



Engineers, Surveyors, Planners, Scientists

Delivering **Solutions.**

5500 New Albany Rd., Columbus, OH 43054

p. 614.775.4500

f. 614.775.4800

info@emht.com

2018 0418

Carr Farms Traffic Impact Study

Epcon Communities, Inc.

July 3, 2018

emht.com

TABLE OF CONTENTS

1.0 INTRODUCTION	1
2.0 EXISTING CONDITIONS.....	3
3.0 TRAFFIC FORECAST	5
3.1 Leppert Road Feasibility Study Traffic Projections and Adjustments	5
3.2 Trip Generation	5
3.3 Traffic Volume Projections	7
4.0 TRAFFIC ANALYSIS.....	8
4.1 Turn Lane Warrants and Sizing	8
4.2 Capacity Analysis	8
5.0 CONCLUSIONS AND RECOMMENDATIONS.....	10

TABLES

TABLE 1: 2015 Traffic Projection.....	6
TABLE 2: 2018 Traffic Projection for Carr Farms.....	6
TABLE 3: 2018 Traffic Projection For Grener Park.....	6
TABLE 4: Turn Lane Warrants And Length	8
TABLE 5: Capacity Analysis Results	9

FIGURES

FIGURE 1: Location Map	1
FIGURE 2: Site Plan.....	2

EXHIBITS

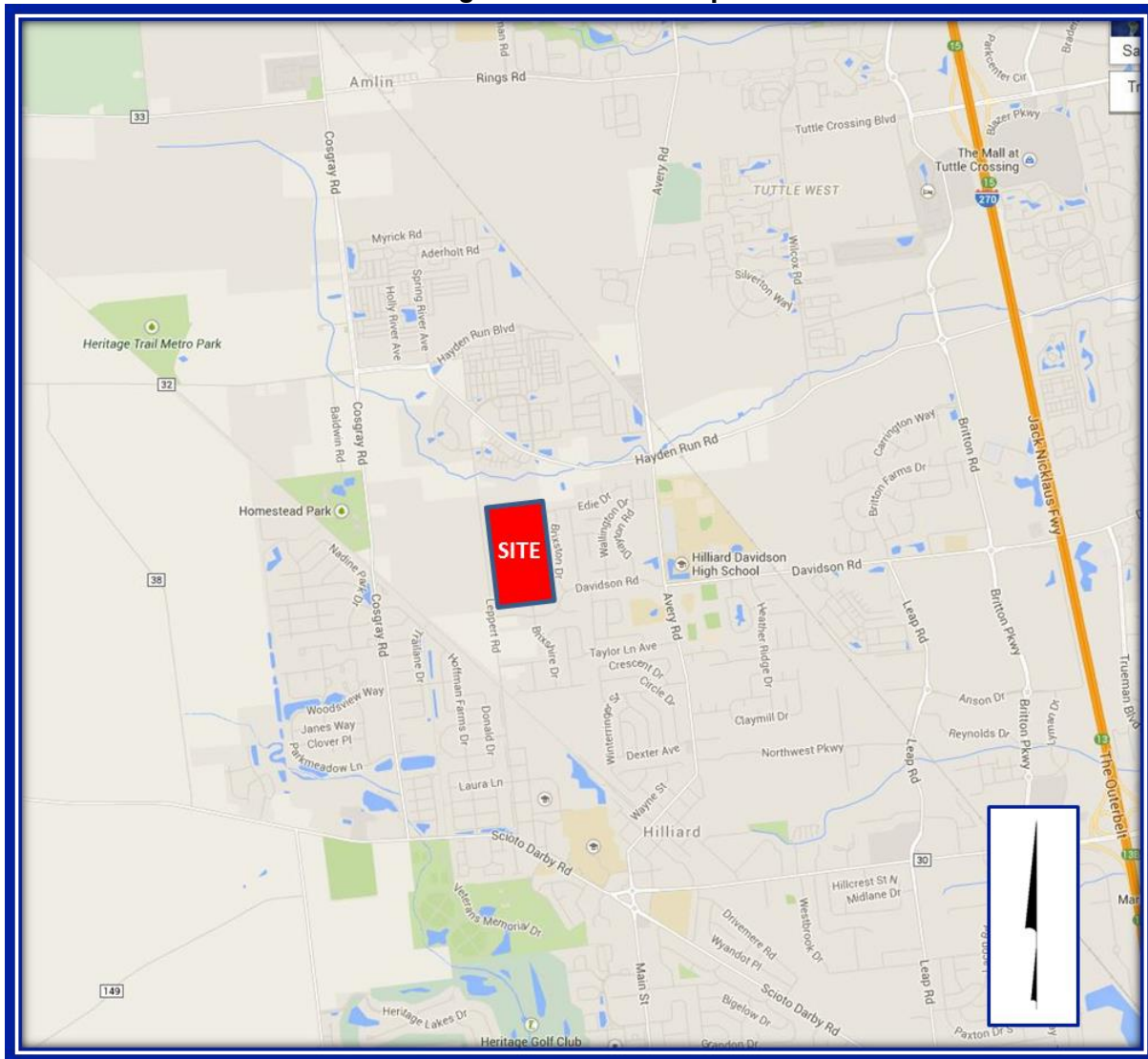
Exhibit 1: Trail Connectivity Exhibit

APPENDIX A:	Traffic Volume Calculations
APPENDIX B:	Turn Lane Warrants
APPENDIX C:	Capacity Analysis Reports
APPENDIX D:	Turn Lane Sizing Calculations

1.0 INTRODUCTION

This Traffic Impact Study (TIS) summarizes traffic analysis and results related to planned development on the Carr Farms tract in Hilliard, Ohio. Carr Farms is located along the east side of Leppert Road, north of Davidson Road and south of Hayden Run Road as shown in **Figure 1**.

Figure 1: Location Map



Carr Farms is the proposed site of residential homes accessed by an internal street network that connects to Leppert Road and existing subdivisions adjacent to the site. The site plan shown in **Figure 2** illustrates a concept for 59 traditional single-family lots at the southern end of the site (Subarea B) with access to Leppert Road and Brixshire Drive. The balance of the site provides for 179 “age-targeted” residential units on a combination of fee-simple and two-family lots. This northern portion of the site (Subarea A) accesses two connections to Leppert Road and an extension of Edie Drive. An access connection to the Courtyards at Hayden Run is required at the northeast corner of the site as further discussed below.

Figure 2-Site Plan



“Age-targeted” means that 179 units will be designed and marketed to age 55 and over, “empty-nest” buyers. The same developer has offered homes similar to those planned for this property at locations around central Ohio and elsewhere for over 30 years. The dwellings proposed here range between 1,500 and 3,300 square feet. While not legally restricted to age 55 and older buyers, design features of the community such as 2 to 3 bedroom homes, primarily single-story living space (basements and upstairs bonus suites are optional on some units), common lawn care and snow removal by the homeowners association, are primarily preferred by older buyers, often retired or semi-retired, and typically without children living at home. As a result, vehicular trip rates for these types of units are lower than that for generic single-family detached housing as further documented below.

This same site was zoned for traditional single-family residential development in 2015, and the development plan proposed at that time is similar in some respects to the current plan. The currently proposed plan accesses Leppert Road at a modern roundabout that has been planned for some time roughly in the middle of the site, and a secondary side street intersection near the northern property line referred to as Road G on the current development plan. These two access points are very similar to the 2015 plan in terms of location but the northern access point (Road G) connects to more lots than previously. The current plan differs from the 2015 plan by featuring an additional southern access, shown as Road H on the current development plan, for the 59-lot neighborhood comprising Subarea B. Otherwise, Subarea B connects to surrounding residential areas in a manner similar to the 2015 plan.

When this site was zoned in 2015, the following infrastructure requirements were included in the current PUD at developer cost:

- Widen Leppert Road and resurface both lanes along the site frontage to provide two 11-foot wide vehicle lanes
- Provide a 4 foot wide, full-depth paved shoulder and ditch improvement on the east side of Leppert Road
- Provide a shared use path on the east side of Leppert Road for the full site frontage, connecting to Davidson Road
- Pay a proportionate share of the cost of the roundabout improvement at the main entrance to Carr Farms

The Study Area for this TIS consists of the following intersections:

- Leppert Road/Davidson Road
- Leppert Road/Hayden Run Road
- Leppert Road/Site Drives (middle access as roundabout)

2.0 EXISTING CONDITIONS

A public improvement of Leppert Road is planned and currently under design by the FCEO. The concept provides for one lane per direction on Leppert Road, from the Heritage Trail (south of Weston Trail Drive) to a point approximately 400 feet north of Hayden Run (south of Hayden Run Road). The draft Feasibility Study for the project includes a modern roundabout at the Leppert

Road/Davidson Road intersection and no operational changes to the Leppert Road/Weston Trail Drive intersection (side-street stop control with no auxiliary lanes). The Feasibility Study provides two access points intended to serve Carr Farms, including a modern roundabout located approximately 1,550 feet north of Davidson Road and a street stub located approximately 950 feet north of the roundabout. The project proposes shared use paths on both sides of Leppert Road.

The Courtyards at Hayden Run is adjacent to the northeast corner of the Carr Farms site and has 50 age-targeted homes that are similar to the fee simple units proposed for Carr Farms and built by the same developer. Zoning for the Courtyards at Hayden Run reflects a commitment to connect access from that neighborhood into Carr Farms and the extent of that connection is under negotiation between the City and the applicant. In order to support those discussions, this study reflects a two-way connection that may be gated to discourage through traffic but available to residents of either neighborhood traveling in either direction.

Grener Park is a planned City of Hilliard park on over 100 acres extending from the west side of Leppert Road (opposite Carr Farms) to Cosgray Road. A planned access road connects Homestead Park, located west of Cosgray Road, through Grener Park to Leppert Road where it will connect at the modern roundabout planned approximately 1,550 feet north of Davidson Road. The development concept for the park consists of 24 soccer fields and a 125,000 square foot recreational community center and a second access to Leppert Road opposite Davidson Road. This is different from the alternative park plans reflected in the Leppert Road Feasibility Study, and this TIS adjusts Feasibility Study projections to account for the updated park concept.

Leppert Road and Davidson Road are both Network Collector facilities on the City's Thoroughfare Plan. Hayden Run Road is a Major Arterial and the portion of Hayden Run Road inside the Study Area (the Hayden Run Road/Leppert Road intersection) is in the City of Columbus and posted 45 mph. Leppert Road is a City of Hilliard roadway along most of the Carr Farms frontage but speed limit signs are not posted. County segments of Leppert Road, south of Davidson Road and near Hayden Run are signed 45 mph. Even though the legal speed inside Hilliard would typically be lower under Ohio law, this study will use a design speed of 45 mph on Leppert Road. Davidson Road is signed 25 mph in the Study Area.

Bicycle and pedestrian features in the area include future shared use paths along both sides of the Leppert Road frontage connecting through the site to an existing portion of the Hayden Run Trail at the northeast corner of the Carr Farms property. These trail facilities are part of the Central Ohio Greenways system and the Bicycle Network in Hilliard's Thoroughfare Plan. The City's Thoroughfare Plan as well as the Leppert Road Feasibility Study call for on-street bicycle facilities in addition to the shared use path. The Feasibility Study recommends building Leppert Road with 4-foot wide shoulders capable of use as bicycle lanes. The Carr Farms development plan proposes a sidewalk along internal streets connecting to adjacent neighborhoods and trail facilities in the area. In addition, the plan proposes an internal pathway system connecting both subareas of the site to internal green space, sidewalks and amenities.

3.0 TRAFFIC FORECAST

3.1 Leppert Road Feasibility Study Traffic Projections and Adjustments

This study relied on the traffic forecast prepared by others for the Leppert Road Feasibility Study along with record counts available from the 2015 study of Carr Farms. The Leppert Road/Hayden Run Road intersection was not included in the Feasibility Study and the 2015 count of that intersection was increased to opening and design year conditions using the same 3% annual growth rate applied to Leppert Road north of Davidson Road as documented in the Feasibility Study. With the growth rate applied, Leppert Road/Hayden Run Road volumes were further increased in order to balance volumes on the south leg of the intersection with the Feasibility Study volumes.

The Feasibility Study provided opening year (2020) and design year (2030) traffic forecasts for morning and afternoon peak hour conditions. This study adjusted those volumes to account for the following changes:

1. Remove Grener Park generated traffic and replace it with a new forecast based on the current development concept for the park.
 - a. This applies only to afternoon peak-hour conditions. The Feasibility Study assumed the Grener Park soccer fields would not generate traffic during the morning peak hour and therefore nothing was deducted from morning peak volumes.
2. Remove Carr Farms generated traffic based on the previously approved 2015 development plan and replace with a new forecast based on the current development plan for the site.
3. Re-route “cut-through” traffic that the Feasibility Study consultant assumed would use Carr Farms streets and the Grener Park connection between Leppert Road and Cosgray Road.
 - a. “Cut-through” traffic was moved to Davidson Road in the scenarios with Grener Park developed without Carr Farms.
 - b. “Cut-through” traffic was not included in the scenarios without the Grener Park connection to Cosgray Road.
 - c. The original Feasibility Study “cut-through” assumptions were maintained in the scenario with both Grener Park and Carr Farms developed.

3.2 Trip Generation

We removed traffic previously projected for the Carr Farms site from the volumes presented in the Feasibility Study to obtain background volumes. **Table 1** shows the trip generation previously calculated for the 160 single-family homes proposed in 2015. This study replaced that trip forecast with the information shown in **Table 2**, based on rates provided in Trip Generation Manual, 10th edition (Institute of Transportation Engineers, 2017). **Table 3** shows trip generation for the current Grener Park development concept.

Comparing tables 1 and 2 shows that the currently proposed development on the Carr Farms acreage generates less traffic than the plan proposed in 2015. The previous plan generated 160 trip ends in the afternoon peak hour while the current plan generates 133, a 17% reduction. The previous plan generated 122 trip ends in the morning peak hour while the current plan generates 108, an 11% reduction. The Senior Adult Housing units are the reason for this trip reduction. Even though more units are proposed now compared to the 2015 plan, Senior Adult Housing generates less than half the vehicle trips per unit associated with traditional single-family homes.

Traffic counts verify the low trip generating characteristics of Senior Adult Housing. This study counted the Hayden Run Road/Eventing Way intersection on May 9, 2018 including both morning and afternoon peak hours. The 50 units developed by Epcon Communities on that site generated trips at or below the ITE rates. A 2016 count of 65 detached Senior Adult Housing units developed by Epcon Communities on Welbourne Place in the New Albany area produced trip rates significantly lower than the ITE rates.

Table 1-2015 Traffic Projection for Carr Farms (removed from Feasibility Study volumes)

Land Use	Square Feet or Units	ITE Code	Time Period	ITE Formula	Total Trips	Trips Entering	Trips Exiting
Single Family - Detached Site	160 units	210	ADT	$\ln(T)=0.92\ln(x)+2.72$	1,618	809	809
			AM Peak	$T=0.70(x)+9.74$	122	31	91
			PM Peak	$\ln(T)=0.90\ln(x)+0.51$	160	101	59

Table 2-2018 Traffic Projection for Carr Farms

Land Use	Square Feet or Units	ITE Code	Time Period	ITE Formula	Total Trips	Trips Entering	Trips Exiting
Single Family - Detached South Parcel	59 units	210	ADT	$\ln(T)=0.92\ln(x)+2.71$	640	320	320
			AM Peak	$T=0.71(x)+4.8$	47	12	35
			PM Peak	$\ln(T)=0.96\ln(x)+0.2$	61	38	23
Senior Adult Housing (Detached) North Parcel	135 units	251	ADT	$\ln(T)=0.88\ln(x)+2.28$	734	367	367
			AM Peak	$\ln(T)=0.76\ln(x)+0.21$	52	17	35
			PM Peak	$\ln(T)=0.78\ln(x)+0.28$	61	37	24
Senior Adult Housing (Attached) North Parcel	44 units	252	ADT	Average Rate=3.70	164	82	82
			AM Peak	Average Rate=0.20	9	3	6
			PM Peak	Average Rate=0.26	11	6	5

Table 3-2018 Traffic Projection for Grener Park

Land Use	Square Feet or Units	ITE Code	Time Period	ITE Formula	Total Trips	Trips Entering	Trips Exiting
Soccer Complex	24 fields	488	ADT	Average Rate = 71.33	1,712	856	856
			AM Peak	Average Rate = 0.99	24	15	9
			PM Peak	Average Rate = 16.43	394	260	134
Recreational Community Center	125,000 sf	495	ADT	Average Rate = 28.82	3,604	1,802	1,802
			AM Peak	Average Rate = 1.76	220	145	75
			PM Peak	Average Rate = 2.31	289	136	153

The 2015 study of Carr Farms included trip generation for 50,000 square feet of commercial development planned by others near the Leppert Road/Hayden Run Road intersection. Those trips are also included in the Feasibility Study traffic projections for 2020 and 2030 and therefore not separately detailed here.

3.3 Traffic Volume Projections

This study adds projected Carr Farms site-generated traffic to background traffic to determine Opening Year (2020) and Horizon Year (2030) traffic conditions for use in traffic analyses. Background traffic refers to existing counted traffic volumes and growth anticipated for reasons other than Carr Farms development. Background traffic is based on 2020 and 2030 projections from the Feasibility Study for Leppert Road, adjusted to account for Greener Park concept updates and “cut-through” traffic as described above.

Site-generated trip ends and other projected traffic volumes were distributed to the street network as follows:

Carr Farms North Parcel-Senior Adult Housing

- 10% to/from the west on Hayden Run Road
- 25% to/from the east on Davidson Road
- 15% to/from the east via Edie Drive
- 13% to/from the east on Hayden Run Road via Leppert Road
- 12% to/from the east on Hayden Run Road via Eventing Way
- 25% to/from the south on Leppert Road

Carr Farms South Parcel-Single Family

- 10% to/from the west on Hayden Run Road
- 30% to/from the east on Davidson Road
- 35% to/from the east on Hayden Run Road via Leppert Road
- 25% to/from the south on Leppert Road

Courtyards at Hayden Run Cut-Through

- 25% to/from the south on Leppert Road via Carr Farms
- 15% to/from the east via Carr Farms and Edie Drive
- 10% to/from the west on Hayden Run Road via Carr Farms
- 50% to/from Hayden Run Road via Eventing Way (outside Study Area)

Greener Park

- 23% to/from the south on Leppert Road
- 22% to/from the east on Davidson Road
- 10% to/from the west on Hayden Run Road
- 10% to/from the east on Hayden Run Road
- 35% to/from Cosgray Road (outside Study Area)

Traffic volume plates illustrating morning and afternoon weekday peak hour traffic volume calculations and total traffic volumes used for analysis are available in **Appendix A**.

4.0 TRAFFIC ANALYSES

City staff recommended the following analysis scenarios for both horizon years:

- Background + growth only (no Carr Farms and no Greener Park traffic)
- Background + growth + Greener Park (no Carr Farms traffic)
- Background + growth + Carr Farms (no Greener Park traffic)
- Background + growth + Carr Farms + Greener Park

Our methodology examined the worst case condition first (2030 design year with all growth, Carr Farms and Greener Park traffic included). When that analysis controlled the result, such as where no improvements were needed to support the maximum traffic projection, lesser scenarios were not analyzed. Turn lane sizing used full-build, 2030 volumes to determine the recommended size and identified the length attributable to Carr Farms traffic.

4.1 Turn Lane Warrants and Sizing

The Location and Design Manual § 400 provides the methodology used to determine whether left or right turn lanes are warranted on the uncontrolled through approach to side-street stop controlled intersections. **Appendix B** documents the warrant analysis and lane sizing for all Study Area intersections, and **Table 4** summarizes the results of turn-lane analysis for site access points.

Table 4-Turn Lane Warrants and Length

Intersection	Movement	No Build				Full Build (Carr Farms and Greener Park)				Build Carr Farms Only (no Greener Park)				Length if Warranted
		2020		2030		2020		2030		2020		2030		2030 Full Build
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	Higher of AM or PM
Leppert Rd/Davidson Rd	NBR	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	275 ft
	NBL					No	Yes	Yes	Yes					175 ft
	SBR					No	Yes	No	Yes					175 ft
	SBL	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	175 ft
Leppert Rd/Carr South Access	NBR					No	No	No	No	No	No	No	No	-
	SBL					No	No	No	Yes	No	No	No	Yes	175 ft
Leppert Rd/Carr-Greener Main Access	NBR					No	No	No	No	No	No	No	No	-
	NBL					Yes	Yes	Yes	Yes					175 ft
	SBR					No	No	Yes	Yes					175 ft
	SBL					No	No	Yes	Yes	No	No	No	No	175 ft
Leppert Rd/Carr North Access	NBR					No	No	No	No	No	No	No	No	-
	SBL					No	No	No	No	No	No	No	No	-

Table 3 also summarizes the results of turn length calculations for warranted turn lanes. The lengths indicated in Table 3 include both the vehicle storage and deceleration component calculated in accordance with the Location and Design Manual § 400.

4.2 Capacity Analysis

This study assessed traffic operations at Study Area intersections using HCS 7 software implementing Highway Capacity Manual (HCM) procedures. Where modern roundabouts were considered, Sidra software was used for analysis. Analysis results provide average delay (seconds

per vehicle) and Level of Service (LOS). Levels of Service are expressed in terms of letter grades with LOS A representing the highest quality traffic flow and minimal delay, and LOS F representing poor traffic operations and significant delay. **Table 5** summarizes the results of capacity analyses and detailed reports are available in **Appendix C**.

Minimum acceptable intersection operations inside the City of Hilliard provide level of service (LOS) of E for an intersection that includes provisions for non-motorized users. The City of Hilliard determines the provisions for non-motorized users that provide a sufficient level of safety based on vehicle traffic volumes, turning movements, sight distance, and vehicle speed. If the intersection does not include provisions for non-motorized users, then a minimum overall LOS of D is required. Intersections under the jurisdiction of the Franklin County Engineer are required to meet LOS C. Intersections under the jurisdiction of the City of Columbus (Hayden Run Road/Leppert Road) are required to provide a minimum overall intersection level of service (LOS) D with minimum approach LOS D and minimum LOS E in any individual movement.

Table 5-Capacity Analysis Results
(X/Y=Level of Service/Average Delay in Seconds)

Time Period	Year	Scenario	Conditions	EBLT	EBTH	EBRT	WBTL	WBTH	WBRT	NBLT	NBTH	NBRT	SBLT	SBTH	SBRT	TOTAL
Leppert Road/Hayden Run Road																
AM Peak Hour	2030	Full Build	Existing Conditions	B/16.1	C/34.7	B/17.6	C/20.4	B/10.7	-	C/26.1	C/27.0	-	D/36.3	C/23.6	-	C/27.1
				-	-	-	-	-	-	-	-	-	-	-	-	-
PM Peak Hour	2020	Full Build	Existing Conditions	C/30.4	C/21.9	C/21.0	C/21.5	C/21.4	-	C/23.9	C/22.2	-	C/25.1	C/20.1	-	C/21.9
				-	-	-	-	-	-	-	-	-	-	-	-	-
PM Peak Hour	2030	Full Build	Existing Conditions	D/38.8	C/20.7	B/19.6	C/28.4	C/29.6	-	C/27.6	C/25.3	-	C/29.1	C/22.4	-	C/26.7
				-	-	-	-	-	-	-	-	-	-	-	-	-
Leppert Road/North Drive																
AM Peak Hour	2030	Full Build	Two-way stop- Existing lane	-	-	-	-	B/12.8	-	-	-	-	-	A/7.9	-	-
PM Peak Hour	2020	Full Build	Two-way stop- Existing lane	-	-	-	-	B/13.7	-	-	-	-	-	A/7.8	-	-
PM Peak Hour	2030	Full Build	Two-way stop- Existing lane	-	-	-	-	C/18.0	-	-	-	-	-	A/8.2	-	-
Leppert Road/Main Drive																
AM Peak Hour	2030	Full Build	Two-way stop- Existing lane	B/13.1			B/14.7			A/8.1	-	A/0.4	A/7.9	-	A/0.1	-
			Roundabout	B/11.7	A/5.7	A/5.8	B/11.7	A/5.8	A/5.8	B/10.2	A/4.2	A/4.2	A/9.9	A/3.9	A/4.0	A/4.8
PM Peak Hour	2020	Full Build	Two-way stop- Existing lane	C/24.4			C/20.4			A/8.8	-	A/1.0	A/8.0	-	A/0.2	-
			Roundabout	B/12.8	A/6.8	A/6.9	B/13.5	A/7.6	A/7.6	B/10.8	A/4.9	A/4.9	B/10.3	A/4.4	A/4.4	A/5.9
PM Peak Hour	2030	Full Build	Two-way stop- Existing lane	E/36.0			D/26.2			A/9.2	-	A/1.2	A/8.2	-	A/0.3	-
			+NBLT, & SBLT	D/34.4			D/25.4			A/9.2	-	-	A/8.2	-	-	-
			Roundabout	B/12.8	A/6.8	A/6.8	B/14.0	A/8.0	A/8.1	B/10.8	A/4.8	A/4.8	B/10.3	A/4.3	A/4.3	A/5.7
Leppert Road/Main Drive With No Southern Access																
AM Peak Hour	2030	Full Build	Two-way stop- Existing lane	B/13.2			B/14.5			A/8.1	-	A/0.3	A/7.9	-	A/0.1	-
			Roundabout	B/11.7	A/5.7	A/5.7	B/11.8	A/5.8	A/5.9	B/10.2	A/4.3	A/4.3	A/9.9	A/3.9	A/4.0	A/5.0
PM Peak Hour	2020	Full Build	Two-way stop- Existing lane	D/25.5			C/21.9			A/8.7	-	A/0.9	A/8.1	-	A/0.4	-
			Roundabout	B/12.8	A/6.8	A/6.8	B/13.6	A/7.6	A/7.7	B/10.9	A/5.0	A/5.0	B/10.5	A/4.5	A/4.6	A/6.2
PM Peak Hour	2030	Full Build	Two-way stop- Existing lane	E/38.5			D/29.5			A/9.1	-	A/1.1	A/8.2	-	A/0.5	-
			+NBLT, & SBLT	E/36.5			D/28.3			A/9.1	-	-	A/8.2	-	-	-
			+NBLT, SBLT, EBLT, WBTL	E/48.9	C/16.2		E/46.3	C/15.2		A/9.1	-	-	A/8.2	-	-	-
			Roundabout	B/12.7	A/6.8	A/6.8	B/14.1	A/8.1	A/8.1	B/10.8	A/4.9	A/4.9	B/10.4	A/4.4	A/4.5	A/6.0

Table 5 Continued-Capacity Analysis Results
(X/Y=Level of Service/Average Delay in Seconds)

Time Period	Year	Scenario	Conditions	EBLT	EBTH	EBRT	WBLT	WBTH	WBRT	NBLT	NBTH	NBRT	SBLT	SBTH	SBRT	TOTAL
Leppert Road/South Drive																
AM Peak Hour	2030	Full Build	Two-way stop- Existing lane	-	-	-	B/11.9			-	-	-	A/8.0			-
PM Peak Hour	2020	Full Build	Two-way stop- Existing lane	-	-	-	B/13.9			-	-	-	A/8.2			-
PM Peak Hour	2030	Full Build	Two-way stop- Existing lane	-	-	-	C/15.8			-	-	-	A/8.4			-
Leppert Road/Davidson Road																
AM Peak Hour	2020	No Build	Existing Conditions				B/14.5						A/8.0			
PM Peak Hour	2020	No Build	Existing Conditions				E/36.4						A/8.2			-
			+SBLT, & WBLT	-	-	-	D/33.1	-	B/10.3	-	-	-	A/8.2	-	-	-
AM Peak Hour	2020	Full Build	Existing Conditions	B/14.9			C/23.7			A/7.8	-	A/0.2	A/8.2	-	A/0.3	-
			Existing Conditions	E/46.9			F/1929.8			A/8.4	-	A/0.5	A/8.5	-	A/0.8	-
PM Peak Hour	2020	Full Build	Ex + NBR,NBL,SBR,SBL,EBL,WBL Roundabout	E/48.3	B/10.9	F/817.0	C/18.9	A/8.4	A/8.4	A/8.4	A/8.9	B/11.1	A/5.2	A/5.2	A/9.0	
			Roundabout	B/13.7	A/7.7	A/7.8	B/15.7	A/9.7	A/9.7	B/14.8	A/8.9	A/8.9	B/11.1	A/5.2	A/5.2	A/9.0
PM Peak Hour	2020	Build Carr Only-No Grener	Ex Conditions				F/50.6						A/8.3			
			Ex. Cond. +SBLT, & WBLT				E/41.7	B/10.6						A/8.3		
			Ex. Cond. +NBRT, SBLT & WBLT				D/33.0	B/10.1						A/8.3		
AM Peak Hour	2030	No Build	Existing Conditions				C/19.3						A/8.3			
PM Peak Hour	2030	No Build	Existing Conditions				F/285.8						A/8.5			-
			Ex Cond+NBRT, SBLT, & WBLT	-	-	-	F/89.7	-	B/10.2	-	-	-	A/8.5	-	-	-
AM Peak Hour	2030	Full Build	Existing Conditions	C/11.7			E/49.4			A/8.0	-	A/0.2	A/8.4	-	A/0.4	-
			Roundabout	B/11.8	A/5.8	A/5.9	B/12.8	A/6.8	A/6.8	B/11.2	A/5.2	A/5.3	B/10.2	A/4.2	A/4.3	A/6.5
PM Peak Hour	2030	Full Build	Existing Conditions	F/132.9			F/4621.4			A/8.8	-	A/0.7	A/8.8	-	A/1.1	-
			+NBR, NBL, SBR, SBL, EBL, & WBL	F/77.8	-	D/29.3	F/2631.1	-	C/24.3	A/8.8	-	-	A/8.8	-	-	-
			Roundabout	B/13.9	A/8.0	A/8.0	B/16.9	B/10.9	B/11.0	B/16.3	B/10.3	B/10.4	B/11.1	A/5.1	A/5.1	A/9.5

5.0 CONCLUSIONS AND RECOMMENDATIONS

Results of the analyses performed for this study are discussed below for each intersection in the Study Area.

Leppert Road/Hayden Run Road

This intersection attained LOS C under existing roadway conditions and 2030 full build traffic volumes including Carr Farms, Grener Park and all other growth included in this study. The existing northbound left turn lane length (510 feet) exceeds the maximum calculated length under 2030 full build conditions (325 feet including storage, deceleration and taper length). The westbound left turn lane length (330 feet) is nearly sufficient to provide the storage length needed for 2030 full build traffic volumes (350 feet) but is not long enough to provide storage, deceleration and taper which requires a total of 475 feet. No build volumes in the 2030 design year (without Carr Farms or Grener Park traffic) require 450 feet of westbound left turn lane. Adding Carr Farms traffic volumes to the 2030 no build does not increase the 450 foot no build length.

No improvements to this intersection are recommended in conjunction with developing Carr Farms.

Leppert Road/Carr Farms North Access

This intersection attained LOS C or better under existing/planned roadway conditions and 2030 full build traffic volumes including Carr Farms, Grener Park and all other growth included in this study. No turn lanes are warranted in conjunction with development. The Leppert Road/Carr Farms North Access intersection is expected to operate within guidelines with 1 lane per direction on Leppert Road as proposed in the Leppert Road Feasibility Study and no additional improvements to this intersection are recommended as a result of developing Carr Farms.

Leppert Road/Carr Farms/Grener Park Main Access

The Leppert Road Feasibility Study recommends a modern roundabout for this future intersection. A single lane roundabout at this location attained LOS A with 2030 full build traffic volumes including Carr Farms, Grener Park and all other growth included in this study. Without the roundabout improvement, this intersection operates at LOS C or better under two-way stop control and single lane approaches in the 2020 design year. By the 2030 design year, intersection operation deteriorates to LOS E on the eastbound, Grener Park approach and LOS D on the westbound, Carr Farms approach with single lane approaches. Adding northbound and southbound left turn lanes on Leppert Road improves 2030 operations to LOS D.

Without a roundabout improvement, Grener Park development warrants a northbound left turn lane in 2020, and a southbound right turn lane in 2030. Carr Farms and Grener Park development together warrant a southbound left turn lane in 2030. Carr Farms does not warrant turn lane improvements absent the additional traffic generated by Grener Park. Right turn lane improvements are not warranted. Combined morning and afternoon, total entering traffic volumes at this intersection are 1,914 total vehicles for all traffic, 135 vehicles (7%) arising from Carr Farms development and 394 (21%) arising from Grener Park development. See the discussion below about the Carr Farms southern access for information on how these percentages change if the southern access is not provided.

The single lane modern roundabout recommended in the Leppert Road Feasibility Study is the recommended improvement for this intersection. Carr Farms should make a proportionate contribution to the cost of the roundabout improvement.

Leppert Road/Carr Farms Southern Access

This intersection attains LOS C or better with single lane approaches and 2030 full build traffic volumes including Carr Farms, Grener Park and all other growth included in this study. Afternoon peak-hour conditions cause a southbound left turn lane warrant to meet criteria in the 2030 design year, but auxiliary lanes are not needed for capacity. While ODOT's turn lane warrants provide one indication of how turning traffic interacts with through movements on a roadway, local agencies frequently balance vehicular roadway capacity and convenience with the needs of other users of the public right-of-way and the role of the road corridor in the local street network.

Hilliard's street design guidelines disfavor addition of auxiliary lanes particularly when, as is the case here, they are not needed to meet capacity/LOS goals. The additional pavement width associated with an auxiliary lane may tend to promote higher vehicle speeds and lengthen pedestrian crossing distance, neither of which support City goals for their roadways. Considering all of the foregoing, the warranted left turn lane is not recommended for further consideration.

The City-approved scope of services for this study requires an examination of an alternative without this southern access to Carr Farms from Leppert Road. Instead, this alternative would connect the traditional single family lots through the senior adult housing to access the proposed roundabout referred to above as the "main access", located about 1,550 feet north of Davidson Road. Under roundabout control, this intersection operates at LOS A in the 2030 morning and afternoon peak hours and the additional traffic reassigned from the southern access point causes a minimal increase in delay of about 0.2 seconds.

Without the roundabout improvement, the main access struggles to accommodate the additional traffic caused by removing the southern access. While two-way stop control with warranted turn lane additions (NBL, SBL) provides acceptable LOS D on the eastbound and westbound approaches when the southern access is available, removing the southern access degrades eastbound performance to LOS E. Adding eastbound and westbound left turn lanes did not mitigate the LOS E performance.

Removing the southern access point slightly changes the proportion of traffic at the Leppert Road/Carr Farms/Grener Park Main Access. Combined morning and afternoon, total entering traffic volumes at the Leppert Road/Carr Farms/Grener Park Main Access intersection are 1,943 total vehicles for all traffic, 164 vehicles (8%) arising from Carr Farms development and 394 (20%) arising from Grener Park development.

The southern access benefits the area by separating traffic generated by different land uses and distributing traffic to the surrounding street system in a more balanced way. Traffic impacts arising from removing the southern access are not at a level that controls the decision however. The impacts outlined above should be considered, particularly if the main access intersection is expected to operate under stop sign control for a significant time.

Leppert Road/Davidson Road

Background Conditions without Carr Farms or Grener Park

The morning peak hour at this intersection provides LOS C or better under background conditions in the 2020 and 2030 design years. The afternoon peak hour controls the analysis and is the focus of the rest of the discussion about this intersection. The Davidson Road approach to Leppert Road operates at LOS E under 2020 no build conditions and LOS F under 2030 no build conditions. Adding a southbound left turn lane warranted under no build conditions (SBL) and a westbound left turn lane (WBL) on the stop-controlled Davidson Road approach improves LOS to D in 2020 no build.

Even if all turn movements are provided an exclusive lane, the westbound left turn movement remains at LOS F in 2030 no build with delay of 90 seconds per vehicle on the stop-controlled westbound approach. This intersection therefore requires the roundabout improvement recommended in the Leppert Road Feasibility Study by 2030, irrespective of whether Carr Farms or Grener Park are developed or not.

Background Conditions with Carr Farms Developed without Grener Park

Since the discussion above established that the existing Leppert Road/Davidson Road intersection is capable of supporting 2020 background traffic without development, this study also assessed conditions with 2020 background volumes plus Carr Farms traffic added alone, without Grener Park. Adding Carr Farms traffic to 2020 afternoon peak, background volumes degrades the Davidson Road approach LOS by one letter grade. Performance of existing lanes (single lane approaches) drops from LOS E to LOS F with about 14 seconds of added delay on the westbound approach. Performance with the same turn lanes added to the background condition (SBL and WBL) drops from LOS D to LOS E with almost 9 seconds of added delay.

Adding a northbound right turn lane to the SBL and WBL, restores the westbound approach to LOS D with delay comparable to the background condition. The northbound right turn lane is warranted in the no build condition without Carr Farms traffic, but it is needed for capacity mitigation in the 2020 design year as a result of Carr Farms development.

Full Build Conditions with Both Carr Farms and Grener Park

The single lane modern roundabout recommended in the Leppert Road Feasibility Study is the recommended improvement for this intersection. A single lane roundabout at this location attained LOS A with 2030 full build traffic volumes including Carr Farms, Grener Park and all other growth included in this study. Combined morning and afternoon, total entering traffic volumes at this intersection are 2,633 total vehicles for all traffic, 100 vehicles (4%) arising from Carr Farms development and 514 (20%) arising from Grener Park development.

The need for a northbound right turn lane improvement is a mixture of turn lane warrants under existing background conditions and capacity mitigation of Carr Farms traffic in the short term prior to the roundabout improvement. The roundabout improvement will likely waste any pavement added in the short term and adding turn lanes to this intersection is not a recommended solution for that reason. In lieu of constructing a lane, the community would receive more long-term value from a proportional contribution to the roundabout improvement planned as part of the Leppert Road project.

Pedestrian/Trail Connectivity Planning

A scaled drawing is attached illustrating anticipated trail connectivity for non-motorized travel, including off-site trail links. A multi-use path connection to the Hayden Run trail system is provided in the northeast portion of the site that links to the future Leppert Road shared use path and bike lanes. This connection would ultimately link to Grener Park and through Grener to Homestead Park once Grener is developed. The Carr Farms project also includes development of a shared-use path on the east side of Leppert Road along the entire frontage of the site, consistent with the City of Hilliard Comprehensive Plan.

Summary of Proposed Improvements







Recommended mitigation of traffic volumes generated by Carr Farms development consists of the following:

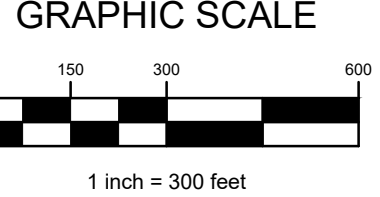
1. Make a proportional (7%) contribution to the Leppert Road/Main Access roundabout improvement.
 - a. In the event that Carr Farms is developed prior to the Leppert Road improvement, the Main Access intersection should operate under side street stop control with no auxiliary lanes required.
2. Make a proportional (4%) contribution to the Leppert Road/Davidson Road roundabout improvement.
3. Provide a shared use path on the east side of Leppert Road for the full site frontage, connecting to Davidson Road or contribute the cost of the path toward the Leppert Road improvement project.

J:\20180418\DWG\04\Sherris\Exhibits\Open Space and Pedestrian Connectivity Plan - REVISED 7-02-2018.dwg, Last Saved By: rrwinn, 7/2/2018 4:23 PM



LEGEND

-  FUTURE MULTI - USE PATH (OFF-ROAD & ON-ROAD)
-  FUTURE MULTI - USE PATH (OFF-ROAD)
-  PROPOSED PUBLIC IMPROVEMENT MULTI - USE PATH (OFF-ROAD & ON-ROAD)
-  EXISTING SIDEWALK
-  EXISTING MULTI - USE PATH
-  FUTURE ROAD



CARR FARMS

CITY OF HILLIARD, FRANKLIN COUNTY, OHIO

TRAIL CONNECTIVITY PLAN

PREPARED FOR:



EPCON
Communities

500 STONEHENGE PARKWAY
DUBLIN, OHIO 43017

PREPARED BY:



EMHT

Evans, Mechwart, Hambleton & Tilton, Inc.
Engineers • Surveyors • Planners • Scientists
5500 New Albany Road, Columbus, OH 43254
Phone: 614.775.4500 Toll free: 888.775.3448
emht.com

DATE:	JULY 3, 2018
REVISED:	
REVISED:	
REVISED:	
REVISED:	
REVISED:	