Andrew Petersen <apetersen@bowman.com>; Daniela Jurado <djurado@bowman.com>

Subject: RE: Chick-fil-A Tucker Methodology Coordination - GDOT

Good Morning Ronaldo,

I wanted to follow up on my previous email and see if you received my previous email with the attached methodology for this project, and if there is any additional information you require for the TIA of this project.

Please do not hesitate to contact us.

Thank you in advance,

RODRIGO MEIRELLES VAN VLIET

Engineer I | **BOWMAN**

O: (321) 270-8905

rmeirelles@bowman.com

From: Rodrigo Meirelles

Sent: Thursday, June 3, 2021 2:06 PM

To: rmathis@dot.ga.gov

Cc: Andrew Petersen <apetersen@bowman.com>; Daniela Jurado <djurado@bowman.com>

Subject: Chick-fil-A Tucker Methodology Coordination - GDOT

Good Morning Ronaldo,

I am contacting you regarding a Chick-fil-A project at 4431 Hugh Howell Rd, Tucker, GA. The site will be replacing the existing Presbyterian Church. Attached you will find a Methodology Statement with the Trip Generation for this site and the most recent Site Plan.

We want to schedule a meeting with the GDOT to verify that our methodology for this Traffic Impact Study is acceptable. Could you reply to this email with the best time for you to discuss this project?

Thank you in advance.

Sincerely,

RODRIGO MEIRELLES VAN VLIET

Engineer I | **BOWMAN**

4450 W Eau Gallie Boulevard, Suite 144, Melbourne, FL 32934

O: (321) 270-8905

rmeirelles@bowman.com | bowman.com

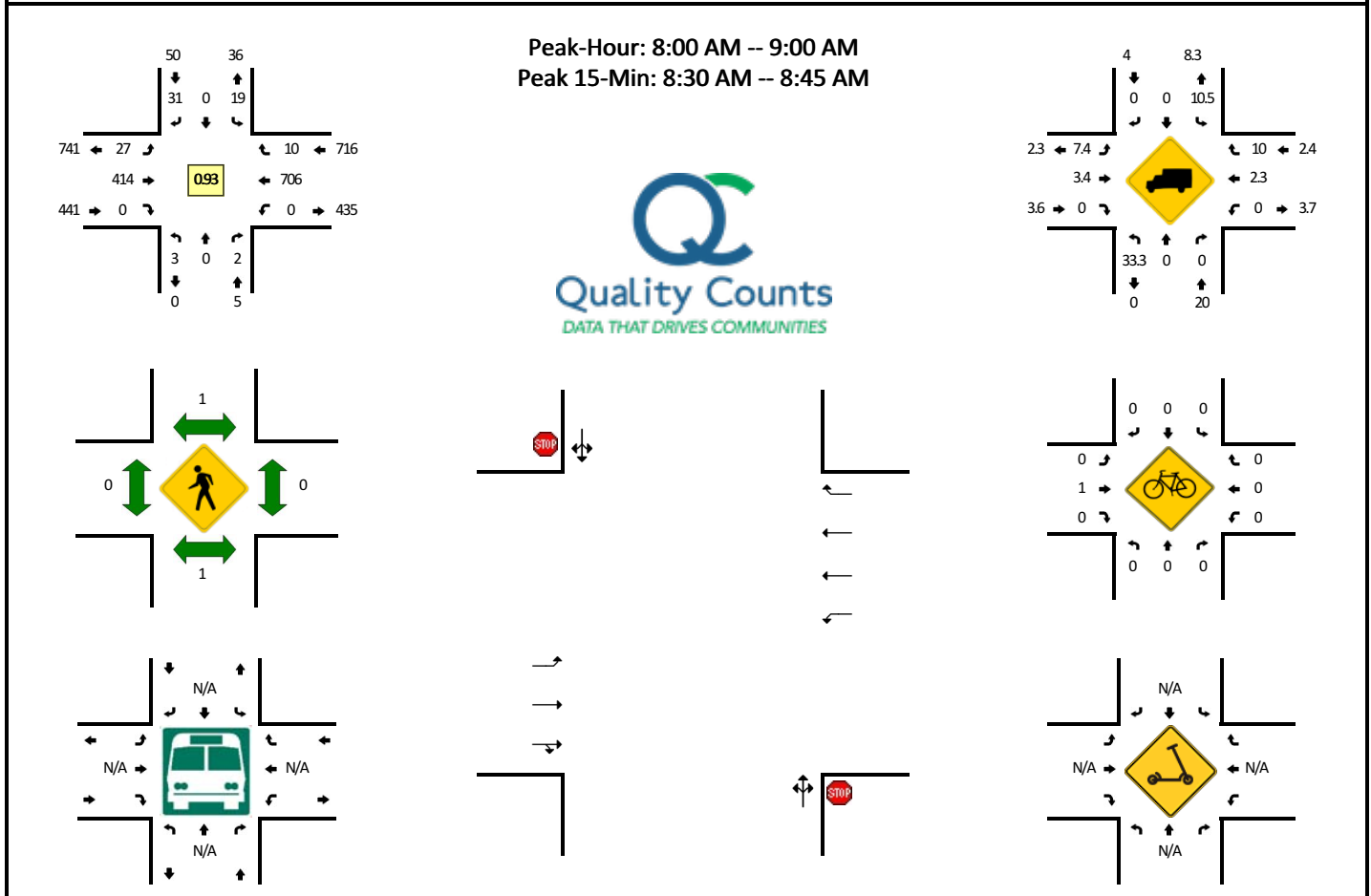


Georgia is a state of natural beauty. And it's a state that spends millions each year cleaning up litter that not only mars that beauty, but also affects road safety, the environment and the economy. Do your part – don't litter. How can you play an active role in protecting the splendor of the Peach State? Find out at <http://keepgaclean.com/>.

APPENDIX C

LOCATION: Rosser Ter -- Hugh Howell Rd
CITY/STATE: Tucker, GA

QC JOB #: 15488401
DATE: Tue, Jun 15 2021

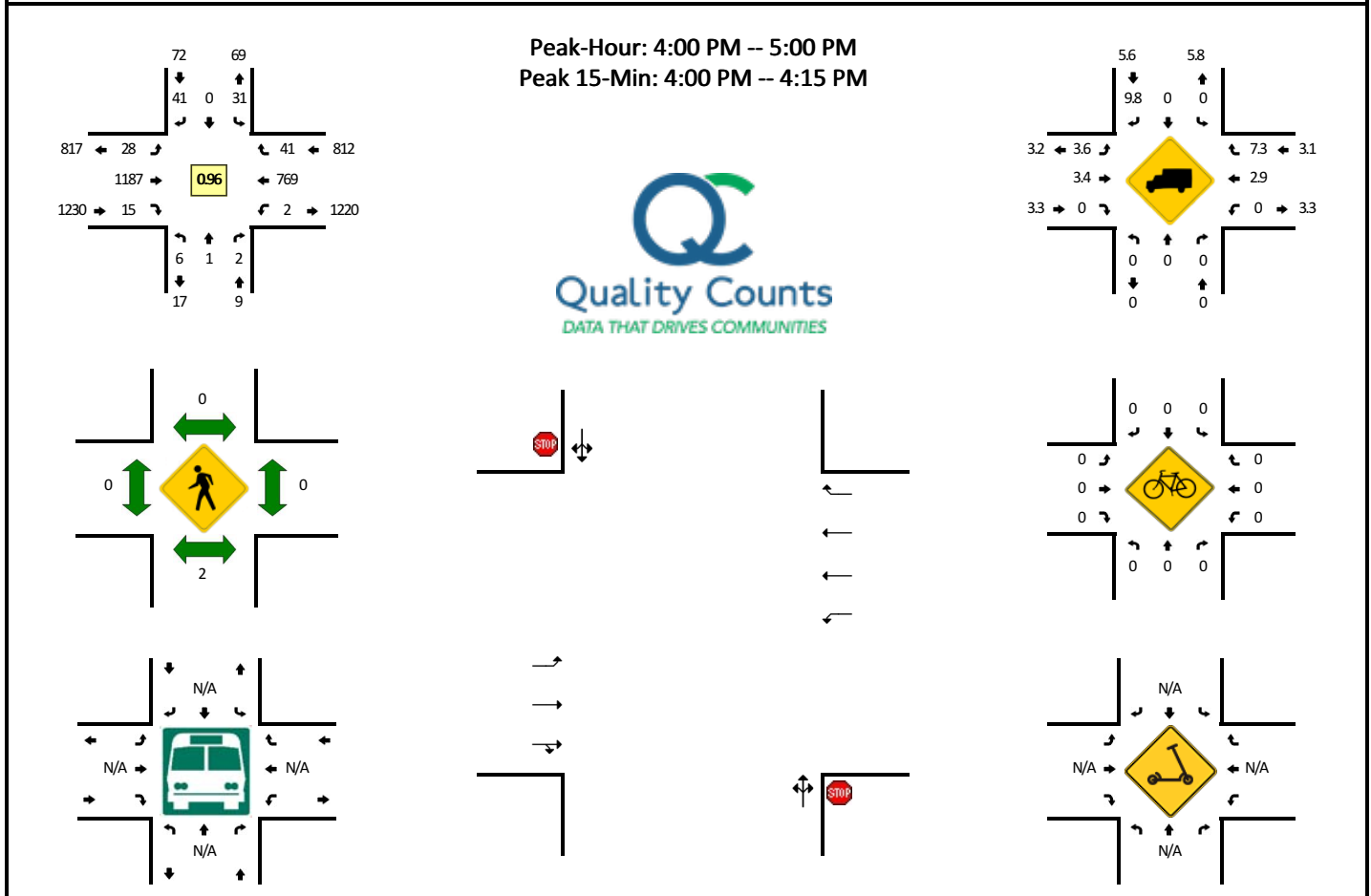


15-Min Count Period Beginning At	Rosser Ter (Northbound)				Rosser Ter (Southbound)				Hugh Howell Rd (Eastbound)				Hugh Howell Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
7:00 AM	2	0	0	0	2	0	7	0	1	59	0	0	0	118	5	0	194	
7:15 AM	2	0	0	0	5	0	5	0	1	87	0	0	0	124	2	0	226	
7:30 AM	2	0	0	0	3	1	4	0	11	60	0	0	1	167	3	0	252	
7:45 AM	4	0	1	0	5	0	12	0	2	98	1	0	0	165	3	0	291	963
8:00 AM	0	0	0	0	3	0	7	0	4	100	0	0	0	170	2	0	286	1055
8:15 AM	1	0	1	0	4	0	8	0	6	103	0	0	0	168	4	0	295	1124
8:30 AM	1	0	0	0	7	0	8	0	5	107	0	0	0	196	2	0	326	1198
8:45 AM	1	0	1	0	5	0	8	0	11	104	0	1	0	172	2	0	305	1212
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	4	0	0	0	28	0	32	0	20	428	0	0	0	784	8	0	1304	
Heavy Trucks	0	0	0	0	0	0	0	0	0	20	0	0	0	4	0	0	24	
Buses																		
Pedestrians		4				0				0				0			4	
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0	
Scooters																		

Comments:

LOCATION: Rosser Ter -- Hugh Howell Rd
CITY/STATE: Tucker, GA

QC JOB #: 15488402
DATE: Tue, Jun 15 2021

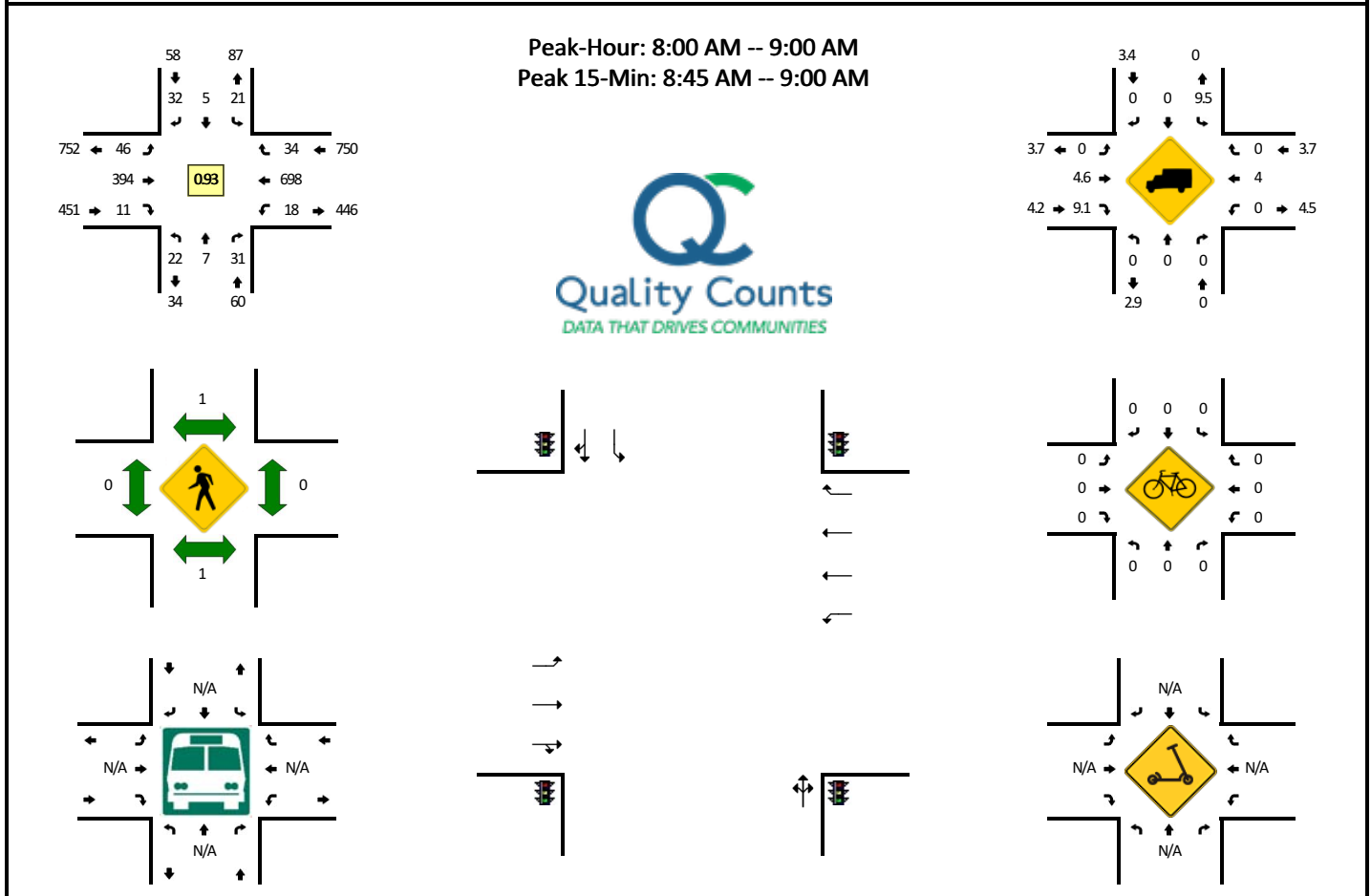


15-Min Count Period Beginning At	Rosser Ter (Northbound)				Rosser Ter (Southbound)				Hugh Howell Rd (Eastbound)				Hugh Howell Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	0	0	0	0	9	0	11	0	3	315	3	0	0	203	8	0	552	
4:15 PM	2	0	0	0	9	0	6	0	12	294	3	0	1	196	12	0	535	
4:30 PM	3	0	1	0	6	0	11	0	4	329	6	0	0	169	11	0	540	
4:45 PM	1	1	1	0	7	0	13	0	8	249	3	1	1	201	10	0	496	2123
5:00 PM	0	0	1	0	6	0	11	0	2	285	6	0	0	187	9	0	507	2078
5:15 PM	3	0	0	0	9	0	9	0	7	332	2	0	1	193	11	0	567	2110
5:30 PM	2	0	0	0	2	0	11	0	7	302	2	0	0	165	9	0	500	2070
5:45 PM	1	0	1	0	1	1	7	0	9	316	7	0	0	189	5	0	537	2111
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	0	0	0	0	36	0	44	0	12	1260	12	0	0	812	32	0	2208	
Heavy Trucks	0	0	0	0	0	0	4	0	0	32	0	0	0	32	4	0	72	
Buses																		
Pedestrians		4				0				0				0			4	
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0	
Scooters																		

Comments:

LOCATION: Cowan Rd -- Hugh Howell Rd
CITY/STATE: Tucker, GA

QC JOB #: 15488403
DATE: Tue, Jun 15 2021



15-Min Count Period Beginning At	Cowan Rd (Northbound)				Cowan Rd (Southbound)				Hugh Howell Rd (Eastbound)				Hugh Howell Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
7:00 AM	2	0	7	0	0	2	1	0	8	52	3	0	3	125	2	0	205	
7:15 AM	4	2	8	0	4	0	3	0	5	74	1	0	6	122	7	0	236	
7:30 AM	4	0	5	0	3	0	6	0	8	63	4	0	7	161	5	0	266	
7:45 AM	4	1	3	0	4	4	4	0	7	91	2	1	6	174	3	0	304	1011
8:00 AM	8	2	9	0	3	3	7	0	11	90	0	0	6	163	11	0	313	1119
8:15 AM	3	3	8	0	6	0	7	0	13	95	4	0	3	170	3	0	315	1198
8:30 AM	4	1	4	0	6	1	6	0	6	99	3	0	6	190	9	0	335	1267
8:45 AM	7	1	10	0	6	1	12	0	16	110	4	0	3	175	11	0	356	1319
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	28	4	40	0	24	4	48	0	64	440	16	0	12	700	44	0	1424	
Heavy Trucks	0	0	0	0	4	0	0	0	0	16	4	0	0	32	0	0	56	
Buses																		
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Scooters																		

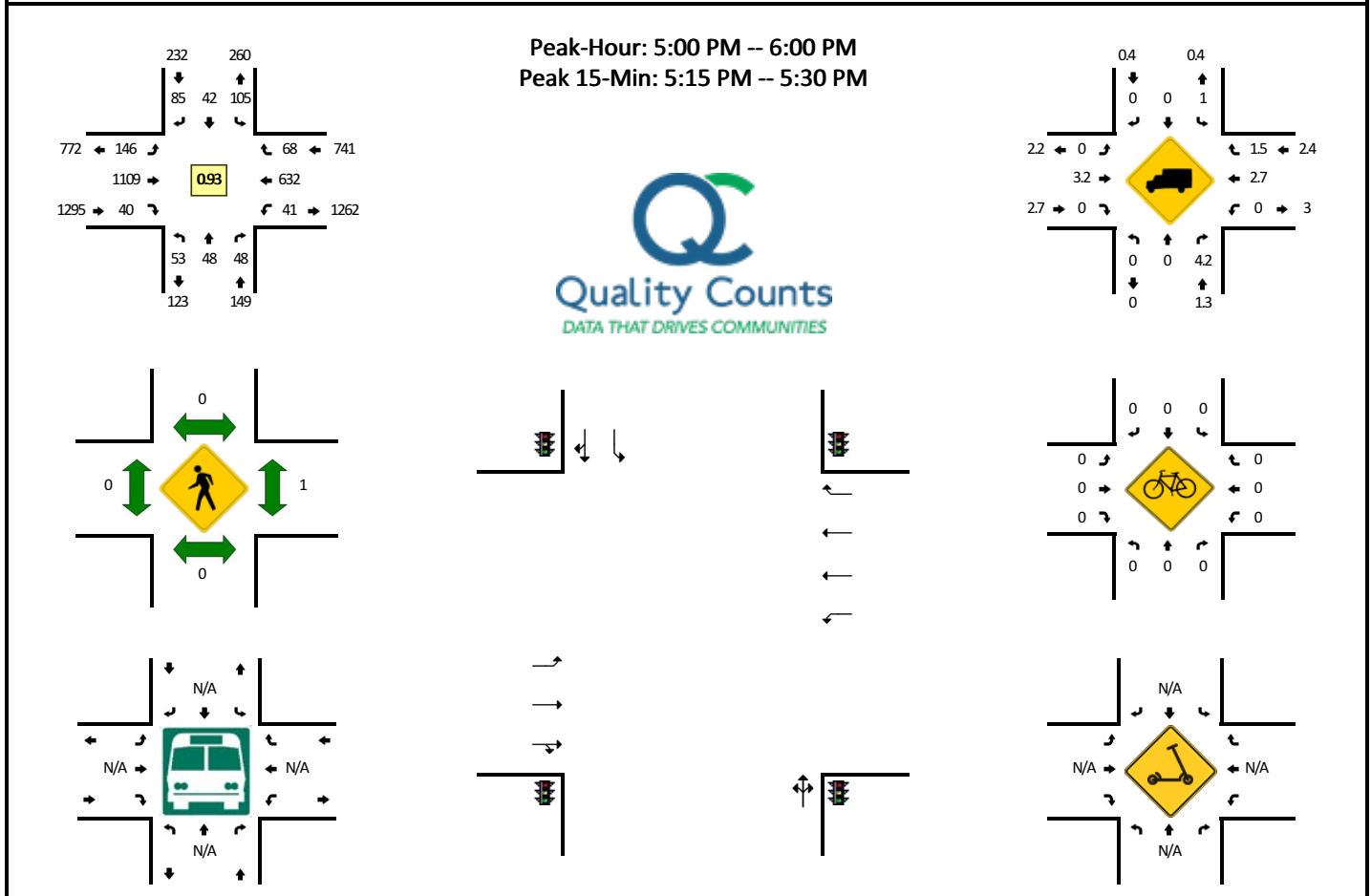
Comments:

Report generated on 6/21/2021 10:17 AM

SOURCE: Quality Counts, LLC (<http://www.qualitycounts.net>) 1-877-580-2212

LOCATION: Cowan Rd -- Hugh Howell Rd
CITY/STATE: Tucker, GA

QC JOB #: 15488404
DATE: Tue, Jun 15 2021

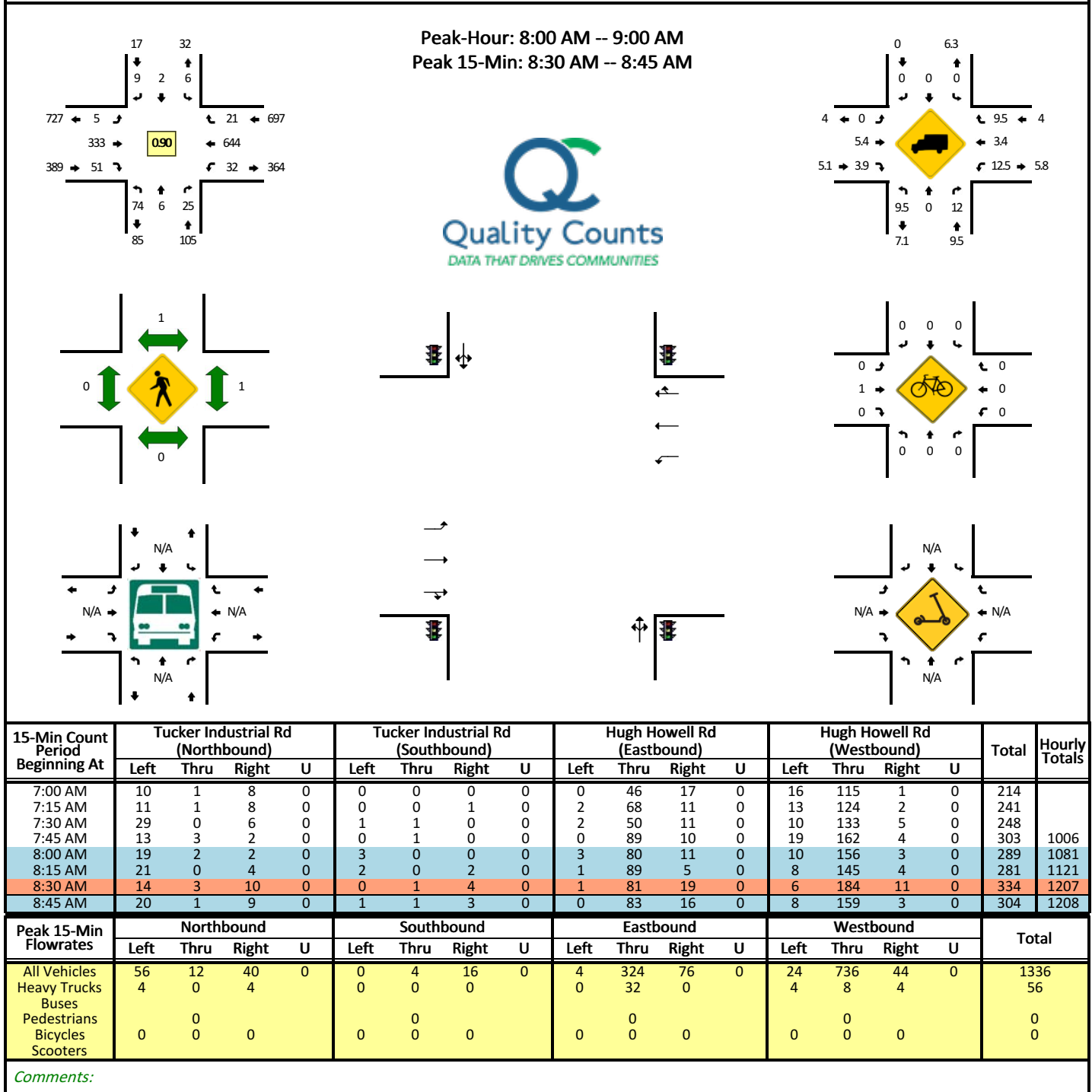


15-Min Count Period Beginning At	Cowan Rd (Northbound)				Cowan Rd (Southbound)				Hugh Howell Rd (Eastbound)				Hugh Howell Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	11	6	13	0	18	7	29	0	37	291	18	0	15	181	17	0	643	
4:15 PM	18	5	19	0	23	14	29	0	37	260	7	0	9	159	22	0	602	
4:30 PM	9	11	11	0	19	5	15	0	35	301	5	0	14	159	13	0	597	
4:45 PM	13	7	11	0	26	9	25	0	29	228	10	0	11	175	24	0	568	2410
5:00 PM	11	13	8	0	24	6	15	0	46	268	16	0	8	153	17	0	585	2352
5:15 PM	15	12	15	0	22	10	24	0	36	296	9	1	10	183	16	0	649	2399
5:30 PM	13	8	17	0	25	14	19	0	37	258	8	1	12	144	17	0	573	2375
5:45 PM	14	15	8	0	34	12	27	0	25	287	7	0	11	152	18	0	610	2417
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	60	48	60	0	88	40	96	0	144	1184	36	4	40	732	64	0	2596	
Heavy Trucks	0	0	4	0	0	0	0	0	0	36	0	0	0	4	0	0	44	
Buses																		
Pedestrians	0	0			0	0			0	0			0	0			0	
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0	
Scoters																		

Comments:

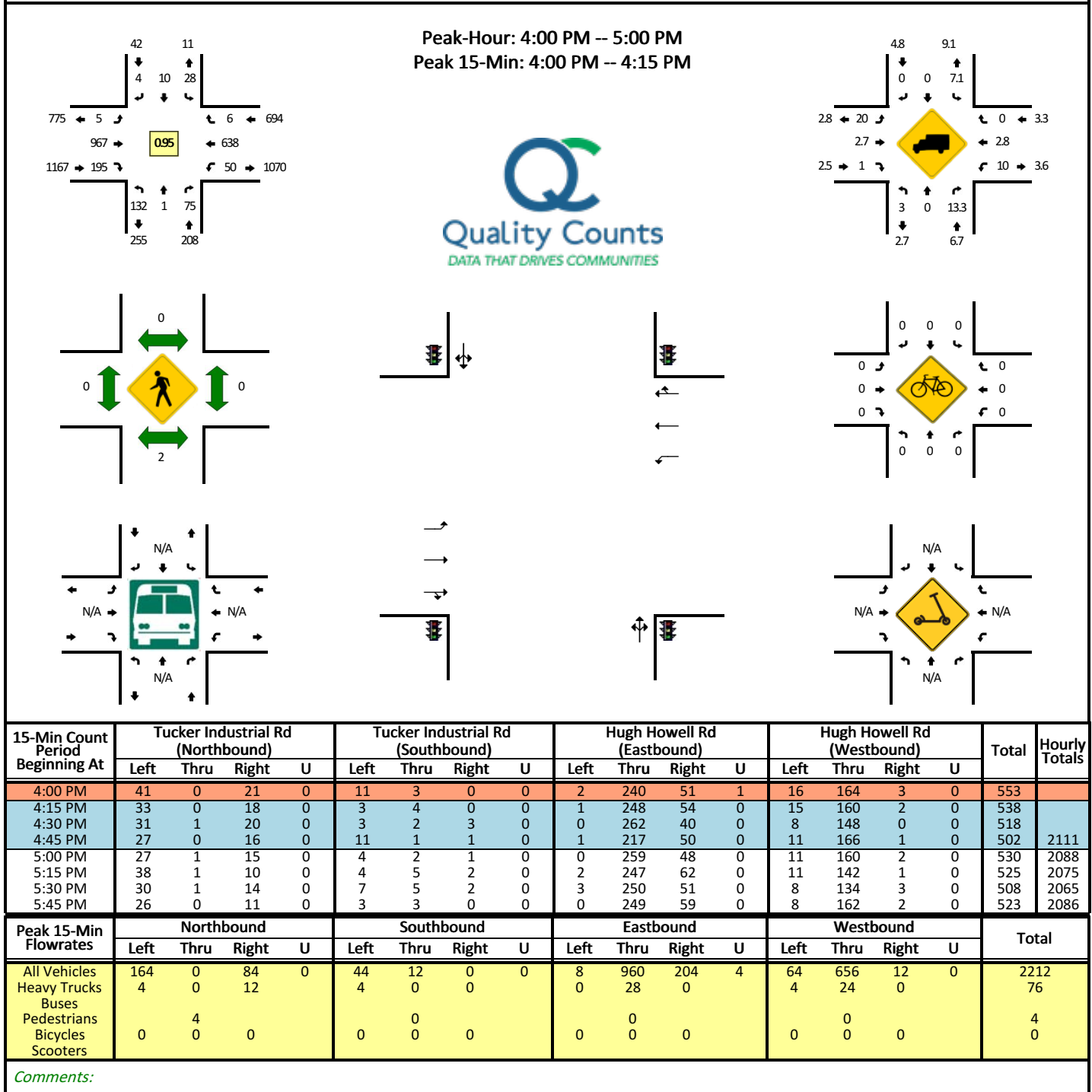
LOCATION: Tucker Industrial Rd -- Hugh Howell Rd
CITY/STATE: Tucker, GA

QC JOB #: 15488405
DATE: Tue, Jun 15 2021



LOCATION: Tucker Industrial Rd -- Hugh Howell Rd
CITY/STATE: Tucker, GA

QC JOB #: 15488406
DATE: Tue, Jun 15 2021



Project ID: 22-180036-001
Location: Dillard St & Cowan Rd
City: Tucker

Day: Tuesday
Date: 3/1/2022

Groups Printed - Cars, PU, Vans - Heavy Trucks

	Dillard St Northbound						Dillard St Southbound						Cowan Rd Eastbound						Cowan Rd Westbound							
Start Time	Left	Thru	Rgt	Uturn	Peds	App. Total	Left	Thru	Rgt	Uturn	Peds	App. Total	Left	Thru	Rgt	Uturn	Peds	App. Total	Left	Thru	Rgt	Uturn	Peds	App. Total	Int. Total	
7:00 AM	1	0	5	0	1	6	0	0	0	0	0	0	0	13	0	0	0	0	13	2	3	0	0	0	5	24
7:15 AM	0	0	14	0	0	14	0	0	0	0	0	0	0	9	0	0	0	0	9	1	8	0	0	0	9	32
7:30 AM	0	0	7	0	1	7	0	0	0	0	0	0	0	8	0	0	0	0	8	4	7	0	0	0	11	26
7:45 AM	5	0	6	0	0	11	0	0	0	0	0	0	0	27	0	0	0	0	27	4	10	0	0	0	14	52
Total	6	0	32	0	2	38	0	0	0	0	0	0	0	57	0	0	0	0	57	11	28	0	0	0	39	134
8:00 AM	2	0	5	0	0	7	0	0	0	0	0	0	0	13	1	0	0	0	14	3	9	0	0	0	12	33
8:15 AM	2	0	4	0	0	6	0	0	0	0	0	0	0	14	0	0	0	0	14	1	20	0	0	0	21	41
8:30 AM	0	0	2	0	0	2	0	0	0	0	0	0	0	16	1	0	1	17	1	9	0	0	0	10	29	
8:45 AM	0	0	4	0	0	4	0	0	0	0	0	0	0	10	0	0	0	10	2	13	0	0	0	15	29	
Total	4	0	15	0	0	19	0	0	0	0	0	0	0	53	2	0	1	55	7	51	0	0	0	58	132	
BREAK																										
4:00 PM	2	0	7	0	0	9	0	0	0	0	0	0	0	43	2	0	0	45	4	20	0	0	0	24	78	
4:15 PM	0	0	6	0	1	6	0	0	0	0	0	0	0	44	1	0	1	45	3	15	0	0	0	18	69	
4:30 PM	0	0	8	0	2	8	0	0	0	0	0	0	0	38	2	0	1	40	3	28	0	0	0	31	79	
4:45 PM	1	0	10	0	0	11	0	0	0	0	0	0	0	23	1	0	0	24	5	26	0	1	0	32	67	
Total	3	0	31	0	3	34	0	0	0	0	0	0	0	148	6	0	2	154	15	89	0	1	0	105	293	
5:00 PM	0	0	5	0	1	5	0	0	0	0	0	0	0	26	1	0	0	27	7	28	0	0	2	35	67	
5:15 PM	2	0	6	0	0	8	0	0	0	0	0	0	0	36	0	0	0	36	6	30	0	0	0	36	80	
5:30 PM	0	0	12	0	0	12	0	0	0	0	0	0	0	35	2	0	0	37	7	20	0	0	0	27	76	
5:45 PM	0	0	6	0	0	6	0	0	0	0	0	0	0	37	1	0	0	38	7	19	0	0	0	26	70	
Total	2	0	29	0	1	31	0	0	0	0	0	0	0	134	4	0	0	138	27	97	0	0	2	124	293	
Grand Total	15	0	107	0	6	122	0	0	0	0	0	0	0	392	12	0	3	404	60	265	0	1	2	326	852	
Apprch %	12.3	0.0	87.7	0.0	4.9		0.0	0.0	0.0	0.0	0.0		0.0	97.0	3.0	0.0	0.7		18.4	81.3	0.0	0.3	0.6			
Total %	1.8	0.0	12.6	0.0	0.7	14.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	46.0	1.4	0.0	0.4	47.4	7.0	31.1	0.0	0.1	0.2	38.3		
Cars, PU, Vans	15	0	105	0		120	0	0	0	0		0	0	382	10	0		392	60	255	0	1		316	828	
% Cars, PU, Vans	100.0	0.0	98.1	0.0		98.4	0.0	0.0	0.0	0.0		0.0	0.0	97.4	83.3	0.0		97.0	100.0	96.2	0.0	100.0		96.9	97.2	
Heavy trucks	0	0	2	0		2	0	0	0	0		0	0	10	2	0		12	0	10	0	0		10	24	
%Heavy trucks	0.0	0.0	1.9	0.0		1.6	0.0	0.0	0.0	0.0		0.0	0.0	2.6	16.7	0.0		3.0	0.0	3.8	0.0	0.0		3.1	2.8	

Project ID: 22-180036-001
Location: Dillard St & Cowan Rd
City: Tucker

PEAK HOURS

Day: Tuesday
Date: 3/1/2022

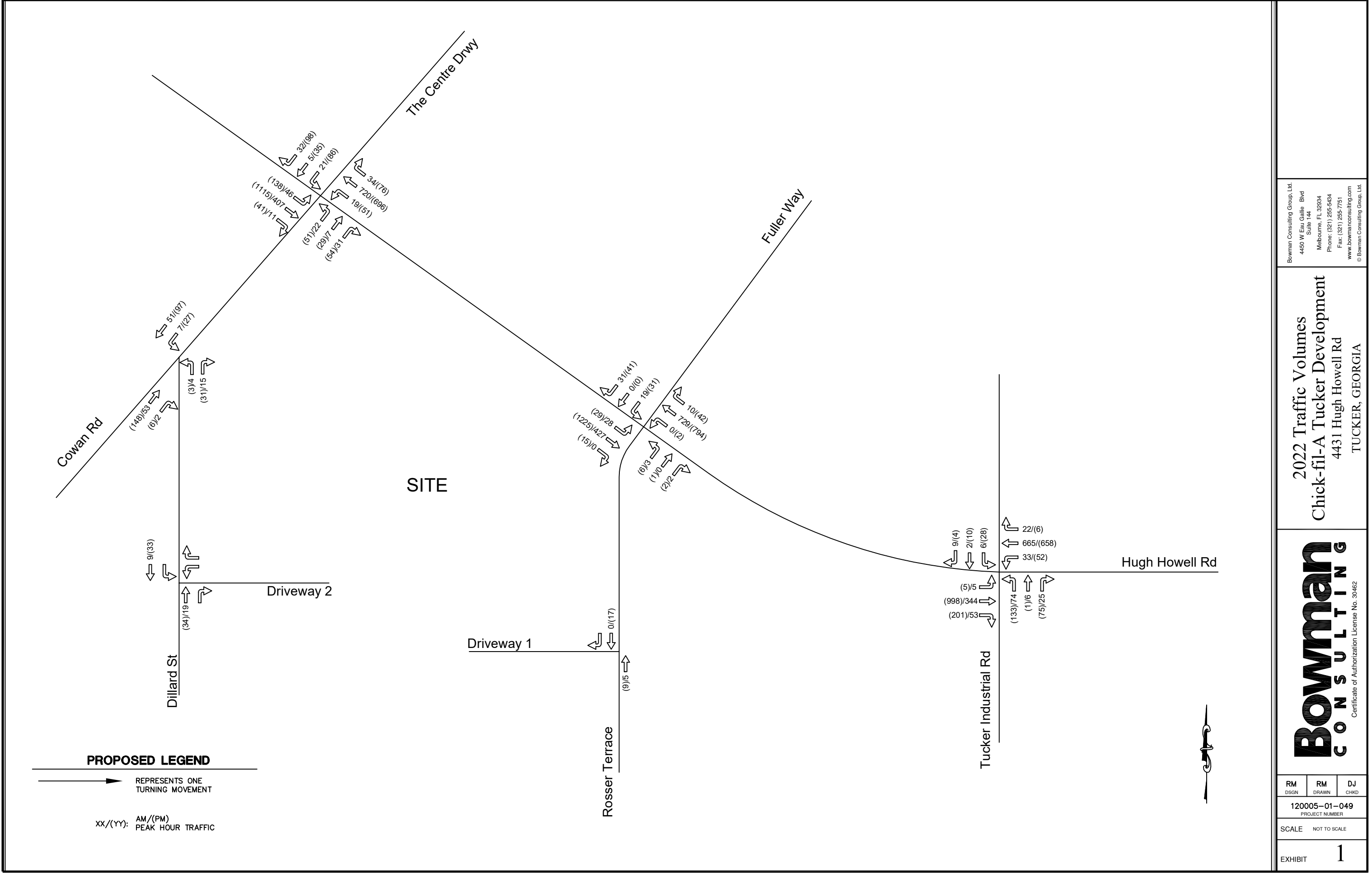
AM

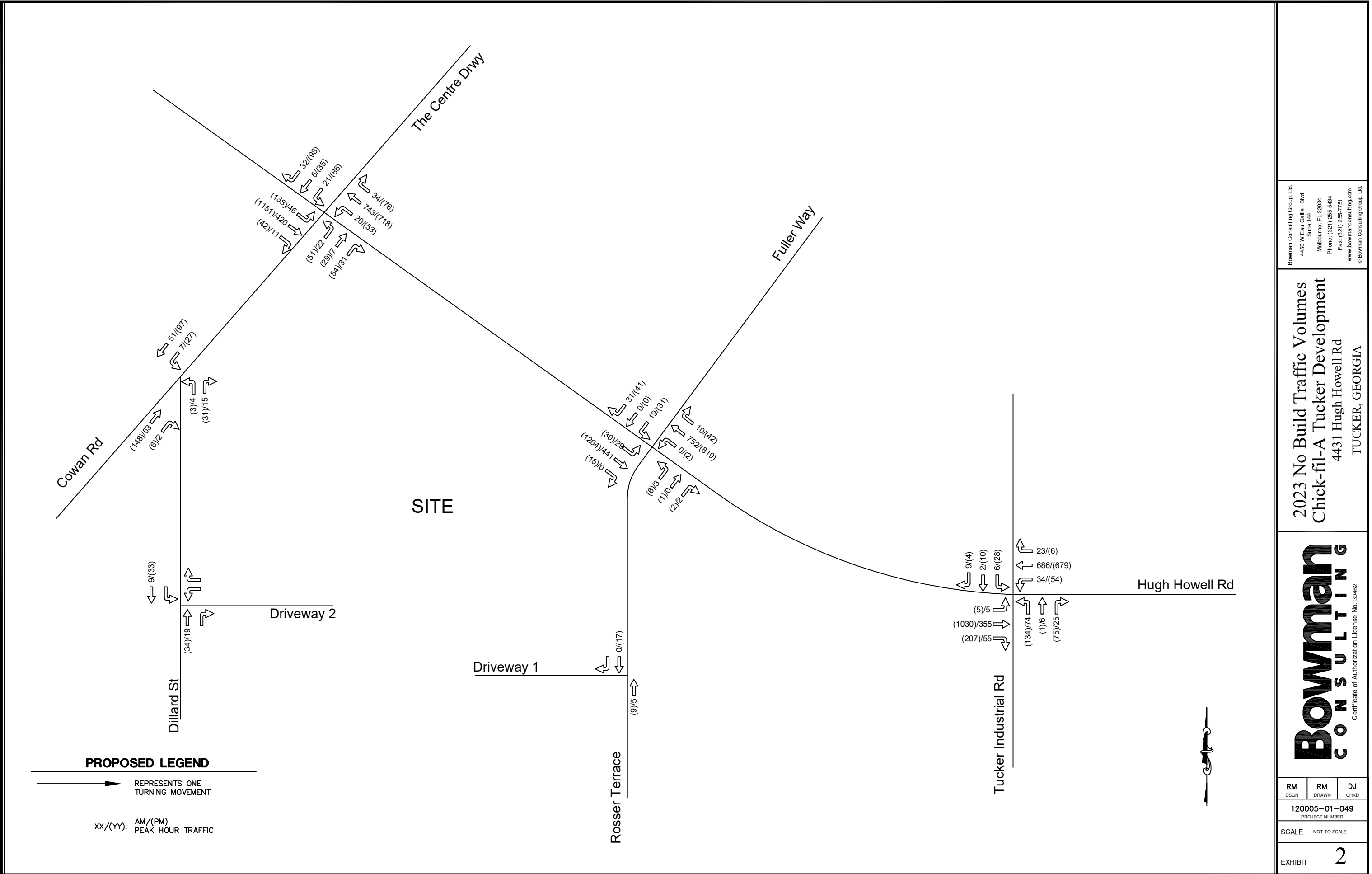
	Dillard St Northbound					Dillard St Southbound					Cowan Rd Eastbound					Cowan Rd Westbound					
Start Time	Left	Thru	Rgt	Uturn	App. Total	Left	Thru	Rgt	Uturn	App. Total	Left	Thru	Rgt	Uturn	App. Total	Left	Thru	Rgt	Uturn	App. Total	Int. Total
Peak Hour Analysis from 07:00 AM - 09:00 AM																					
Peak Hour for Entire Intersection Begins at 07:45 AM																					
7:45 AM	5	0	6	0	11	0	0	0	0	0	0	27	0	0	27	4	10	0	0	14	52
8:00 AM	2	0	5	0	7	0	0	0	0	0	0	13	1	0	14	3	9	0	0	12	33
8:15 AM	2	0	4	0	6	0	0	0	0	0	0	14	0	0	14	1	20	0	0	21	41
8:30 AM	0	0	2	0	2	0	0	0	0	0	0	16	1	0	17	1	9	0	0	10	29
Total Volume	9	0	17	0	26	0	0	0	0	0	0	70	2	0	72	9	48	0	0	57	155
% App. Total	34.6	0.0	65.4	0.0	100	0.0	0.0	0.0	0.0	0	0.0	97.2	2.8	0.0	100	15.8	84.2	0.0	0.0	100	
PHF	0.591										0.667					0.679					0.745
Cars, PU, Vans	9	0	17	0	26	0	0	0	0	0	0	67	1	0	68	9	44	0	0	53	147
% Cars, PU, Vans	100.0	0.0	100.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	95.7	50.0	0.0	94.4	100.0	91.7	0.0	0.0	93.0	94.8
Heavy trucks	0	0	0	0	0	0	0	0	0	0	0	3	1	0	4	0	4	0	0	4	8
% Heavy trucks	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.3	50.0	0.0	5.6	0.0	8.3	0.0	0.0	7.0	5.2

PM

	Dillard St Northbound					Dillard St Southbound					Cowan Rd Eastbound					Cowan Rd Westbound					
Start Time	Left	Thru	Rgt	Uturn	App. Total	Left	Thru	Rgt	Uturn	App. Total	Left	Thru	Rgt	Uturn	App. Total	Left	Thru	Rgt	Uturn	App. Total	Int. Total
Peak Hour Analysis from 04:00 PM - 06:00 PM																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
5:00 PM	0	0	5	0	5	0	0	0	0	0	0	26	1	0	27	7	28	0	0	35	67
5:15 PM	2	0	6	0	8	0	0	0	0	0	0	36	0	0	36	6	30	0	0	36	80
5:30 PM	0	0	12	0	12	0	0	0	0	0	0	35	2	0	37	7	20	0	0	27	76
5:45 PM	0	0	6	0	6	0	0	0	0	0	0	37	1	0	38	7	19	0	0	26	70
Total Volume	2	0	29	0	31	0	0	0	0	0	0	134	4	0	138	27	97	0	0	124	293
% App. Total	6.5	0.0	93.5	0.0	100	0.0	0.0	0.0	0.0	0	0.0	97.1	2.9	0.0	100	21.8	78.2	0.0	0.0	100	
PHF	0.646										0.908					0.861					0.916
Cars, PU, Vans	2	0	29	0	31	0	0	0	0	0	0	134	3	0	137	27	97	0	0	124	292
% Cars, PU, Vans	100.0	0.0	100.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	75.0	0.0	99.3	100.0	100.0	0.0	0.0	100.0	99.7
Heavy trucks	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1
% Heavy trucks	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.3

APPENDIX D



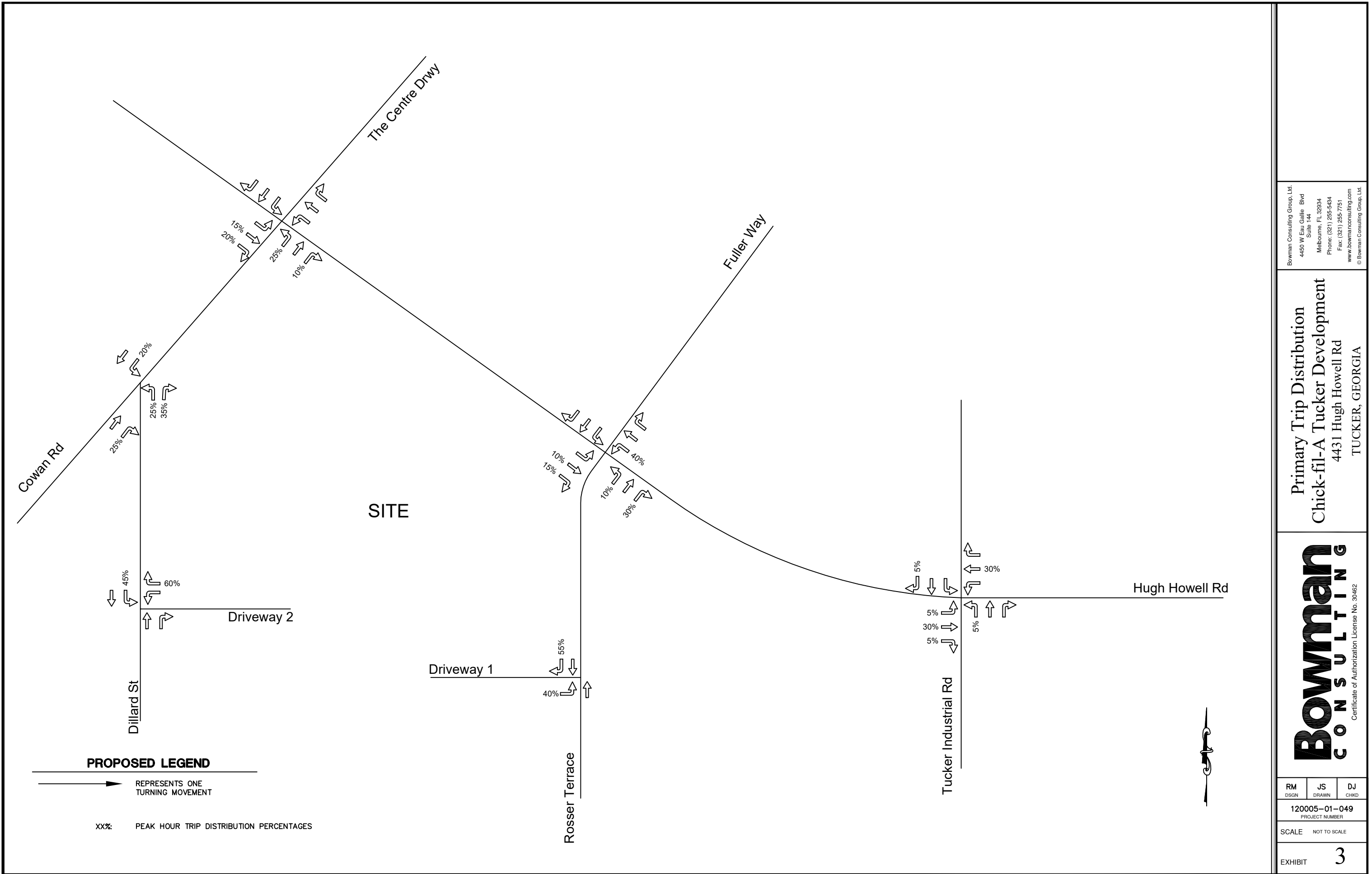


2023 No Build Traffic Volumes
Chick-fil-A Tucker Development
4431 Hugh Howell Rd
TUCKER, GEORGIA

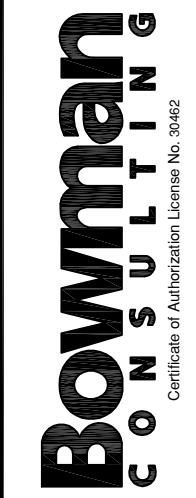
Bowman
CONSULTING
Certificate of Authorization License No. 30462

RM DSGN	RM DRAWN	DJ CHKD
120005-01-049 PROJECT NUMBER		
SCALE NOT TO SCALE		
EXHIBIT		2

Bowman Consulting Group, Ltd.
4450 W Eau Gallie Blvd
Suite 144
Melbourne, FL 32934
Phone: (321) 255-5434
Fax: (321) 255-7751
www.bowmanconsulting.com
© Bowman Consulting Group, Ltd.

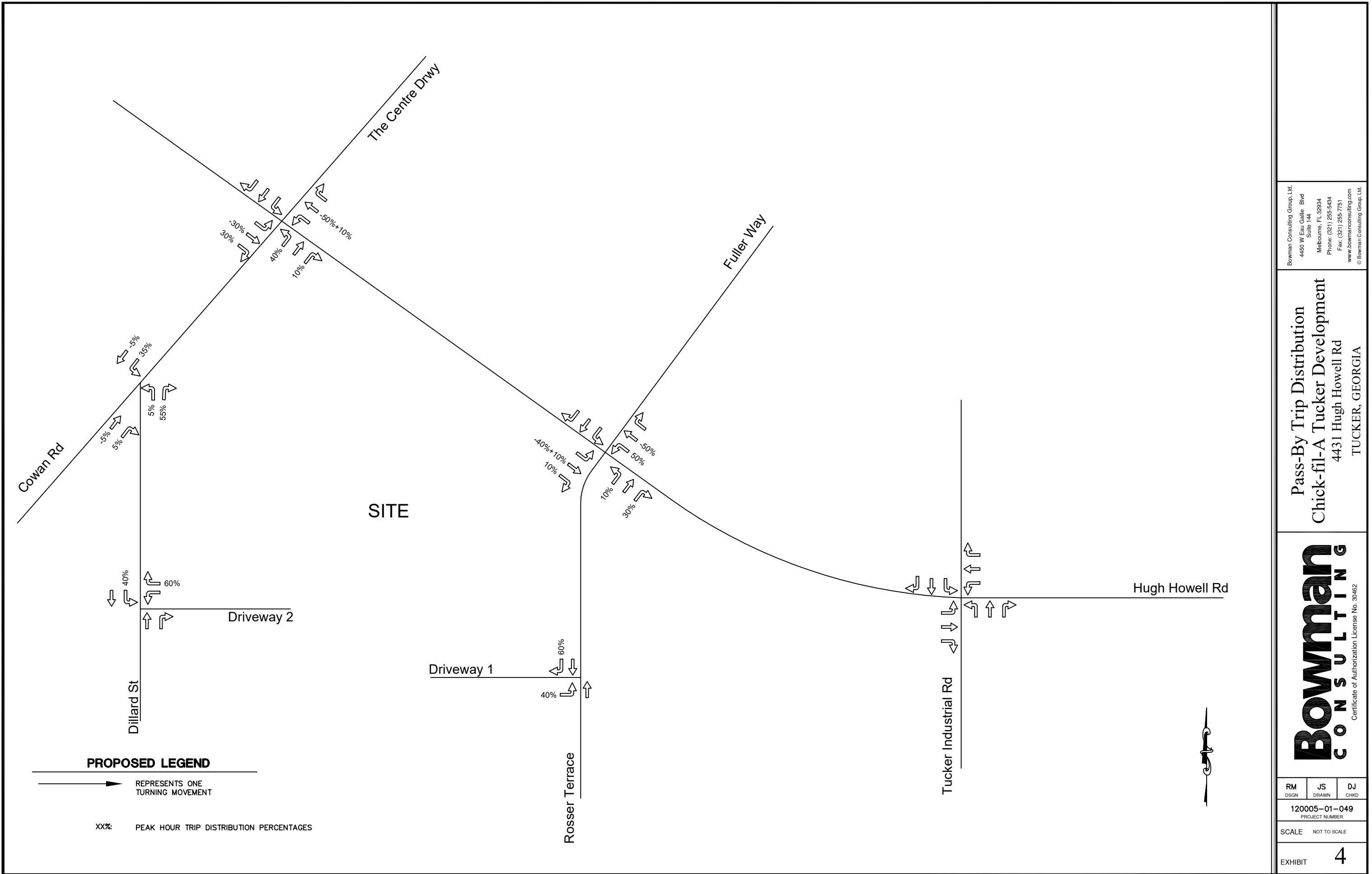


Primary Trip Distribution
Chick-fil-A Tucker Development
4431 Hugh Howell Rd
TUCKER, GEORGIA



RM DSGN	JS DRAWN	DJ CHKD
120005-01-049 PROJECT NUMBER		
SCALE NOT TO SCALE		
EXHIBIT		3

Bowman Consulting Group, Ltd.
4450 W Eau Gallie Blvd
Suite 144
Melbourne, FL 32934
Phone: (321) 255-5434
Fax: (321) 255-7751
www.bowmanconsulting.com
© Bowman Consulting Group, Ltd.



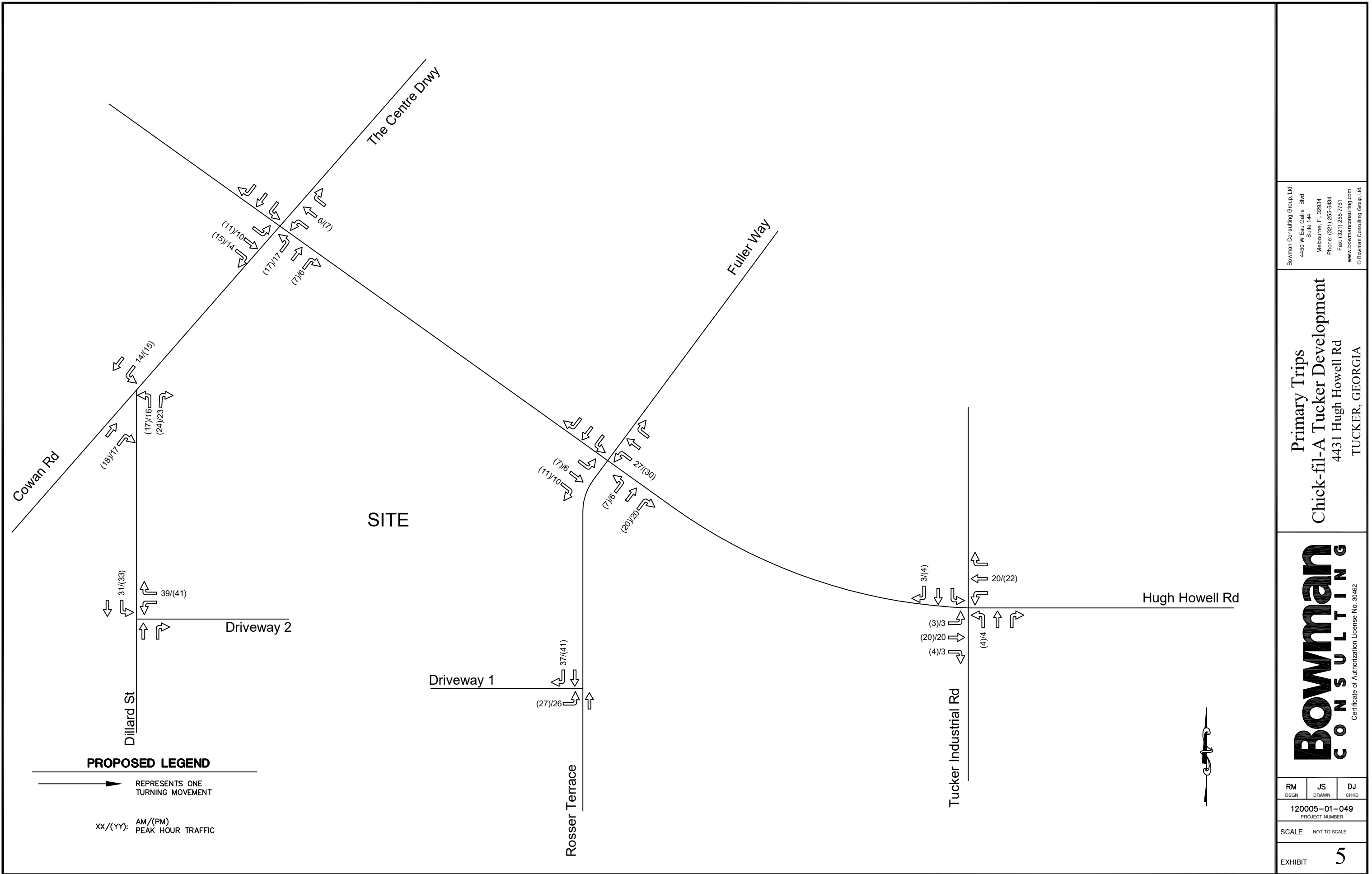
Pass-By Trip Distribution
Chick-fil-A Tucker Development
4431 Hugh Howell Rd
TUCKER, GEORGIA

Bowman
CONSULTING

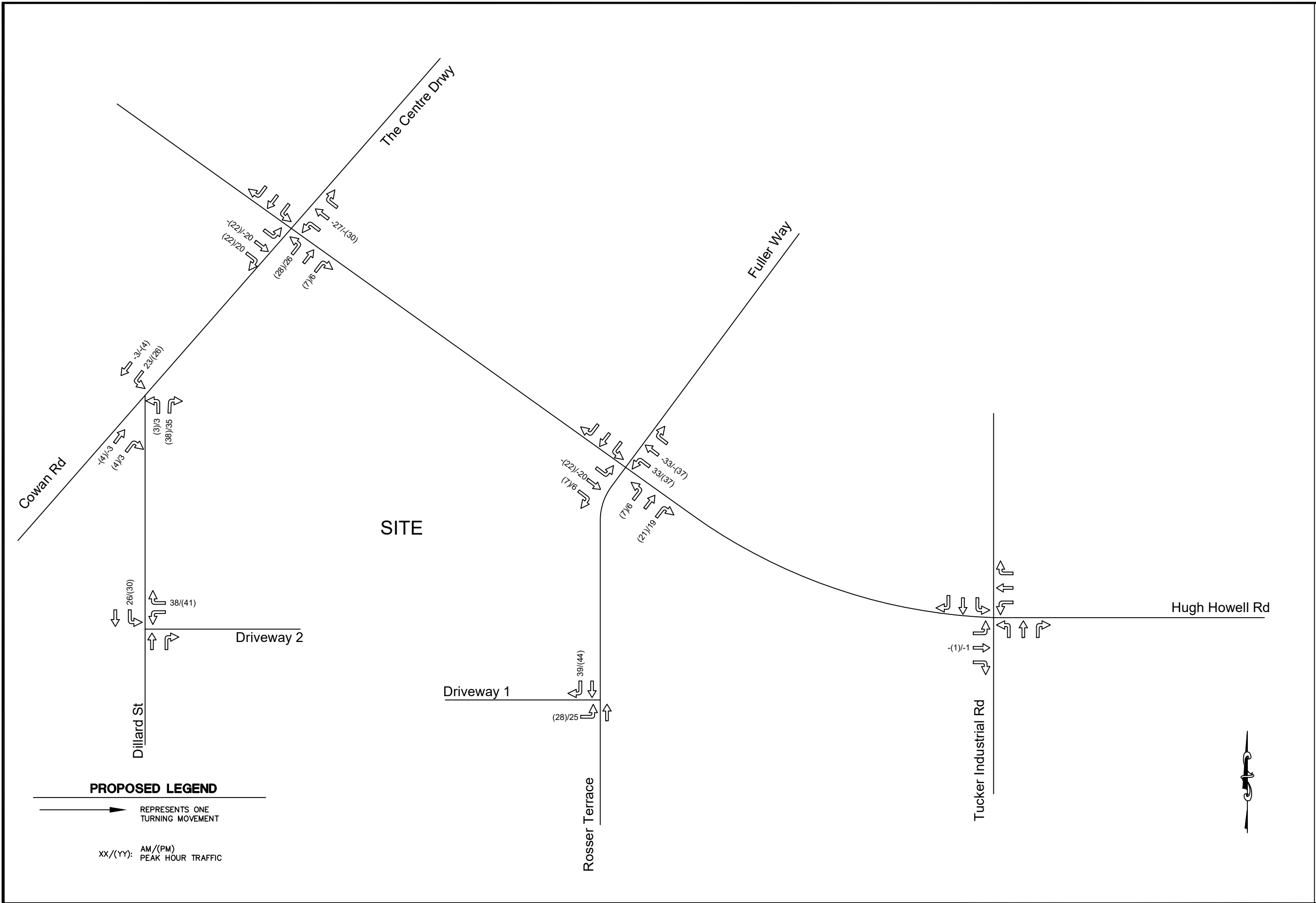
Certificate of Authorization License No. 30462

RM DSGN	JS DRAWN	DJ CHKD
120005-01-049 PROJECT NUMBER		
SCALE NOT TO SCALE		
EXHIBIT		4

Bowman Consulting Group, Ltd.
4450 W Eau Gallie Blvd
Suite 144
Melbourne, FL 32934
Phone: (321) 255-5434
Fax: (321) 255-7751
www.bowmanconsulting.com
© Bowman Consulting Group, Ltd.



Bowman Consulting Group, Ltd.
4450 W Eau Gallie Blvd
Suite 144
Melbourne, FL 32934
Phone: (321) 255-5434
Fax: (321) 255-7751
www.bowmanconsulting.com
© Bowman Consulting Group, Ltd.



PROPOSED LEGEND

→ REPRESENTS ONE TURNING MOVEMENT

XX/(YY): AM/(PM)
PEAK HOUR TRAFFIC

Bowman
CONSULTING

Certificate of Authorization License No. 30462

RM DSGN	JS DRAWN	DJ CHKD
------------	-------------	------------

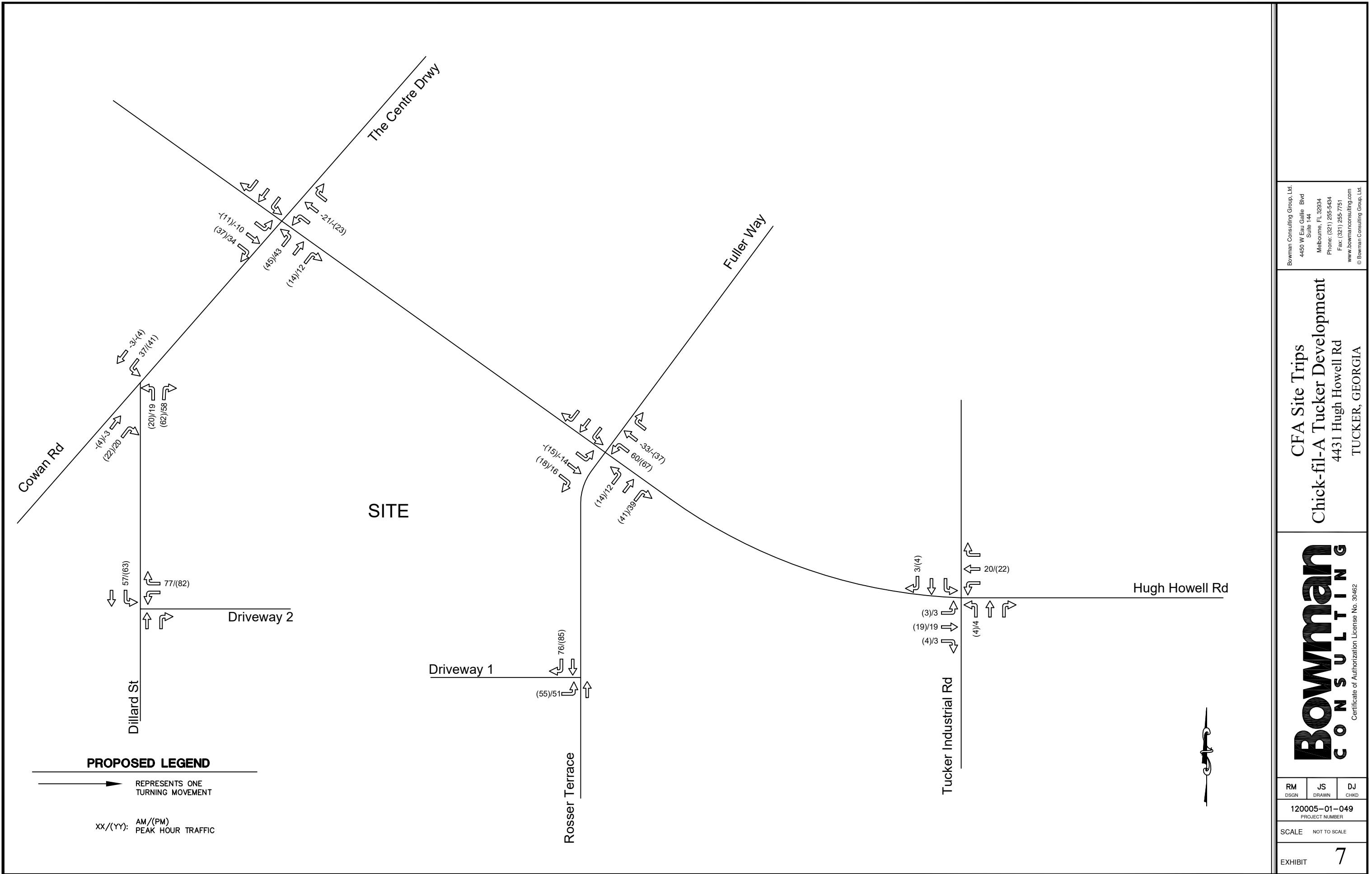
120005-01-049
PROJECT NUMBER

SCALE NOT TO SCALE

EXHIBIT 6

Pass-By Trips
Chick-fil-A Tucker Development
4431 Hugh Howell Rd
TUCKER, GEORGIA

Bowman Consulting Group, Ltd.
4450 W Eau Gallie Blvd
Suite 144
Melbourne, FL 32934
Phone: (321) 255-5434
Fax: (321) 255-7751
www.bowmanconsulting.com
© Bowman Consulting Group, Ltd.

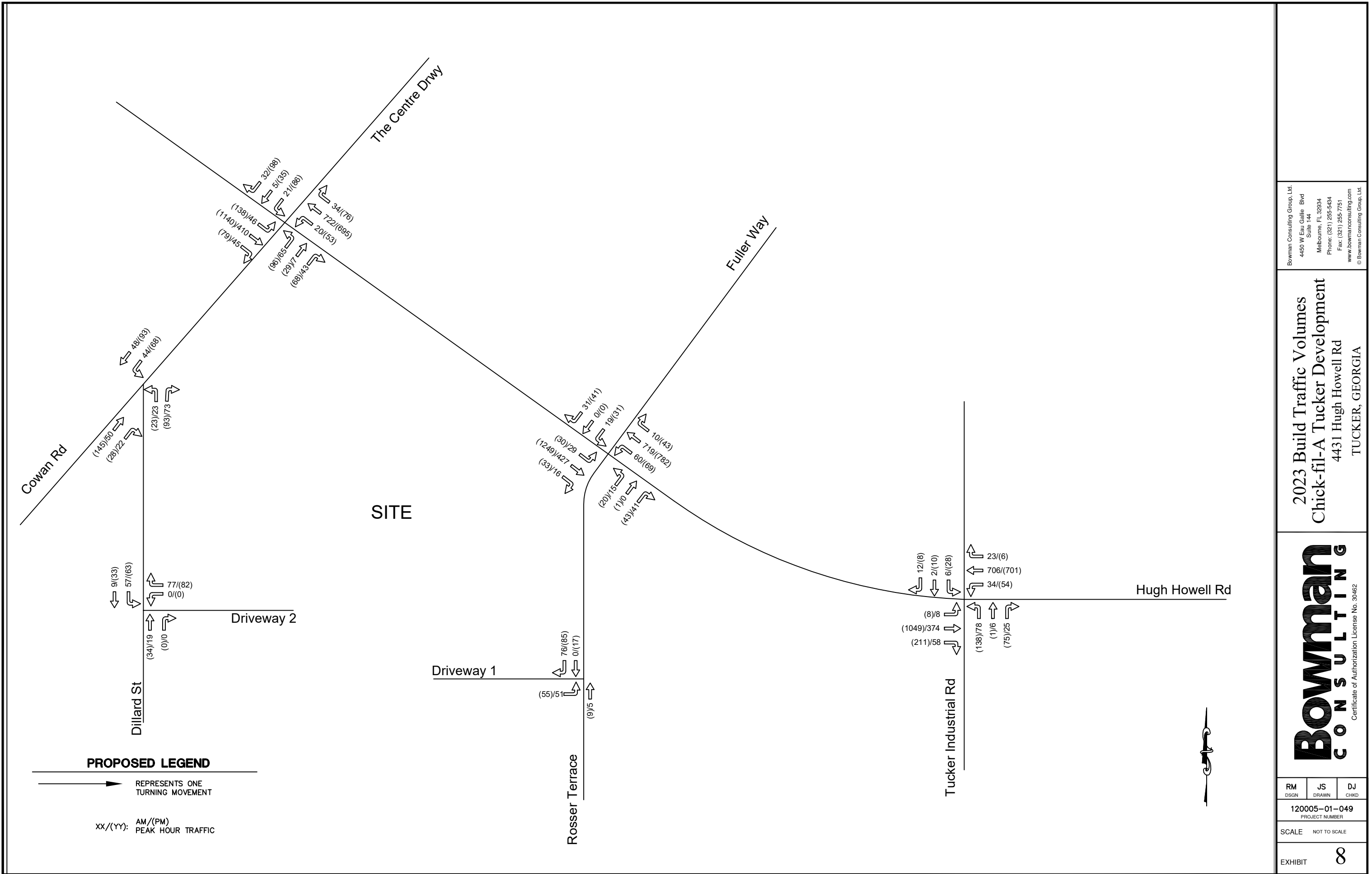


CFA Site Trips
Chick-fil-A Tucker Development
4431 Hugh Howell Rd
TUCKER, GEORGIA

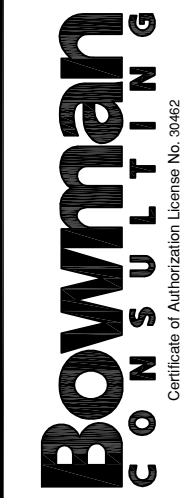
Bowman
CONSULTING
Certificate of Authorization License No. 30462

RM DSGN	JS DRAWN	DJ CHKD
120005-01-049 PROJECT NUMBER		
SCALE NOT TO SCALE		
EXHIBIT		7

Bowman Consulting Group, Ltd.
4450 W Eau Gallie Blvd
Suite 144
Melbourne, FL 32934
Phone: (321) 255-5434
Fax: (321) 255-7751
www.bowmanconsulting.com
© Bowman Consulting Group, Ltd.



2023 Build Traffic Volumes
Chick-fil-A Tucker Development
4431 Hugh Howell Rd
TUCKER, GEORGIA



RM	JS	DJ
DSGN	DRAWN	CHKD
120005-01-049		
PROJECT NUMBER		
SCALE NOT TO SCALE		
EXHIBIT		8

Bowman Consulting Group, Ltd.
4450 W Eau Gallie Blvd
Suite 144
Melbourne, FL 32934
Phone: (321) 255-5434
Fax: (321) 255-7751
www.bowmanconsulting.com
© Bowman Consulting Group, Ltd.

APPENDIX E

Memorandum

To: Chick-fil-A, Inc.

From: Andrew J. Petersen, P.E. - Director
Daniela Jurado – Analyst
Rodrigo Meirelles -Analyst

Date: 06/18/2021

Re: Chick-Fil-A – Trip Generation Memorandum

Bowman Consulting has been retained by Chick-fil-A, Inc. to perform a Trip Generation at three fully operational Chick-Fil-A (CFA) Restaurants to determine the expected morning and evening peak hour trip generation rates for this facilities.

The purposes of the trip generation and stacking assessment are as follows:

- Determine the appropriate independent variable to assess the applicable CFA trip generation rates.
- Determine the expected trip generation rates for the CFA based on data collected from three existing CFA Sites.
- Determine if the Institute of Transportation Engineers (ITE) trip generation rates are consistent with calculated expected number of vehicular trips on the proposed CFA.
- Select the appropriate trip generation rates for the proposed CFA.

Selected Sites

For the preparation of this assessment, three Chick-Fil-A sites have been evaluated. The following criteria has been considered for the site selection:

- Type of Facility (Chick-Fil-A Restaurant)
- Operation (Drive-thru and Indoor sitting)
- Location of the facilities

The following sites were selected for the data collection.

Location 1	• Chick-Fil A Piedmont • Address: 2580 Piedmont Rd NE, Atlanta, GA 30324 • Surveyed Site Intensity: 5,200 SF • AADT of Adjacent Street: 44,100
Location 2	• Chick-Fil A Druid Hills • Address: 2340 N Druid Hills Rd NE, Atlanta, GA 30329 • Surveyed Site Intensity: 4,550 SF • AADT of Adjacent Street: 56,300

Location 3

- **Chick-Fil A Northside Dr**
- **Address:** 1100 Northside Dr NW, Atlanta, GA 30318
- **Surveyed Site Intensity:** 4,450SF
- **AADT of Adjacent Street:** 30,300

Study Methodology

The study was based on average weekday entering/exiting volumes at each one of the selected Chick-Fil-A locations provided by the Atlanta Department of Transportation. The information corresponds to the average weekday data from two months in 2019 and February 2021 while school was in session.

The procedures and evaluation for this assessment are in accordance with the Institute of Traffic Engineers (ITE) Trip Generation Manual Handbook, 3rd Edition. The ITE is the leading resource for such data and provides traffic and parking related data for numerous land use and building types. Additionally, ITE provides trip and parking generation procedures to determine site specific trip and parking generation rates.

Data Collection

For the purposes of this study the following data was collected:

- Site specific data for existing Chick Fil A sites: Square Footage and location.
- Published GDOT AADT counts.
- ITE Trip Generation information and variables.
- Average trips generated by the surveyed Chick Fil A sites provided by the Atlanta Department of Transportation, see **Attachment A**.

Trip Generation Data

Table 1 displays the trip generation data collected on the three existing sites.

Table 1. Collected Trip Generation Data

Facility	Location	Square Footage	Adjacent Street ADTs	Time	In	Out	Total
CFA	2580 Piedmont Rd NE, Atlanta, GA 30324	5,200	44,100	AM	221	221	442
				PM	202	202	404
CFA	2340 N Druid Hills Rd NE Atlanta, GA 30329	4,550	56,300	AM	184	248	432
				Noon	306	412	718
				PM	192	308	500
CFA	1100 Northside Dr NW Atlanta, GA 30318	4,450	30,300	AM	262	262	524
				Noon	263	263	526
				PM	164	164	328

To assess the trip generation rates for the Chick-Fil-A two independent variables were evaluated: Gross Floor Area (GFA), AADT Adjacent Street.

To select the independent variables, the best fitted curve models were evaluated based on the conceptual validity of signs of the equations and goodness of fit. The results of these evaluation are presented in **Table 2**.

Table 2. Trip Generation Model evaluation

Model	Independent Variable	Equation	R ²	Signs Conceptually Valid	Acceptable Goodness of FIT
AM Models	1,000 SF GFA	$y = -64.523x + 771.41$	0.271	No	No
	AADT of Adjacent Street	$y = -0.0036x + 622.44$	0.8563	No	Yes
PM Models	1,000 SF GFA	$y = 11.859x + 354.53$	0.0031	Yes	No
	AADT of Adjacent Street	$y = 0.0066x + 123.51$	0.9895	Yes	Yes

Models containing the GFA variable were found to be not conceptually valid, with equations that reflect an inverse relationship between the GFA and the number of trips generated by the site and unacceptable goodness of fit.

Models using AADT of Adjacent Street as independent variable show acceptable goodness of fit. However, the AM model Based on AADT of adjacent street shows signs non conceptually valid, therefore, the weighted average was evaluated for this time period.

Based on the results presented in **Table 2** the Adjacent Street Traffic was selected as independent variable for both the morning and evening peak hours.

Following the procedures presented on the ITE *trip generation Handbook*, Chapter 9 and Appendix J, the use of the weighted average rate for the Morning peak was validated by comparing the weighted standard deviation with the weighted Average trip rate. **Table 3** presents the validation for the use of weighted average for the morning peak hour trip rate.

Table 3. Validation of AM Weighted average trip generation

Location	AADT of adjacent Steet	Peak Hour AM	Trip rate	Value	Value Squared	weight	Value Squared *weight
2580 Piedmont Rd	44,100	442	0.01002	0.00	0.0000005	0.34	0.00000015
2340 N Druid Hills Rd	56,300	432	0.00767	0.00	0.0000091	0.43	0.00000394
1100 Northside Dr	30,300	524	0.01729	0.01	0.0000435	0.23	0.00001009
Total	130,700.00	1,398.00	0.01070	-	Variance		0.00001418
Weighted Sample Variance							0.00001773
Weighted Std Dev							0.00
Percentage of W StdDev							39%
Acceptable (less than 55% Trip Rate)							Yes

As presented in **Table 3** the standard deviation of the data falls in the allowable 55% threshold according to the procedures presented on the ITE trip generation Handbook, Chapter 9 and Appendix J, therefore, the use of weighted average trip generation rate is acceptable.

The selected trip generation equations for CFA facilities are presented in **Table 4**.

Table 4. Trip Generation equations for CFA facilities

Model	Independent Variable	Equation
AM	AADT of Adjacent Street	$Total\ AM\ CFA\ trips = 0.0107 \times AADT\ of\ Adjacent\ Street$
PM	AADT of Adjacent Street	$Total\ PM\ CFA\ trips = 0.0066 \times AADT\ of\ Adjacent\ Street + 123.51$

The evening peak hour model is the resulting fitted curve with AADT of adjacent street as independent variable. The trip generation rate for the morning peak hour is 0.0107 trips/AADT of Adjacent Street Traffic.

Conclusions and Recommendations

- Both, the morning and evening models containing the GFA variable were found to have unacceptable goodness of fit, the morning models is not conceptually valid, with an

equation that reflects an inverse relationship between the GFA, and the number of trips generated by the site.

- Models using AADT of Adjacent Street as independent variable show acceptable goodness of fit.
- The evening peak hour model is fitted curve with AADT of adjacent street as independent variable.
- The AM model Based on AADT of adjacent street shows signs non conceptually valid therefore, the weighted average was evaluated for this time period.
- The evaluation of the data for the morning peak hour shows that the standard deviation of the data falls in the allowable 55% threshold according to the procedures presented on the ITE trip generation Handbook, Chapter 9 and Appendix J, therefore, the use of weighted average trip generation rate is acceptable.
- The trip generation rate for the morning peak hour is 0.0107 trips/AADT of Adjacent Street Traffic.

ATTACHMENT A

From: Rome, Christopher <crome@AtlantaGa.Gov>
Sent: Wednesday, June 9, 2021 10:32 AM
To: Daniela Jurado; Rodriguez, Juan C.; Moore, Clyde
Cc: Rodrigo Meirelles; Andrew Petersen; Bridgette Ganter; Smoot-Madison, Betty; Brown, Barrington G.
Subject: [EXTERNAL] RE: Traffic Impact Study Methodology Chick-Fil-A Cheshire Bridge Rd & Sheridan Rd

1100 Northside Dr

- AM Peak – 262 trips in, assume 262 trips out– 524 total trips
- Noon Peak – 263 trips in, assume 263 trips out – 526 total trips
- PM Peak – 164 trips in, assume 164 trips out – 328 total trips

Have you contacted GDOT's RTOP program or collected TMC's already at the I-85 ramps? That data will be more accurate than StreetLight Insight TMCs which are still in beta.

Chris Rome, PE, PTOE

Senior Multimodal Transportation Engineer
City of Atlanta Department of Transportation
470-653-3016
crome@atlantaga.gov

From: Daniela Jurado <djurado@bowman.com>
Sent: Wednesday, June 9, 2021 8:39 AM
To: Rome, Christopher <crome@AtlantaGa.Gov>; Rodriguez, Juan C. <JCRodriguez@AtlantaGa.Gov>; Moore, Clyde <CMoore@AtlantaGa.Gov>
Cc: Rodrigo Meirelles <rmeirelles@bowman.com>; Andrew Petersen <apetersen@bowman.com>; Bridgette Ganter <bganter@bowman.com>; Smoot-Madison, Betty <bsmoot-madison@AtlantaGa.Gov>; Brown, Barrington G. <BGBrown@AtlantaGa.Gov>
Subject: [EXTERNAL] RE: Traffic Impact Study Methodology Chick-Fil-A Cheshire Bridge Rd & Sheridan Rd

Good Morning Chris,

Would it be possible to also pull out the Turning movements for Cheshire Bridge at I-85 ramps for the am noon and pm?

Thank you,

DANIELA JURADO

Project Manager | **BOWMAN**
4450 W Eau Gallie Boulevard, Suite 144, Melbourne, FL 32934
O: (321) 270-8905 | D: (321) 270-8977 | M: (786) 370-2762
djurado@bowman.com | bowman.com



From: Rome, Christopher <crome@AtlantaGa.Gov>
Sent: Tuesday, June 8, 2021 7:09 PM
To: Daniela Jurado <djurado@bowman.com>; Rodriguez, Juan C. <JCRodriguez@AtlantaGa.Gov>; Moore, Clyde <CMoore@AtlantaGa.Gov>
Cc: Rodrigo Meirelles <rmeirelles@bowman.com>; Andrew Petersen <apetersen@bowman.com>; Bridgette Ganter <bganter@bowman.com>; Smoot-Madison, Betty <bsmoot-madison@AtlantaGa.Gov>; Brown, Barrington G. <BGBrown@AtlantaGa.Gov>
Subject: [EXTERNAL] RE: Traffic Impact Study Methodology Chick-Fil-A Cheshire Bridge Rd & Sheridan Rd

Tucker is outside of our data licensing geographic limits.
I'll pull the data from the Northside Dr site tomorrow.

Chris Rome, PE, PTOE

Senior Multimodal Transportation Engineer
City of Atlanta Department of Transportation
470-653-3016
crome@atlantaga.gov

From: Daniela Jurado <djurado@bowman.com>
Sent: Tuesday, June 8, 2021 7:00 PM
To: Rome, Christopher <crome@AtlantaGa.Gov>; Rodriguez, Juan C. <JCRodriguez@AtlantaGa.Gov>; Moore, Clyde <CMoore@AtlantaGa.Gov>
Cc: Rodrigo Meirelles <rmeirelles@bowman.com>; Andrew Petersen <apetersen@bowman.com>; Bridgette Ganter <bganter@bowman.com>; Smoot-Madison, Betty <bsmoot-madison@AtlantaGa.Gov>; Brown, Barrington G. <BGBrown@AtlantaGa.Gov>
Subject: [EXTERNAL] RE: Traffic Impact Study Methodology Chick-Fil-A Cheshire Bridge Rd & Sheridan Rd

Thank you for the information. We would like to have the information for the following sites:

Location	AADT
1100 Northside Dr NW	30,300
4340 Hugh Howell Rd, Tucker, GA 30084	25,300

The reason is, we also want to evaluate the trip generation based on the AADT of adjacent street.

Thank you in advance.

Sincerely,

DANIELA JURADO

Project Manager | **BOWMAN**
4450 W Eau Gallie Boulevard, Suite 144, Melbourne, FL 32934
O: (321) 270-8905 | D: (321) 270-8977 | M: (786) 370-2762
djurado@bowman.com | bowman.com



From: Rome, Christopher <crome@AtlantaGa.Gov>

Sent: Tuesday, June 8, 2021 5:21 PM

To: Daniela Jurado <djurado@bowman.com>; Rodriguez, Juan C. <JCRodriguez@AtlantaGa.Gov>;

Moore, Clyde <CMoore@AtlantaGa.Gov>

Cc: Rodrigo Meirelles <rmeirelles@bowman.com>; Andrew Petersen <apetersen@bowman.com>;

Bridgette Ganter <bganter@bowman.com>; Smoot-Madison, Betty <bsmoot-madison@AtlantaGa.Gov>;

Brown, Barrington G. <BGBrown@AtlantaGa.Gov>

Subject: [EXTERNAL] RE: Traffic Impact Study Methodology Chick-Fil-A Cheshire Bridge Rd & Sheridan Rd

I think it depends on the site characteristics if the Miami site is similar.

I used our StreetLight Data Insight platform access to look at the number of trips entering two Chick-fil-A locations in Atlanta. This is average weekday (M-Th) information from 2 months in 2019 and February 2021 when school was in session. The 1 standard deviation from the ITE land use code trip generation seems too low for an accurate assessment of site impact. If you have a specific site location in Atlanta that you think will be more representative of the conditions for the proposed site at Cheshire Bridge and Sheridan Rd, let me know and I can pull data for those locations.

2580 Piedmont Rd

- AM Peak – 221 trips in, assume 221 trips out– 442 total trips
- Noon Peak – 332 trips in, assume 332 trips out – 664 total trips
- PM Peak – 202 trips in, assume 202 trips out – 404 total trips

2340 N Druid Hills Rd

- AM Peak – 184 trips in, 248 trips out– 432 total trips
- Noon Peak – 306 trips in, 412 trips out – 718 total trips
- PM Peak – 192 trips in, 308 trips out – 500 total trips

Chris Rome, PE, PTOE

Senior Multimodal Transportation Engineer

City of Atlanta Department of Transportation

470-653-3016

crome@atlantaga.gov

From: Daniela Jurado <djurado@bowman.com>

Sent: Tuesday, June 8, 2021 2:36 PM

To: Rome, Christopher <crome@AtlantaGa.Gov>; Rodriguez, Juan C. <JCRodriguez@AtlantaGa.Gov>;

Moore, Clyde <CMoore@AtlantaGa.Gov>

Cc: Rodrigo Meirelles <rmeirelles@bowman.com>; Andrew Petersen <apetersen@bowman.com>;

Bridgette Ganter <bganter@bowman.com>; Smoot-Madison, Betty <bsmoot-madison@AtlantaGa.Gov>;

Brown, Barrington G. <BGBrown@AtlantaGa.Gov>

Subject: [EXTERNAL] RE: Traffic Impact Study Methodology Chick-Fil-A Cheshire Bridge Rd & Sheridan Rd

Good Afternoon Chris,

APPENDIX F

2023 NO BUILD CONDITIONS Capacity Analysis

1: Rosser Terrace/Fuller Way & Hugh Howell Rd

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	29	441	0	0	752	10	3	0	2	19	0	31
Future Volume (vph)	29	441	0	0	752	10	3	0	2	19	0	31
Adj. Flow (vph)	31	474	0	0	809	11	3	0	2	20	0	33
Lane Group Flow (vph)	31	474	0	0	809	11	0	5	0	0	53	0
Sign Control	Free				Free				Stop			
Intersection Summary												
Control Type: Unsignalized												
Intersection Capacity Utilization 34.1%												
ICU Level of Service A												
Analysis Period (min) 15												

Intersection												
Int Delay, s/veh	0.6											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	29	441	0	0	752	10	3	0	2	19	0	31
Future Vol, veh/h	29	441	0	0	752	10	3	0	2	19	0	31
Conflicting Peds, #/hr	1	0	1	1	0	1	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	100	-	-	100	-	100	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	1	-	-	1	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	7	3	0	0	2	10	33	0	0	10	0	0
Mvmt Flow	31	474	0	0	809	11	3	0	2	20	0	33
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	821	0	0	475	0	0	942	1358	238	1109	1347	406
Stage 1	-	-	-	-	-	-	537	537	-	810	810	-
Stage 2	-	-	-	-	-	-	405	821	-	299	537	-
Critical Hdwy	4.24	-	-	4.1	-	-	8.16	6.5	6.9	7.7	6.5	6.9
Critical Hdwy Stg 1	-	-	-	-	-	-	7.16	5.5	-	6.7	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	7.16	5.5	-	6.7	5.5	-
Follow-up Hdwy	2.27	-	-	2.2	-	-	3.83	4	3.3	3.6	4	3.3
Pot Cap-1 Maneuver	1139	-	-	*1369	-	-	*533	444	*912	*568	455	*796
Stage 1	-	-	-	-	-	-	*723	712	-	*726	655	-
Stage 2	-	-	-	-	-	-	*687	645	-	*837	712	-
Platoon blocked, %	1	-	-	1	-	-	1	1	1	1	1	1
Mov Cap-1 Maneuver	1138	-	-	*1368	-	-	*500	431	*911	*554	442	*796
Mov Cap-2 Maneuver	-	-	-	-	-	-	*528	491	-	*593	508	-
Stage 1	-	-	-	-	-	-	*702	692	-	*706	654	-
Stage 2	-	-	-	-	-	-	*658	644	-	*812	692	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.5			0			10.7			9.7		
HCM LOS							B			A		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	635	1138	-	-	*1368	-	-	796				
HCM Lane V/C Ratio	0.008	0.027	-	-	-	-	-	0.042				
HCM Control Delay (s)	10.7	8.3	-	-	0	-	-	9.7				
HCM Lane LOS	B	A	-	-	A	-	-	A				
HCM 95th %tile Q(veh)	0	0.1	-	-	0	-	-	0.1				
Notes												
~: Volume exceeds capacity		\$: Delay exceeds 300s				+: Computation Not Defined				*: All major volume in platoon		

2: Cowan Rd/The Centre Driveway & Hugh Howell Rd

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	46	420	11	20	743	34	22	7	31	21	5	32
Future Volume (vph)	46	420	11	20	743	34	22	7	31	21	5	32
Adj. Flow (vph)	49	452	12	22	799	37	24	8	33	23	5	34
Lane Group Flow (vph)	49	464	0	22	799	37	0	65	0	23	39	0
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA		pm+pt	NA	
Protected Phases	1	6		5	2			8		7	4	
Permitted Phases	6			2		2	8			4		
Detector Phase	1	6		5	2	2	8	8		7	4	
Switch Phase												
Minimum Initial (s)	7.0	10.0		5.0	10.0	10.0	7.0	7.0		5.0	7.0	
Minimum Split (s)	13.2	27.4		10.3	32.1	32.1	35.5	35.5		11.1	35.5	
Total Split (s)	26.0	85.0		17.0	76.0	76.0	42.0	42.0		16.0	58.0	
Total Split (%)	16.3%	53.1%		10.6%	47.5%	47.5%	26.3%	26.3%		10.0%	36.3%	
Maximum Green (s)	19.8	78.9		11.7	69.9	69.9	35.5	35.5		9.9	51.5	
Yellow Time (s)	3.4	4.6		3.1	4.6	4.6	3.5	3.5		3.1	3.5	
All-Red Time (s)	2.8	1.5		2.2	1.5	1.5	3.0	3.0		3.0	3.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0		0.0		0.0	0.0	
Total Lost Time (s)	6.2	6.1		5.3	6.1	6.1		6.5		6.1	6.5	
Lead/Lag	Lead	Lag		Lead	Lag	Lag	Lag	Lag		Lead		
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes	Yes	Yes		Yes		
Vehicle Extension (s)	3.0	5.0		3.0	5.0	5.0	3.0	3.0		3.0	3.0	
Minimum Gap (s)	0.2	3.0		0.2	3.0	3.0	0.2	0.2		0.2	0.2	
Time Before Reduce (s)	0.0	20.0		0.0	20.0	20.0	0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	10.0		0.0	10.0	10.0	0.0	0.0		0.0	0.0	
Recall Mode	None	C-Max		None	C-Max	C-Max	None	None		None	None	
Walk Time (s)		7.0			7.0	7.0	7.0	7.0			7.0	
Flash Dont Walk (s)		10.0			19.0	19.0	22.0	22.0			22.0	
Pedestrian Calls (#/hr)		0			0	0	0	0			0	
Act Effct Green (s)	126.1	121.8		123.8	118.1	118.1		9.6		19.0	18.6	
Actuated g/C Ratio	0.79	0.76		0.77	0.74	0.74		0.06		0.12	0.12	
v/c Ratio	0.09	0.18		0.03	0.31	0.03		0.55		0.17	0.19	
Control Delay	5.0	7.1		4.5	8.0	0.1		58.3		60.5	21.6	
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0		0.0	0.0	
Total Delay	5.0	7.1		4.5	8.0	0.1		58.3		60.5	21.6	
LOS	A	A		A	A	A		E		E	C	
Approach Delay		6.9			7.6			58.3			36.0	
Approach LOS		A			A			E			D	
Queue Length 50th (ft)	10	79		4	144	0		36		21	5	
Queue Length 95th (ft)	25	120		12	202	0		88		48	40	
Internal Link Dist (ft)		969			335			119			430	
Turn Bay Length (ft)	125			115								
Base Capacity (vph)	634	2603		801	2561	1202		361		147	519	
Starvation Cap Reductn	0	0		0	0	0		0		0	0	
Spillback Cap Reductn	0	0		0	0	0		0		0	0	
Storage Cap Reductn	0	0		0	0	0		0		0	0	
Reduced v/c Ratio	0.08	0.18		0.03	0.31	0.03		0.18		0.16	0.08	
Intersection Summary												

2: Cowan Rd/The Centre Driveway & Hugh Howell Rd

Cycle Length: 160

Actuated Cycle Length: 160

Offset: 148.9 (93%), Referenced to phase 2:WBTL and 6:EBTL, Start of Yellow

Natural Cycle: 95

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.55

Intersection Signal Delay: 10.7

Intersection LOS: B

Intersection Capacity Utilization 53.3%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 2: Cowan Rd/The Centre Driveway & Hugh Howell Rd



HCM 6th Signalized Intersection Summary

2: Cowan Rd/The Centre Driveway & Hugh Howell Rd

2023 NO BUILD - AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	46	420	11	20	743	34	22	7	31	21	5	32
Future Volume (veh/h)	46	420	11	20	743	34	22	7	31	21	5	32
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1900	1826	1826	1900	1841	1900	1900	1900	1900	1752	1900	1900
Adj Flow Rate, veh/h	49	452	12	22	799	37	24	8	33	23	5	34
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	0	5	5	0	4	0	0	0	0	10	0	0
Cap, veh/h	603	2612	69	759	2558	1177	56	17	43	148	24	161
Arrive On Green	0.04	0.76	0.76	0.04	1.00	1.00	0.05	0.05	0.05	0.02	0.11	0.11
Sat Flow, veh/h	1810	3452	92	1810	3497	1609	471	309	804	1668	211	1432
Grp Volume(v), veh/h	49	227	237	22	799	37	65	0	0	23	0	39
Grp Sat Flow(s),veh/h/ln	1810	1735	1809	1810	1749	1609	1583	0	0	1668	0	1642
Q Serve(g_s), s	1.0	5.9	5.9	0.5	0.0	0.0	4.9	0.0	0.0	2.0	0.0	3.5
Cycle Q Clear(g_c), s	1.0	5.9	5.9	0.5	0.0	0.0	6.4	0.0	0.0	2.0	0.0	3.5
Prop In Lane	1.00		0.05	1.00		1.00	0.37		0.51	1.00		0.87
Lane Grp Cap(c), veh/h	603	1312	1369	759	2558	1177	116	0	0	148	0	184
V/C Ratio(X)	0.08	0.17	0.17	0.03	0.31	0.03	0.56	0.00	0.00	0.16	0.00	0.21
Avail Cap(c_a), veh/h	757	1312	1369	856	2558	1177	376	0	0	218	0	529
HCM Platoon Ratio	1.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	4.3	5.5	5.5	4.9	0.0	0.0	74.6	0.0	0.0	67.7	0.0	64.6
Incr Delay (d2), s/veh	0.1	0.3	0.3	0.0	0.3	0.0	4.1	0.0	0.0	0.5	0.0	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	2.0	2.1	0.2	0.1	0.0	2.8	0.0	0.0	0.9	0.0	1.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	4.4	5.7	5.7	4.9	0.3	0.0	78.7	0.0	0.0	68.2	0.0	65.2
LnGrp LOS	A	A	A	A	A	A	E	A	A	E	A	E
Approach Vol, veh/h		513			858			65			62	
Approach Delay, s/veh		5.6			0.4			78.7			66.3	
Approach LOS		A			A			E			E	
Timer - Assigned Phs	1	2		4	5	6	7	8				
Phs Duration (G+Y+Rc), s	12.4	123.1		24.4	8.4	127.1	9.3	15.1				
Change Period (Y+Rc), s	* 6.2	6.1		6.5	* 5.3	6.1	6.1	6.5				
Max Green Setting (Gmax), s	* 20	69.9		51.5	* 12	78.9	9.9	35.5				
Max Q Clear Time (g_c+I1), s	3.0	2.0		5.5	2.5	7.9	4.0	8.4				
Green Ext Time (p_c), s	0.1	13.6		0.2	0.0	5.9	0.0	0.3				
Intersection Summary												
HCM 6th Ctrl Delay				8.3								
HCM 6th LOS				A								
Notes												
* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.												

Lanes, Volumes, Timings
3: Tucker Industrial Rd & Hugh Howell Rd

2023 NO BUILD - AM

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	5	355	55	34	686	23	74	6	25	6	2	9
Future Volume (vph)	5	355	55	34	686	23	74	6	25	6	2	9
Adj. Flow (vph)	6	394	61	38	762	26	82	7	28	7	2	10
Lane Group Flow (vph)	6	455	0	38	788	0	0	117	0	0	19	0
Turn Type	Prot	NA		Prot	NA		Perm	NA		Perm	NA	
Protected Phases	1	6		5	2			4			8	
Permitted Phases							4			8		
Detector Phase	1	6		5	2		4	4		8	8	
Switch Phase												
Minimum Initial (s)	5.0	10.0		5.0	10.0		7.0	7.0		7.0	7.0	
Minimum Split (s)	11.1	31.4		10.9	31.4		31.1	31.1		33.9	33.9	
Total Split (s)	15.0	89.0		15.0	89.0		56.0	56.0		56.0	56.0	
Total Split (%)	9.4%	55.6%		9.4%	55.6%		35.0%	35.0%		35.0%	35.0%	
Maximum Green (s)	8.9	82.6		9.1	82.6		49.9	49.9		50.1	50.1	
Yellow Time (s)	3.5	4.7		3.3	4.7		3.3	3.3		3.0	3.0	
All-Red Time (s)	2.6	1.7		2.6	1.7		2.8	2.8		2.9	2.9	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0			0.0	
Total Lost Time (s)	6.1	6.4		5.9	6.4			6.1			5.9	
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
Vehicle Extension (s)	3.0	5.0		3.0	5.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	0.2	3.0		0.2	3.0		0.2	0.2		0.2	0.2	
Time Before Reduce (s)	0.0	20.0		0.0	20.0		0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	15.0		0.0	15.0		0.0	0.0		0.0	0.0	
Recall Mode	None	C-Max		None	C-Max		None	None		None	None	
Walk Time (s)		7.0			7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)		18.0			18.0		18.0	18.0		21.0	21.0	
Pedestrian Calls (#/hr)		0			0		0	0		0	0	
Act Effect Green (s)	6.2	116.9		9.1	127.0			17.8			18.0	
Actuated g/C Ratio	0.04	0.73		0.06	0.79			0.11			0.11	
v/c Ratio	0.09	0.18		0.42	0.29			0.72			0.10	
Control Delay	67.4	9.2		85.4	5.6			85.2			38.4	
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	
Total Delay	67.4	9.2		85.4	5.6			85.2			38.4	
LOS	E	A		F	A			F			D	
Approach Delay		9.9			9.3			85.2			38.4	
Approach LOS		A			A			F			D	
Queue Length 50th (ft)	5	108		39	90			110			9	
Queue Length 95th (ft)	20	171		79	203			175			35	
Internal Link Dist (ft)		1068			568			739			1148	
Turn Bay Length (ft)	150			100								
Base Capacity (vph)	100	2462		101	2760			439			539	
Starvation Cap Reductn	0	0		0	0			0			0	
Spillback Cap Reductn	0	0		0	0			0			0	
Storage Cap Reductn	0	0		0	0			0			0	
Reduced v/c Ratio	0.06	0.18		0.38	0.29			0.27			0.04	
Intersection Summary												

Lanes, Volumes, Timings 3: Tucker Industrial Rd & Hugh Howell Rd

2023 NO BUILD - AM

Cycle Length: 160

Actuated Cycle Length: 160

Offset: 38.6 (24%), Referenced to phase 2:WBT and 6:EBT, Start of Yellow

Natural Cycle: 80

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.72

Intersection Signal Delay: 16.1

Intersection LOS: B

Intersection Capacity Utilization 50.1%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 3: Tucker Industrial Rd & Hugh Howell Rd



HCM 6th Signalized Intersection Summary

3: Tucker Industrial Rd & Hugh Howell Rd

2023 NO BUILD - AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	355	55	34	686	23	74	6	25	6	2	9
Future Volume (veh/h)	5	355	55	34	686	23	74	6	25	6	2	9
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1900	1826	1826	1722	1856	1856	1900	1976	1900	1900	1976	1900
Adj Flow Rate, veh/h	6	394	61	38	762	26	82	7	28	7	2	10
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	0	5	5	12	3	3	0	0	0	0	0	0
Cap, veh/h	13	2297	353	48	2730	93	139	10	35	76	30	83
Arrive On Green	0.01	1.00	1.00	0.03	0.78	0.78	0.09	0.09	0.09	0.09	0.09	0.09
Sat Flow, veh/h	1810	3005	461	1640	3478	119	1099	104	378	489	333	913
Grp Volume(v), veh/h	6	226	229	38	386	402	117	0	0	19	0	0
Grp Sat Flow(s),veh/h/ln	1810	1735	1731	1640	1763	1834	1581	0	0	1735	0	0
Q Serve(g_s), s	0.5	0.0	0.0	3.7	9.6	9.7	10.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	0.5	0.0	0.0	3.7	9.6	9.7	11.5	0.0	0.0	1.5	0.0	0.0
Prop In Lane	1.00		0.27	1.00		0.06	0.70		0.24	0.37		0.53
Lane Grp Cap(c), veh/h	13	1326	1324	48	1384	1440	183	0	0	189	0	0
V/C Ratio(X)	0.45	0.17	0.17	0.80	0.28	0.28	0.64	0.00	0.00	0.10	0.00	0.00
Avail Cap(c_a), veh/h	101	1326	1324	93	1384	1440	523	0	0	545	0	0
HCM Platoon Ratio	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	78.5	0.0	0.0	77.2	4.7	4.7	71.1	0.0	0.0	66.7	0.0	0.0
Incr Delay (d2), s/veh	22.3	0.3	0.3	25.3	0.5	0.5	3.7	0.0	0.0	0.2	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	0.1	0.1	1.9	3.2	3.3	4.9	0.0	0.0	0.7	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	100.8	0.3	0.3	102.5	5.2	5.2	74.8	0.0	0.0	67.0	0.0	0.0
LnGrp LOS	F	A	A	F	A	A	E	A	A	E	A	A
Approach Vol, veh/h		461			826			117			19	
Approach Delay, s/veh		1.6			9.7			74.8			67.0	
Approach LOS		A			A			E			E	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	7.3	132.0		20.7	10.5	128.7		20.7				
Change Period (Y+Rc), s	6.1	* 6.4		6.1	* 5.9	* 6.4		* 6.1				
Max Green Setting (Gmax), s	8.9	* 83		49.9	* 9.1	* 83		* 50				
Max Q Clear Time (g_c+I1), s	2.5	11.7		13.5	5.7	2.0		3.5				
Green Ext Time (p_c), s	0.0	11.8		0.6	0.0	5.8		0.1				
Intersection Summary												
HCM 6th Ctrl Delay				13.2								
HCM 6th LOS				B								
Notes												
* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.												

Lanes, Volumes, Timings
4: Dillard St & Cowan Rd

2023 NO BUILD - AM

						
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations					 	
Traffic Volume (vph)	53	2	7	51	4	15
Future Volume (vph)	53	2	7	51	4	15
Adj. Flow (vph)	72	3	9	69	5	20
Lane Group Flow (vph)	75	0	0	78	25	0
Sign Control	Free			Free	Stop	
Intersection Summary						
Control Type: Unsignalized						
Intersection Capacity Utilization 18.6%				ICU Level of Service A		
Analysis Period (min) 15						

Intersection						
Int Delay, s/veh	1.7					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	53	2	7	51	4	15
Future Vol, veh/h	53	2	7	51	4	15
Conflicting Peds, #/hr	0	0	0	0	1	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	74	74	74	74	74	74
Heavy Vehicles, %	4	50	0	8	0	0
Mvmt Flow	72	3	9	69	5	20
Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	75	0	162	74
Stage 1	-	-	-	-	74	-
Stage 2	-	-	-	-	88	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	1537	-	834	993
Stage 1	-	-	-	-	954	-
Stage 2	-	-	-	-	940	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1537	-	828	993
Mov Cap-2 Maneuver	-	-	-	-	828	-
Stage 1	-	-	-	-	954	-
Stage 2	-	-	-	-	933	-
Approach	EB		WB		NB	
HCM Control Delay, s	0		0.9		8.9	
HCM LOS					A	
Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT	
Capacity (veh/h)	953	-	-	1537	-	
HCM Lane V/C Ratio	0.027	-	-	0.006	-	
HCM Control Delay (s)	8.9	-	-	7.4	0	
HCM Lane LOS	A	-	-	A	A	
HCM 95th %tile Q(veh)	0.1	-	-	0	-	

1: Rosser Terrace/Fuller Way & Hugh Howell Rd

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	30	1264	15	2	819	43	6	1	2	31	0	41
Future Volume (vph)	30	1264	15	2	819	43	6	1	2	31	0	41
Adj. Flow (vph)	31	1317	16	2	853	45	6	1	2	32	0	43
Lane Group Flow (vph)	31	1333	0	2	853	45	0	9	0	0	75	0
Sign Control	Free				Free				Stop			
Intersection Summary												
Control Type: Unsignalized												
Intersection Capacity Utilization 46.5%						ICU Level of Service A						
Analysis Period (min) 15												

HCM 6th TWSC
1: Rosser Terrace/Fuller Way & Hugh Howell Rd

2023 NO BUILD - PM

Intersection												
Int Delay, s/veh	0.5											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	30	1264	15	2	819	43	6	1	2	31	0	41
Future Vol, veh/h	30	1264	15	2	819	43	6	1	2	31	0	41
Conflicting Peds, #/hr	0	0	2	2	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	100	-	-	100	-	100	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	1	-	-	1	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	96	96	96	96	96	96	96	96	96	96	96	96
Heavy Vehicles, %	4	3	0	0	3	7	0	0	0	0	0	10
Mvmt Flow	31	1317	16	2	853	45	6	1	2	32	0	43
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	898	0	0	1335	0	0	1820	2291	669	1578	2254	427
Stage 1	-	-	-	-	-	-	1389	1389	-	857	857	-
Stage 2	-	-	-	-	-	-	431	902	-	721	1397	-
Critical Hdwy	4.18	-	-	4.1	-	-	7.5	6.5	6.9	7.5	6.5	7.1
Critical Hdwy Stg 1	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5	-
Follow-up Hdwy	2.24	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.4
Pot Cap-1 Maneuver	*1118	-	-	*878	-	-	*187	*56	*585	*412	*62	*736
Stage 1	-	-	-	-	-	-	*551	*483	-	*715	*626	-
Stage 2	-	-	-	-	-	-	*715	*626	-	*551	*477	-
Platoon blocked, %	1	-	-	1	-	-	1	1	1	1	1	1
Mov Cap-1 Maneuver	*1118	-	-	*876	-	-	*171	*54	*583	*400	*60	*736
Mov Cap-2 Maneuver	-	-	-	-	-	-	*343	*263	-	*448	*268	-
Stage 1	-	-	-	-	-	-	*535	*468	-	*695	*624	-
Stage 2	-	-	-	-	-	-	*672	*624	-	*533	*462	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.2			0			15.2			10.2		
HCM LOS							C			B		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	364	* 1118	-	-	* 876	-	-	736				
HCM Lane V/C Ratio	0.026	0.028	-	-	0.002	-	-	0.058				
HCM Control Delay (s)	15.2	8.3	-	-	9.1	-	-	10.2				
HCM Lane LOS	C	A	-	-	A	-	-	B				
HCM 95th %tile Q(veh)	0.1	0.1	-	-	0	-	-	0.2				
Notes												
~: Volume exceeds capacity		\$: Delay exceeds 300s				+: Computation Not Defined				*: All major volume in platoon		

2: Cowan Rd/The Centre Driveway & Hugh Howell Rd

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	138	1151	42	53	718	76	51	29	54	86	35	98
Future Volume (vph)	138	1151	42	53	718	76	51	29	54	86	35	98
Adj. Flow (vph)	148	1238	45	57	772	82	55	31	58	92	38	105
Lane Group Flow (vph)	148	1283	0	57	772	82	0	144	0	92	143	0
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA		pm+pt	NA	
Protected Phases	1	6		5	2			8		7	4	
Permitted Phases	6			2		2	8			4		
Detector Phase	1	6		5	2	2	8	8		7	4	
Switch Phase												
Minimum Initial (s)	7.0	10.0		5.0	10.0	10.0	7.0	7.0		5.0	7.0	
Minimum Split (s)	13.2	27.4		10.3	32.1	32.1	35.5	35.5		11.1	35.5	
Total Split (s)	16.0	94.0		15.0	93.0	93.0	36.0	36.0		15.0	51.0	
Total Split (%)	10.0%	58.8%		9.4%	58.1%	58.1%	22.5%	22.5%		9.4%	31.9%	
Maximum Green (s)	9.8	87.9		9.7	86.9	86.9	29.5	29.5		8.9	44.5	
Yellow Time (s)	3.4	4.6		3.1	4.6	4.6	3.5	3.5		3.1	3.5	
All-Red Time (s)	2.8	1.5		2.2	1.5	1.5	3.0	3.0		3.0	3.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0		0.0		0.0	0.0	
Total Lost Time (s)	6.2	6.1		5.3	6.1	6.1		6.5		6.1	6.5	
Lead/Lag	Lead	Lag		Lead	Lag	Lag	Lag	Lag		Lead		
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes	Yes	Yes		Yes		
Vehicle Extension (s)	3.0	5.0		3.0	5.0	5.0	3.0	3.0		3.0	3.0	
Minimum Gap (s)	0.2	3.0		0.2	3.0	3.0	0.2	0.2		0.2	0.2	
Time Before Reduce (s)	0.0	20.0		0.0	20.0	20.0	0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	10.0		0.0	10.0	10.0	0.0	0.0		0.0	0.0	
Recall Mode	None	C-Max		None	C-Max	C-Max	None	None		None	None	
Walk Time (s)		7.0			7.0	7.0	7.0	7.0			7.0	
Flash Dont Walk (s)		10.0			19.0	19.0	22.0	22.0			22.0	
Pedestrian Calls (#/hr)		0			0	0	0	0			0	
Act Effect Green (s)	111.0	102.9		105.1	97.2	97.2		19.4		34.8	34.4	
Actuated g/C Ratio	0.69	0.64		0.66	0.61	0.61		0.12		0.22	0.22	
v/c Ratio	0.32	0.57		0.21	0.36	0.08		0.76		0.41	0.35	
Control Delay	10.2	18.8		8.7	13.6	0.5		82.2		55.8	23.1	
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0		0.0	0.0	
Total Delay	10.2	18.8		8.7	13.6	0.5		82.2		55.8	23.1	
LOS	B	B		A	B	A		F		E	C	
Approach Delay		17.9			12.1			82.2			35.9	
Approach LOS		B			B			F			D	
Queue Length 50th (ft)	46	394		13	166	0		129		81	49	
Queue Length 95th (ft)	85	541		m27	199	m3		201		127	109	
Internal Link Dist (ft)		969			335			94			430	
Turn Bay Length (ft)	125			115								
Base Capacity (vph)	476	2245		298	2129	1001		279		228	500	
Starvation Cap Reductn	0	0		0	0	0		0		0	0	
Spillback Cap Reductn	0	0		0	0	0		0		0	0	
Storage Cap Reductn	0	0		0	0	0		0		0	0	
Reduced v/c Ratio	0.31	0.57		0.19	0.36	0.08		0.52		0.40	0.29	
Intersection Summary												

2: Cowan Rd/The Centre Driveway & Hugh Howell Rd

Cycle Length: 160

Actuated Cycle Length: 160

Offset: 102.9 (64%), Referenced to phase 2:WBTL and 6:EBTL, Start of Yellow

Natural Cycle: 95

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.76

Intersection Signal Delay: 20.9

Intersection LOS: C

Intersection Capacity Utilization 73.8%

ICU Level of Service D

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: Cowan Rd/The Centre Driveway & Hugh Howell Rd



HCM 6th Signalized Intersection Summary

2: Cowan Rd/The Centre Driveway & Hugh Howell Rd

2023 NO BUILD - PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	138	1151	42	53	718	76	51	29	54	86	35	98
Future Volume (veh/h)	138	1151	42	53	718	76	51	29	54	86	35	98
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1900	1856	1856	1900	1856	1870	1900	1900	1900	1885	1900	1900
Adj Flow Rate, veh/h	148	1238	45	57	772	82	55	31	58	92	38	105
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	0	3	3	0	3	2	0	0	0	1	0	0
Cap, veh/h	540	2270	82	299	2234	1004	88	45	69	255	91	252
Arrive On Green	0.04	0.65	0.65	0.06	1.00	1.00	0.11	0.11	0.11	0.06	0.21	0.21
Sat Flow, veh/h	1810	3470	126	1810	3526	1585	510	403	616	1795	445	1231
Grp Volume(v), veh/h	148	629	654	57	772	82	144	0	0	92	0	143
Grp Sat Flow(s),veh/h/ln	1810	1763	1833	1810	1763	1585	1529	0	0	1795	0	1676
Q Serve(g_s), s	4.6	30.7	30.7	1.8	0.0	0.0	12.8	0.0	0.0	7.1	0.0	11.9
Cycle Q Clear(g_c), s	4.6	30.7	30.7	1.8	0.0	0.0	14.7	0.0	0.0	7.1	0.0	11.9
Prop In Lane	1.00		0.07	1.00		1.00	0.38		0.40	1.00		0.73
Lane Grp Cap(c), veh/h	540	1153	1199	299	2234	1004	201	0	0	255	0	344
V/C Ratio(X)	0.27	0.55	0.55	0.19	0.35	0.08	0.71	0.00	0.00	0.36	0.00	0.42
Avail Cap(c_a), veh/h	572	1153	1199	357	2234	1004	311	0	0	255	0	466
HCM Platoon Ratio	1.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	9.1	14.9	14.9	11.7	0.0	0.0	69.6	0.0	0.0	56.8	0.0	55.3
Incr Delay (d2), s/veh	0.3	1.9	1.8	0.3	0.4	0.2	4.7	0.0	0.0	0.9	0.0	0.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.8	12.2	12.6	0.7	0.1	0.0	6.1	0.0	0.0	3.3	0.0	5.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	9.3	16.7	16.7	12.1	0.4	0.2	74.2	0.0	0.0	57.6	0.0	56.1
LnGrp LOS	A	B	B	B	A	A	E	A	A	E	A	E
Approach Vol, veh/h	1431				911				144			
Approach Delay, s/veh	15.9				1.1				74.2			
Approach LOS	B				A				E			
Timer - Assigned Phs	1	2		4	5	6	7	8				
Phs Duration (G+Y+Rc), s	13.2	107.5		39.3	9.9	110.8	15.0	24.3				
Change Period (Y+Rc), s	* 6.2	6.1		6.5	* 5.3	6.1	6.1	6.5				
Max Green Setting (Gmax), s	* 9.8	86.9		44.5	* 9.7	87.9	8.9	29.5				
Max Q Clear Time (g_c+l1), s	6.6	2.0		13.9	3.8	32.7	9.1	16.7				
Green Ext Time (p_c), s	0.1	13.8		0.9	0.0	24.7	0.0	0.6				

Intersection Summary

HCM 6th Ctrl Delay	17.6
HCM 6th LOS	B

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Lanes, Volumes, Timings
3: Tucker Industrial Rd & Hugh Howell Rd

2023 NO BUILD - PM

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	5	1030	207	54	679	6	134	1	75	28	10	4
Future Volume (vph)	5	1030	207	54	679	6	134	1	75	28	10	4
Adj. Flow (vph)	5	1084	218	57	715	6	141	1	79	29	11	4
Lane Group Flow (vph)	5	1302	0	57	721	0	0	221	0	0	44	0
Turn Type	Prot	NA		Prot	NA		Perm	NA		Perm	NA	
Protected Phases	1	6		5	2			4			8	
Permitted Phases							4			8		
Detector Phase	1	6		5	2		4	4		8	8	
Switch Phase												
Minimum Initial (s)	5.0	10.0		5.0	10.0		7.0	7.0		7.0	7.0	
Minimum Split (s)	11.1	31.4		10.9	31.4		31.1	31.1		33.9	33.9	
Total Split (s)	15.0	110.0		15.0	110.0		35.0	35.0		35.0	35.0	
Total Split (%)	9.4%	68.8%		9.4%	68.8%		21.9%	21.9%		21.9%	21.9%	
Maximum Green (s)	8.9	103.6		9.1	103.6		28.9	28.9		29.1	29.1	
Yellow Time (s)	3.5	4.7		3.3	4.7		3.3	3.3		3.0	3.0	
All-Red Time (s)	2.6	1.7		2.6	1.7		2.8	2.8		2.9	2.9	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0			0.0	
Total Lost Time (s)	6.1	6.4		5.9	6.4			6.1			5.9	
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
Vehicle Extension (s)	3.0	5.0		3.0	5.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	0.2	3.0		0.2	3.0		0.2	0.2		0.2	0.2	
Time Before Reduce (s)	0.0	20.0		0.0	20.0		0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	15.0		0.0	15.0		0.0	0.0		0.0	0.0	
Recall Mode	None	C-Max		None	C-Max		None	None		None	None	
Walk Time (s)		7.0			7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)		18.0			18.0		18.0	18.0		21.0	21.0	
Pedestrian Calls (#/hr)		0			0		0	0		0	0	
Act Effect Green (s)	6.2	109.2		8.7	118.6			26.2			26.4	
Actuated g/C Ratio	0.04	0.68		0.05	0.74			0.16			0.16	
v/c Ratio	0.09	0.56		0.65	0.28			0.89			0.18	
Control Delay	90.8	6.2		104.9	7.8			94.3			54.1	
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	
Total Delay	90.8	6.2		104.9	7.8			94.3			54.1	
LOS	F	A		F	A			F			D	
Approach Delay		6.5			14.9			94.3			54.1	
Approach LOS		A			B			F			D	
Queue Length 50th (ft)	5	113		59	117			211			37	
Queue Length 95th (ft)	m11	124		#124	196			#347			76	
Internal Link Dist (ft)		1068			568			739			1148	
Turn Bay Length (ft)	150			100								
Base Capacity (vph)	83	2339		93	2595			273			262	
Starvation Cap Reductn	0	0		0	0			0			0	
Spillback Cap Reductn	0	0		0	0			0			0	
Storage Cap Reductn	0	0		0	0			0			0	
Reduced v/c Ratio	0.06	0.56		0.61	0.28			0.81			0.17	
Intersection Summary												

Lanes, Volumes, Timings

3: Tucker Industrial Rd & Hugh Howell Rd

2023 NO BUILD - PM

Cycle Length: 160

Actuated Cycle Length: 160

Offset: 118.6 (74%), Referenced to phase 2:WBT and 6:EBT, Start of Yellow

Natural Cycle: 80

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.89

Intersection Signal Delay: 18.4

Intersection LOS: B

Intersection Capacity Utilization 68.5%

ICU Level of Service C

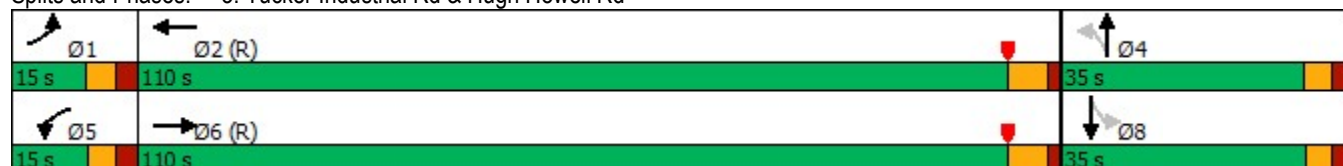
Analysis Period (min) 15

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: Tucker Industrial Rd & Hugh Howell Rd



HCM 6th Signalized Intersection Summary

3: Tucker Industrial Rd & Hugh Howell Rd

2023 NO BUILD - PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	1030	207	54	679	6	134	1	75	28	10	4
Future Volume (veh/h)	5	1030	207	54	679	6	134	1	75	28	10	4
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1604	1856	1856	1752	1856	1856	1900	1976	1900	1900	1976	1900
Adj Flow Rate, veh/h	5	1084	218	57	715	6	141	1	79	29	11	4
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	20	3	3	10	3	3	0	0	0	0	0	0
Cap, veh/h	10	2023	405	71	2604	22	191	1	86	175	64	20
Arrive On Green	0.01	1.00	1.00	0.04	0.73	0.73	0.15	0.15	0.15	0.15	0.15	0.15
Sat Flow, veh/h	1527	2926	586	1668	3583	30	1024	7	573	915	423	134
Grp Volume(v), veh/h	5	651	651	57	352	369	221	0	0	44	0	0
Grp Sat Flow(s),veh/h/ln	1527	1763	1749	1668	1763	1850	1604	0	0	1472	0	0
Q Serve(g_s), s	0.5	0.0	0.0	5.4	10.9	10.9	17.7	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	0.5	0.0	0.0	5.4	10.9	10.9	21.6	0.0	0.0	3.9	0.0	0.0
Prop In Lane	1.00		0.34	1.00		0.02	0.64		0.36	0.66		0.09
Lane Grp Cap(c), veh/h	10	1219	1210	71	1281	1345	279	0	0	259	0	0
V/C Ratio(X)	0.53	0.53	0.54	0.80	0.27	0.27	0.79	0.00	0.00	0.17	0.00	0.00
Avail Cap(c_a), veh/h	85	1219	1210	95	1281	1345	325	0	0	307	0	0
HCM Platoon Ratio	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	78.8	0.0	0.0	75.9	7.5	7.5	66.5	0.0	0.0	59.3	0.0	0.0
Incr Delay (d2), s/veh	38.4	1.7	1.7	28.5	0.5	0.5	11.0	0.0	0.0	0.3	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	0.6	0.6	2.9	4.0	4.1	9.7	0.0	0.0	1.6	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	117.2	1.7	1.7	104.4	8.0	8.0	77.6	0.0	0.0	59.6	0.0	0.0
LnGrp LOS	F	A	A	F	A	A	E	A	A	E	A	A
Approach Vol, veh/h	1307			778			221			44		
Approach Delay, s/veh	2.1			15.0			77.6			59.6		
Approach LOS	A			B			E			E		
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	7.1	122.7		30.2	12.7	117.0		30.2				
Change Period (Y+Rc), s	6.1	* 6.4		6.1	* 5.9	* 6.4		* 6.1				
Max Green Setting (Gmax), s	8.9	* 1E2		28.9	* 9.1	* 1E2		* 29				
Max Q Clear Time (g_c+I1), s	2.5	12.9		23.6	7.4	2.0		5.9				
Green Ext Time (p_c), s	0.0	10.4		0.5	0.0	30.9		0.2				
Intersection Summary												
HCM 6th Ctrl Delay	14.6											
HCM 6th LOS	B											
Notes												

Lanes, Volumes, Timings
4: Dillard St & Cowan Rd

2023 NO BUILD - PM

						
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations					 	
Traffic Volume (vph)	149	6	27	97	3	31
Future Volume (vph)	149	6	27	97	3	31
Adj. Flow (vph)	162	7	29	105	3	34
Lane Group Flow (vph)	169	0	0	134	37	0
Sign Control	Free			Free	Stop	
Intersection Summary						
Control Type: Unsignalized						
Intersection Capacity Utilization 29.0%				ICU Level of Service A		
Analysis Period (min) 15						

Intersection						
Int Delay, s/veh	1.7					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑			↑	↕	
Traffic Vol, veh/h	149	6	27	97	3	31
Future Vol, veh/h	149	6	27	97	3	31
Conflicting Peds, #/hr	0	1	1	0	1	2
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	25	0	0	0	0
Mvmt Flow	162	7	29	105	3	34
Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	170	0	331	169
Stage 1	-	-	-	-	167	-
Stage 2	-	-	-	-	164	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	1420	-	668	880
Stage 1	-	-	-	-	867	-
Stage 2	-	-	-	-	870	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1419	-	652	877
Mov Cap-2 Maneuver	-	-	-	-	652	-
Stage 1	-	-	-	-	866	-
Stage 2	-	-	-	-	850	-
Approach	EB		WB		NB	
HCM Control Delay, s	0		1.7		9.4	
HCM LOS					A	
Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT	
Capacity (veh/h)	851	-	-	1419	-	
HCM Lane V/C Ratio	0.043	-	-	0.021	-	
HCM Control Delay (s)	9.4	-	-	7.6	-	
HCM Lane LOS	A	-	-	A	-	
HCM 95th %tile Q(veh)	0.1	-	-	0.1	-	

2023 BUILD CONDITIONS Capacity Analysis

1: Rosser Terrace/Fuller Way & Hugh Howell Rd

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	29	427	16	60	719	10	15	0	41	19	0	31
Future Volume (vph)	29	427	16	60	719	10	15	0	41	19	0	31
Adj. Flow (vph)	31	459	17	65	773	11	16	0	44	20	0	33
Lane Group Flow (vph)	31	476	0	65	773	11	0	16	44	0	53	0
Sign Control	Free			Free			Stop			Stop		
Intersection Summary												
Control Type: Unsignalized												
Intersection Capacity Utilization 42.8%						ICU Level of Service A						
Analysis Period (min) 15												

Intersection												
Int Delay, s/veh	1.3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	29	427	16	60	719	10	15	0	41	19	0	31
Future Vol, veh/h	29	427	16	60	719	10	15	0	41	19	0	31
Conflicting Peds, #/hr	1	0	1	1	0	1	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	100	-	-	100	-	100	-	-	10	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	1	-	-	1	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	7	3	0	0	2	10	33	0	0	10	0	0
Mvmt Flow	31	459	17	65	773	11	16	0	44	20	0	33
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	785	0	0	477	0	0	1048	1446	239	1196	1443	388
Stage 1	-	-	-	-	-	-	531	531	-	904	904	-
Stage 2	-	-	-	-	-	-	517	915	-	292	539	-
Critical Hdwy	4.24	-	-	4.1	-	-	8.16	6.5	6.9	7.7	6.5	6.9
Critical Hdwy Stg 1	-	-	-	-	-	-	7.16	5.5	-	6.7	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	7.16	5.5	-	6.7	5.5	-
Follow-up Hdwy	2.27	-	-	2.2	-	-	3.83	4	3.3	3.6	4	3.3
Pot Cap-1 Maneuver	*1159	-	-	1342	-	-	*550	338	*931	*585	341	*796
Stage 1	-	-	-	-	-	-	*682	689	-	*609	577	-
Stage 2	-	-	-	-	-	-	*687	569	-	*854	683	-
Platoon blocked, %	1	-	-	1	-	-	1	1	1	1	1	1
Mov Cap-1 Maneuver	*1158	-	-	1341	-	-	*497	313	*930	*526	315	*796
Mov Cap-2 Maneuver	-	-	-	-	-	-	*510	402	-	*525	405	-
Stage 1	-	-	-	-	-	-	*662	670	-	*592	549	-
Stage 2	-	-	-	-	-	-	*626	541	-	*792	664	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.5			0.6			10			9.7		
HCM LOS							B			A		
Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1			
Capacity (veh/h)	510	930	* 1158	-	-	1341	-	-	796			
HCM Lane V/C Ratio	0.032	0.047	0.027	-	-	0.048	-	-	0.042			
HCM Control Delay (s)	12.3	9.1	8.2	-	-	7.8	-	-	9.7			
HCM Lane LOS	B	A	A	-	-	A	-	-	A			
HCM 95th %tile Q(veh)	0.1	0.1	0.1	-	-	0.2	-	-	0.1			
Notes												
~: Volume exceeds capacity		\$: Delay exceeds 300s		+: Computation Not Defined				*: All major volume in platoon				

2: Cowan Rd/The Centre Driveway & Hugh Howell Rd

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	46	410	45	20	722	34	65	7	43	21	5	32
Future Volume (vph)	46	410	45	20	722	34	65	7	43	21	5	32
Adj. Flow (vph)	49	441	48	22	776	37	70	8	46	23	5	34
Lane Group Flow (vph)	49	489	0	22	776	37	0	124	0	23	39	0
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA		pm+pt	NA	
Protected Phases	1	6		5	2			8		7	4	
Permitted Phases	6			2		2	8			4		
Detector Phase	1	6		5	2	2	8	8		7	4	
Switch Phase												
Minimum Initial (s)	7.0	10.0		5.0	10.0	10.0	7.0	7.0		5.0	7.0	
Minimum Split (s)	13.2	27.4		10.3	32.1	32.1	35.5	35.5		11.1	35.5	
Total Split (s)	26.0	85.0		17.0	76.0	76.0	42.0	42.0		16.0	58.0	
Total Split (%)	16.3%	53.1%		10.6%	47.5%	47.5%	26.3%	26.3%		10.0%	36.3%	
Maximum Green (s)	19.8	78.9		11.7	69.9	69.9	35.5	35.5		9.9	51.5	
Yellow Time (s)	3.4	4.6		3.1	4.6	4.6	3.5	3.5		3.1	3.5	
All-Red Time (s)	2.8	1.5		2.2	1.5	1.5	3.0	3.0		3.0	3.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0		0.0		0.0	0.0	
Total Lost Time (s)	6.2	6.1		5.3	6.1	6.1		6.5		6.1	6.5	
Lead/Lag	Lead	Lag		Lead	Lag	Lag	Lag	Lag		Lead		
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes	Yes	Yes		Yes		
Vehicle Extension (s)	3.0	5.0		3.0	5.0	5.0	3.0	3.0		3.0	3.0	
Minimum Gap (s)	0.2	3.0		0.2	3.0	3.0	0.2	0.2		0.2	0.2	
Time Before Reduce (s)	0.0	20.0		0.0	20.0	20.0	0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	10.0		0.0	10.0	10.0	0.0	0.0		0.0	0.0	
Recall Mode	None	C-Max		None	C-Max	C-Max	None	None		None	None	
Walk Time (s)		7.0			7.0	7.0	7.0	7.0			7.0	
Flash Dont Walk (s)		10.0			19.0	19.0	22.0	22.0			22.0	
Pedestrian Calls (#/hr)		0			0	0	0	0			0	
Act Effect Green (s)	118.5	114.0		116.0	110.2	110.2		17.3		26.7	26.3	
Actuated g/C Ratio	0.74	0.71		0.72	0.69	0.69		0.11		0.17	0.16	
v/c Ratio	0.10	0.20		0.03	0.32	0.03		0.73		0.12	0.14	
Control Delay	7.6	10.1		7.0	11.1	0.1		81.6		51.1	17.7	
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0		0.0	0.0	
Total Delay	7.6	10.1		7.0	11.1	0.1		81.6		51.1	17.7	
LOS	A	B		A	B	A		F		D	B	
Approach Delay		9.9			10.5			81.6			30.1	
Approach LOS		A			B			F			C	
Queue Length 50th (ft)	13	100		5	166	0		110		20	4	
Queue Length 95th (ft)	33	155		16	218	0		178		44	36	
Internal Link Dist (ft)		969			335			119			430	
Turn Bay Length (ft)	125			115								
Base Capacity (vph)	604	2401		741	2391	1131		334		196	519	
Starvation Cap Reductn	0	0		0	0	0		0		0	0	
Spillback Cap Reductn	0	0		0	0	0		0		0	0	
Storage Cap Reductn	0	0		0	0	0		0		0	0	
Reduced v/c Ratio	0.08	0.20		0.03	0.32	0.03		0.37		0.12	0.08	
Intersection Summary												

2: Cowan Rd/The Centre Driveway & Hugh Howell Rd

Cycle Length: 160

Actuated Cycle Length: 160

Offset: 148.9 (93%), Referenced to phase 2:WBTL and 6:EBTL, Start of Yellow

Natural Cycle: 95

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.73

Intersection Signal Delay: 16.7

Intersection LOS: B

Intersection Capacity Utilization 56.4%

ICU Level of Service B

Analysis Period (min) 15

Splits and Phases: 2: Cowan Rd/The Centre Driveway & Hugh Howell Rd



HCM 6th Signalized Intersection Summary

2: Cowan Rd/The Centre Driveway & Hugh Howell Rd

2023 BUILD - AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	46	410	45	20	722	34	65	7	43	21	5	32
Future Volume (veh/h)	46	410	45	20	722	34	65	7	43	21	5	32
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1900	1826	1826	1900	1841	1900	1900	1900	1900	1752	1900	1900
Adj Flow Rate, veh/h	49	441	48	22	776	37	70	8	46	23	5	34
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	0	5	5	0	4	0	0	0	0	10	0	0
Cap, veh/h	585	2252	244	694	2408	1108	113	14	54	194	33	222
Arrive On Green	0.04	0.71	0.71	0.04	1.00	1.00	0.10	0.10	0.10	0.02	0.16	0.16
Sat Flow, veh/h	1810	3157	342	1810	3497	1609	805	141	558	1668	211	1432
Grp Volume(v), veh/h	49	241	248	22	776	37	124	0	0	23	0	39
Grp Sat Flow(s),veh/h/ln	1810	1735	1764	1810	1749	1609	1504	0	0	1668	0	1642
Q Serve(g_s), s	1.2	7.4	7.5	0.6	0.0	0.0	12.3	0.0	0.0	1.9	0.0	3.3
Cycle Q Clear(g_c), s	1.2	7.4	7.5	0.6	0.0	0.0	13.0	0.0	0.0	1.9	0.0	3.3
Prop In Lane	1.00		0.19	1.00		1.00	0.56		0.37	1.00		0.87
Lane Grp Cap(c), veh/h	585	1237	1258	694	2408	1108	181	0	0	194	0	255
V/C Ratio(X)	0.08	0.20	0.20	0.03	0.32	0.03	0.68	0.00	0.00	0.12	0.00	0.15
Avail Cap(c_a), veh/h	738	1237	1258	791	2408	1108	367	0	0	264	0	529
HCM Platoon Ratio	1.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	6.1	7.6	7.6	6.8	0.0	0.0	71.0	0.0	0.0	61.4	0.0	58.5
Incr Delay (d2), s/veh	0.1	0.4	0.4	0.0	0.4	0.1	4.5	0.0	0.0	0.3	0.0	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	2.7	2.8	0.2	0.1	0.0	5.3	0.0	0.0	0.8	0.0	1.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	6.2	8.0	8.0	6.8	0.4	0.1	75.5	0.0	0.0	61.7	0.0	58.7
LnGrp LOS	A	A	A	A	A	A	E	A	A	E	A	E
Approach Vol, veh/h	538			835			124			62		
Approach Delay, s/veh	7.8			0.5			75.5			59.8		
Approach LOS	A			A			E			E		
Timer - Assigned Phs	1	2		4	5	6	7	8				
Phs Duration (G+Y+Rc), s	12.4	116.2		31.3	8.4	120.2	9.3	22.0				
Change Period (Y+Rc), s	* 6.2	6.1		6.5	* 5.3	6.1	6.1	6.5				
Max Green Setting (Gmax), s	* 20	69.9		51.5	* 12	78.9	9.9	35.5				
Max Q Clear Time (g_c+I1), s	3.2	2.0		5.3	2.6	9.5	3.9	15.0				
Green Ext Time (p_c), s	0.1	13.1		0.2	0.0	6.3	0.0	0.6				
Intersection Summary												
HCM 6th Ctrl Delay	11.4											
HCM 6th LOS	B											
Notes												

Lanes, Volumes, Timings
3: Tucker Industrial Rd & Hugh Howell Rd

2023 BUILD - AM

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	8	374	58	34	706	23	78	6	25	6	2	12
Future Volume (vph)	8	374	58	34	706	23	78	6	25	6	2	12
Adj. Flow (vph)	9	416	64	38	784	26	87	7	28	7	2	13
Lane Group Flow (vph)	9	480	0	38	810	0	0	122	0	0	22	0
Turn Type	Prot	NA		Prot	NA		Perm	NA		Perm	NA	
Protected Phases	1	6		5	2			4			8	
Permitted Phases							4			8		
Detector Phase	1	6		5	2		4	4		8	8	
Switch Phase												
Minimum Initial (s)	5.0	10.0		5.0	10.0		7.0	7.0		7.0	7.0	
Minimum Split (s)	11.1	31.4		10.9	31.4		31.1	31.1		33.9	33.9	
Total Split (s)	15.0	89.0		15.0	89.0		56.0	56.0		56.0	56.0	
Total Split (%)	9.4%	55.6%		9.4%	55.6%		35.0%	35.0%		35.0%	35.0%	
Maximum Green (s)	8.9	82.6		9.1	82.6		49.9	49.9		50.1	50.1	
Yellow Time (s)	3.5	4.7		3.3	4.7		3.3	3.3		3.0	3.0	
All-Red Time (s)	2.6	1.7		2.6	1.7		2.8	2.8		2.9	2.9	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0			0.0	
Total Lost Time (s)	6.1	6.4		5.9	6.4			6.1			5.9	
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
Vehicle Extension (s)	3.0	5.0		3.0	5.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	0.2	3.0		0.2	3.0		0.2	0.2		0.2	0.2	
Time Before Reduce (s)	0.0	20.0		0.0	20.0		0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	15.0		0.0	15.0		0.0	0.0		0.0	0.0	
Recall Mode	None	C-Max		None	C-Max		None	None		None	None	
Walk Time (s)		7.0			7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)		18.0			18.0		18.0	18.0		21.0	21.0	
Pedestrian Calls (#/hr)		0			0		0	0		0	0	
Act Effect Green (s)	6.4	116.2		9.1	126.2			18.5			18.7	
Actuated g/C Ratio	0.04	0.73		0.06	0.79			0.12			0.12	
v/c Ratio	0.13	0.20		0.42	0.30			0.73			0.10	
Control Delay	85.8	9.4		85.4	5.9			85.2			35.0	
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	
Total Delay	85.8	9.4		85.4	5.9			85.2			35.0	
LOS	F	A		F	A			F			D	
Approach Delay		10.8			9.5			85.2			35.0	
Approach LOS		B			A			F			D	
Queue Length 50th (ft)	7	119		39	95			115			9	
Queue Length 95th (ft)	m26	187		79	216			181			36	
Internal Link Dist (ft)		1068			568			739			1148	
Turn Bay Length (ft)	150			100								
Base Capacity (vph)	100	2447		101	2743			437			543	
Starvation Cap Reductn	0	0		0	0			0			0	
Spillback Cap Reductn	0	0		0	0			0			0	
Storage Cap Reductn	0	0		0	0			0			0	
Reduced v/c Ratio	0.09	0.20		0.38	0.30			0.28			0.04	
Intersection Summary												

Lanes, Volumes, Timings

3: Tucker Industrial Rd & Hugh Howell Rd

2023 BUILD - AM

Cycle Length: 160

Actuated Cycle Length: 160

Offset: 38.6 (24%), Referenced to phase 2:WBT and 6:EBT, Start of Yellow

Natural Cycle: 80

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.73

Intersection Signal Delay: 16.5

Intersection LOS: B

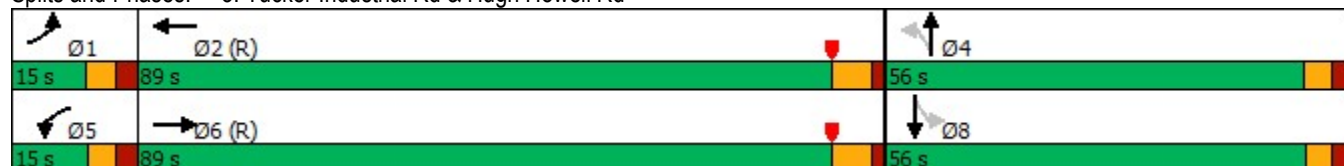
Intersection Capacity Utilization 51.8%

ICU Level of Service A

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: Tucker Industrial Rd & Hugh Howell Rd



HCM 6th Signalized Intersection Summary

3: Tucker Industrial Rd & Hugh Howell Rd

2023 BUILD - AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	8	374	58	34	706	23	78	6	25	6	2	12
Future Volume (veh/h)	8	374	58	34	706	23	78	6	25	6	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1900	1826	1826	1722	1856	1856	1900	1976	1900	1900	1976	1900
Adj Flow Rate, veh/h	9	416	64	38	784	26	87	7	28	7	2	13
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	0	5	5	12	3	3	0	0	0	0	0	0
Cap, veh/h	19	2290	350	48	2712	90	145	9	34	68	29	98
Arrive On Green	0.02	1.00	1.00	0.03	0.78	0.78	0.09	0.09	0.09	0.09	0.09	0.09
Sat Flow, veh/h	1810	3007	459	1640	3482	115	1126	93	363	406	311	1037
Grp Volume(v), veh/h	9	239	241	38	397	413	122	0	0	22	0	0
Grp Sat Flow(s),veh/h/ln	1810	1735	1732	1640	1763	1835	1581	0	0	1755	0	0
Q Serve(g_s), s	0.8	0.0	0.0	3.7	10.3	10.3	10.2	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	0.8	0.0	0.0	3.7	10.3	10.3	12.0	0.0	0.0	1.8	0.0	0.0
Prop In Lane	1.00		0.27	1.00		0.06	0.71		0.23	0.32		0.59
Lane Grp Cap(c), veh/h	19	1321	1318	48	1373	1429	188	0	0	196	0	0
V/C Ratio(X)	0.48	0.18	0.18	0.80	0.29	0.29	0.65	0.00	0.00	0.11	0.00	0.00
Avail Cap(c_a), veh/h	101	1321	1318	93	1373	1429	522	0	0	548	0	0
HCM Platoon Ratio	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	77.9	0.0	0.0	77.2	5.0	5.0	70.9	0.0	0.0	66.4	0.0	0.0
Incr Delay (d2), s/veh	18.1	0.3	0.3	25.3	0.5	0.5	3.7	0.0	0.0	0.3	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.5	0.1	0.1	1.9	3.4	3.5	5.1	0.0	0.0	0.8	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	96.0	0.3	0.3	102.5	5.6	5.6	74.6	0.0	0.0	66.7	0.0	0.0
LnGrp LOS	F	A	A	F	A	A	E	A	A	E	A	A
Approach Vol, veh/h		489			848			122			22	
Approach Delay, s/veh		2.1			9.9			74.6			66.7	
Approach LOS		A			A			E			E	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	7.7	131.0		21.2	10.5	128.2		21.2				
Change Period (Y+Rc), s	6.1	* 6.4		6.1	* 5.9	* 6.4		* 6.1				
Max Green Setting (Gmax), s	8.9	* 83		49.9	* 9.1	* 83		* 50				
Max Q Clear Time (g_c+I1), s	2.8	12.3		14.0	5.7	2.0		3.8				
Green Ext Time (p_c), s	0.0	12.3		0.7	0.0	6.2		0.1				
Intersection Summary												
HCM 6th Ctrl Delay				13.5								
HCM 6th LOS				B								
Notes												
* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.												

						
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	50	22	44	48	23	73
Future Volume (vph)	50	22	44	48	23	73
Adj. Flow (vph)	68	30	59	65	31	99
Lane Group Flow (vph)	98	0	0	124	130	0
Sign Control	Free			Free	Stop	
Intersection Summary						
Control Type: Unsignalized						
Intersection Capacity Utilization 24.1%				ICU Level of Service A		
Analysis Period (min) 15						

Intersection						
Int Delay, s/veh	4.9					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	50	22	44	48	23	73
Future Vol, veh/h	50	22	44	48	23	73
Conflicting Peds, #/hr	0	0	0	0	1	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	74	74	74	74	74	74
Heavy Vehicles, %	4	50	0	8	0	0
Mvmt Flow	68	30	59	65	31	99
Major/Minor	Major1	Major2		Minor1		
Conflicting Flow All	0	0	98	0	267	83
Stage 1	-	-	-	-	83	-
Stage 2	-	-	-	-	184	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	1508	-	727	982
Stage 1	-	-	-	-	945	-
Stage 2	-	-	-	-	852	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1508	-	696	982
Mov Cap-2 Maneuver	-	-	-	-	696	-
Stage 1	-	-	-	-	945	-
Stage 2	-	-	-	-	816	-
Approach	EB	WB		NB		
HCM Control Delay, s	0	3.6		9.7		
HCM LOS	A					
Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT	
Capacity (veh/h)	894	-	-	1508	-	
HCM Lane V/C Ratio	0.145	-	-	0.039	-	
HCM Control Delay (s)	9.7	-	-	7.5	0	
HCM Lane LOS	A	-	-	A	A	
HCM 95th %tile Q(veh)	0.5	-	-	0.1	-	

1: Rosser Terrace/Fuller Way & Hugh Howell Rd

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	30	1249	33	69	782	43	20	1	43	31	0	41
Future Volume (vph)	30	1249	33	69	782	43	20	1	43	31	0	41
Adj. Flow (vph)	31	1301	34	72	815	45	21	1	45	32	0	43
Lane Group Flow (vph)	31	1335	0	72	815	45	0	22	45	0	75	0
Sign Control	Free				Free				Stop			
Intersection Summary												
Control Type: Unsignalized												
Intersection Capacity Utilization 60.3%						ICU Level of Service B						
Analysis Period (min) 15												

HCM 6th TWSC
1: Rosser Terrace/Fuller Way & Hugh Howell Rd

2023 BUILD - PM

Intersection												
Int Delay, s/veh	1.1											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	30	1249	33	69	782	43	20	1	43	31	0	41
Future Vol, veh/h	30	1249	33	69	782	43	20	1	43	31	0	41
Conflicting Peds, #/hr	0	0	2	2	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	100	-	-	100	-	100	-	-	10	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	1	-	-	1	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	96	96	96	96	96	96	96	96	96	96	96	96
Heavy Vehicles, %	4	3	0	0	3	7	0	0	0	0	0	10
Mvmt Flow	31	1301	34	72	815	45	21	1	45	32	0	43
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	860	0	0	1337	0	0	1934	2386	670	1672	2358	408
Stage 1	-	-	-	-	-	-	1382	1382	-	959	959	-
Stage 2	-	-	-	-	-	-	552	1004	-	713	1399	-
Critical Hdwy	4.18	-	-	4.1	-	-	7.5	6.5	6.9	7.5	6.5	7.1
Critical Hdwy Stg 1	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5	-
Follow-up Hdwy	2.24	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.4
Pot Cap-1 Maneuver	1145	-	-	*878	-	-	*117	*41	*585	*271	45	*754
Stage 1	-	-	-	-	-	-	*551	*483	-	*609	560	-
Stage 2	-	-	-	-	-	-	*733	*526	-	*551	475	-
Platoon blocked, %	1	-	-	1	-	-	1	1	1	1	1	1
Mov Cap-1 Maneuver	1145	-	-	*876	-	-	*101	*37	*583	*229	40	*754
Mov Cap-2 Maneuver	-	-	-	-	-	-	*305	*227	-	*324	220	-
Stage 1	-	-	-	-	-	-	*535	*469	-	*593	514	-
Stage 2	-	-	-	-	-	-	*635	*483	-	*494	461	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.2			0.7			13.7			10.1		
HCM LOS							B			B		
Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1			
Capacity (veh/h)	300	583	1145	-	-	*876	-	-	754			
HCM Lane V/C Ratio	0.073	0.077	0.027	-	-	0.082	-	-	0.057			
HCM Control Delay (s)	17.9	11.7	8.2	-	-	9.5	-	-	10.1			
HCM Lane LOS	C	B	A	-	-	A	-	-	B			
HCM 95th %tile Q(veh)	0.2	0.2	0.1	-	-	0.3	-	-	0.2			
Notes												
~: Volume exceeds capacity		\$: Delay exceeds 300s				+: Computation Not Defined				*: All major volume in platoon		

2: Cowan Rd/The Centre Driveway & Hugh Howell Rd

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	138	1140	79	53	695	76	96	29	68	86	35	98
Future Volume (vph)	138	1140	79	53	695	76	96	29	68	86	35	98
Adj. Flow (vph)	148	1226	85	57	747	82	103	31	73	92	38	105
Lane Group Flow (vph)	148	1311	0	57	747	82	0	207	0	92	143	0
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA		pm+pt	NA	
Protected Phases	1	6		5	2			8		7	4	
Permitted Phases	6			2		2	8			4		
Detector Phase	1	6		5	2	2	8	8		7	4	
Switch Phase												
Minimum Initial (s)	7.0	10.0		5.0	10.0	10.0	7.0	7.0		5.0	7.0	
Minimum Split (s)	13.2	27.4		10.3	32.1	32.1	35.5	35.5		11.1	35.5	
Total Split (s)	16.0	94.0		15.0	93.0	93.0	36.0	36.0		15.0	51.0	
Total Split (%)	10.0%	58.8%		9.4%	58.1%	58.1%	22.5%	22.5%		9.4%	31.9%	
Maximum Green (s)	9.8	87.9		9.7	86.9	86.9	29.5	29.5		8.9	44.5	
Yellow Time (s)	3.4	4.6		3.1	4.6	4.6	3.5	3.5		3.1	3.5	
All-Red Time (s)	2.8	1.5		2.2	1.5	1.5	3.0	3.0		3.0	3.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0		0.0		0.0	0.0	
Total Lost Time (s)	6.2	6.1		5.3	6.1	6.1		6.5		6.1	6.5	
Lead/Lag	Lead	Lag		Lead	Lag	Lag	Lag	Lag		Lead		
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes	Yes	Yes		Yes		
Vehicle Extension (s)	3.0	5.0		3.0	5.0	5.0	3.0	3.0		3.0	3.0	
Minimum Gap (s)	0.2	3.0		0.2	3.0	3.0	0.2	0.2		0.2	0.2	
Time Before Reduce (s)	0.0	20.0		0.0	20.0	20.0	0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	10.0		0.0	10.0	10.0	0.0	0.0		0.0	0.0	
Recall Mode	None	C-Max		None	C-Max	C-Max	None	None		None	None	
Walk Time (s)		7.0			7.0	7.0	7.0	7.0			7.0	
Flash Dont Walk (s)		10.0			19.0	19.0	22.0	22.0			22.0	
Pedestrian Calls (#/hr)		0			0	0	0	0			0	
Act Effct Green (s)	103.7	95.9		98.9	90.8	90.8		26.2		41.5	41.1	
Actuated g/C Ratio	0.65	0.60		0.62	0.57	0.57		0.16		0.26	0.26	
v/c Ratio	0.33	0.63		0.24	0.38	0.09		0.88		0.32	0.30	
Control Delay	12.6	23.5		11.0	16.4	0.6		93.7		48.7	20.6	
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0		0.0	0.0	
Total Delay	12.6	23.5		11.0	16.4	0.6		93.7		48.7	20.6	
LOS	B	C		B	B	A		F		D	C	
Approach Delay		22.4			14.6			93.7			31.6	
Approach LOS		C			B			F			C	
Queue Length 50th (ft)	57	481		16	167	0		196		74	45	
Queue Length 95th (ft)	89	580		m28	194	m3		#323		125	107	
Internal Link Dist (ft)		969			335			94			430	
Turn Bay Length (ft)	125			115								
Base Capacity (vph)	447	2086		261	1988	942		264		285	500	
Starvation Cap Reductn	0	0		0	0	0		0		0	0	
Spillback Cap Reductn	0	0		0	0	0		0		0	0	
Storage Cap Reductn	0	0		0	0	0		0		0	0	
Reduced v/c Ratio	0.33	0.63		0.22	0.38	0.09		0.78		0.32	0.29	
Intersection Summary												

2: Cowan Rd/The Centre Driveway & Hugh Howell Rd

Cycle Length: 160

Actuated Cycle Length: 160

Offset: 102.9 (64%), Referenced to phase 2:WBTL and 6:EBTL, Start of Yellow

Natural Cycle: 95

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.88

Intersection Signal Delay: 26.0

Intersection LOS: C

Intersection Capacity Utilization 77.9%

ICU Level of Service D

Analysis Period (min) 15

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: Cowan Rd/The Centre Driveway & Hugh Howell Rd



HCM 6th Signalized Intersection Summary

2: Cowan Rd/The Centre Driveway & Hugh Howell Rd

2023 BUILD - PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	138	1140	79	53	695	76	96	29	68	86	35	98
Future Volume (veh/h)	138	1140	79	53	695	76	96	29	68	86	35	98
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1900	1856	1856	1900	1856	1870	1900	1900	1900	1885	1900	1900
Adj Flow Rate, veh/h	148	1226	85	57	747	82	103	31	73	92	38	105
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	0	3	3	0	3	2	0	0	0	1	0	0
Cap, veh/h	523	2044	141	261	2075	933	143	38	80	307	111	306
Arrive On Green	0.05	0.61	0.61	0.06	1.00	1.00	0.16	0.16	0.16	0.05	0.25	0.25
Sat Flow, veh/h	1810	3345	232	1810	3526	1585	700	241	513	1795	446	1231
Grp Volume(v), veh/h	148	645	666	57	747	82	207	0	0	92	0	143
Grp Sat Flow(s),veh/h/ln	1810	1763	1814	1810	1763	1585	1454	0	0	1795	0	1677
Q Serve(g_s), s	5.2	35.9	36.1	2.0	0.0	0.0	21.7	0.0	0.0	6.7	0.0	11.2
Cycle Q Clear(g_c), s	5.2	35.9	36.1	2.0	0.0	0.0	22.4	0.0	0.0	6.7	0.0	11.2
Prop In Lane	1.00		0.13	1.00		1.00	0.50		0.35	1.00		0.73
Lane Grp Cap(c), veh/h	523	1077	1108	261	2075	933	261	0	0	307	0	416
V/C Ratio(X)	0.28	0.60	0.60	0.22	0.36	0.09	0.79	0.00	0.00	0.30	0.00	0.34
Avail Cap(c_a), veh/h	551	1077	1108	319	2075	933	301	0	0	311	0	466
HCM Platoon Ratio	1.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	11.7	19.1	19.1	15.4	0.0	0.0	66.3	0.0	0.0	50.9	0.0	49.4
Incr Delay (d2), s/veh	0.3	2.5	2.4	0.4	0.5	0.2	11.8	0.0	0.0	0.5	0.0	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.1	14.7	15.2	0.8	0.1	0.0	9.2	0.0	0.0	3.1	0.0	4.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	12.0	21.6	21.5	15.8	0.5	0.2	78.1	0.0	0.0	51.5	0.0	49.9
LnGrp LOS	B	C	C	B	A	A	E	A	A	D	A	D
Approach Vol, veh/h	1459				886				207			
Approach Delay, s/veh	20.6				1.4				78.1			
Approach LOS	C				A				E			
Timer - Assigned Phs	1	2		4	5	6	7	8				
Phs Duration (G+Y+Rc), s	13.5	100.3		46.2	9.9	103.9	14.7	31.6				
Change Period (Y+Rc), s	* 6.2	6.1		6.5	* 5.3	6.1	6.1	6.5				
Max Green Setting (Gmax), s	* 9.8	86.9		44.5	* 9.7	87.9	8.9	29.5				
Max Q Clear Time (g_c+l1), s	7.2	2.0		13.2	4.0	38.1	8.7	24.4				
Green Ext Time (p_c), s	0.1	13.2		0.9	0.0	24.5	0.0	0.5				
Intersection Summary												
HCM 6th Ctrl Delay	21.3											
HCM 6th LOS	C											
Notes												

Lanes, Volumes, Timings
3: Tucker Industrial Rd & Hugh Howell Rd

2023 BUILD - PM

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	8	1049	211	54	701	6	138	1	75	28	10	8
Future Volume (vph)	8	1049	211	54	701	6	138	1	75	28	10	8
Adj. Flow (vph)	8	1104	222	57	738	6	145	1	79	29	11	8
Lane Group Flow (vph)	8	1326	0	57	744	0	0	225	0	0	48	0
Turn Type	Prot	NA		Prot	NA		Perm	NA		Perm	NA	
Protected Phases	1	6		5	2			4			8	
Permitted Phases							4			8		
Detector Phase	1	6		5	2		4	4		8	8	
Switch Phase												
Minimum Initial (s)	5.0	10.0		5.0	10.0		7.0	7.0		7.0	7.0	
Minimum Split (s)	11.1	31.4		10.9	31.4		31.1	31.1		33.9	33.9	
Total Split (s)	15.0	110.0		15.0	110.0		35.0	35.0		35.0	35.0	
Total Split (%)	9.4%	68.8%		9.4%	68.8%		21.9%	21.9%		21.9%	21.9%	
Maximum Green (s)	8.9	103.6		9.1	103.6		28.9	28.9		29.1	29.1	
Yellow Time (s)	3.5	4.7		3.3	4.7		3.3	3.3		3.0	3.0	
All-Red Time (s)	2.6	1.7		2.6	1.7		2.8	2.8		2.9	2.9	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0			0.0	
Total Lost Time (s)	6.1	6.4		5.9	6.4			6.1			5.9	
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
Vehicle Extension (s)	3.0	5.0		3.0	5.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	0.2	3.0		0.2	3.0		0.2	0.2		0.2	0.2	
Time Before Reduce (s)	0.0	20.0		0.0	20.0		0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	15.0		0.0	15.0		0.0	0.0		0.0	0.0	
Recall Mode	None	C-Max		None	C-Max		None	None		None	None	
Walk Time (s)		7.0			7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)		18.0			18.0		18.0	18.0		21.0	21.0	
Pedestrian Calls (#/hr)		0			0		0	0		0	0	
Act Effect Green (s)	6.5	109.0		8.7	118.2			26.5			26.7	
Actuated g/C Ratio	0.04	0.68		0.05	0.74			0.17			0.17	
v/c Ratio	0.13	0.57		0.65	0.29			0.90			0.19	
Control Delay	90.4	6.4		104.9	8.0			95.4			51.0	
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	
Total Delay	90.4	6.4		104.9	8.0			95.4			51.0	
LOS	F	A		F	A			F			D	
Approach Delay		6.9			14.9			95.4			51.0	
Approach LOS		A			B			F			D	
Queue Length 50th (ft)	8	128		59	122			215			38	
Queue Length 95th (ft)	m17	142		#124	206			#359			79	
Internal Link Dist (ft)		1068			568			739			1148	
Turn Bay Length (ft)	150			100								
Base Capacity (vph)	83	2334		93	2587			273			269	
Starvation Cap Reductn	0	0		0	0			0			0	
Spillback Cap Reductn	0	0		0	0			0			0	
Storage Cap Reductn	0	0		0	0			0			0	
Reduced v/c Ratio	0.10	0.57		0.61	0.29			0.82			0.18	
Intersection Summary												

Lanes, Volumes, Timings

3: Tucker Industrial Rd & Hugh Howell Rd

2023 BUILD - PM

Cycle Length: 160

Actuated Cycle Length: 160

Offset: 118.6 (74%), Referenced to phase 2:WBT and 6:EBT, Start of Yellow

Natural Cycle: 90

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.90

Intersection Signal Delay: 18.7

Intersection LOS: B

Intersection Capacity Utilization 70.3%

ICU Level of Service C

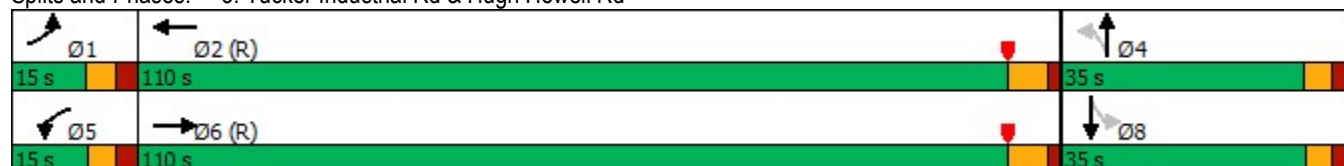
Analysis Period (min) 15

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: Tucker Industrial Rd & Hugh Howell Rd



HCM 6th Signalized Intersection Summary

3: Tucker Industrial Rd & Hugh Howell Rd

2023 BUILD - PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	8	1049	211	54	701	6	138	1	75	28	10	8
Future Volume (veh/h)	8	1049	211	54	701	6	138	1	75	28	10	8
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1604	1856	1856	1752	1856	1856	1900	1976	1900	1900	1976	1900
Adj Flow Rate, veh/h	8	1104	222	57	738	6	145	1	79	29	11	8
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	20	3	3	10	3	3	0	0	0	0	0	0
Cap, veh/h	14	2015	403	71	2583	21	195	1	86	167	63	39
Arrive On Green	0.02	1.00	1.00	0.04	0.72	0.72	0.15	0.15	0.15	0.15	0.15	0.15
Sat Flow, veh/h	1527	2926	586	1668	3584	29	1028	7	560	853	409	252
Grp Volume(v), veh/h	8	663	663	57	363	381	225	0	0	48	0	0
Grp Sat Flow(s),veh/h/ln	1527	1763	1749	1668	1763	1850	1596	0	0	1513	0	0
Q Serve(g_s), s	0.8	0.0	0.0	5.4	11.6	11.6	18.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	0.8	0.0	0.0	5.4	11.6	11.6	22.1	0.0	0.0	4.1	0.0	0.0
Prop In Lane	1.00		0.33	1.00		0.02	0.64		0.35	0.60		0.17
Lane Grp Cap(c), veh/h	14	1214	1204	71	1270	1333	282	0	0	269	0	0
V/C Ratio(X)	0.56	0.55	0.55	0.80	0.29	0.29	0.80	0.00	0.00	0.18	0.00	0.00
Avail Cap(c_a), veh/h	85	1214	1204	95	1270	1333	324	0	0	312	0	0
HCM Platoon Ratio	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	78.2	0.0	0.0	75.9	7.9	7.9	66.3	0.0	0.0	58.9	0.0	0.0
Incr Delay (d2), s/veh	30.1	1.8	1.8	28.5	0.6	0.5	11.6	0.0	0.0	0.3	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.6	0.6	2.9	4.2	4.4	9.9	0.0	0.0	1.7	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	108.3	1.8	1.8	104.4	8.4	8.4	77.9	0.0	0.0	59.2	0.0	0.0
LnGrp LOS	F	A	A	F	A	A	E	A	A	E	A	A
Approach Vol, veh/h	1334			801			225			48		
Approach Delay, s/veh	2.4			15.3			77.9			59.2		
Approach LOS	A			B			E			E		
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	7.6	121.7		30.7	12.7	116.6		30.7				
Change Period (Y+Rc), s	6.1	* 6.4		6.1	* 5.9	* 6.4		* 6.1				
Max Green Setting (Gmax), s	8.9	* 1E2		28.9	* 9.1	* 1E2		* 29				
Max Q Clear Time (g_c+I1), s	2.8	13.6		24.1	7.4	2.0		6.1				
Green Ext Time (p_c), s	0.0	10.9		0.5	0.0	32.2		0.2				
Intersection Summary												
HCM 6th Ctrl Delay	14.9											
HCM 6th LOS	B											
Notes												

						
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations					 	
Traffic Volume (vph)	145	28	68	93	23	93
Future Volume (vph)	145	28	68	93	23	93
Adj. Flow (vph)	158	30	74	101	25	101
Lane Group Flow (vph)	188	0	0	175	126	0
Sign Control	Free			Free	Stop	
Intersection Summary						
Control Type: Unsignalized						
Intersection Capacity Utilization 35.7%				ICU Level of Service A		
Analysis Period (min) 15						

Intersection						
Int Delay, s/veh	3.9					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑			↑	↕	
Traffic Vol, veh/h	145	28	68	93	23	93
Future Vol, veh/h	145	28	68	93	23	93
Conflicting Peds, #/hr	0	1	1	0	1	2
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	25	0	0	0	0
Mvmt Flow	158	30	74	101	25	101
Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	189	0	424	176
Stage 1	-	-	-	-	174	-
Stage 2	-	-	-	-	250	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	1397	-	591	872
Stage 1	-	-	-	-	861	-
Stage 2	-	-	-	-	796	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1396	-	557	870
Mov Cap-2 Maneuver	-	-	-	-	557	-
Stage 1	-	-	-	-	860	-
Stage 2	-	-	-	-	751	-
Approach	EB		WB		NB	
HCM Control Delay, s	0		3.3		10.5	
HCM LOS					B	
Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT	
Capacity (veh/h)	783	-	-	1396	-	
HCM Lane V/C Ratio	0.161	-	-	0.053	-	
HCM Control Delay (s)	10.5	-	-	7.7	-	
HCM Lane LOS	B	-	-	A	-	
HCM 95th %tile Q(veh)	0.6	-	-	0.2	-	

2023 BUILD IMPROVED CONDITIONS
Capacity Analysis

2: Cowan Rd/The Centre Driveway & Hugh Howell Rd

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	138	1140	79	53	695	76	96	29	68	86	35	98
Future Volume (vph)	138	1140	79	53	695	76	96	29	68	86	35	98
Adj. Flow (vph)	148	1226	85	57	747	82	103	31	73	92	38	105
Lane Group Flow (vph)	148	1311	0	57	747	82	0	207	0	92	143	0
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA		pm+pt	NA	
Protected Phases	1	6		5	2			8		7	4	
Permitted Phases	6			2		2	8			4		
Detector Phase	1	6		5	2	2	8	8		7	4	
Switch Phase												
Minimum Initial (s)	7.0	10.0		5.0	10.0	10.0	7.0	7.0		5.0	7.0	
Minimum Split (s)	13.2	27.4		10.3	32.1	32.1	35.5	35.5		11.1	35.5	
Total Split (s)	16.0	87.0		15.0	86.0	86.0	46.0	46.0		12.0	58.0	
Total Split (%)	10.0%	54.4%		9.4%	53.8%	53.8%	28.8%	28.8%		7.5%	36.3%	
Maximum Green (s)	9.8	80.9		9.7	79.9	79.9	39.5	39.5		5.9	51.5	
Yellow Time (s)	3.4	4.6		3.1	4.6	4.6	3.5	3.5		3.1	3.5	
All-Red Time (s)	2.8	1.5		2.2	1.5	1.5	3.0	3.0		3.0	3.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0		0.0		0.0	0.0	
Total Lost Time (s)	6.2	6.1		5.3	6.1	6.1		6.5		6.1	6.5	
Lead/Lag	Lead	Lag		Lead	Lag	Lag	Lag	Lag		Lead		
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes	Yes	Yes		Yes		
Vehicle Extension (s)	3.0	5.0		3.0	5.0	5.0	3.0	3.0		3.0	3.0	
Minimum Gap (s)	0.2	3.0		0.2	3.0	3.0	0.2	0.2		0.2	0.2	
Time Before Reduce (s)	0.0	20.0		0.0	20.0	20.0	0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	10.0		0.0	10.0	10.0	0.0	0.0		0.0	0.0	
Recall Mode	None	C-Max		None	C-Max	C-Max	None	None		None	None	
Walk Time (s)		7.0			7.0	7.0	7.0	7.0			7.0	
Flash Dont Walk (s)		10.0			19.0	19.0	22.0	22.0			22.0	
Pedestrian Calls (#/hr)		0			0	0	0	0			0	
Act Effct Green (s)	105.5	97.1		99.5	91.4	91.4		27.9		40.3	39.9	
Actuated g/C Ratio	0.66	0.61		0.62	0.57	0.57		0.17		0.25	0.25	
v/c Ratio	0.33	0.62		0.24	0.37	0.09		0.82		0.34	0.31	
Control Delay	12.6	23.3		11.1	16.3	0.6		83.0		49.4	18.7	
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0		0.0	0.0	
Total Delay	12.6	23.3		11.1	16.3	0.6		83.0		49.4	18.7	
LOS	B	C		B	B	A		F		D	B	
Approach Delay		22.2			14.5			83.0			30.7	
Approach LOS		C			B			F			C	
Queue Length 50th (ft)	52	451		15	165	0		196		77	42	
Queue Length 95th (ft)	98	631		m32	197	m3		276		119	96	
Internal Link Dist (ft)		969			335			94			430	
Turn Bay Length (ft)	125			115								
Base Capacity (vph)	458	2112		266	2003	948		349		267	570	
Starvation Cap Reductn	0	0		0	0	0		0		0	0	
Spillback Cap Reductn	0	0		0	0	0		0		0	0	
Storage Cap Reductn	0	0		0	0	0		0		0	0	
Reduced v/c Ratio	0.32	0.62		0.21	0.37	0.09		0.59		0.34	0.25	
Intersection Summary												

2: Cowan Rd/The Centre Driveway & Hugh Howell Rd

Cycle Length: 160

Actuated Cycle Length: 160

Offset: 102.9 (64%), Referenced to phase 2:WBTL and 6:EBTL, Start of Yellow

Natural Cycle: 95

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.82

Intersection Signal Delay: 25.0

Intersection LOS: C

Intersection Capacity Utilization 77.9%

ICU Level of Service D

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: Cowan Rd/The Centre Driveway & Hugh Howell Rd



HCM 6th Signalized Intersection Summary

2: Cowan Rd/The Centre Driveway & Hugh Howell Rd

2023 BUILD IMP - PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	138	1140	79	53	695	76	96	29	68	86	35	98
Future Volume (veh/h)	138	1140	79	53	695	76	96	29	68	86	35	98
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1900	1856	1856	1900	1856	1870	1900	1900	1900	1885	1900	1900
Adj Flow Rate, veh/h	148	1226	85	57	747	82	103	31	73	92	38	105
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	0	3	3	0	3	2	0	0	0	1	0	0
Cap, veh/h	531	2090	145	271	2129	957	145	39	82	281	104	289
Arrive On Green	0.04	0.62	0.62	0.06	1.00	1.00	0.16	0.16	0.16	0.04	0.23	0.23
Sat Flow, veh/h	1810	3345	232	1810	3526	1585	699	243	513	1795	446	1231
Grp Volume(v), veh/h	148	645	666	57	747	82	207	0	0	92	0	143
Grp Sat Flow(s),veh/h/ln	1810	1763	1814	1810	1763	1585	1454	0	0	1795	0	1677
Q Serve(g_s), s	5.0	34.6	34.8	1.9	0.0	0.0	21.6	0.0	0.0	5.9	0.0	11.4
Cycle Q Clear(g_c), s	5.0	34.6	34.8	1.9	0.0	0.0	22.3	0.0	0.0	5.9	0.0	11.4
Prop In Lane	1.00		0.13	1.00		1.00	0.50		0.35	1.00		0.73
Lane Grp Cap(c), veh/h	531	1102	1134	271	2129	957	266	0	0	281	0	393
V/C Ratio(X)	0.28	0.59	0.59	0.21	0.35	0.09	0.78	0.00	0.00	0.33	0.00	0.36
Avail Cap(c_a), veh/h	562	1102	1134	328	2129	957	392	0	0	281	0	540
HCM Platoon Ratio	1.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	10.8	17.8	17.8	14.3	0.0	0.0	65.8	0.0	0.0	52.8	0.0	51.3
Incr Delay (d2), s/veh	0.3	2.3	2.2	0.4	0.5	0.2	5.9	0.0	0.0	0.7	0.0	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.0	14.1	14.5	0.8	0.1	0.0	8.7	0.0	0.0	3.2	0.0	4.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	11.1	20.0	20.0	14.6	0.5	0.2	71.7	0.0	0.0	53.5	0.0	51.8
LnGrp LOS	B	C	C	B	A	A	E	A	A	D	A	D
Approach Vol, veh/h	1459				886				207		235	
Approach Delay, s/veh	19.1				1.3				71.7		52.5	
Approach LOS	B				A				E		D	
Timer - Assigned Phs	1	2		4	5	6	7	8				
Phs Duration (G+Y+Rc), s	13.3	102.7		44.0	9.9	106.1	12.0	32.0				
Change Period (Y+Rc), s	* 6.2	6.1		6.5	* 5.3	6.1	6.1	6.5				
Max Green Setting (Gmax), s	* 9.8	79.9		51.5	* 9.7	80.9	5.9	39.5				
Max Q Clear Time (g_c+I1), s	7.0	2.0		13.4	3.9	36.8	7.9	24.3				
Green Ext Time (p_c), s	0.1	13.1		0.9	0.0	23.0	0.0	1.0				
Intersection Summary												
HCM 6th Ctrl Delay	20.2											
HCM 6th LOS	C											
Notes												
User approved pedestrian interval to be less than phase max green.												
* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.												

2: Cowan Rd/The Centre Driveway & Hugh Howell Rd

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	46	410	45	20	722	34	65	7	43	21	5	32
Future Volume (vph)	46	410	45	20	722	34	65	7	43	21	5	32
Adj. Flow (vph)	49	441	48	22	776	37	70	8	46	23	5	34
Lane Group Flow (vph)	49	489	0	22	776	37	70	54	0	23	39	0
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA		pm+pt	NA	
Protected Phases	1	6		5	2			8		7	4	
Permitted Phases	6			2		2	8			4		
Detector Phase	1	6		5	2	2	8	8		7	4	
Switch Phase												
Minimum Initial (s)	7.0	10.0		5.0	10.0	10.0	7.0	7.0		5.0	7.0	
Minimum Split (s)	13.2	27.4		10.3	32.1	32.1	35.5	35.5		11.1	35.5	
Total Split (s)	26.0	85.0		17.0	76.0	76.0	42.0	42.0		16.0	58.0	
Total Split (%)	16.3%	53.1%		10.6%	47.5%	47.5%	26.3%	26.3%		10.0%	36.3%	
Maximum Green (s)	19.8	78.9		11.7	69.9	69.9	35.5	35.5		9.9	51.5	
Yellow Time (s)	3.4	4.6		3.1	4.6	4.6	3.5	3.5		3.1	3.5	
All-Red Time (s)	2.8	1.5		2.2	1.5	1.5	3.0	3.0		3.0	3.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.2	6.1		5.3	6.1	6.1	6.5	6.5		6.1	6.5	
Lead/Lag	Lead	Lag		Lead	Lag	Lag	Lag	Lag		Lead		
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes	Yes	Yes		Yes		
Vehicle Extension (s)	3.0	5.0		3.0	5.0	5.0	3.0	3.0		3.0	3.0	
Minimum Gap (s)	0.2	3.0		0.2	3.0	3.0	0.2	0.2		0.2	0.2	
Time Before Reduce (s)	0.0	20.0		0.0	20.0	20.0	0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	10.0		0.0	10.0	10.0	0.0	0.0		0.0	0.0	
Recall Mode	None	C-Max		None	C-Max	C-Max	None	None		None	None	
Walk Time (s)		7.0			7.0	7.0	7.0	7.0			7.0	
Flash Dont Walk (s)		10.0			19.0	19.0	22.0	22.0			22.0	
Pedestrian Calls (#/hr)		0			0	0	0	0			0	
Act Effect Green (s)	122.3	118.0		119.9	114.2	114.2	13.4	13.4		22.8	22.4	
Actuated g/C Ratio	0.76	0.74		0.75	0.71	0.71	0.08	0.08		0.14	0.14	
v/c Ratio	0.09	0.20		0.03	0.31	0.03	0.60	0.30		0.15	0.16	
Control Delay	6.2	8.5		5.7	9.5	0.1	90.7	25.1		55.9	19.5	
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	6.2	8.5		5.7	9.5	0.1	90.7	25.1		55.9	19.5	
LOS	A	A		A	A	A	F	C		E	B	
Approach Delay		8.3			9.0			62.1			33.0	
Approach LOS		A			A			E			C	
Queue Length 50th (ft)	12	92		5	153	0	72	8		21	4	
Queue Length 95th (ft)	29	140		14	215	0	125	52		46	38	
Internal Link Dist (ft)		969			335			119			430	
Turn Bay Length (ft)	125			115								
Base Capacity (vph)	625	2485		764	2477	1167	308	403		161	519	
Starvation Cap Reductn	0	0		0	0	0	0	0		0	0	
Spillback Cap Reductn	0	0		0	0	0	0	0		0	0	
Storage Cap Reductn	0	0		0	0	0	0	0		0	0	
Reduced v/c Ratio	0.08	0.20		0.03	0.31	0.03	0.23	0.13		0.14	0.08	
Intersection Summary												

2: Cowan Rd/The Centre Driveway & Hugh Howell Rd

Cycle Length: 160

Actuated Cycle Length: 160

Offset: 148.9 (93%), Referenced to phase 2:WBTL and 6:EBTL, Start of Yellow

Natural Cycle: 95

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.60

Intersection Signal Delay: 13.9

Intersection LOS: B

Intersection Capacity Utilization 53.4%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 2: Cowan Rd/The Centre Driveway & Hugh Howell Rd



HCM 6th Signalized Intersection Summary

2: Cowan Rd/The Centre Driveway & Hugh Howell Rd

2023 BUILD I LT- AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	46	410	45	20	722	34	65	7	43	21	5	32
Future Volume (veh/h)	46	410	45	20	722	34	65	7	43	21	5	32
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1900	1826	1767	1900	1841	1900	1900	1900	1900	1752	1900	1900
Adj Flow Rate, veh/h	49	441	48	22	776	37	70	8	46	23	5	34
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	0	5	9	0	4	0	0	0	0	10	0	0
Cap, veh/h	607	2354	255	729	2520	1160	135	16	91	120	26	176
Arrive On Green	0.04	0.75	0.75	0.04	1.00	1.00	0.06	0.06	0.06	0.02	0.12	0.12
Sat Flow, veh/h	1810	3157	342	1810	3497	1609	1390	244	1403	1668	211	1432
Grp Volume(v), veh/h	49	241	248	22	776	37	70	0	54	23	0	39
Grp Sat Flow(s),veh/h/ln	1810	1735	1764	1810	1749	1609	1390	0	1647	1668	0	1642
Q Serve(g_s), s	1.1	6.6	6.6	0.5	0.0	0.0	7.9	0.0	5.1	2.0	0.0	3.4
Cycle Q Clear(g_c), s	1.1	6.6	6.6	0.5	0.0	0.0	7.9	0.0	5.1	2.0	0.0	3.4
Prop In Lane	1.00		0.19	1.00		1.00	1.00		0.85	1.00		0.87
Lane Grp Cap(c), veh/h	607	1293	1315	729	2520	1160	135	0	107	120	0	202
V/C Ratio(X)	0.08	0.19	0.19	0.03	0.31	0.03	0.52	0.00	0.51	0.19	0.00	0.19
Avail Cap(c_a), veh/h	760	1293	1315	826	2520	1160	353	0	366	190	0	529
HCM Platoon Ratio	1.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	4.8	6.0	6.0	5.4	0.0	0.0	73.7	0.0	72.3	66.2	0.0	63.0
Incr Delay (d2), s/veh	0.1	0.3	0.3	0.0	0.3	0.1	3.0	0.0	3.7	0.8	0.0	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	2.3	2.3	0.2	0.1	0.0	3.0	0.0	2.3	0.9	0.0	1.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	4.8	6.3	6.3	5.4	0.3	0.1	76.7	0.0	76.0	67.0	0.0	63.5
LnGrp LOS	A	A	A	A	A	A	E	A	E	E	A	E
Approach Vol, veh/h	538			835			124			62		
Approach Delay, s/veh	6.2			0.4			76.4			64.8		
Approach LOS	A			A			E			E		
Timer - Assigned Phs	1	2		4	5	6	7	8				
Phs Duration (G+Y+Rc), s	12.4	121.4		26.2	8.4	125.4	9.3	16.9				
Change Period (Y+Rc), s	* 6.2	6.1		6.5	* 5.3	6.1	6.1	6.5				
Max Green Setting (Gmax), s	* 20	69.9		51.5	* 12	78.9	9.9	35.5				
Max Q Clear Time (g_c+I1), s	3.1	2.0		5.4	2.5	8.6	4.0	9.9				
Green Ext Time (p_c), s	0.1	13.1		0.2	0.0	6.3	0.0	0.5				

Intersection Summary

HCM 6th Ctrl Delay	11.0
HCM 6th LOS	B

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Lanes, Volumes, Timings
2: Cowan Rd/The Centre Driveway & Hugh Howell Rd

2023 BUILD I LT- PM

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	138	1140	79	53	695	76	96	29	68	86	35	98
Future Volume (vph)	138	1140	79	53	695	76	96	29	68	86	35	98
Adj. Flow (vph)	148	1226	85	57	747	82	103	31	73	92	38	105
Lane Group Flow (vph)	148	1311	0	57	747	82	103	104	0	92	143	0
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA		pm+pt	NA	
Protected Phases	1	6		5	2			8		7	4	
Permitted Phases	6			2		2	8			4		
Detector Phase	1	6		5	2	2	8	8		7	4	
Switch Phase												
Minimum Initial (s)	7.0	10.0		5.0	10.0	10.0	7.0	7.0		5.0	7.0	
Minimum Split (s)	13.2	27.4		10.3	32.1	32.1	35.5	35.5		11.1	35.5	
Total Split (s)	16.0	94.0		15.0	93.0	93.0	36.0	36.0		15.0	51.0	
Total Split (%)	10.0%	58.8%		9.4%	58.1%	58.1%	22.5%	22.5%		9.4%	31.9%	
Maximum Green (s)	9.8	87.9		9.7	86.9	86.9	29.5	29.5		8.9	44.5	
Yellow Time (s)	3.4	4.6		3.1	4.6	4.6	3.5	3.5		3.1	3.5	
All-Red Time (s)	2.8	1.5		2.2	1.5	1.5	3.0	3.0		3.0	3.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.2	6.1		5.3	6.1	6.1	6.5	6.5		6.1	6.5	
Lead/Lag	Lead	Lag		Lead	Lag	Lag	Lag	Lag		Lead		
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes	Yes	Yes		Yes		
Vehicle Extension (s)	3.0	5.0		3.0	5.0	5.0	3.0	3.0		3.0	3.0	
Minimum Gap (s)	0.2	3.0		0.2	3.0	3.0	0.2	0.2		0.2	0.2	
Time Before Reduce (s)	0.0	20.0		0.0	20.0	20.0	0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	10.0		0.0	10.0	10.0	0.0	0.0		0.0	0.0	
Recall Mode	None	C-Max		None	C-Max	C-Max	None	None		None	None	
Walk Time (s)		7.0			7.0	7.0	7.0	7.0			7.0	
Flash Dont Walk (s)		10.0			19.0	19.0	22.0	22.0			22.0	
Pedestrian Calls (#/hr)		0			0	0	0	0			0	
Act Effct Green (s)	112.3	104.0		106.0	98.2	98.2	18.3	18.3		33.6	33.2	
Actuated g/C Ratio	0.70	0.65		0.66	0.61	0.61	0.11	0.11		0.21	0.21	
v/c Ratio	0.30	0.58		0.22	0.35	0.08	0.72	0.43		0.43	0.36	
Control Delay	9.6	18.3		8.6	13.1	0.6	93.2	31.3		57.7	23.7	
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	9.6	18.3		8.6	13.1	0.6	93.2	31.3		57.7	23.7	
LOS	A	B		A	B	A	F	C		E	C	
Approach Delay		17.4			11.7			62.1			37.0	
Approach LOS		B			B			E			D	
Queue Length 50th (ft)	45	398		13	160	0	106	38		81	50	
Queue Length 95th (ft)	83	546		m26	194	m3	167	97		129	110	
Internal Link Dist (ft)		969			335			94			430	
Turn Bay Length (ft)	125			115								
Base Capacity (vph)	496	2262		293	2150	1010	233	355		216	500	
Starvation Cap Reductn	0	0		0	0	0	0	0		0	0	
Spillback Cap Reductn	0	0		0	0	0	0	0		0	0	
Storage Cap Reductn	0	0		0	0	0	0	0		0	0	
Reduced v/c Ratio	0.30	0.58		0.19	0.35	0.08	0.44	0.29		0.43	0.29	
Intersection Summary												

Cycle Length: 160	
Actuated Cycle Length: 160	
Offset: 102.9 (64%), Referenced to phase 2:WBTL and 6:EBTL, Start of Yellow	
Natural Cycle: 95	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.72	
Intersection Signal Delay: 20.6	Intersection LOS: C
Intersection Capacity Utilization 72.2%	ICU Level of Service C
Analysis Period (min) 15	
m Volume for 95th percentile queue is metered by upstream signal.	

Splits and Phases: 2: Cowan Rd/The Centre Driveway & Hugh Howell Rd



HCM 6th Signalized Intersection Summary

2: Cowan Rd/The Centre Driveway & Hugh Howell Rd

2023 BUILD I LT- PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	138	1140	79	53	695	76	96	29	68	86	35	98
Future Volume (veh/h)	138	1140	79	53	695	76	96	29	68	86	35	98
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1900	1856	1900	1900	1856	1870	1900	1900	1841	1885	1900	1900
Adj Flow Rate, veh/h	148	1226	85	57	747	82	103	31	73	92	38	105
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	0	3	0	0	3	2	0	0	4	1	0	0
Cap, veh/h	557	2224	154	297	2271	1021	172	51	119	199	87	239
Arrive On Green	0.04	0.66	0.66	0.06	1.00	1.00	0.10	0.10	0.10	0.06	0.19	0.19
Sat Flow, veh/h	1810	3345	232	1810	3526	1585	1262	502	1181	1795	445	1231
Grp Volume(v), veh/h	148	645	666	57	747	82	103	0	104	92	0	143
Grp Sat Flow(s),veh/h/ln	1810	1763	1814	1810	1763	1585	1262	0	1683	1795	0	1676
Q Serve(g_s), s	4.4	31.0	31.1	1.7	0.0	0.0	12.8	0.0	9.5	7.2	0.0	12.0
Cycle Q Clear(g_c), s	4.4	31.0	31.1	1.7	0.0	0.0	12.8	0.0	9.5	7.2	0.0	12.0
Prop In Lane	1.00		0.13	1.00		1.00	1.00		0.70	1.00		0.73
Lane Grp Cap(c), veh/h	557	1172	1206	297	2271	1021	172	0	170	199	0	326
V/C Ratio(X)	0.27	0.55	0.55	0.19	0.33	0.08	0.60	0.00	0.61	0.46	0.00	0.44
Avail Cap(c_a), veh/h	589	1172	1206	355	2271	1021	278	0	310	199	0	466
HCM Platoon Ratio	1.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	8.5	14.2	14.2	11.3	0.0	0.0	70.4	0.0	68.9	58.7	0.0	56.7
Incr Delay (d2), s/veh	0.3	1.9	1.8	0.3	0.4	0.2	3.3	0.0	3.6	1.7	0.0	0.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.7	12.1	12.6	0.6	0.1	0.0	4.3	0.0	4.3	3.4	0.0	5.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	8.7	16.0	16.0	11.6	0.4	0.2	73.7	0.0	72.5	60.3	0.0	57.7
LnGrp LOS	A	B	B	B	A	A	E	A	E	E	A	E
Approach Vol, veh/h	1459			886			207			235		
Approach Delay, s/veh	15.3			1.1			73.1			58.7		
Approach LOS	B			A			E			E		
Timer - Assigned Phs	1	2		4	5	6	7	8				
Phs Duration (G+Y+Rc), s	13.2	109.2		37.6	9.9	112.5	15.0	22.6				
Change Period (Y+Rc), s	* 6.2	6.1		6.5	* 5.3	6.1	6.1	6.5				
Max Green Setting (Gmax), s	* 9.8	86.9		44.5	* 9.7	87.9	8.9	29.5				
Max Q Clear Time (g_c+I1), s	6.4	2.0		14.0	3.7	33.1	9.2	14.8				
Green Ext Time (p_c), s	0.1	13.2		0.9	0.0	25.5	0.0	0.8				

Intersection Summary

HCM 6th Ctrl Delay	18.7
HCM 6th LOS	B

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Lanes, Volumes, Timings
2: Cowan Rd/The Centre Driveway & Hugh Howell Rd

2023 BUILD I RT- AM

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	46	410	45	20	722	34	65	7	43	21	5	32
Future Volume (vph)	46	410	45	20	722	34	65	7	43	21	5	32
Adj. Flow (vph)	49	441	48	22	776	37	70	8	46	23	5	34
Lane Group Flow (vph)	49	489	0	22	776	37	0	78	46	23	39	0
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA	Perm	pm+pt	NA	
Protected Phases	1	6		5	2			8		7	4	
Permitted Phases	6			2		2	8		8	4		
Detector Phase	1	6		5	2	2	8	8	8	7	4	
Switch Phase												
Minimum Initial (s)	7.0	10.0		5.0	10.0	10.0	7.0	7.0	7.0	5.0	7.0	
Minimum Split (s)	13.2	27.4		10.3	32.1	32.1	35.5	35.5	35.5	11.1	35.5	
Total Split (s)	26.0	85.0		17.0	76.0	76.0	42.0	42.0	42.0	16.0	58.0	
Total Split (%)	16.3%	53.1%		10.6%	47.5%	47.5%	26.3%	26.3%	26.3%	10.0%	36.3%	
Maximum Green (s)	19.8	78.9		11.7	69.9	69.9	35.5	35.5	35.5	9.9	51.5	
Yellow Time (s)	3.4	4.6		3.1	4.6	4.6	3.5	3.5	3.5	3.1	3.5	
All-Red Time (s)	2.8	1.5		2.2	1.5	1.5	3.0	3.0	3.0	3.0	3.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0		0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.2	6.1		5.3	6.1	6.1		6.5	6.5	6.1	6.5	
Lead/Lag	Lead	Lag		Lead	Lag	Lag	Lag	Lag	Lag	Lead		
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes		
Vehicle Extension (s)	3.0	5.0		3.0	5.0	5.0	3.0	3.0	3.0	3.0	3.0	
Minimum Gap (s)	0.2	3.0		0.2	3.0	3.0	0.2	0.2	0.2	0.2	0.2	
Time Before Reduce (s)	0.0	20.0		0.0	20.0	20.0	0.0	0.0	0.0	0.0	0.0	
Time To Reduce (s)	0.0	10.0		0.0	10.0	10.0	0.0	0.0	0.0	0.0	0.0	
Recall Mode	None	C-Max		None	C-Max	C-Max	None	None	None	None	None	
Walk Time (s)		7.0			7.0	7.0	7.0	7.0	7.0		7.0	
Flash Dont Walk (s)		10.0			19.0	19.0	22.0	22.0	22.0		22.0	
Pedestrian Calls (#/hr)		0			0	0	0	0	0		0	
Act Effct Green (s)	121.3	116.9		118.8	113.1	113.1		14.5	14.5	23.9	23.5	
Actuated g/C Ratio	0.76	0.73		0.74	0.71	0.71		0.09	0.09	0.15	0.15	
v/c Ratio	0.10	0.20		0.03	0.32	0.03		0.63	0.17	0.15	0.15	
Control Delay	6.6	8.9		6.0	9.9	0.1		91.4	1.3	54.6	19.0	
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0	0.0	0.0	0.0	
Total Delay	6.6	8.9		6.0	9.9	0.1		91.4	1.3	54.6	19.0	
LOS	A	A		A	A	A		F	A	D	B	
Approach Delay		8.7			9.4			58.0			32.2	
Approach LOS		A			A			E			C	
Queue Length 50th (ft)	12	94		5	157	0		80	0	20	4	
Queue Length 95th (ft)	30	144		15	217	0		135	0	45	38	
Internal Link Dist (ft)		969			335			119			430	
Turn Bay Length (ft)	125			115								
Base Capacity (vph)	618	2462		758	2453	1157		303	468	165	519	
Starvation Cap Reductn	0	0		0	0	0		0	0	0	0	
Spillback Cap Reductn	0	0		0	0	0		0	0	0	0	
Storage Cap Reductn	0	0		0	0	0		0	0	0	0	
Reduced v/c Ratio	0.08	0.20		0.03	0.32	0.03		0.26	0.10	0.14	0.08	
Intersection Summary												

2: Cowan Rd/The Centre Driveway & Hugh Howell Rd

Cycle Length: 160

Actuated Cycle Length: 160

Offset: 148.9 (93%), Referenced to phase 2:WBTL and 6:EBTL, Start of Yellow

Natural Cycle: 95

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.63

Intersection Signal Delay: 13.9

Intersection LOS: B

Intersection Capacity Utilization 53.8%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 2: Cowan Rd/The Centre Driveway & Hugh Howell Rd



HCM 6th Signalized Intersection Summary

2: Cowan Rd/The Centre Driveway & Hugh Howell Rd

2023 BUILD I RT- AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	46	410	45	20	722	34	65	7	43	21	5	32
Future Volume (veh/h)	46	410	45	20	722	34	65	7	43	21	5	32
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1900	1826	1767	1900	1841	1900	1900	1900	1900	1752	1900	1900
Adj Flow Rate, veh/h	49	441	48	22	776	37	70	8	0	23	5	34
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	0	5	9	0	4	0	0	0	0	10	0	0
Cap, veh/h	604	2343	254	726	2509	1154	130	10		202	27	181
Arrive On Green	0.04	0.74	0.74	0.04	1.00	1.00	0.07	0.07	0.00	0.02	0.13	0.13
Sat Flow, veh/h	1810	3157	342	1810	3497	1609	1283	147	1610	1668	211	1432
Grp Volume(v), veh/h	49	241	248	22	776	37	78	0	0	23	0	39
Grp Sat Flow(s),veh/h/ln	1810	1735	1764	1810	1749	1609	1429	0	1610	1668	0	1642
Q Serve(g_s), s	1.1	6.7	6.7	0.5	0.0	0.0	8.6	0.0	0.0	2.0	0.0	3.4
Cycle Q Clear(g_c), s	1.1	6.7	6.7	0.5	0.0	0.0	8.6	0.0	0.0	2.0	0.0	3.4
Prop In Lane	1.00		0.19	1.00		1.00	0.90		1.00	1.00		0.87
Lane Grp Cap(c), veh/h	604	1288	1310	726	2509	1154	140	0		202	0	207
V/C Ratio(X)	0.08	0.19	0.19	0.03	0.31	0.03	0.56	0.00		0.11	0.00	0.19
Avail Cap(c_a), veh/h	758	1288	1310	823	2509	1154	360	0		271	0	529
HCM Platoon Ratio	1.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	4.9	6.2	6.2	5.5	0.0	0.0	73.5	0.0	0.0	65.6	0.0	62.6
Incr Delay (d2), s/veh	0.1	0.3	0.3	0.0	0.3	0.1	3.4	0.0	0.0	0.2	0.0	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	2.3	2.4	0.2	0.1	0.0	3.3	0.0	0.0	0.9	0.0	1.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	4.9	6.5	6.5	5.5	0.3	0.1	76.9	0.0	0.0	65.9	0.0	63.0
LnGrp LOS	A	A	A	A	A	A	E	A		E	A	E
Approach Vol, veh/h	538			835			78			62		
Approach Delay, s/veh	6.4			0.4			76.9			64.1		
Approach LOS	A			A			E			E		
Timer - Assigned Phs	1	2		4	5	6	7	8				
Phs Duration (G+Y+Rc), s	12.4	120.9		26.7	8.4	124.9	9.3	17.4				
Change Period (Y+Rc), s	* 6.2	6.1		6.5	* 5.3	6.1	6.1	6.5				
Max Green Setting (Gmax), s	* 20	69.9		51.5	* 12	78.9	9.9	35.5				
Max Q Clear Time (g_c+I1), s	3.1	2.0		5.4	2.5	8.7	4.0	10.6				
Green Ext Time (p_c), s	0.1	13.1		0.2	0.0	6.3	0.0	0.4				

Intersection Summary

HCM 6th Ctrl Delay	9.1
HCM 6th LOS	A

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Unsignalized Delay for [NBR] is excluded from calculations of the approach delay and intersection delay.

2: Cowan Rd/The Centre Driveway & Hugh Howell Rd

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	138	1140	79	53	695	76	96	29	68	86	35	98
Future Volume (vph)	138	1140	79	53	695	76	96	29	68	86	35	98
Adj. Flow (vph)	148	1226	85	57	747	82	103	31	73	92	38	105
Lane Group Flow (vph)	148	1311	0	57	747	82	0	134	73	92	143	0
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA	Perm	pm+pt	NA	
Protected Phases	1	6		5	2			8		7	4	
Permitted Phases	6			2		2	8		8	4		
Detector Phase	1	6		5	2	2	8	8	8	7	4	
Switch Phase												
Minimum Initial (s)	7.0	10.0		5.0	10.0	10.0	7.0	7.0	7.0	5.0	7.0	
Minimum Split (s)	13.2	27.4		10.3	32.1	32.1	35.5	35.5	35.5	11.1	35.5	
Total Split (s)	16.0	94.0		15.0	93.0	93.0	36.0	36.0	36.0	15.0	51.0	
Total Split (%)	10.0%	58.8%		9.4%	58.1%	58.1%	22.5%	22.5%	22.5%	9.4%	31.9%	
Maximum Green (s)	9.8	87.9		9.7	86.9	86.9	29.5	29.5	29.5	8.9	44.5	
Yellow Time (s)	3.4	4.6		3.1	4.6	4.6	3.5	3.5	3.5	3.1	3.5	
All-Red Time (s)	2.8	1.5		2.2	1.5	1.5	3.0	3.0	3.0	3.0	3.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0		0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.2	6.1		5.3	6.1	6.1		6.5	6.5	6.1	6.5	
Lead/Lag	Lead	Lag		Lead	Lag	Lag	Lag	Lag	Lag	Lead		
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes		
Vehicle Extension (s)	3.0	5.0		3.0	5.0	5.0	3.0	3.0	3.0	3.0	3.0	
Minimum Gap (s)	0.2	3.0		0.2	3.0	3.0	0.2	0.2	0.2	0.2	0.2	
Time Before Reduce (s)	0.0	20.0		0.0	20.0	20.0	0.0	0.0	0.0	0.0	0.0	
Time To Reduce (s)	0.0	10.0		0.0	10.0	10.0	0.0	0.0	0.0	0.0	0.0	
Recall Mode	None	C-Max		None	C-Max	C-Max	None	None	None	None	None	
Walk Time (s)		7.0			7.0	7.0	7.0	7.0	7.0		7.0	
Flash Dont Walk (s)		10.0			19.0	19.0	22.0	22.0	22.0		22.0	
Pedestrian Calls (#/hr)		0			0	0	0	0	0		0	
Act Effect Green (s)	108.5	100.7		103.3	95.3	95.3		21.6	21.6	36.9	36.5	
Actuated g/C Ratio	0.68	0.63		0.65	0.60	0.60		0.14	0.14	0.23	0.23	
v/c Ratio	0.32	0.60		0.23	0.36	0.08		0.77	0.25	0.42	0.34	
Control Delay	11.0	20.6		9.6	14.3	0.6		92.8	5.9	54.7	22.1	
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0	0.0	0.0	0.0	
Total Delay	11.0	20.6		9.6	14.3	0.6		92.8	5.9	54.7	22.1	
LOS	B	C		A	B	A		F	A	D	C	
Approach Delay		19.6			12.7			62.2			34.8	
Approach LOS		B			B			E			C	
Queue Length 50th (ft)	49	425		14	163	0		137	0	79	48	
Queue Length 95th (ft)	89	580		m28	194	m3		207	24	125	107	
Internal Link Dist (ft)		969			335			94			430	
Turn Bay Length (ft)	125			115								
Base Capacity (vph)	474	2189		280	2088	984		239	363	219	500	
Starvation Cap Reductn	0	0		0	0	0		0	0	0	0	
Spillback Cap Reductn	0	0		0	0	0		0	0	0	0	
Storage Cap Reductn	0	0		0	0	0		0	0	0	0	
Reduced v/c Ratio	0.31	0.60		0.20	0.36	0.08		0.56	0.20	0.42	0.29	
Intersection Summary												

2: Cowan Rd/The Centre Driveway & Hugh Howell Rd

Cycle Length: 160

Actuated Cycle Length: 160

Offset: 102.9 (64%), Referenced to phase 2:WBTL and 6:EBTL, Start of Yellow

Natural Cycle: 95

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.77

Intersection Signal Delay: 21.9

Intersection LOS: C

Intersection Capacity Utilization 73.8%

ICU Level of Service D

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: Cowan Rd/The Centre Driveway & Hugh Howell Rd



HCM 6th Signalized Intersection Summary

2: Cowan Rd/The Centre Driveway & Hugh Howell Rd

2023 BUILD RT CH - PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	138	1140	79	53	695	76	96	29	68	86	35	98
Future Volume (veh/h)	138	1140	79	53	695	76	96	29	68	86	35	98
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1900	1856	1900	1900	1856	1870	1900	1900	1841	1885	1900	1900
Adj Flow Rate, veh/h	148	1226	85	57	747	82	103	31	0	92	38	105
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	0	3	0	0	3	2	0	0	4	1	0	0
Cap, veh/h	548	2177	151	288	2222	999	161	36		328	93	257
Arrive On Green	0.04	0.65	0.65	0.06	1.00	1.00	0.11	0.11	0.00	0.06	0.21	0.21
Sat Flow, veh/h	1810	3345	232	1810	3526	1585	1052	317	1560	1795	445	1231
Grp Volume(v), veh/h	148	645	666	57	747	82	134	0	0	92	0	143
Grp Sat Flow(s),veh/h/ln	1810	1763	1814	1810	1763	1585	1369	0	1560	1795	0	1676
Q Serve(g_s), s	4.6	32.3	32.4	1.8	0.0	0.0	15.4	0.0	0.0	7.1	0.0	11.8
Cycle Q Clear(g_c), s	4.6	32.3	32.4	1.8	0.0	0.0	15.4	0.0	0.0	7.1	0.0	11.8
Prop In Lane	1.00		0.13	1.00		1.00	0.77		1.00	1.00		0.73
Lane Grp Cap(c), veh/h	548	1147	1180	288	2222	999	197	0		328	0	350
V/C Ratio(X)	0.27	0.56	0.56	0.20	0.34	0.08	0.68	0.00		0.28	0.00	0.41
Avail Cap(c_a), veh/h	579	1147	1180	346	2222	999	292	0		328	0	466
HCM Platoon Ratio	1.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	9.3	15.4	15.4	12.3	0.0	0.0	69.5	0.0	0.0	56.3	0.0	54.8
Incr Delay (d2), s/veh	0.3	2.0	2.0	0.3	0.4	0.2	4.1	0.0	0.0	0.5	0.0	0.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.8	12.8	13.2	0.7	0.1	0.0	5.6	0.0	0.0	3.3	0.0	5.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	9.5	17.4	17.4	12.6	0.4	0.2	73.6	0.0	0.0	56.7	0.0	55.5
LnGrp LOS	A	B	B	B	A	A	E	A		E	A	E
Approach Vol, veh/h	1459				886				134		235	
Approach Delay, s/veh	16.6				1.2				73.6		56.0	
Approach LOS	B				A				E		E	
Timer - Assigned Phs	1	2		4	5	6	7	8				
Phs Duration (G+Y+Rc), s	13.2	106.9		39.9	9.9	110.2	15.0	24.9				
Change Period (Y+Rc), s	* 6.2	6.1		6.5	* 5.3	6.1	6.1	6.5				
Max Green Setting (Gmax), s	* 9.8	86.9		44.5	* 9.7	87.9	8.9	29.5				
Max Q Clear Time (g_c+I1), s	6.6	2.0		13.8	3.8	34.4	9.1	17.4				
Green Ext Time (p_c), s	0.1	13.2		0.9	0.0	25.3	0.0	0.5				

Intersection Summary

HCM 6th Ctrl Delay	17.8
HCM 6th LOS	B

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Unsignalized Delay for [NBR] is excluded from calculations of the approach delay and intersection delay.