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## SUGAR FARMS AND RENNER ROAD TRACT

Traffic Impact Study

Pulte Homes of Ohio, LLC and Harmony Development Group, LLC

June 25, 2019



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1.0 INTRODUCTION

This regional analysis and Traffic Impact Study (TIS) summarizes traffic analysis and results related to development of the Sugar Farms and Renner Road sites in western Columbus and Franklin County, Ohio. The scope of this study was set forth by an approved Memorandum of Understanding (MOU) between EMH&T, the City of Columbus, the Franklin County Engineer's Office, and the City of Hilliard, as documented in **Appendix A**. In addition to site access points and adjacent intersections often scoped for a typical traffic impact study, this TIS is a regional study of 9 existing intersections, some located a mile or more from the development sites. **Figure 1** shows the Study Area and both sites with the Sugar Farms site shown in yellow and the Renner Road site shown in red.

Figure 1: Location Map





## 1.1 Site Description

The Sugar Farms Site is located north of Renner Road on 256 acres and is expected to consist of 548 single family residences and 220 units of multi-family apartments. There are three access points proposed for this site:

- On the north side of Renner Road approximately 1000 feet east of Alton & Darby Creek Road
- On the east side of Alton & Darby Creek Road across from Walker Road (the site drive will become the fourth leg of this intersection)
- On the east side of Alton & Darby Creek Road approximately 1800 feet north of Walker Road

**Figure 2** shows the site plan for the Sugar Farms Site and the Renner Road site.

The Renner Road Site is located south of Renner Road on 117 acres and is expected to consist of 165 single family residences and 185 multi-family units. There are two access points proposed for this site:

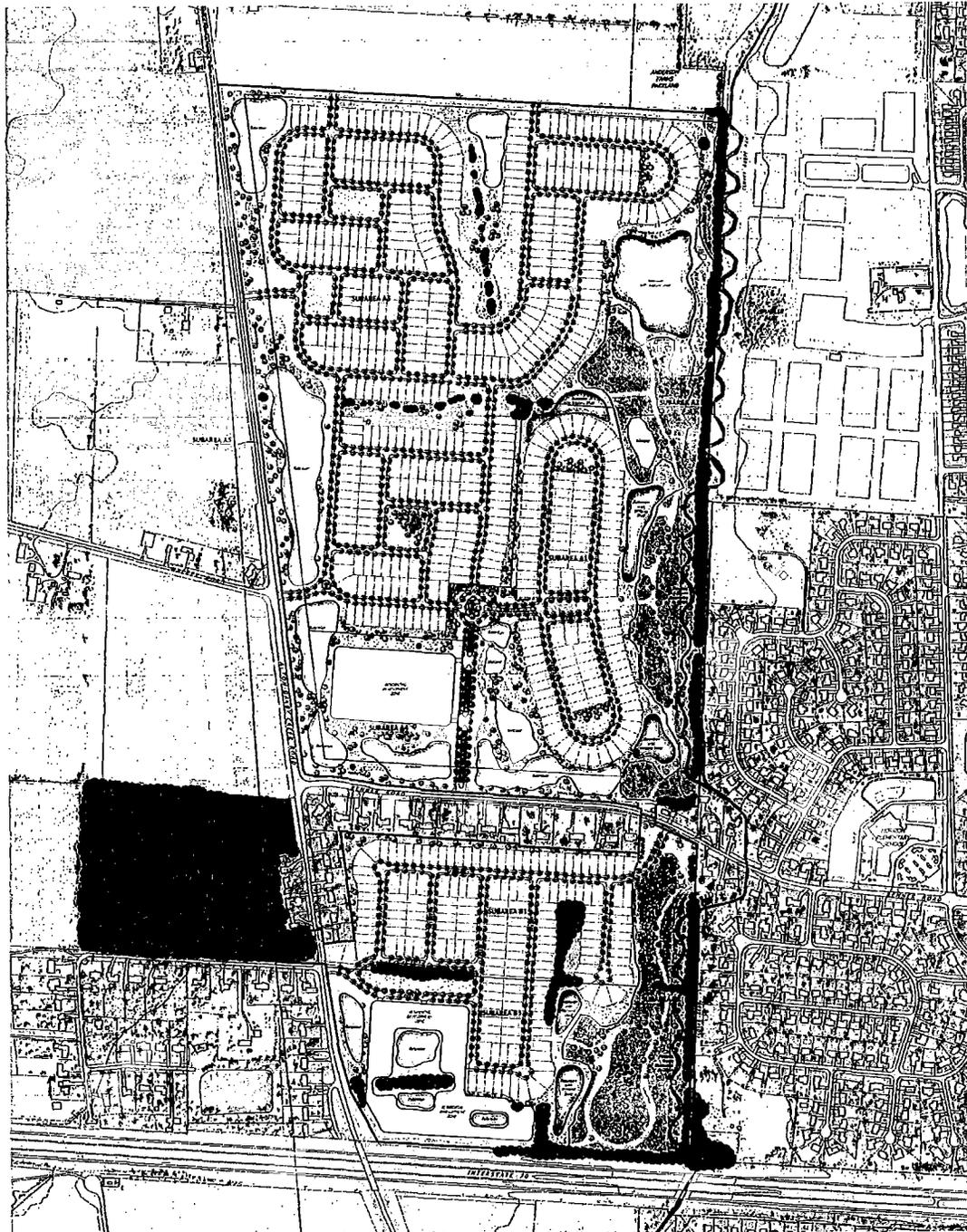
- On the south side of Renner Road approximately 2200 feet east of Alton & Darby Creek Road
- On the east side of Alton Darby Creek Road approximately 800 feet south of Renner Road, opposite Cole Road

## 1.2 Study Area

The Study Area for this TIS consists of the following intersections (as numbered in **Figure 1**):

1. Alton & Darby Creek Road/Roberts Road
2. Alton & Darby Creek Road/Sugar Farms Drive 1
3. Alton & Darby Creek Road/Walker Road/Sugar Farms Drive 2
4. Alton & Darby Creek Road/Renner Road
5. Alton & Darby Creek Road/Cole Road/Renner Site Drive 1
6. Renner Road/Sugar Farms Drive 3
7. Renner Road/Renner Site Drive 2
8. Renner Road/Spindler Road
9. Renner Road/Tanglewood Park Boulevard
10. Renner Road/Hilliard & Rome Road
11. Alton & Darby Creek Road/Feder Road
12. Hilliard & Rome Road/Feder Road/Fisher Road

**Figure 2: Sugar Farms and Renner Road Site Plan**



PLAT INFORMATION		OWNER		REVISIONS		DATE	
100-000001	100-000002	100-000003	100-000004	100-000005	100-000006	100-000007	100-000008
100-000009	100-000010	100-000011	100-000012	100-000013	100-000014	100-000015	100-000016
100-000017	100-000018	100-000019	100-000020	100-000021	100-000022	100-000023	100-000024
100-000025	100-000026	100-000027	100-000028	100-000029	100-000030	100-000031	100-000032

Illustrative Master Plan



**SUGAR FARMS and RENNER SOUTH**  
Columbus, OH



April 12, 2019



## 2.0 EXISTING CONDITIONS

Hilliard & Rome Road is a north-south arterial that has an interchange with IR-70 just south of the study area. This roadway has a posted speed limit of 45 MPH and consists of three through lanes in each direction. At its intersection with Renner Road, Hilliard & Rome Road has a northbound and southbound left turn lane as well as a northbound right turn lane. The intersection operates with split phasing on Renner Road to allow for dual westbound left turn lanes. The Hilliard & Rome Corridor is predominately commercial and retail within the study area, with single-family and multi-family residences further north.

Renner Road is a two-lane east-west arterial that ends at Alton Darby Creek Road to the west and becomes Trabue Road east of study area where it terminates in Upper Arlington. This roadway has a posted speed limit of 45 MPH and left turn lanes are provided in both directions at the signalized intersections with Spindler Road and Tanglewood Park Boulevard. Several right turn lanes are also provided. The Renner Road Corridor consists mainly of residential uses, both single-family and multi-family, as well as Hilliard Horizon Elementary School in the northwest quadrant of the intersection with Spindler Road.

Alton & Darby Creek Road is a two-lane north-south arterial connecting US-40 to the south with Scioto & Darby Creek Road to the north. The roadway is predominately bordered by farm land with several single family homes on individual lots toward the north and south ends of the study area. The speed limit is unmarked through this section of the roadway, and left turn lanes are provided at the signalized intersections with Feder Road, Renner Road, Walker Road and Roberts Road.

Roberts Road is an east-west arterial between Alton & Darby Creek Road and its interchange with IR-270 east of the Study Area. It is a two-lane roadway within the study limits and widens to provide two through lanes in each direction to the east outside of the study limits. Roberts Road is a collector route west of Alton & Darby Creek Road that ends at Walker Road near Hilliard Bradley High School and Brown Elementary School. East of Alton & Darby Creek Road, Roberts Road provides one through lane per direction plus turn lanes at some neighborhood access points in the area. The intersection is signalized with left turn lanes present on all four approaches and bike lanes in all directions. The speed limit on Roberts Road is 35 MPH in the study area.

Feder Road is a two-lane east-west arterial within the study area connecting Alton & Darby Creek Road and Hilliard & Rome Road. At Hilliard & Rome Road it becomes Fisher Road and continues east toward Downtown Columbus as an arterial. West of Alton & Darby Creek Road the roadway becomes a collector and rural in character. Feder Road has a speed limit of 45 MPH in the Study Area. Turn lanes are present at both Study Area intersections on Feder Road, and improvements are planned at the intersection with Hilliard & Rome Road around the Opening Year of this study. These plans are included in **Appendix B** for reference.

Walker Road and Spindler Road are collector roadways that provide one through-lane per direction. Walker Road is a County roadway with an assumed speed limit of 55 mph. Spindler Road is posted at 35 mph. Tanglewood Park Boulevard is a local street posted at 25 mph. Cole Road is a township road posted "No Outlet" that provides access to about 30 single-family residential properties.





The traffic counts (including the dates the counts were obtained) can be found in **Appendix C**.

### 3.2 Trip Generation

Peak hour trip generation for the proposed developments was determined using the data and methodology in Trip Generation, 10<sup>th</sup> Edition (Institute of Transportation Engineers (ITE), 2017). Morning and afternoon peak hour volumes were determined for the sites using ITE Land Use Codes 210 – Single Family Detached Housing and 220 – Multifamily Housing (Low-Rise). **Table 1** shows the trip generation calculations for the proposed sites.

**Table 1: Trip Generation**

Table 1 Trip Generation Calculations Sugar Farms and Renner Rd South Site Institute of Transportation Engineers, 10th Edition							
Sugar Farms (Northern Parcel)							
Land Use	Single Family Units	ITE Code	Time Period	ITE Formula	Total Units	AM Peak (Morning)	PM Peak (Afternoon)
Single Family - Detached	548 units	210	ADT	$\ln(T)=0.92\ln(x)+2.71$	4974	2487	2487
			AM Peak	$T=0.71(x)+4.8$	394	99	295
			PM Peak	$\ln(T)=0.96\ln(x)+0.2$	520	328	192
Multifamily Housing Low Rise	220 units	220	ADT	$T=7.56(x) - 40.86$	1,622	811	811
			AM Peak	$\ln(T)=0.95\ln(x)-0.51$	101	23	78
			PM Peak	$\ln(T)=0.89\ln(x)-0.02$	119	75	44
Northern Parcel Total	768 units		ADT		6,596	3,298	3,298
			AM Peak		495	122	373
			PM Peak		639	403	236
Renner Rd South (Southern Parcel)							
Single Family - Detached	165 units	210	ADT	$\ln(T)=0.92\ln(x)+2.71$	1648	824	824
			AM Peak	$T=0.71(x)+4.8$	122	31	91
			PM Peak	$\ln(T)=0.96\ln(x)+0.2$	164	103	61
Multifamily Housing Low Rise	185 units	220	ADT	$T=7.56(x) - 40.86$	1,358	679	679
			AM Peak	$\ln(T)=0.95\ln(x)-0.51$	86	20	66
			PM Peak	$\ln(T)=0.89\ln(x)-0.02$	102	64	38
Southern Parcel Total	350 units		ADT		3,006	1,503	1,503
			AM Peak		208	51	157
			PM Peak		266	167	99
Total Northern and Southern Parcels	1,118 units		ADT		9,602	4,801	4,801
			AM Peak		703	173	530
			PM Peak		905	570	335

### 3.3 Traffic Volume Projections

Count data was projected to the Opening Year (2019) and Horizon Year (2029) using growth rates provided by the Mid-Ohio Regional Planning Commission (MORPC) at all intersections north of IR-70. The City of Columbus and the Franklin County Engineer's Office (FCEO) provided growth rates for intersections south of IR-70 in the study area. **Appendix D** contains correspondence with



MORPC and the review agencies documenting growth rates for the roadways within the study network.

We distributed site traffic to the adjacent street network using percentages based on counted traffic volumes and input from the City of Columbus and FCEO. Global traffic assignments are as listed below:

- 8% to/from the north on Alton & Darby Creek Road
- 2% to/from the west on Roberts Road
- 5% to/from the east on Roberts Road
- 2% to/from the west on Walker Road
- 5% to/from the south on Alton & Darby Creek Road
- 2% to/from the north on Spindler Road
- 3% to/from the north on Tanglewood Park Boulevard
- 7% to/from the east on Renner Road
- 3% to/from the north on Hilliard & Rome Road
- 29% to/from I-70 via Renner Road
- 25% to/from I-70 via Feder Road
- 2% to/from the south on Hilliard & Rome Road
- 5% to/from the east on Fisher Road
- 2% to/from the west on Feder Road

From this general distribution, specific site traffic assignments were made at the site drives and carried throughout the network. These volumes were added to background traffic to produce Opening Year and Horizon Year Total Traffic for use in the analysis. The traffic volume plates, general distribution, specific distribution, and calculations can be found in **Appendix E**.

After initially assigning site traffic to/from the Renner Road site as described above, this study recommended Right In/Right Out (RIRO) turning restrictions at the Alton & Darby Creek Road/Renner Site Drive/Cole Road, and we adjusted the distribution of exiting traffic to reflect that limitation in consultation with City of Columbus staff. We transferred left turn movements from the RIRO intersection to the full-movement access point on Renner Road and reduced the proportion of outbound traffic using Feder Road to access I-70 from 25% to 4% with the remainder becoming right turns out of the site using Renner Road to access I-70.

## 4.0 TRAFFIC ANALYSES AND RESULTS

### 4.1 Traffic Signal Warrants

EMH&T evaluated Eight-Hour Traffic Signal Warrants at the proposed site access drives to determine if expected volumes meet criteria specified in the Ohio Manual of Uniform Traffic Control Devices (OMUTCD) § 4C. Any intersection not meeting the Eight-Hour Warrant was also evaluated using the Four-Hour Warrant.

We used two recent 24-hour counts in the Study Area to establish the relationship between the 8<sup>th</sup> and 4<sup>th</sup> highest hours of the day to the PM peak hour for which this study projected volumes. We used the 24-hour counts to calculate the following factors for signal warrant analysis in this study:



	Renner Rd <u>Count</u>	Feder Rd <u>Count</u>	<u>Use</u>
• Eighth Hour/Peak Hour	73%	69%	<b>71%</b>
• Fourth Hour/Peak Hour	78%	81%	<b>80%</b>

The counts used to determine these factors can be found in **Appendix C**.

**Table 2** shows the results of the Eight Hour Signal Warrant analysis. Eighth Hour volumes were determined using the 71% factor from above.

**Table 2: Eight Hour Signal Warrant Results**

Condition	MUTCD Threshold			
	Major Street Total		Minor Street Approach	
	100%	70%	100%	70%
A	500	350	150	105
B	750	525	75	53

Note: Renner Road and Alton & Darby Creek Road both have speed limits greater than 40 MPH; therefore, 70% criteria applies to major street and minor street approaches.

Signal Warrant Data Alton & Darby Creek Road	Year	2019	2029
	Peak Hour Volume (Major)	1543	1748
	Peak Hour Volume (Minor Approach)	52	52
	8th Highest Hour Volume (Major)	1095	1241
	8th Highest Hour Volume (Minor Approach)	36	36
	Condition A Met	No	No
	Condition B Met	No	No
	Signal Warranted	No	No

Signal Warrant Data Renner Road	Year	2019	2029
	Peak Hour Volume (Major)	1461	1600
	Peak Hour Volume (Minor Approach)	96	96
	8th Highest Hour Volume (Major)	1037	1136
	8th Highest Hour Volume (Minor Approach)	68	68
	Condition A Met	No	No
	Condition B Met	Yes	Yes
	Signal Warranted	Yes	Yes

Signal Warrant Data Renner Road	Year	2019	2029
	Peak Hour Volume (Major)	1502	1641
	Peak Hour Volume (Minor Approach)	82	82
	8th Highest Hour Volume (Major)	1066	1165
	8th Highest Hour Volume (Minor Approach)	58	58
	Condition A Met	No	No
	Condition B Met	No	No
	Signal Warranted*	No	No

\*While the minor approach is shown to meet Condition B, the right turn volume is substantially higher than the left turn volume at this location. See below for additional discussion.



Right Turn Reduction was not applied to the volumes before conducting the warrants. The impact of not applying the reduction is summarized as follows:

1. The Renner Road and Sugar Farms Drive 3 intersection is the only location where a signal would be recommended based on warrants and capacity needs (see below for capacity results). At this drive, the exiting left turn volume significantly exceeds the right turn volume (146 vs. 7 in the AM Peak, 91 vs. 5 in the PM Peak).
2. The Renner Road and Renner Site Drive 2 intersection meets the warrant threshold, but will likely not meet when a reduction is applied. The threshold is only exceeded by five vehicles and the right turn volume is substantially higher than the left turn volume.
3. The Sugar Farms access intersection on Alton & Darby Creek Road north of Walker Road does not meet warrants using full right turn volume in the Horizon Year.

Based on the above summary, Right Turn Reduction would not change the recommendations of this study. A signal is only warranted at the Renner Road and Sugar Farms Drive 3 intersection.

#### 4.2 Signalized & Unsignalized Capacity Analysis

EMH&T conducted intersection capacity analysis at all Study Area intersections using the HCM6 methodology in Synchro Version 10. The following Level of Service (LOS) criteria was used in the analysis:

- City of Columbus and City of Hilliard
  - o Minimum overall intersection LOS D, with approach minimum LOS D and individual movement LOS E
- Franklin County
  - o Minimum overall intersection LOS C and minimum LOS D for individual movements

All No-Build and Build scenarios were analyzed to determine if improvements are needed to bring the intersections to an acceptable Level of Service (LOS) and delay in the pre-development condition, and then again in the developed condition. Two-Way Stop Control (TWSC) intersections exhibiting poor LOS that met signal warrants as shown in **Table 2** were also analyzed as signalized intersections. We analyzed modern roundabout solutions as an alternative to widening and signalization in the Alton & Darby Creek Road corridor.

**Table 3** shows the results of the capacity analysis including LOS and Average Delay per Vehicle for each intersection overall and within each intersection by approach and for every movement. Detailed capacity reports can be found in **Appendix F**.



**Table 3: Capacity Analysis Results**  
**Alton & Darby Creek Rd/ Roberts Rd Capacity Analysis Results**

	2019 AM/PM Results			
	No-Build (ex lanes)		No-Build (ex lanes)	
	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
EBLT	C	26.5	D	35.4
EBTH	C	30.1	D	38.6
EBRT				
<b>EB Approach</b>	<b>C</b>	<b>29.5</b>	<b>D</b>	<b>37.9</b>
WBLT	C	23.4	C	30.5
WBTH	D	51.9	E	69.7
WBRT				
<b>WB Approach</b>	<b>D</b>	<b>47.6</b>	<b>E</b>	<b>58.9</b>
NBLT	B	19.3	B	19.9
NBTH	D	42.0	E	56.7
NBRT				
<b>NB Approach</b>	<b>D</b>	<b>41.7</b>	<b>E</b>	<b>56.2</b>
SBLT	C	24.7	F	93.5
SBTH	C	24.5	C	21.8
SBRT				
<b>SB Approach</b>	<b>C</b>	<b>24.6</b>	<b>D</b>	<b>45.5</b>
<b>Intersection</b>	<b>D</b>	<b>35.8</b>	<b>D</b>	<b>51.4</b>

Note: Per the City of Hilliard, incremental improvements such as turn lane length increases or signal modifications are not desired at this intersection. This analysis shows that the intersection does not meet agency LOS/Delay criteria under 2019 No Build conditions in the PM Peak. No additional signalized analysis is provided; see **Table 6** in Section 4.4 for roundabout analysis results.



**Table 3: Capacity Analysis Results (cont.)**  
**Alton & Darby Creek Rd/ Sugar Farm Drive 1 Capacity Analysis Results**

	2019/2029 AM Results			
	Build (ex lanes)		Build (ex lanes+NBR+SBL)	
	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
EBLT	-	-	-	-
EBTH	-	-	-	-
EBRT	-	-	-	-
<b>EB Approach</b>	-	-	-	-
WBLT	D/E	33.8/48.9	D/E	32.9/46.9
WBTH				
WBRT				
<b>WB Approach</b>	<b>D/E</b>	<b>33.8/48.9</b>	<b>D/E</b>	<b>32.9/46.9</b>
NBLT	-	-	-	-
NBTH	-	-	-	-
NBRT	-	-	-	-
<b>NB Approach</b>	<b>A/A</b>	<b>0.0/0.0</b>	<b>A/A</b>	<b>0.0/0.0</b>
SBLT	A/A	9.2/9.5	A/A	9.2/9.5
SBTH	A/A	0.0/0.0	A/A	0.0/0.0
SBRT	-	-	-	-
<b>SB Approach</b>	<b>A/A</b>	<b>0.2/0.1</b>	<b>A/A</b>	<b>0.2/0.1</b>
<b>Intersection</b>	<b>A/A</b>	<b>2.2/2.8</b>	<b>A/A</b>	<b>2.2/2.7</b>

	2019/2029 PM Results			
	Build (ex lanes)		Build (ex lanes+NBR+SBL)	
	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
EBLT	-	-	-	-
EBTH	-	-	-	-
EBRT	-	-	-	-
<b>EB Approach</b>	-	-	-	-
WBLT	F/F	52.5/91.0	E/F	47.1/74.8
WBTH				
WBRT				
<b>WB Approach</b>	<b>F/F</b>	<b>52.5/91.0</b>	<b>E/F</b>	<b>47.1/74.8</b>
NBLT	-	-	-	-
NBTH	-	-	-	-
NBRT	-	-	-	-
<b>NB Approach</b>	<b>A/A</b>	<b>0.0/0.0</b>	<b>A/A</b>	<b>0.0/0.0</b>
SBLT	A/B	9.6/10.1	A/B	9.6/10.1
SBTH	A/A	0.0/0.0	A/A	0.0/0.0
SBRT	-	-	-	-
<b>SB Approach</b>	<b>A/A</b>	<b>0.3/0.3</b>	<b>A/A</b>	<b>0.3/0.3</b>
<b>Intersection</b>	<b>A/A</b>	<b>1.9/2.8</b>	<b>A/A</b>	<b>1.7/2.3</b>



**Table 3: Capacity Analysis Results (cont.)**

**Alton & Darby Creek Rd/ Walker Rd/ Sugar Farm Drive 2 Capacity Analysis Results**

	2019/2029 AM Results					
	No-Build (ex lanes)		Build (ex lanes)		Build (ex+EBL+WBL+SBL)	
	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
EBLT	B/B	17.9/18.3	B/C	18.5/20.5	B/B	15.5/17.0
EBTH					B/B	17.5/19.2
EBRT					B/B	17.5/19.2
<b>EB Approach</b>	<b>B/B</b>	<b>17.9/18.3</b>	<b>B/C</b>	<b>18.5/20.5</b>	<b>B/B</b>	<b>17.4/19.1</b>
WBLT	-	-	B/B	17.2/19.0	C/C	21.1/23.5
WBTH	-	-			B/B	15.1/16.5
WBRT	-	-			B/B	15.1/16.5
<b>WB Approach</b>	-	-	<b>B/B</b>	<b>17.2/19.0</b>	<b>B/C</b>	<b>19.5/21.6</b>
NBLT	A/A	6.6/9.5	A/A	4.2/4.5	A/B	9.9/12.4
NBTH	A/A	4.8/6.5	A/A	5.6/6.5	A/A	7.5/9.5
NBRT	-	-			A/A	7.5/9.5
<b>NB Approach</b>	<b>A/A</b>	<b>5.3/7.2</b>			<b>A/A</b>	<b>5.3/6.0</b>
SBLT	-	-	B/B	13.5/16.6	B/B	11.4/14.0
SBTH	B/B	12.2/18.2			B/B	19.5/27.2
SBRT					B/C	19.5/27.2
<b>SB Approach</b>	<b>B/B</b>	<b>12.2/18.2</b>	<b>B/B</b>	<b>13.5/16.6</b>	<b>B/C</b>	<b>19.4/27.0</b>
<b>Intersection</b>	<b>A/B</b>	<b>9.1/12.3</b>	<b>B/B</b>	<b>10.2/11.9</b>	<b>B/B</b>	<b>13.6/17.5</b>

	2019/2029 PM Results					
	No-Build (ex. Lanes)		Build (ex. Lanes)		Build (ex+EBL+WBL+SBL)	
	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
EBLT	C/C	20.3/24.4	C/C	24.1/28.6	C/C	21.3/24.4
EBTH					C/C	23.5/26.9
EBRT					C/C	23.5/26.9
<b>EB Approach</b>	<b>C/C</b>	<b>20.3/24.4</b>	<b>C/C</b>	<b>24.1/28.6</b>	<b>C/C</b>	<b>23.3/26.6</b>
WBLT	-	-	C/C	22.7/26.6	C/C	25.9/29.9
WBTH	-	-			C/C	20.9/23.9
WBRT	-	-			C/C	20.9/23.9
<b>WB Approach</b>	-	-	<b>C/C</b>	<b>22.7/26.6</b>	<b>C/C</b>	<b>24.6/28.3</b>
NBLT	A/B	7.5/10.2	A/A	3.0/3.0	B/B	10.0/14.4
NBTH	A/A	4.0/4.1	A/A	5.2/6.1	A/A	6.4/8.5
NBRT	-	-			A/A	6.4/8.5
<b>NB Approach</b>	<b>A/A</b>	<b>4.6/5.1</b>			<b>A/A</b>	<b>4.9/5.7</b>
SBLT	-	-	B/B	14.0/19.5	B/B	11.8/15.0
SBTH	B/B	11.9/15.1			B/B	13.6/22.4
SBRT					B/C	13.6/22.4
<b>SB Approach</b>	<b>B/B</b>	<b>11.9/15.1</b>	<b>B/B</b>	<b>14.0/19.5</b>	<b>B/C</b>	<b>13.6/22.1</b>
<b>Intersection</b>	<b>A/B</b>	<b>8.9/10.8</b>	<b>B/B</b>	<b>10.5/13.6</b>	<b>B/B</b>	<b>11.4/16.4</b>



**Table 3: Capacity Analysis Results (cont.)**  
**Alton & Darby Creek Rd/ Renner Rd Capacity Analysis Results**

	2019/2029 AM Results					
	No-Build (ex lanes)		Build (ex lanes)		2029 AM Build (ex+NBR)	
	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
EBLT	-	-	-	-	-	-
EBTH	-	-	-	-	-	-
EBRT	-	-	-	-	-	-
<b>EB Approach</b>	-	-	-	-	-	-
WBLT	B/C	18.8/22.1	C/C	21.8/23.9	C	20.9
WBTH	-	-	-	-	-	-
WBRT	B/B	16.5/18.6	B/B	18.3/17.8	B	17.4
<b>WB Approach</b>	<b>B/B</b>	<b>17.0/19.3</b>	<b>B/B</b>	<b>19.2/19.4</b>	<b>B</b>	<b>18.4</b>
NBLT	-	-	-	-	-	-
NBTH	C/D	21.9/40.0	C/F	32.9/83.1	C	20.2
NBRT					A	4.1
<b>NB Approach</b>	<b>C/D</b>	<b>21.9/40.0</b>	<b>C/F</b>	<b>32.9/83.1</b>	<b>B</b>	<b>17.2</b>
SBLT	B/C	13.0/20.9	B/C	18.2/26.0	C	22.6
SBTH	A/A	5.0/5.4	A/A	5.6/6.2	A	6.8
SBRT	-	-	-	-	-	-
<b>SB Approach</b>	<b>A/B</b>	<b>8.2/11.6</b>	<b>B/B</b>	<b>10.1/13.3</b>	<b>B</b>	<b>12.4</b>
<b>Intersection</b>	<b>B/C</b>	<b>15.5/24.5</b>	<b>C/D</b>	<b>20.6/41.2</b>	<b>B</b>	<b>15.3</b>

	2019/2029 PM Results					
	No-Build (ex lanes)		Build (ex lanes)		Build (ex Lanes, new timings), 2029 ex+NBR	
	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
EBLT	-	-	-	-	-	-
EBTH	-	-	-	-	-	-
EBRT	-	-	-	-	-	-
<b>EB Approach</b>	-	-	-	-	-	-
WBLT	C/D	24.7/35.0	D/D	36.1/46.7	D/C	53.3/29.6
WBTH	-	-	-	-	-	-
WBRT	B/C	19.4/24.2	C/C	22.5/23.6	C/C	32.8/20.5
<b>WB Approach</b>	<b>C/C</b>	<b>21.7/29.1</b>	<b>C/C</b>	<b>28.7/34.1</b>	<b>D/C</b>	<b>42.1/24.7</b>
NBLT	-	-	-	-	-	-
NBTH	C/D	25.6/43.6	F/F	82.6/139.4	D/C	40.1/26.2
NBRT					D/B	40.1/16.4
<b>NB Approach</b>	<b>C/D</b>	<b>25.6/43.6</b>	<b>F/F</b>	<b>82.6/139.4</b>	<b>D/C</b>	<b>40.1/23.3</b>
SBLT	B/C	15.7/31.2	D/D	36.6/43.0	D/C	54.9/27.1
SBTH	A/A	8.3/9.6	A/B	9.5/10.5	A/B	8.9/12.0
SBRT	-	-	-	-	-	-
<b>SB Approach</b>	<b>B/B</b>	<b>10.5/16.1</b>	<b>B/C</b>	<b>17.5/20.3</b>	<b>C/B</b>	<b>22.4/16.6</b>
<b>Intersection</b>	<b>B/C</b>	<b>18.6/28.4</b>	<b>D/E</b>	<b>42.1/63.2</b>	<b>C/C</b>	<b>33.9/21.1</b>



**Table 3: Capacity Analysis Results (cont.)**

**Alton & Darby Creek Rd/ Cole Rd/ Renner Drive 1 Capacity Analysis Results**

	2019/2029 AM Results					
	No-Build (ex lanes)		Build (ex lanes)		Build (ex+NBR)	
	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
EBLT	C/D	23.2/28.3	-	-	-	-
EBTH			E/E	36.5/47.1	E/E	36.5/47.1
EBRT			E/E	36.5/47.1	E/E	36.5/47.1
<b>EB Approach</b>	<b>C/D</b>	<b>23.2/28.3</b>	<b>E/E</b>	<b>36.5/47.1</b>	<b>E/E</b>	<b>36.5/47.1</b>
WBLT	-	-	-	-	-	-
WBTH	-	-	-	-	-	-
WBRT	-	-	C/C	15.0/16.2	B/C	14.8/16.0
<b>WB Approach</b>	-	-	<b>C/C</b>	<b>15.0/16.2</b>	<b>B/C</b>	<b>14.8/16.0</b>
NBLT	A/A	8.4/8.7	A/A	9.1/9.3	A/A	9.1/9.3
NBTH	A/A	0.0/0.0	A/A	0.0/0.0	A/A	0.0/0.0
NBRT	-	-	-	-	-	-
<b>NB Approach</b>	<b>A/A</b>	<b>0.1/0.1</b>	<b>A/A</b>	<b>0.1/0.1</b>	<b>A/A</b>	<b>0.1/0.1</b>
SBLT	-	-	-	-	-	-
SBTH	-	-	-	-	-	-
SBRT	-	-	-	-	-	-
<b>SB Approach</b>	<b>A/A</b>	<b>0.0/0.0</b>	<b>A/A</b>	<b>0.0/0.0</b>	<b>A/A</b>	<b>0.0/0.0</b>
<b>Intersection</b>	<b>A/A</b>	<b>0.5/0.5</b>	<b>A/A</b>	<b>0.9/1.0</b>	<b>A/A</b>	<b>0.9/1.0</b>

	2019/2029 PM Results					
	No-Build (ex lanes)		Build (ex lanes)		Build (ex+NBR)	
	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
EBLT	E/F	38.8/54.5	F/F	72.7/108.0	F/F	72.7/108.0
EBTH			F/F	72.7/108.0	F/F	72.7/108.0
EBRT			F/F	72.7/108.0	F/F	72.7/108.0
<b>EB Approach</b>	<b>E/F</b>	<b>38.8/54.5</b>	<b>F/F</b>	<b>72.7/108.0</b>	<b>F/F</b>	<b>72.7/108.0</b>
WBLT	-	-	-	-	-	-
WBTH	-	-	-	-	-	-
WBRT	-	-	C/C	16.2/17.5	C/C	15.6/16.9
<b>WB Approach</b>	-	-	<b>C/C</b>	<b>16.2/17.5</b>	<b>C/C</b>	<b>15.6/16.9</b>
NBLT	A/B	10.0/10.6	B/B	10.5/11.2	B/B	10.5/11.2
NBTH	A/A	0.0/0.0	A/A	0.0/0.0	A/A	0.0/0.0
NBRT	-	-	-	-	-	-
<b>NB Approach</b>	<b>A/A</b>	<b>0.2/0.1</b>	<b>A/A</b>	<b>0.1/0.1</b>	<b>A/A</b>	<b>0.1/0.1</b>
SBLT	-	-	-	-	-	-
SBTH	-	-	-	-	-	-
SBRT	-	-	-	-	-	-
<b>SB Approach</b>	<b>A/A</b>	<b>0.0/0.0</b>	<b>A/A</b>	<b>0.0/0.0</b>	<b>A/A</b>	<b>0.1/0.1</b>
<b>Intersection</b>	<b>A/A</b>	<b>0.6/0.7</b>	<b>A/C</b>	<b>1.0/1.2</b>	<b>A/B</b>	<b>1.0/1.2</b>



**Table 3: Capacity Analysis Results (cont.)**  
**Renner Rd/ Sugar Farm Drive 3 Capacity Analysis Results**

	2019/2029 AM Results			
	Build (ex lanes)		Build (ex+EBL+Signal)	
	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
EBLT	A/A	8.2/8.3	A/B	7.2/11.5
EBTH	A/A	0.0/0.0	A/A	6.4/8.9
EBRT	-	-	-	-
<b>EB Approach</b>	<b>A/A</b>	<b>0.0/0.0</b>	<b>A/A</b>	<b>6.4/8.9</b>
WBLT	-	-	-	-
WBTH	A/A	0.0/0.0	A/A	6.2/9.6
WBRT				
<b>WB Approach</b>	<b>A/A</b>	<b>0.0/0.0</b>	<b>A/A</b>	<b>6.2/9.6</b>
NBLT	-	-	-	-
NBTH	-	-	-	-
NBRT	-	-	-	-
<b>NB Approach</b>	-	-	-	-
SBLT	D/D	27.5/34.6	A/C	8.9/28.3
SBTH				
SBRT				
<b>SB Approach</b>	<b>D/D</b>	<b>27.5/34.6</b>	<b>A/C</b>	<b>8.9/28.3</b>
<b>Intersection</b>	<b>A/A</b>	<b>4.3/4.9</b>	<b>A/B</b>	<b>6.7/12.0</b>

	2019/2029 PM Results			
	Build (ex lanes)		Build (ex+EBL+Signal)	
	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
EBLT	A/B	10.0/10.3	B/C	17.9/21.6
EBTH	A/A	0.0/0.0	A/A	6.0/6.3
EBRT	-	-	-	-
<b>EB Approach</b>	<b>A/A</b>	<b>0.2/0.1</b>	<b>A/A</b>	<b>6.2/6.5</b>
WBLT	-	-	-	-
WBTH	A/A	0.0/0.0	B/B	12.4/14.7
WBRT				
<b>WB Approach</b>	<b>A/A</b>	<b>0.0/0.0</b>	<b>B/B</b>	<b>12.4/14.7</b>
NBLT	-	-	-	-
NBTH	-	-	-	-
NBRT	-	-	-	-
<b>NB Approach</b>	-	-	-	-
SBLT	F/F	66.2/105.1	C/C	32.4/32.6
SBTH				
SBRT				
<b>SB Approach</b>	<b>F/F</b>	<b>66.2/105.1</b>	<b>C/C</b>	<b>32.4/36.6</b>
<b>Intersection</b>	<b>A/A</b>	<b>4.4/6.3</b>	<b>B/B</b>	<b>11.6/12.9</b>



**Table 3: Capacity Analysis Results (cont.)**  
**Renner Rd/ Renner Drive 2 Capacity Analysis Results**

	2019/2029 AM Results			
	Build (ex lanes)		Build (ex+WBL)	
	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
EBLT	-	-	-	-
EBTH	-	-	-	-
EBRT	-	-	-	-
<b>EB Approach</b>	<b>A/A</b>	<b>0.0/0.0</b>	<b>A/A</b>	<b>0.0/0.0</b>
WBLT	A/A	8.9/9.1	A/A	8.9/9.1
WBTH	A/A	0.0/0.0	A/A	0.0/0.0
WBRT				
<b>WB Approach</b>	<b>A/A</b>	<b>0.5/0.5</b>	<b>A/A</b>	<b>0.5/0.5</b>
NBLT	C/C	19.4/22.0	C/C	19.4/21.9
NBTH				
NBRT				
<b>NB Approach</b>	<b>C/C</b>	<b>19.4/22.0</b>	<b>C/C</b>	<b>19.4/21.9</b>
SBLT	-	-	-	-
SBTH	-	-	-	-
SBRT	-	-	-	-
<b>SB Approach</b>	-	-	-	-
<b>Intersection</b>	<b>A/A</b>	<b>2.5/2.6</b>	<b>A/A</b>	<b>2.5/2.6</b>

	2019/2029 PM Results			
	Build (ex lanes)		Build (ex+WBL)	
	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
EBLT	-	-	-	-
EBTH	-	-	-	-
EBRT	-	-	-	-
<b>EB Approach</b>	<b>A/A</b>	<b>0.0/0.0</b>	<b>A/A</b>	<b>0.0/0.0</b>
WBLT	A/A	9.2/9.4	A/A	9.2/9.4
WBTH	A/A	0.0/0.0	A/A	0.0/0.0
WBRT				
<b>WB Approach</b>	<b>A/A</b>	<b>0.7/0.7</b>	<b>A/A</b>	<b>0.7/0.7</b>
NBLT	D/E	31.3/41.3	D/E	28.8/36.2
NBTH				
NBRT				
<b>NB Approach</b>	<b>D/E</b>	<b>31.3/41.3</b>	<b>D/E</b>	<b>28.8/36.2</b>
SBLT	-	-	-	-
SBTH	-	-	-	-
SBRT	-	-	-	-
<b>SB Approach</b>	-	-	-	-
<b>Intersection</b>	<b>A/A</b>	<b>2.0/2.4</b>	<b>A/A</b>	<b>1.9/2.1</b>



**Table 3: Capacity Analysis Results (cont.)**  
**Spindler Rd/ Renner Rd Capacity Analysis Results**

	2019/2029 AM Results			
	No-Build (ex lanes)		Build (ex lanes)	
	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
EBLT	A/A	6.7/7.2	A/A	7.4/7.8
EBTH	A/A	6.3/6.8	A/A	8.4/8.9
EBRT				
<b>EB Approach</b>	<b>A/A</b>	<b>6.3/6.8</b>	<b>A/A</b>	<b>8.4/8.9</b>
WBLT	A/A	7.7/8.4	B/B	11.6/12.6
WBTH	A/A	5.7/6.1	A/A	6.0/6.2
WBRT	A/A	4.9/5.1	A/A	4.8/4.9
<b>WB Approach</b>	<b>A/A</b>	<b>5.6/5.9</b>	<b>A/A</b>	<b>5.9/6.2</b>
NBLT	A/A	9.5/9.4	B/B	10.4/11.1
NBTH				
NBRT				
<b>NB Approach</b>	<b>A/A</b>	<b>9.5/9.4</b>	<b>B/B</b>	<b>10.4/11.1</b>
SBLT	B/B	11.7/11.7	B/B	12.9/13.8
SBTH	A/A	9.9/9.8	B/B	10.9/11.5
SBRT				
<b>SB Approach</b>	<b>B/B</b>	<b>11.4/11.3</b>	<b>B/B</b>	<b>12.4/13.3</b>
<b>Intersection</b>	<b>A/A</b>	<b>7.5/7.8</b>	<b>A/A</b>	<b>8.5/9.0</b>

	2019/2029 PM Results			
	No-Build (ex. Lanes)		Build (ex. Lanes)	
	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
EBLT	B/B	10.5/11.3	B/B	14.9/16.5
EBTH	A/A	5.1/5.0	A/A	4.7/4.7
EBRT				
<b>EB Approach</b>	<b>A/A</b>	<b>5.5/5.5</b>	<b>A/A</b>	<b>5.4/5.5</b>
WBLT	A/A	6.4/6.5	A/A	6.7/6.8
WBTH	A/A	7.0/7.2	A/A	8.7/10.1
WBRT	A/A	4.1/4.0	A/A	3.3/3.2
<b>WB Approach</b>	<b>A/A</b>	<b>6.5/6.6</b>	<b>A/A</b>	<b>8.0/9.1</b>
NBLT	B/B	11.4/12.5	B/B	16.5/18.0
NBTH				
NBRT				
<b>NB Approach</b>	<b>B/B</b>	<b>11.4/12.5</b>	<b>B/B</b>	<b>16.5/18.0</b>
SBLT	B/B	12.3/13.4	B/B	17.8/19.5
SBTH	B/B	11.7/12.8	B/B	17.1/18.8
SBRT				
<b>SB Approach</b>	<b>B/B</b>	<b>12.1/13.2</b>	<b>B/B</b>	<b>17.6/19.3</b>
<b>Intersection</b>	<b>A/A</b>	<b>6.9/7.1</b>	<b>A/A</b>	<b>8.2/9.0</b>



**Table 3: Capacity Analysis Results (cont.)**

**Bloomington Blvd/ Tanglewood Park Blvd/ Renner Road Capacity Analysis Results**

	2019/2029 AM Results					
	No-Build (ex lanes)		Build (ex lanes)		Build (ex+SBRT+WBRT)	
	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
EBLT	A/A	5.4/5.8	A/A	6.0/6.4	A/A	5.8/6.2
EBTH	A/A	6.9/7.7	A/B	9.1/10.2	A/B	9.1/10.2
EBRT						
<b>EB Approach</b>	<b>A/A</b>	<b>6.7/7.3</b>	<b>A/A</b>	<b>8.6/9.6</b>	<b>A/A</b>	<b>8.6/9.5</b>
WBLT	A/A	3.9/4.7	B/B	15.0/17.7	B/B	14.9/17.5
WBTH	A/A	3.7/4.1	A/B	9.8/10.4	A/A	9.4/9.9
WBRT					A/A	7.9/8.3
<b>WB Approach</b>	<b>A/A</b>	<b>3.7/4.1</b>	<b>B/B</b>	<b>10.0/10.7</b>	<b>A/B</b>	<b>9.4/10.0</b>
NBLT	D/D	46.7/46.2	D/D	47.1/46.6	D/D	43.2/42.5
NBTH	D/D	45.1/44.3	D/D	45.0/44.3	D/D	45.1/44.4
NBRT						
<b>NB Approach</b>	<b>D/D</b>	<b>45.3/44.6</b>	<b>D/D</b>	<b>45.3/44.6</b>	<b>D/D</b>	<b>44.9/44.2</b>
SBLT	D/D	54.5/54.2	D/D	54.4/54.2	D/D	54.6/54.3
SBTH	D/D	44.8/44.0	D/D	45.0/44.3	D/D	42.6/41.9
SBRT					D/D	38.5/37.9
<b>SB Approach</b>	<b>D/D</b>	<b>51.0/50.6</b>	<b>D/D</b>	<b>50.9/50.4</b>	<b>D/D</b>	<b>48.8/48.3</b>
<b>Intersection</b>	<b>B/B</b>	<b>15.7/15.9</b>	<b>B/B</b>	<b>16.2/16.9</b>	<b>B/B</b>	<b>15.8/16.4</b>

	2019/2029 PM Results					
	No-Build (ex lanes)		Build (ex lanes)		Build (ex+SBRT+WBRT)	
	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
EBLT	B/D	18.0/49.0	E/F	66.6/87.6	C/C	23.4/30.6
EBTH	B/B	10.0/10.6	A/B	9.6/9.2	A/A	8.1/8.4
EBRT						
<b>EB Approach</b>	<b>B/C</b>	<b>12.7/23.3</b>	<b>C/C</b>	<b>25.1/31.5</b>	<b>B/B</b>	<b>12.3/14.5</b>
WBLT	A/C	7.8/25.5	B/B	13.7/13.3	B/B	11.5/12.3
WBTH	B/D	12.7/45.5	F/F	63.2/71.3	C/C	22.1/24.4
WBRT					B/B	10.3/10.7
<b>WB Approach</b>	<b>B/D</b>	<b>12.4/44.2</b>	<b>E/E</b>	<b>60.8/68.3</b>	<b>C/C</b>	<b>20.0/22.0</b>
NBLT	E/E	57.2/57.3	E/E	61.4/61.6	D/D	41.5/41.7
NBTH	C/C	34.8/34.5	D/D	38.1/39.0	D/D	40.6/40.7
NBRT						
<b>NB Approach</b>	<b>D/D</b>	<b>39.6/39.4</b>	<b>D/D</b>	<b>43.0/43.8</b>	<b>D/D</b>	<b>40.8/40.9</b>
SBLT	D/D	39.9/39.7	D/D	43.7/45.2	D/D	46.7/47.3
SBTH	E/E	59.5/59.4	F/F	113.0/147.6	D/D	40.3/40.4
SBRT					E/E	56.5/58.9
<b>SB Approach</b>	<b>D/D</b>	<b>54.2/54.1</b>	<b>F/F</b>	<b>95.1/121.1</b>	<b>D/D</b>	<b>52.8/54.5</b>
<b>Intersection</b>	<b>C/D</b>	<b>23.3/39.8</b>	<b>E/E</b>	<b>55.7/66.6</b>	<b>C/C</b>	<b>24.6/26.5</b>



**Table 3: Capacity Analysis Results (cont.)**  
**Hilliard & Rome Rd/ Renner Rd Capacity Analysis Results**

	2019/2029 AM Results							
	No-Build (ex lanes)		No-Build (ex+NBL+WBR)		Build (ex+NBL+WBR)		Build (ex+NBL+WBTR +EBR+SBTH), 2029 +EBTH	
	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
EBLT	D/D	41.4/40.9	D/C	37.9/29.5	D/C	37.3/23.8	C/D	31.8/40.4
EBTH	D/D	45.6/45.3	D/C	41.9/32.4	D/C	41.8/26.3	D/D	35.3/42.0
EBRT	E/E	68.4/73.9	E/E	57.3/61.8	F/F	144.6/166.0	C/D	33.6/42.1
<b>EB Approach</b>	<b>E/E</b>	<b>61.8/65.7</b>	<b>D/D</b>	<b>52.8/53.4</b>	<b>F/F</b>	<b>117.1/128.7</b>	<b>C/D</b>	<b>33.9/42.0</b>
WBLT	E/E	56.8/57.5	E/E	55.9/55.7	E/E	67.2/69.4	E/E	56.1/55.8
WBTH	E/E	56.5/55.9	D/D	53.3/52.8	E/E	58.5/58.7	D/D	51.7/51.1
WBRT			D/D	49.7/43.0	D/D	44.4/43.9	D/D	52.0/51.3
<b>WB Approach</b>	<b>E/E</b>	<b>56.7/57.0</b>	<b>D/D</b>	<b>54.9/54.3</b>	<b>E/E</b>	<b>63.5/65.1</b>	<b>D/D</b>	<b>54.7/54.3</b>
NBLT	C/C	25.5/34.2	E/E	63.1/64.4	F/F	132.1/153.4	E/E	79.2/73.7
NBTH	C/C	27.8/29.5	C/C	32.8/33.1	C/C	33.8/34.0	C/C	29.6/31.2
NBRT	C/C	30.7/34.9	D/D	39.8/42.4	D/D	44.0/46.9	C/D	33.7/37.5
<b>NB Approach</b>	<b>C/C</b>	<b>28.4/32.1</b>	<b>D/D</b>	<b>40.2/41.4</b>	<b>D/E</b>	<b>55.9/60.8</b>	<b>D/D</b>	<b>40.4/41.3</b>
SBLT	C/C	25.3/27.3	C/C	28.3/28.8	C/C	28.5/28.6	C/C	26.0/27.8
SBTH	C/D	34.8/38.0	D/D	38.5/39.7	D/D	38.6/39.0	C/D	33.1/35.6
SBRT	C/D	36.3/40.1	D/D	40.5/42.0	D/D	40.6/41.3	C/D	34.5/37.5
<b>SB Approach</b>	<b>C/D</b>	<b>34.4/37.8</b>	<b>D/D</b>	<b>38.2/39.5</b>	<b>D/D</b>	<b>38.3/38.8</b>	<b>C/D</b>	<b>32.8/35.4</b>
<b>Intersection</b>	<b>D/D</b>	<b>40.1/43.4</b>	<b>D/D</b>	<b>43.9/44.8</b>	<b>E/E</b>	<b>68.5/73.6</b>	<b>D/D</b>	<b>38.3/41.3</b>

	2019/2029 PM Results							
	No-Build (ex. Lanes)		No-Build (ex+NBL+WBR)		Build (ex+NBL+WBR)		Build (ex+NBL+WBTR +EBR+SBTH), 2029 +EBTH	
	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
EBLT	E/E	64.0/67.4	E/D	55.2/50.9	E/D	58.0/59.5	E/E	56.2/62.6
EBTH	F/F	116.5/136.2	E/E	65.3/64.8	F/F	88.9/101.5	E/E	77.1/56.3
EBRT	D/D	36.0/37.8	D/D	48.0/46.5	E/E	58.0/79.1	C/C	31.4/32.5
<b>EB Approach</b>	<b>E/E</b>	<b>60.9/67.5</b>	<b>D/D</b>	<b>53.5/51.9</b>	<b>E/E</b>	<b>65.3/81.6</b>	<b>D/D</b>	<b>45.7/42.4</b>
WBLT	E/E	66.6/78.1	E/E	57.5/57.3	E/E	67.6/61.1	E/E	58.8/58.6
WBTH	F/F	122.3/146.1	D/D	51.9/51.4	E/E	74.7/65.7	D/D	47.6/46.8
WBRT			D/D	43.7/36.8	D/D	38.8/37.1	D/D	48.3/47.5
<b>WB Approach</b>	<b>F/F</b>	<b>87.7/103.8</b>	<b>D/D</b>	<b>54.6/53.6</b>	<b>E/E</b>	<b>67.1/60.3</b>	<b>D/D</b>	<b>54.4/54.0</b>
NBLT	F/F	83.7/117.5	E/E	63.2/65.8	E/F	62.8/91.7	D/E	51.3/55.5
NBTH	C/C	25.7/27.5	C/C	30.7/34.6	C/C	28.4/32.7	C/C	30.5/31.9
NBRT	B/B	11.7/12.4	B/B	14.0/14.7	B/B	13.4/14.1	B/B	14.0/13.4
<b>NB Approach</b>	<b>D/D</b>	<b>35.6/44.0</b>	<b>C/D</b>	<b>34.8/37.9</b>	<b>C/D</b>	<b>35.0/44.9</b>	<b>C/D</b>	<b>33.4/35.0</b>
SBLT	C/C	31.3/32.9	C/D	31.5/37.1	C/D	31.7/36.7	C/D	34.6/37.8
SBTH	E/E	55.3/64.2	D/D	42.5/50.9	D/E	51.5/59.5	D/D	46.2/48.4
SBRT	E/E	63.7/74.5	D/E	46.7/58.1	E/E	58.9/69.1	D/E	53.5/57.5
<b>SB Approach</b>	<b>E/E</b>	<b>56.2/65.2</b>	<b>D/D</b>	<b>43.0/52.2</b>	<b>D/E</b>	<b>52.4/60.9</b>	<b>D/D</b>	<b>47.2/49.9</b>
<b>Intersection</b>	<b>D/E</b>	<b>51.2/60.6</b>	<b>D/D</b>	<b>41.9/45.3</b>	<b>D/E</b>	<b>47.7/55.7</b>	<b>D/D</b>	<b>41.2/42.1</b>



**Table 3: Capacity Analysis Results (cont.)**

Alton & Darby Creek Rd/ Feder Rd Capacity Analysis Results

	AM Results									
	No-Build (ex. lanes) 2019/2029		2019 Build (ex. lanes)		2019 Build/ 2029 No-Build (+New Timings+WBR)		2029 Build (+New Timings+WBR)		2029 Build (+New Timings +WBR+NBR)	
	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
EBLT	C/C	20.4/28.5	C	26.8	C/C	22.9/25.6	C	27.0	C	24.3
EBTH	C/D	24.8/35.8	C	30.2	C/D	30.6/37.4	D	42.8	D	35.1
EBRT										
EB Approach	C/C	23.8/34.1	C	29.4	C/C	28.7/34.6	D	39.0	C	32.5
WBLT	B/C	19.4/26.0	C	24.1	C/C	23.6/27.2	C	28.7	C	25.7
WBTH	C/E	34.8/79.0	E	65.2	C/C	26.2/29.5	C	31.1	C	28.1
WBRT					C/D	20.2/44.1	C	24.1	B	19.7
WB Approach	C/E	32.2/70.0	E	59.2	C	21.9/37.9	C	26.2	C	22.3
NBLT	B/B	12.6/14.9	B	16.6	B/B	13.4/12.4	B	15.4	B	16.4
NBTH	C/E	26.6/57.6	D	41.2	C/C	26.3/29.5	F	65.2	C	30.4
NBRT									B	17.0
NB Approach	C/E	26.0/55.8	D	40.1	C/C	25.7/28.8	E	63.1	C	26.9
SBLT	B/D	16.3/41.9	D	43.7	B/C	19.5/26.4	F	118.6	C	26.7
SBTH	B/B	12.4/13.9	B	13.5	B/B	11.1/12.5	B	12.8	B	12.9
SBRT										
SB Approach	B/C	14.2/26.8	C	30.1	B/B	15.7/18.9	E	69.6	C	20.3
Intersection	C/D	23.5/46.7	D	39.0	C/C	22.0/28.9	D	53.8	C	24.7

	PM Results									
	No-Build (ex. lanes) 2019/2029		2019 Build (ex. lanes)		2019 Build/ 2029 No-Build (+WBR)		2029 PM Build (+WBR)		2029 PM Build (+WBR+NBR)	
	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
EBLT	C/C	22.0/34.2	C	30.9	C/C	22.6/27.9	C	32.3	C	30.2
EBTH	C/C	24.0/34.4	C	28.1	C/C	26.5/34.2	D	38.8	D	36.0
EBRT										
EB Approach	C/C	23.3/34.3	C	29.2	C/C	25.0/32.0	D	36.3	C	33.8
WBLT	B/C	18.6/26.3	C	22.0	C/C	20.7/25.2	C	29.5	C	28.2
WBTH	C/E	31.6/67.9	F	107.4	C/C	25.3/31.6	D	38.1	D	35.4
WBRT					C/D	20.1/36.2	C	31.1	C	32.1
WB Approach	C/E	28.2/57.1	F	91.2	C/C	21.5/31.7	C	32.7	C	32.2
NBLT	B/C	18.3/28.0	C	25.7	B/B	19.2/17.9	C	21.5	C	22.2
NBTH	C/D	25.1/41.6	D	44.1	C/C	29.5/24.3	D	38.8	C	29.2
NBRT									B	14.3
NB Approach	C/D	24.8/41.0	D	43.3	C/C	29.0/24.3	D	38.0	C	26.8
SBLT	B/D	17.4/39.2	D	43.8	C/B	23.9/18.4	D	41.0	C	22.8
SBTH	C/D	23.7/50.6	C	34.1	C/C	23.6/26.8	C	27.4	C	30.1
SBRT										
SB Approach	C/D	22.0/47.5	D	37.3	C/C	23.7/24.6	C	31.7	C	27.8
Intersection	C/D	24.3/47.1	D	53.4	C/C	24.3/26.9	C	33.7	C	29.3



**Table 3: Capacity Analysis Results (cont.)**

**Hilliard & Rome Rd/ Feder Rd/Fisher Rd Capacity Analysis Results**

	2019/2029 AM Results					
	No-Build (ex lanes)/ 2029 (ex lanes + City Project)		No-Build (ex lanes+City project, add EBTH WBR)*		Build (ex lanes+City project, add EBTH WBR)*	
	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
EBLT	F/F	191.1/181.5	E/E	58.5/62.8	E/E	59.6/64.7
EBTH	C/F	24.0/139.2	D/D	42.4/44.4	D/D	38.0/40.2
EBRT						
<b>EB Approach</b>	<b>F/F</b>	<b>115.0/162.2</b>	<b>D/D</b>	<b>51.1/54.4</b>	<b>D/D</b>	<b>50.2/53.9</b>
WBLT	D/C	46.9/34.4	D/D	45.9/52.5	D/D	45.0/51.7
WBTH	D/D	48.4/39.3	E/E	63.7/75.9	E/E	61.6/74.0
WBRT	F/D	87.2/50.4	D/D	43.3/47.8	D/D	42.4/47.2
<b>WB Approach</b>	<b>E/D</b>	<b>77.0/47.2</b>	<b>D/D</b>	<b>47.6/53.9</b>	<b>D/D</b>	<b>46.7/53.3</b>
NBLT	E/C	61.5/27.6	C/C	23.3/31.3	C/C	25.8/34.2
NBTH	D/D	41.2/39.9	C/D	32.6/47.1	D/D	37.4/52.8
NBRT						
<b>NB Approach</b>	<b>D/D</b>	<b>42.1/38.9</b>	<b>C/D</b>	<b>32.4/45.2</b>	<b>D/D</b>	<b>36.0/50.1</b>
SBLT	F/F	155.4/131.2	E/E	64.8/73.7	E/E	69.7/79.2
SBTH	C/C	31.0/30.0	C/C	23.2/29.5	C/C	26.4/33.1
SBRT	B/B	10.8/14.6	A/A	8.2/8.5	A/A	8.9/9.2
<b>SB Approach</b>	<b>F/E</b>	<b>85.2/74.3</b>	<b>D/D</b>	<b>39.8/46.2</b>	<b>D/D</b>	<b>41.7/48.6</b>
<b>Intersection</b>	<b>F/F</b>	<b>86.4/96.4</b>	<b>D/D</b>	<b>43.7/50.2</b>	<b>D/D</b>	<b>44.6/51.6</b>

\*Cycle Length increased to 140 s in 2029 AM Peak to accommodate N/S Ped Crossing Times

	2019/2029 PM Results					
	No-Build (ex lanes)/ 2029 (ex lanes + City Project)		No-Build (ex lanes+City project, add EBTH WBR)		Build (ex lanes+City project, add EBTH WBR)	
	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
EBLT	E/F	71.4/87.4	E/E	62.5/64.2	E/E	61.1/63.7
EBTH	C/F	29.3/131.1	D/C	39.1/38.7	D/D	37.6/36.9
EBRT						
<b>EB Approach</b>	<b>D/F</b>	<b>48.2/111.3</b>	<b>D/D</b>	<b>49.6/50.1</b>	<b>D/D</b>	<b>49.0/49.7</b>
WBLT	D/D	53.7/45.0	C/C	31.8/32.6	C/C	31.9/32.4
WBTH	F/F	134.5/102.3	D/E	48.9/62.9	E/E	55.6/76.6
WBRT	F/F	334.5/303.6	D/D	38.2/42.2	D/D	38.9/42.8
<b>WB Approach</b>	<b>F/F</b>	<b>243.5/215.0</b>	<b>D/D</b>	<b>40.6/47.0</b>	<b>D/D</b>	<b>43.3/51.9</b>
NBLT	F/C	151.4/29.2	C/C	24.9/34.8	C/D	28.7/41.4
NBTH	C/C	30.8/29.0	C/D	30.6/36.0	C/D	32.5/38.4
NBRT						
<b>NB Approach</b>	<b>D/C</b>	<b>46.9/28.9</b>	<b>C/C</b>	<b>29.4/35.0</b>	<b>C/D</b>	<b>31.4/37.8</b>
SBLT	E/D	56.9/53.9	E/E	64.1/68.5	E/E	66.2/73.3
SBTH	F/C	81.6/30.8	C/D	32.8/39.1	D/D	35.1/43.3
SBRT	E/C	55.1/25.8	C/C	27.0/32.0	C/D	31.0/41.8
<b>SB Approach</b>	<b>E/C</b>	<b>66.6/31.8</b>	<b>C/D</b>	<b>34.5/40.0</b>	<b>D/D</b>	<b>37.1/46.4</b>
<b>Intersection</b>	<b>F/F</b>	<b>100.6/83.6</b>	<b>D/D</b>	<b>36.9/41.9</b>	<b>D/D</b>	<b>39.1/46.4</b>



### 4.3 Turn Lane Warrant Analysis & Length Calculations

EMH&T conducted turn lane warrants at the unsignalized intersections in the Study Area to determine if left and/or right turn lanes are justified based on anticipated traffic volumes. These warrants were conducted using the methodology and criteria outlined in the Ohio Department of Transportation (ODOT) Location and Design Manual (L&D).

Any turn lane justified based on the warrant criteria, as well as any turn lane improvement deemed necessary from the capacity analysis, was sized using ODOT L&D Manual turn lane length procedures.

**Table 4** shows the results of the turn lane warrant analysis at the unsignalized site drives. The calculated turn lane lengths are also included if a turn lane is warranted. Note that the table only shows the storage length; a 50-foot diverging taper will be required per County design guidelines for the site drive turn lanes.

**Table 4: Turn Lane Warrant Results and Length Calculations**

Drive	Movement	Year Warranted	Storage Length
ADCR & Sugar Farm Drive 1	NBRT	Opening Year	235
	SBLT	Opening Year	235
ADCR & Renner Drive 1	NBRT	Opening Year	235
Renner Drive 2	EBRT	<b>Not Recommended; See Below</b>	
	WBLT	Opening Year	175

The turn lane warrant worksheets and turn lane length calculations can be found in **Appendix G**.

We also completed a queuing analysis with Synchro/SimTraffic modeling software to evaluate queue lengths at signalized intersections. **Table 5** shows the results of the SimTraffic queue length for the *No Build With Improvements* and *Build With Improvements* scenarios compared with the ODOT L&D calculated length, and the recommended storage length for each turn lane. The queue length listed in the table is the longest length calculated for either the AM or PM peak for a given scenario. Calculated values for through movements indicate the turn lane length needed to avoid blockage by queues in the adjacent through lane. As turn lanes are added in Horizon Year scenarios, Horizon Year no block lengths may be less than Opening Year values.

No incremental turn lane length increases are desired at Alton & Darby Creek Road/Roberts Road per the City of Hilliard and that intersection is not included in Table 5. A roundabout is the preferred improvement at this location if needed to accommodate traffic volume growth.



**Table 5: Queuing Results and Length Calculations**

Alton & Darby Creek Road/Sugar Farm Drive 1										
Movement	Existing Storage	Opening Year				Horizon Year				Recommended Storage
		Calculated		Queue Length		Calculated		Queue Length		
		No Build	Build							
NBTH	1800	---	---	---	0	---	---	---	0	---
NBRT	---	---	235	---	0	---	235	---	0	235
WB	---	---	---	---	72	---	---	---	72	---
SBLT	---	---	235	---	35	---	235	---	36	235
SBTH	3600	---	---	---	0	---	---	---	0	---

Alton & Darby Creek Road/Walker Road/Sugar Farm Drive 2										
Movement	Existing Storage	Opening Year				Horizon Year				Recommended Storage
		Calculated		Queue Length		Calculated		Queue Length		
		No Build	Build							
NBLT	350	315	365	94	96	365	365	101	130	No Change
NBTH	1150	600	725	93	182	650	800	130	231	---
SBLT	---	---	235	---	38	---	235	---	45	235
SBTH	1700	---	650	201	318	---	750	309	365	---
EBLT	---	---	235	---	19	---	235	---	23	235
EBTH	5000	---	200	75	81	---	200	81	99	---
WBLT	---	---	---	---	91	---	---	---	97	100
WBTH	1700	---	---	---	54	---	---	---	65	---

Alton & Darby Creek Road/Renner Road										
Movement	Existing Storage	Opening Year				Horizon Year				Recommended Storage
		Calculated		Queue Length		Calculated		Queue Length		
		No Build	Build							
NBTH	1000	---	---	460	871	---	600	679	361	---
NBRT	---	---	---	---	---	---	390	---	97	215
SBLT	350	390	440	162	473	440	465	182	227	465
SBTH	1150	600	600	161	572	550	625	194	214	---
WBRT	375	450	450	153	261	475	475	169	211	No Change
WBLT	1000	325	325	249	504	350	350	226	322	---

Alton & Darby Creek Road/Cole Road/Renner Drive 1										
Movement	Existing Storage	Opening Year				Horizon Year				Recommended Storage
		Calculated		Queue Length		Calculated		Queue Length		
		No Build	Build							
SB	1060	---	---	0	0	---	---	0	0	---
NBTH	3500	---	---	67	94	---	---	98	157	---
NBRT	---	---	235	---	0	---	235	---	0	235
EB	1300	---	---	38	46	---	---	40	43	---
WB	---	---	---	---	31	---	---	---	31	---



**Table 5: Queuing Results and Length Calculations (cont.)**

Renner Road/Sugar Farm Drive 3										
Movement	Existing Storage	Opening Year				Horizon Year				Recommended Storage
		Calculated		Queue Length		Calculated		Queue Length		
		No Build	Build							
SB	---	---	---	---	110	---	---	---	142	---
EBLT	---	---	125	---	30	---	125	---	28	125
EBTH	1300	---	---	---	145	---	---	---	182	---
WBTH	800	---	---	---	276	---	---	---	309	---

Renner Road/Renner Drive 2										
Movement	Existing Storage	Opening Year				Horizon Year				Recommended Storage
		Calculated		Queue Length		Calculated		Queue Length		
		No Build	Build							
NB	---	---	---	---	90	---	---	---	87	100
EBTH	800	---	---	---	0	---	---	---	3	---
WBLT	---	---	125	---	52	---	175	---	52	175
WBTH	650	---	---	---	0	---	---	---	0	---

Renner Road/Spindler Road										
Movement	Existing Storage	Opening Year				Horizon Year				Recommended Storage
		Calculated		Queue Length		Calculated		Queue Length		
		No Build	Build							
NB	460	---	---	51	50	---	---	49	51	---
SBLT	150	250	250	129	149	250	250	131	156	No Change
SBTH	240	100	100	51	56	100	100	50	56	---
WBLT	125	125	125	25	30	125	125	25	28	No Change
WBTH	740	600	775	130	207	650	825	155	236	---
WBRT	250	250	250	44	41	250	250	40	43	No Change
EBLT	145	125	175	49	62	125	175	54	62	No Change
EBTH	750	400	550	105	157	450	600	127	184	---

Renner Road/Tanglewood Boulevard/Bloomington Boulevard										
Movement	Existing Storage	Opening Year				Horizon Year				Recommended Storage
		Calculated		Queue Length		Calculated		Queue Length		
		No Build	Build							
NBLT	120	---	---	31	37	---	---	34	32	No Change
NBTH	170	---	---	88	91	---	---	74	92	---
SBLT	100	175	175	153	166	200	200	158	170	No Change
SBTH	570	400	450	292	56	450	450	283	60	---
SBRT	---	---	400	---	243	---	400	---	264	300
EBLT	190	350	350	160	162	350	400	178	192	No Change
EBTH	950	650	975	180	251	725	975	187	261	---
WBLT	250	175	175	101	42	175	175	61	43	No Change
WBTH	525	800	975	486	267	975	975	448	350	*
WBRT	---	---	---	---	45	---	---	---	46	*

\*Recommend terminating two westbound through lanes approaching from the east as one right turn lane and one through lane



**Table 5: Queuing Results and Length Calculations (cont.)**

Hilliard & Rome Road/Renner Road										
Movement	Existing Storage	Opening Year				Horizon Year				Recommended Storage
		Calculated		Queue Length		Calculated		Queue Length		
		No Build	Build							
NBLT	600	450x2	525x2	527	361	450x2	550x2	678	507	Add 2nd Lane
NBTH	750x3	625x3	625x3	441	344	675x3	675x3	682	386	---
NBRT	420	675	675	183	182	700	700	185	129	No Change
SBLT	325	250	250	122	156	250	250	113	122	No Change
SBTH	730x3	475x3	475x3	394	542	400x4	400x4	485	485	Add 4th Lane
EBLT	90	250	250	140	147	250	250	142	182	No Change**
EBTH	220	250	275	204	307	250	325	254	132	---
EBRT	220	700	850	220	117	725	550x2	263	123	Add 2nd Lane
WBLT	480x2	400x2	400x2	309	291	425x2	425x2	320	348	No Change
WBTH	620	325	350	212	168	325	350	225	174	---
WBRT*	---	225	225	58	148	225	225	57	157	225

\*Lane converted to a Through/Right in Build Condition

\*\*Lane length limited by existing constraints. See Conclusions and Recommendations section for additional discussion

Alton & Darby Creek Road/Feder Road										
Movement	Existing Storage	Opening Year				Horizon Year				Recommended Storage
		Calculated		Queue Length		Calculated		Queue Length		
		No Build	Build							
NBLT	125	125	125	22	23	125	125	105	104	No Change
NBTH	1350	525	550	357	426	650	675	551	522	---
NBRT	---	---	---	---	---	---	250	---	92	250
SBLT	90	440	515	167	273	490	590	248	616	600
SBTH	3500	725	750	394	336	975	975	497	612	---
WBLT	200	275	275	108	122	325	325	135	205	325
WBTH	950	450	250	319	138	250	275	177	337	---
WBRT	---	---	550	---	176	550	575	149	231	325
EBLT	60	265	265	71	94	265	265	94	123	265
EBTH	2375	250	250	155	185	275	275	232	301	---

Hilliard & Rome Road/Feder Road/Fisher Road										
Movement	Planned Storage	Opening Year				Horizon Year				Recommended Storage
		Calculated		Queue Length		Calculated		Queue Length		
		No Build	Build							
NBLT	403	---	---	136	140	---	---	151	174	No Change
NBTH	471x3	---	---	244	256	---	---	279	273	---
SBLT	608x2	---	---	299	389	---	---	366	550	No Change
SBTH	710x2	---	---	308	327	---	---	425	486	---
SBRT	634x2	---	---	307	351	---	---	380	537	No Change
EBLT	648x2	---	---	368	383	---	---	409	472	No Change
EBTH	698	---	---	205	214	---	---	265	276	---
WBLT	496	---	---	126	119	---	---	121	256	No Change
WBTH	855	---	---	288	327	---	---	331	568	---
WBRT	855	---	---	210	215	---	---	246	240	Add 2nd WBRT*

\*Maximize length of lane based on drive location to the east of Hilliard & Rome Road



**Table 5: Queuing Results and Length Calculations (cont.)**

Merge Area Evaluation - South of Hilliard & Rome Road/Feder Road/Fisher Road										
Movement	Existing Storage*	Opening Year				Horizon Year				Recommended Storage
		Calculated		Queue Length		Calculated		Queue Length		
		No Build	Build							
SBTH	425	---	---	178	188	---	---	246	232	No Change

\*Length of roadway with two full southbound through lanes prior to merge taper

The above results for the Merge Area Evaluation show that the anticipated queue lengths do not extend back to the intersection of Hilliard & Rome Road/Feder Road/Fisher Road. The existing length is adequate based on this analysis.

**4.4 Roundabout Analysis.**

In addition to traditional intersection capacity analysis, we used Sidra Version 8 software to analyze roundabout alternatives at intersections along Alton & Darby Creek Road. Analysis settings were as per the ODOT L&D Manual, and the LOS criteria used above for signalized intersections was used to evaluate roundabout configurations. **Table 6** shows the results of the roundabout analysis. Detailed roundabout capacity reports can be found in **Appendix H**. A single circulating lane with single-lane approaches is assumed as the base condition for each roundabout. Headings indicate additional lanes needed as determined in the capacity analysis.



**Table 6: Roundabout Analysis Results**  
**Alton & Darby Creek Rd/ Roberts Rd Capacity Analysis Results**

	2019 AM/PM Results					
	No-Build (+SBRT)			Build (+SBRT+WBRT+EBRT)		
	LOS	Delay (sec/veh)	95th% Queue Length (ft)	LOS	Delay (sec/veh)	95th% Queue Length (ft)
EBLT	B/B	10.2/17.6	73.3/83.7	B/C	10.8/25.5	78.8/119.9
EBTH						
EBRT						
<b>EB Approach</b>	<b>B/B</b>	<b>10.2/17.6</b>	<b>73.3/83.7</b>	<b>B/C</b>	<b>10.8/25.5</b>	<b>78.8/119.9</b>
WBLT	B/C	7.9/20.9	200.6/307.2	A/B	8.7/10.7	69.8/79.3
WBTH						
WBRT				A/A	8.0/8.5	42.8/60.6
<b>WB Approach</b>	<b>B/C</b>	<b>7.9/20.9</b>	<b>200.6/307.2</b>	<b>A/A</b>	<b>8.4/9.8</b>	<b>69.8/79.3</b>
NBLT	B/B	10.7/15.7	218.6/350.1	A/A	6.6/7.8	102.3/147.1
NBTH						
NBRT				A/A	7.2/7.7	34.7/32.1
<b>NB Approach</b>	<b>B/B</b>	<b>10.7/15.7</b>	<b>218.6/350.1</b>	<b>A/A</b>	<b>6.7/7.7</b>	<b>102.3/147.1</b>
SBLT	A/B	7.3/10.7	116.5/293.9	A/B	7.6/13.0	120.7/375.8
SBTH						
SBRT	A/A	6.7/6.2	22.7/4.5	A/A	6.8/6.5	22.2/4.5
<b>SB Approach</b>	<b>A/B</b>	<b>7.2/10.5</b>	<b>116.5/293.9</b>	<b>A/B</b>	<b>7.5/12.9</b>	<b>120.7/375.8</b>
<b>Intersection</b>	<b>B/B</b>	<b>10.1/15.0</b>	<b>---</b>	<b>A/B</b>	<b>7.8/11.4</b>	<b>---</b>

	2029 AM/PM Results					
	No-Build (+SBLT+WBRT+EBRT)			Build (+SBLT+WBRT+EBRT)		
	LOS	Delay (sec/veh)	95th% Queue Length (ft)	LOS	Delay (sec/veh)	95th% Queue Length (ft)
EBLT	B/B	10.5/12.0	80.7/54.8	B/B	10.8/13.6	83.4/67.9
EBTH						
EBRT						
<b>EB Approach</b>	<b>B/B</b>	<b>10.5/12.0</b>	<b>80.7/54.8</b>	<b>B/B</b>	<b>10.8/13.6</b>	<b>83.4/67.9</b>
WBLT	A/B	9.1/11.6	82.6/97.6	A/B	9.8/12.8	95.5/121.3
WBTH						
WBRT				A/B	8.5/10.0	52.0/84.3
<b>WB Approach</b>	<b>A/B</b>	<b>8.9/10.9</b>	<b>82.6/97.6</b>	<b>A/B</b>	<b>9.4/11.9</b>	<b>95.5/121.3</b>
NBLT	A/B	8.7/11.6	134.5/220.8	A/B	9.5/12.8	166.8/260.4
NBTH						
NBRT				A	7.8/8.6	34.5/33.5
<b>NB Approach</b>	<b>A</b>	<b>8.5/11.1</b>	<b>134.5/220.8</b>	<b>A/B</b>	<b>9.1/12.0</b>	<b>166.8/260.4</b>
SBLT	B/B	12.6/12.3	35.8/73.3	B/B	12.8/12.7	37.3/78.7
SBTH						
SBRT	A/A	6.7/6.9	146.1/173.1	A/A	7.5/8.6	164.0/226.7
<b>SB Approach</b>	<b>A/A</b>	<b>8.0/8.7</b>	<b>146.1/173.1</b>	<b>A/A</b>	<b>8.6/9.9</b>	<b>164.0/226.7</b>
<b>Intersection</b>	<b>A/B</b>	<b>8.6/10.1</b>	<b>---</b>	<b>A/B</b>	<b>9.2/11.2</b>	<b>---</b>



**Table 6: Roundabout Analysis Results (cont.)**

**Alton & Darby Creek Rd/ Walker Rd/ Sugar Farms Drive 2 Capacity Analysis Results**

	2019 AM/PM Results					
	No-Build			Build		
	LOS	Delay (sec/veh)	95th% Queue Length (ft)	LOS	Delay (sec/veh)	95th% Queue Length (ft)
EBLT	A/A	7.5/9.4	35.6/28.0	A/B	9.3/11.7	50.0/46.5
EBTH						
EBRT						
<b>EB Approach</b>	<b>A/A</b>	<b>7.5/9.4</b>	<b>35.6/28.0</b>	<b>A/B</b>	<b>9.3/11.7</b>	<b>50.0/46.5</b>
WBLT	---	---	---	B/B	15.6/15.5	39.8/28.7
WBTH						
WBRT						
<b>WB Approach</b>	<b>---</b>	<b>---</b>	<b>---</b>	<b>B/B</b>	<b>15.6/15.5</b>	<b>39.8/28.7</b>
NBLT	A/A	5.3/4.8	135.5/133.9	A/A	5.3/5.1	161.7/234.9
NBTH						
NBRT						
<b>NB Approach</b>	<b>A/A</b>	<b>5.3/4.8</b>	<b>135.5/133.9</b>	<b>A/A</b>	<b>5.3/5.1</b>	<b>161.7/234.9</b>
SBLT	A/A	5.4/4.9	84.5/128.3	A/A	7.9/7.3	150.8/229.5
SBTH						
SBRT						
<b>SB Approach</b>	<b>A/A</b>	<b>5.4/4.9</b>	<b>84.5/128.3</b>	<b>A/A</b>	<b>7.9/7.3</b>	<b>150.8/229.5</b>
<b>Intersection</b>	<b>A/A</b>	<b>5.6/5.1</b>	<b>---</b>	<b>A/A</b>	<b>7.4/6.9</b>	<b>---</b>

	2029 AM/PM Results					
	No-Build			Build		
	LOS	Delay (sec/veh)	95th% Queue Length (ft)	LOS	Delay (sec/veh)	95th% Queue Length (ft)
EBLT	A/B	7.6/10.1	39.0/33.6	A/B	9.5/16.6	56.1/57.6
EBTH						
EBRT						
<b>EB Approach</b>	<b>A/B</b>	<b>7.6/10.1</b>	<b>39.0/33.6</b>	<b>A/B</b>	<b>9.5/16.6</b>	<b>56.1/57.6</b>
WBLT	---	---	---	B/B	16.8/16.6	43.6/32.0
WBTH						
WBRT						
<b>WB Approach</b>	<b>---</b>	<b>---</b>	<b>---</b>	<b>B/B</b>	<b>16.8/16.6</b>	<b>43.6/32.0</b>
NBLT	A/A	5.3/4.8	163.5/162.3	A/A	5.4/5.1	190.4/267.2
NBTH						
NBRT						
<b>NB Approach</b>	<b>A/A</b>	<b>5.3/4.8</b>	<b>163.5/162.3</b>	<b>A/A</b>	<b>5.4/5.1</b>	<b>190.4/267.2</b>
SBLT	A/A	5.4/5.0	95.1/149.7	A/A	7.9/7.7	167.2/271.9
SBTH						
SBRT						
<b>SB Approach</b>	<b>A/A</b>	<b>5.4/5.0</b>	<b>95.1/149.7</b>	<b>A/A</b>	<b>7.9/7.7</b>	<b>167.2/271.9</b>
<b>Intersection</b>	<b>A/A</b>	<b>5.6/5.2</b>	<b>---</b>	<b>A/A</b>	<b>7.4/7.1</b>	<b>---</b>



**Table 6: Roundabout Analysis Results (cont.)**

Alton & Darby Creek Rd/ Renner Rd Capacity Analysis Results

	2019 AM/PM Results					
	No-Build (+SBLT)			Build (+SBLT+WBRT)		
	LOS	Delay (sec/veh)	95th% Queue Length (ft)	LOS	Delay (sec/veh)	95th% Queue Length (ft)
EBLT	---	---	---	---	---	---
EBTH	---	---	---	---	---	---
EBRT	---	---	---	---	---	---
<b>EB Approach</b>	---	---	---	---	---	---
WBLT				B/B	13.9/15.0	26.9/104.5
WBTH	A/B	9.9/17.4	91.5/334.5			
WBRT				A/A	7.4/7.8	63.8/105.1
<b>WB Approach</b>	A/B	9.9/17.4	91.5/334.5	A/B	9.2/11.1	63.8/105.1
NBLT						
NBTH	A/A	7.2/6.2	172.6/151.2	A/B	9.7/11.2	262.5/355.1
NBRT						
<b>NB Approach</b>	A/A	7.2/6.2	172.6/151.2	A/B	9.7/11.2	262.5/355.1
SBLT	B/B	10.1/12.0	35.9/48.9	B/B	10.4/12.1	44.4/57.3
SBTH						
SBRT	A/A	4.6/6.1	49.9/112.6	A/A	4.8/6.7	78.3/143.4
<b>SB Approach</b>	A/A	6.8/7.9	49.9/112.6	A/A	6.8/8.3	78.3/143.4
<b>Intersection</b>	A/B	7.6/10.4	---	A/B	8.4/10.1	---

	2029 AM/PM Results					
	No-Build (+SBLT+WBRT)			Build (+SBLT+WBRT)		
	LOS	Delay (sec/veh)	95th% Queue Length (ft)	LOS	Delay (sec/veh)	95th% Queue Length (ft)
EBLT	---	---	---	---	---	---
EBTH	---	---	---	---	---	---
EBRT	---	---	---	---	---	---
<b>EB Approach</b>	---	---	---	---	---	---
WBLT	B/B	13.1/12.5	16.4/69.0	B/B	13.8/16.4	29.6/135.4
WBTH						
WBRT	A/A	6.9/6.2	59.2/70.9	A/A	7.5/8.0	74.5/122.7
<b>WB Approach</b>	A/A	8.2/9.0	59.2/70.9	A/A	9.2/11.8	74.5/122.7
NBLT						
NBTH	A/A	7.6/6.5	190.7/166.5	A/D*	9.9/16.8	282.7/426.7
NBRT						
<b>NB Approach</b>	A/A	7.6/6.5	190.7/166.5	A/B	9.9/16.8	282.7/426.7
SBLT	B/B	10.2/11.8	39.0/48.0	B/B	10.4/12.3	47.3/67.0
SBTH						
SBRT	A/A	4.6/6.1	53.0/111.4	A/A	4.8/7.2	81.0/176.1
<b>SB Approach</b>	A/A	6.8/7.8	53.0/111.4	A/A	6.8/8.7	81.0/176.1
<b>Intersection</b>	A/A	7.4/7.8	---	A/B	8.4/11.0	---

\*ODOT Standards use SIDRA Methodology for Delay & Degree of Saturation to determine Level of Service. V/C between 0.85 and 0.95 returns LOS D regardless of shorter delay (V/C = 0.858)



**Table 6: Roundabout Analysis Results (cont.)**

Alton & Darby Creek Rd/ Feder Rd

	2019 AM/PM Results					
	No-Build (+SBRT)			Build (+SBRT+NBRT+WBRT)		
	LOS	Delay (sec/veh)	95th% Queue Length (ft)	LOS	Delay (sec/veh)	95th% Queue Length (ft)
EBLT	A/B	9.0/14.8	62.9/79.0	B/C	12.0/21.8	91.0/120.6
EBTH						
EBRT						
<b>EB Approach</b>	<b>A/B</b>	<b>9.0/14.8</b>	<b>62.9/79.0</b>	<b>B/C</b>	<b>12.0/21.8</b>	<b>91.0/120.6</b>
WBLT	A/B	9.4/12.4	94.5/175.2	A/A	9.7/9.9	29.8/69.0
WBTH				A/A	6.8/7.1	52.0/78.8
WBRT				A/A	7.8/8.4	52.0/78.8
<b>WB Approach</b>	<b>A/B</b>	<b>9.4/12.4</b>	<b>94.5/175.2</b>	<b>A/A</b>	<b>7.8/8.4</b>	<b>52.0/78.8</b>
NBLT	B/A	12.9/8.4	217.9/126.0	A/A	9.3/7.1	112.5/90.6
NBTH				A/A	9.3/7.9	31.0/15.8
NBRT				A/A	9.3/7.2	112.5/90.6
<b>NB Approach</b>	<b>B/A</b>	<b>12.9/8.4</b>	<b>217.9/126.0</b>	<b>A/A</b>	<b>9.3/7.2</b>	<b>112.5/90.6</b>
SBLT	A/A	7.4/9.2	64.2/197.5	A/B	8.1/11.1	96.6/273.2
SBTH	A/A	5.2/6.8	2.5/28.4	A/A	5.2/6.8	4.0/28.9
SBRT						
<b>SB Approach</b>						
<b>Intersection</b>	<b>A/B</b>	<b>9.9/10.1</b>	---	<b>A/B</b>	<b>9.0/10.1</b>	---

	2029 AM/PM Results					
	No-Build (+SBRT+NBRT)			Build (+SBLT+NBRT+SBRT)		
	LOS	Delay (sec/veh)	95th% Queue Length (ft)	LOS	Delay (sec/veh)	95th% Queue Length (ft)
EBLT	B/C	10.3/29.7	92.5/178.2	A/B	9.0/14.8	67.4/89.3
EBTH						
EBRT						
<b>EB Approach</b>	<b>B/C</b>	<b>10.3/29.7</b>	<b>92.5/178.2</b>	<b>A/B</b>	<b>9.0/14.8</b>	<b>67.4/89.3</b>
WBLT	B/B	11.5/17.2	140.3/289.8	B/B	10.5/13.3	42.4/127.6
WBTH				A/A	7.4/9.3	70.5/123.1
WBRT				A/B	8.4/11.1	70.5/127.6
<b>WB Approach</b>	<b>B/B</b>	<b>11.5/17.2</b>	<b>140.3/289.8</b>	<b>A/B</b>	<b>8.4/11.1</b>	<b>70.5/127.6</b>
NBLT	A/A	8.4/6.6	124.1/93.1	B/A	10.8/9.8	153.8/151.1
NBTH				A/A	9.0/8.6	35.3/20.7
NBRT				A/A	8.3/6.6	124.1/93.1
<b>NB Approach</b>	<b>A/A</b>	<b>8.3/6.6</b>	<b>124.1/93.1</b>	<b>B/A</b>	<b>10.4/9.7</b>	<b>153.8/151.1</b>
SBLT	A/B	7.5/12.1	81.0/336.3	B/B	10.5/13.3	50.1/93.7
SBTH	A/A	5.1/6.6	2.9/34.1	A/B	5.1/11.1	50.4/316.5
SBRT						
<b>SB Approach</b>						
<b>Intersection</b>	<b>A/B</b>	<b>9.1/13.3</b>	---	<b>A/B</b>	<b>9.0/11.4</b>	---



## 5.0 CONCLUSIONS AND RECOMMENDATIONS

### Traffic Signal Warrant Analysis

Traffic signal warrant analysis shows that two out of the three full-movement site access points evaluated do not meet Eight or Four Hour Warrants (see pages 8 and 9, and **Table 2**). A traffic signal is not recommended at these locations. The intersection of Sugar Farms Drive 3 and Renner Road meets Condition B of the 8-Hour Warrant, and a signal is recommended at this site drive both as a result of the warrant analysis and due to the poor LOS in the peak hours under side-street stop control. A significant portion of the Sugar Farms development will have to be in place to generate the traffic levels needed to warrant signalization. The access point is expected to operate under side street stop control in the interim.

### Intersection Improvements Summary and Recommendations

Capacity analysis results and the results of turn lane warrant analysis show that improvements are required at various intersections in the Study Area, at times due to background deficiencies unrelated to site development and, in some cases, due to the addition of site generated traffic. A summary of improvements and notable results is provided below for each intersection. No Build and Build improvements are shown graphically in schematic diagrams found in **Appendix I**.

The amount of site traffic as a percentage of the total traffic is provided at intersections with background capacity or geometric deficiencies unrelated to the development sites studied here. These locations generally have existing traffic congestion challenges and this percentage supports the determination of a proportionate contribution allocable to site generated traffic that should be applied toward a broader improvement that addresses other sources of traffic and congestion more comprehensively. This is discussed in detail below at applicable locations.

**Table 5** provides proposed turn lane lengths calculated based on ODOT L&D methodology or determined from queue length simulation. Appropriate widening and approach/departure tapers calculated as per ODOT L&D methodology are recommended with all proposed turn lanes in addition to the length given. Additionally, several intersections have specific recommendations for signal retiming, but it is recommended that all signalized intersections be evaluated as volumes continue to increase and signal timings be adjusted to accommodate these volumes.

#### *1. Alton & Darby Creek Road/Roberts Road*

Based on the City of Hilliard's transportation planning guidance, as well as potential multi-modal, safety and other benefits, a modern roundabout is the preferred solution to accommodate future regional growth including traffic generated by the subject site. No interim improvements are recommended at the existing signalized intersection pursuant to the City of Hilliard's preference for a proportional contribution to a future roundabout project. The City of Hilliard has completed numerous roundabout projects in the past several years that can be used to determine an estimated project cost. It is recommended that the Sugar Farms site developer contribute 3.6% and the Renner Site contribute 1.5% based on the proportionate share of traffic projected to enter this intersection. No further contributions or improvements are required or recommended as a result of site traffic being added to this intersection.



#### *2. Alton & Darby Creek Road/Sugar Farms Drive 1*

Left and right turn lanes are warranted in the Opening Year at this site access. Both turn lanes are required to be 285 feet in length (including a 50-foot diverging taper) based on deceleration requirements. This configuration meets performance criteria in the 2019 Opening Year but, as background traffic increases in the Alton & Darby Road corridor, side street traffic entering the roadway from the site will experience increasing delay during peak periods. We do not project that enough site traffic will use this access point to justify signalization, but two other access points provide signalized access that residents of the neighborhood can use as an alternative.

#### *3. Alton & Darby Creek Road/Walker Road/Sugar Farms Drive 2*

The Alton & Darby Creek Road/Walker Road intersection operates with adequate LOS and delay under all scenarios in its current configuration. This includes adding the site drive with no additional turn lanes. However, we recommend a 285-foot southbound left turn lane (including 50-foot diverging taper) at this location in the Opening Year as it will provide operational and potential safety benefit on this high-speed corridor. Additionally, per the Franklin County Engineer's Office Access Management Regulations, a minimum of two lanes exiting and one lane entering the site drive is required. Therefore, it is recommended that the site drive consist of a left turn lane and a through/right lane exiting, plus a single lane entering. Walker Road should be widened to align with the three lane site access point providing a 285-foot eastbound left turn lane (including 50-foot diverging taper).

#### *4. Alton & Darby Creek Road/Renner Road*

This intersection operates with acceptable LOS and Delay under all scenarios excluding the Horizon Year build scenario. A northbound right turn lane is required for capacity and should be installed as a site improvement by the Horizon Year. The southbound left turn lane will require additional length in the Opening Year No-Build scenario based on queue results regardless of whether or not the sites are developed. A full-width lane between this intersection and the intersection to the north is currently striped with transverse markings and the left turn lane can be lengthened by revising pavement markings as a background (non-site) improvement. We suggest that this section be revised with Two-Way Left Turn Lane (TWLTL) markings to provide drivers with additional area to queue if needed in this southbound lane or in the northbound left turn lane at Walker Road.

#### *5. Alton & Darby Creek Road/Cole Road/Renner Site Drive 1*

We recommend a Right-In/Right-Out (RIRO) restriction for Renner Site Drive 1 to address the poor performance of full access at this location. Additionally, we recommend a northbound right turn lane as warranted in the Opening Year with a length of 285 feet (including a 50-foot diverging taper). Side street approaches to Alton & Darby Creek Road, including Cole Road under background conditions, do not meet delay and LOS criteria with side-street stop sign control and turn lane improvements. We do not project that enough site traffic will use this access point to justify signalization, and residents have one unsignalized alternative access to Renner Road near the east property line of the site.



#### *6. Renner Road/Sugar Farms Drive 3*

Left and right turn lanes are warranted in the Opening Year at this site drive if it remains unsignalized. However, a traffic signal is warranted based on OMUTCD Eight Hour criteria. A signal is recommended at this drive as the site nears full build-out. Volumes on Renner Road meet OMUTCD major road thresholds in the Opening Year, so this signal warrant is driven by site traffic volumes using this access point. As with the Alton & Darby Creek Road/Walker Road/Sugar Farms Drive 2 intersection, this intersection operates with adequate LOS and Delay in all Build scenarios as a signal with single-lane approaches. We recommend that a 225-foot eastbound left turn lane (including a 50-foot diverging taper) be installed in the Opening Year to provide operational and potential safety benefits on Renner Road. No other turn lanes are recommended.

#### *7. Renner Road/Renner Site Drive 2*

A westbound left turn lane is required at this location with a length of 225 feet (including a 50-foot diverging taper). It is recommended that the left turn lane be installed in the Opening Year. A right turn lane is warranted, but it is not recommended at this location for several reasons: 1) Additional pavement width required by this lane will create a longer crossing distance for pedestrians utilizing the regional shared-use path connection that will cross Renner Road in this area. 2) Higher operating speeds associated with multi-lane roadways do not support multi-modal goals in this area. 3) The capacity benefits of this improvement are negligible.

This study evaluated sight distance available to drivers exiting the site on the northbound approach to Renner Road. We applied the methodology and criteria contained in the ODOT L&D Manual to this location and found that the intersection location shown on the site plan may place sight lines outside road right of way to the west of the intersection. Shifting the intersection location east on the applicants property attained sight distance within existing right of way. Other solutions may be preferred and preliminary engineering of the site should refine the location and design of the access point to meet sight distance criteria based on field survey.

#### *8. Renner Road/Spindler Road*

This intersection has left turn lanes in each direction and a westbound right turn lane. The intersection functions much better than the LOS and Delay required by agency criteria in all scenarios, and no improvements are required to accommodate Horizon Year traffic volumes.

#### *9. Renner Road/Tanglewood Park Boulevard*

The No Build analysis shows that this intersection is near the limits of acceptable operation with long LOS D approach delays, several movements with LOS E, and westbound queues that extend nearly to the Meijer Drive. These conditions mean that the incremental addition of traffic volume pushes the intersection beyond the City's acceptable operation criteria in both the Opening Year and the Horizon Year. This location is at the western terminus of the Hilliard & Rome Road/Renner Road Horizon Year Vision Plan discussed below and recommended improvements at Tanglewood Boulevard provide a logical terminus for widening related to the dual northbound left turn lanes needed at Hilliard & Rome Road/Renner Road. Improvements are therefore tied to impacts of both site development and non-site background growth and we recommend that the Vision Plan include



improvements to this intersection consisting of a southbound right turn lane and a westbound right turn lane.

#### *10. Hilliard & Rome Road/Renner Road*

A comprehensive solution is required at this location to address existing congestion and accommodate future traffic volumes in all scenarios. City staff worked with EMH&T and the developers to propose a Horizon Year Vision Plan for this location and adjacent intersections that goes beyond traditional incremental intersection improvements. This plan improves access management, reduces queue lengths, and provides corridor benefits in addition to capacity improvements determined in the analysis. Rather than implementing smaller, isolated changes focused on incremental site impact, the Vision Plan presents a more comprehensive solution for the Hilliard & Rome Road and Renner Road area to handle anticipated growth.

Site traffic as a percentage of total traffic entering the intersection was determined for this location, with 4.6% expected from the Sugar Farms site and 2.5% expected from the Renner Site. This proportional impact of site development on this intersection provides the basis for the development agreement or MOU between the maintaining agencies and the developers for implementation of the Vision Plan project. See below for further discussion regarding the Vision Plan.

#### *11. Alton & Darby Creek Road/Feder Road*

A westbound right turn lane is required to meet capacity analysis criteria in the Opening Year Build scenario and the Horizon Year No-Build scenario. A northbound right turn lane is required in the Horizon Year Build scenario.

Queue analysis reveals additional challenges at this intersection beyond those found through capacity analysis. In all scenarios (No Build and Build), a significant amount of southbound left turn volume is present. Capacity analysis shows this traffic can be accommodated with signal timing revisions but queue calculations show the existing southbound left turn lane length (90 feet) is too short to accommodate background traffic. The eastbound left turn lane is similarly deficient in the No-Build condition as only 60 feet exists. Existing drainage culverts located about 460 feet north of the southbound stop line and 520 feet west of the eastbound stop line appear to limit the length of existing left turn lanes and associated widening tapers.

We recommend that the developers and maintaining agency work cooperatively to address the regional challenges at this intersection including background deficiencies and site impacts. A potential assignment of improvement responsibility has been discussed with the Franklin County Engineer's Office as described below:

#### *County Managed Improvements*

The eastbound left turn lane length extension and associated drainage structure widening is a regional improvement. Additionally, a westbound right turn lane is also a regional improvement. The existing drainage structure on the north leg should be widened as a regional improvement and appropriate left turn lane length may be attainable on the west leg without impacting that drainage structure. The County Engineer's office is willing to complete these improvements as future public projects and no developer contribution is required.



#### *Developer Managed Improvements*

Without changing the existing drainage structures, the developer was asked to widen the north leg by adding pavement north and south of the structure limits to accommodate the southbound left turn lane extension. The developer was also asked to provide a northbound right turn lane.

Sugar Farms traffic comprises 9.5% and the Renner Site comprises 2.9% of the total intersection volume. The cost of site improvements suggested by the County Engineer as a percentage of total project cost is about 45%, much higher than the site traffic percentage of total traffic. Project funding sources may be available to proceed in this manner subject to a development agreement or MOU entered into by the maintaining agencies and the developers.

A roundabout was studied as a potential alternative for this intersection but dismissed due to impacts to private property and utilities.

#### *12. Hilliard & Rome Road/Feder Road/Fisher Road*

Improvements are planned for this intersection that will be in place in the Opening Year (see **Appendix B** for relevant plan sheets). However, additional No Build improvements are required to accommodate Horizon Year volumes. These No Build improvements accommodate the site traffic and no additional Build improvements are required.

EMH&T was provided with a 2013 study titled Feder Road at Hilliard Rome Road Alternatives Evaluation Report (CIP 530086-100027) that included capacity analysis at this intersection. The reference study also determined that additional lanes beyond the City's planned improvements were needed to bring the intersection to acceptable Level of Service and Delay values. Our analyses and the referenced analyses determined that additional eastbound through capacity is needed, for example. Both studies show a need for additional improvements, so it is recommended that this intersection be monitored as Horizon Year volumes are realized and the improvements shown in **Appendix I** schematic diagrams implemented as needed.

#### **Roundabout Analysis**

Roundabout analysis was completed for each signalized intersection in the Alton & Darby Creek Road corridor as an alternative to traditional widening. **Table 6** above shows the LOS and Delay results for the roundabout configurations required in the Horizon Year scenarios. Roundabout alternatives are also shown graphically in the schematic diagrams found in **Appendix I**.

#### **Hilliard & Rome Road/Renner Road Horizon Year Vision Plan**

EMH&T worked with the City of Columbus to develop concepts for a Horizon Year Vision Plan in the Renner Road corridor between Tanglewood Park Boulevard and Rentra Drive to ensure the solution provided acceptable intersection and corridor operations in the Horizon Year. Further study beyond the scope of this Traffic Impact Study is recommended to determine final intersection layouts, associated physical impacts, access management improvements, and to refine project cost estimates. A traditional intersection upgrade is preferred at this time and the concept shown in **Appendix I** should advance to preliminary engineering.



### **Pedestrian/Trail Connectivity Planning**

**Appendix J** contains a diagram outlining the proposed pedestrian/trail connectivity, including links to existing off-site trails and pedestrian pathways. A connection is proposed to the Central Ohio Greenway Trail to the north of the Sugar Farms site as indicated on the diagram. Additionally, a crossing will be provided on Renner Road to link the Renner Site with the Sugar Farms Site, connecting the southern site to the pedestrian network. Note that the diagram shown in **Appendix J** is subject to City Council review and approval of zoning and development agreements for these sites. Final, approved versions of these documents may supplement the material in **Appendix J**.

EMHT

APPENDIX A:

Approved Memorandum of Understanding



Engineers, Surveyors, Planners, Scientists

December 1, 2018

Daniel R. Blechschmidt, PE  
Transportation Planning Engineer  
Division of Planning and Operations  
Department of Public Service  
109 N. Front Street  
Columbus, Ohio 43215

Subject: Sugar Farm – Traffic Impact Study  
Memorandum of Understanding

Dear Mr. Blechschmidt,

This Memorandum of Understanding (MOU) is submitted to document the scope of the above captioned traffic study as discussed in our meeting on June 7, 2018 and revised per comments received on November 20, 2018. These comments and correspondence discussing various aspects of the study have been included for reference to document scope-defining decisions. Following your concurrence, EMH&T will prepare a traffic impact study in accordance with the methodologies and assumptions described below.

**Proposed Development & Access Plan**

The planned development consists of a northern and southern parcel.

**Northern Parcel**

The 256 acre, Sugar Farm site is situated in the northeast quadrant of the Alton & Darby Creek Road/Renner Road intersection. The proposed development is expected to consist of approximately 548 single family and 220 apartment dwelling units. Access to the site is planned via three access points:

1. On the north side of Renner Road approximately 1000 feet east of Alton & Darby Creek Road
2. On the east side of Alton & Darby Creek Road across from Walker Road
3. On the east side of Alton & Darby Creek Road approximately 1800 feet north of Walker Road

**Southern Parcel**

The 117 acre, Renner Road site is situated in the southeast quadrant of the Alton & Darby Creek Road/Renner Road intersection. The proposed development is expected to consist of approximately 165 single family and 185 multi-family dwelling units. Access to the site is planned via two access points:

1. On the south side of Renner Road approximately 1500 feet east of Alton & Darby Creek Road
2. On the east side of Alton & Darby Creek aligned with Cole Road