



Traffic Impact Study

Viking Commerce Center

N. Hamilton Road @ Beecher Road
Gahanna, Ohio

Prepared for

Gallas Zadeh Development

By

 **Trans** ASSOCIATES

Trans Associates Engineering Consultants, Inc.

October 31, 2016

GALZAD - 16140



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October 31, 2016

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Introduction

Gallas Zadeh Development has plans to develop a parcel of land located on the northwest quadrant of the North Hamilton Road and Beecher Road signalized intersection in Gahanna, Ohio. The project location is shown in Figure 1.

Based upon a plan dated 08-02-16, the site may be developed with 8,300 sf of shopping center, 18,000 sf of general office space, and 13,000 sf of medical/dental office space. The site plan showing this development package is contained in Appendix A.

More recent planning indicates that, the 8,300 sf of “shopping center” may be split into 5,700 sf of restaurant space and 2,600 sf of general retail space. As such, the traffic study presented in this report was based on the current thoughts of what might actually be constructed.

The preliminary site plan shows that the proposed Viking Commerce Center development will have two access drives. The access drive on North Hamilton Road will be right-in/right-out (RIRO) only and located 420 feet north of the signalized intersection. Due to the presence of a concrete median on North Hamilton Road, no pork chop island will be required at the RIRO access drive. The access point that leads onto Beecher Road will be located about 325 feet (centerline to centerline) to the west of the signalized intersection and it will be a full access drive.

As part of the planning process for the proposed development, the project team evaluated options for providing a safe and efficient site access system. With traffic management being instituted by the city along Hamilton Road, restrictions are placed on property access. This is the case with the subject site where the barrier median on Hamilton Road causes site access to be restricted to right-in/right-out movements. As with most traffic management programs, additional property access is to take place via streets that intersect with the major road.



A development, such as that proposed for the subject site, requires an access system that permits drivers to arrive and depart in all directions in order to be economically viable. Thus, an access point on Beecher Road is a necessary component of the site access system. It is understood that the section of Beecher Road between the ravine and Hamilton Road was constructed for the purpose of serving the properties to the north and south of this portion of Beecher Road. As such, it is understood that the subject property has a right of access off this road. Beyond this, an access point on Beecher Road is essential to providing site access for fire/emergency vehicles.

The proposed site driveway has been located as far west as possible from Hamilton Road. This places the driveway about 240 feet west of the eastbound Beecher Road stop bar at Hamilton Road. One of the objectives of this traffic study is to evaluate traffic operations along Beecher Road to ensure that drivers can safely enter and exit the site at this driveway -- and that the driveway does not impede traffic flows on Beecher Road itself.

An additional focus of this study is to determine the impacts, if any, the development will have on the operation of the North Hamilton Road and Beecher Road signalized intersection. Any improvements that might be required to mitigate the traffic impacts of this development will be investigated.

FILE NAME: X:\Active ISO Projects\OH Office Projects\GALZAD Galas Zaden\16140 Viking Commerce Center\Drawings\Created\Figure 1 - Project Location.dgn



 SCALE: N.T.S.	 Trans ASSOCIATES Small Firm Client Experience, Big Firm Capabilities 941 Chatham Lane, Suite 319 Columbus, Ohio, 43221 / (614) 459-7930	PROJECT NO. GALZAD - 16140	FIGURE
		PROJECT: VIKING COMMERCE CENTER N HAMILTON @ BEECHER	1
		TITLE: PROJECT LOCATION	DATE 10/18/16 D.B. SA C.B. DRC REV.

This study has been prepared based upon the specific analysis items that have been requested by the City.

Study Parameters

This study will focus mainly on the following intersections:

1. North Hamilton Road and Beecher Road
2. North Hamilton Road and Right-In/Right-Out Access Drive
3. Beecher Road and Full Access Drive

In order to properly evaluate the effects that the newly generated traffic from the proposed development will have on the operation of the North Hamilton Road and Beecher Road intersection, both “no-build” and “build” conditions will be considered. The “no-build” condition will identify the expected operating characteristics without the proposed development. The “build” condition includes the newly generated trips from the development on top of the no-build traffic volumes. By comparing the results of the no-build and build analyses, the specific impacts of the development can be established. The “opening year” for this development is assumed to be 2017. Conditions twenty years beyond the expected opening of the development must also be evaluated -- thus making the “design year” as 2037. Traffic conditions during the critical AM and PM commuter peak hours will be evaluated.

Existing Conditions

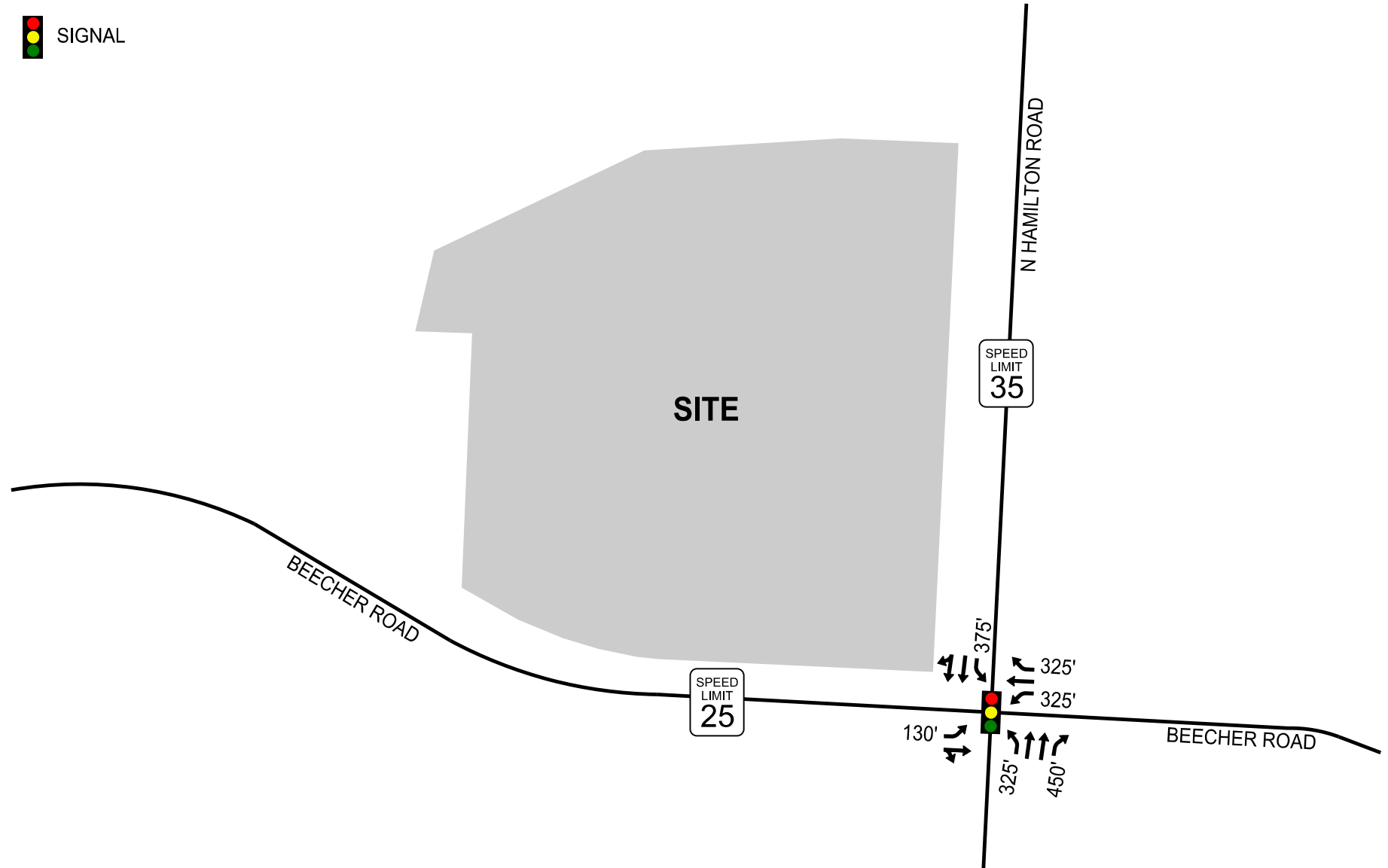
Existing roadway conditions are detailed in Figure 2. The intersection of North Hamilton Road and Beecher Road is signalized. North Hamilton Road runs in the north-south direction while Beecher Road runs in the east-west direction. At the signal, the northbound approach contains two through lanes, a 325 foot left turn lane and a 450 foot right turn lane. The southbound approach has a 375 foot left turn lane, a through lane and a shared through/right lane. The westbound approach at the signal has a single through lane, and exclusive right and left turn lanes both 325 feet long. The eastbound approach of Beecher Road has a shared through/right lane and a 130 foot left turn lane. The speed limit is 35 mph on North Hamilton Road and 25 mph on Beecher Road.

There is a mix of land uses on the east of North Hamilton Road at the signalized intersection while the west is undeveloped. The west leg of Beecher Road leads to a residential neighborhood and the Columbus Academy School about 0.75 miles west of the signalized intersection.

Background Traffic

Intersection turning movement count data was collected for the existing intersection (North Hamilton Road and Beecher Road) by Trans Associates personnel in May 2016 for the purpose of this study during the hours of 6:45 to 8:15 AM and 2:30 to 6:45 PM. Based on this data, the AM peak hour period occurs from 7:15 to 8:15 AM while the PM peak hour occurs from 4:45 to 5:45 PM. Copies of all count data are provided in Appendix B.

FILE NAME: X:\Active ISO Projects\OH Office Projects\GALZAD Gallas Zadeh\16140 Viking Commerce Center\Drawings\Created\Figure 2 - Existing Conditions.dgn



NOTE: ONLY STORAGE
LENGTHS SHOWN



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PROJECT: VIKING COMMERCE CENTER
N HAMILTON @ BEECHER

TITLE: EXISTING CONDITIONS

FIGURE

2

DATE 10/18/16
D.B. SA
C.B. DRC
REV. _____

Due to the absence of the 2016 graduating senior class of Columbus Academy during the time period traffic counts were collected in May 2016, new intersection turning movement count data was collected in October 2016 for the west leg of Beecher Road.

Columbus Academy is a pre-kindergarten to twelve grade school with a student population of 1,087 and it accounts for a large portion of the traffic on Beecher Road before the start of school and after school discharge. This is especially evident during the AM peak period -- where a majority of the traffic on Beecher Road is related to school drop-offs. This impacts the AM commuter peak hour traffic volumes.

The existing traffic volumes were applied directly as the “no build” traffic for the 2017 opening year. The 2017 opening year AM and PM peak hour traffic volumes are presented in Figure 3. The current traffic volumes were projected out to the design year (2037) to account for potential growth along the North Hamilton Road and Beecher Road corridors.

The Mid-Ohio Regional Planning Commission (MORPC) was contacted for the purpose of estimating the magnitude of this growth. Based on this correspondence (found in Appendix C), the following linear annual growth rates were used:

- Beecher Road, east of Hamilton Road: 1.0%
- Beecher Road, west of Hamilton Road : 0.5%
- Hamilton Road, north of Beecher Road: 1.0%
- Hamilton Road, south of Beecher Road: 1.0%

These growth rates were applied to the current traffic volumes shown in Figure 3 over a 20 year horizon. The resulting background traffic volumes are illustrated in Figure 4.

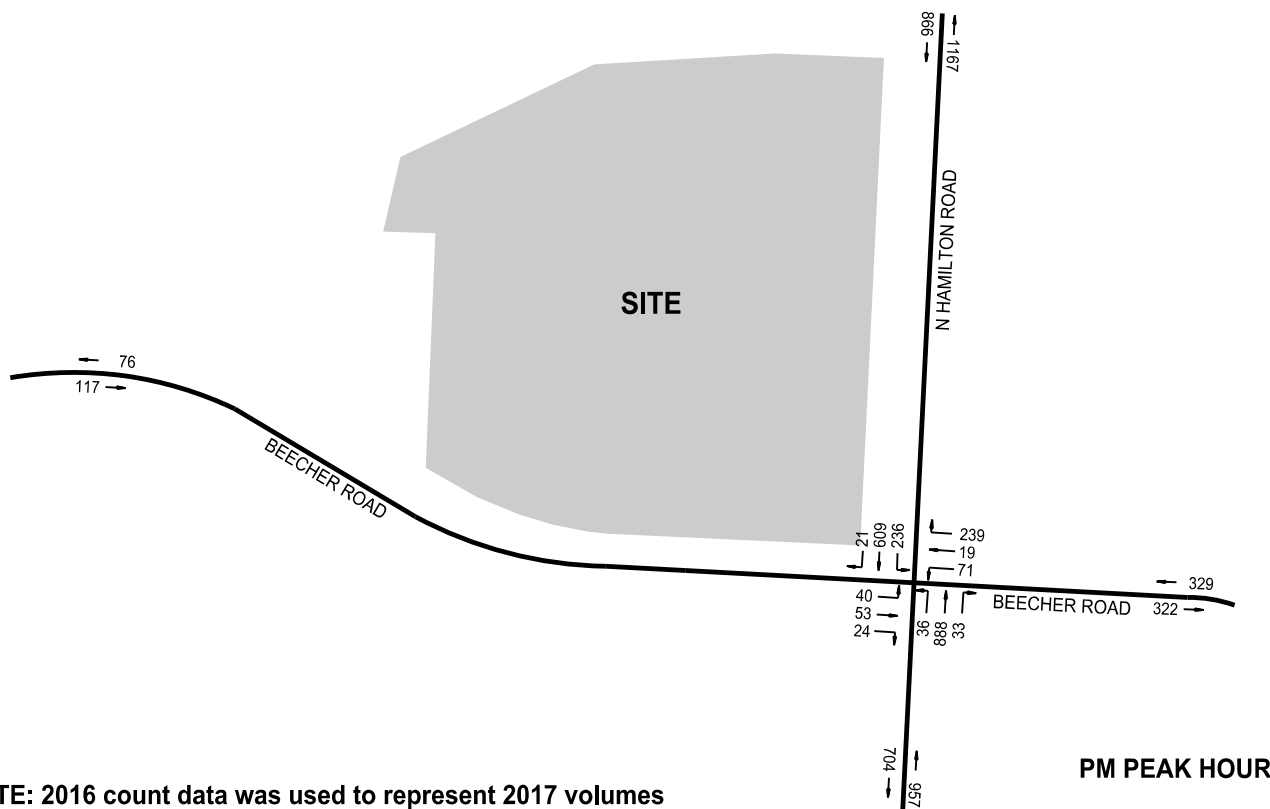
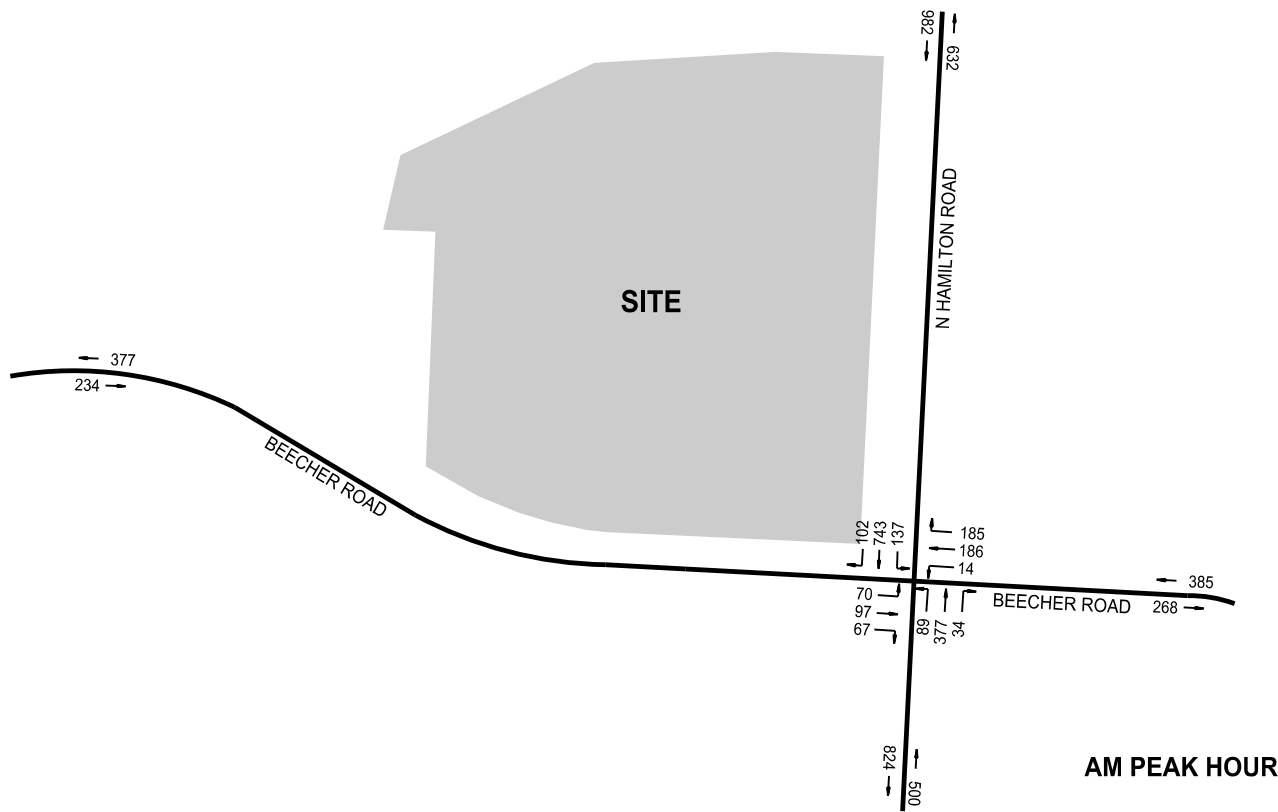
Proposed Build Conditions

Trip Generation

The *ITE Trip Generation Manual (9th Edition)* was consulted for determining trip generation rates for the proposed Viking Commerce Center development. In total, the development could be characterized using a combination of land use codes 720 (Medical/Dental Office Building which is a total of 31,000-sf), 820 (Shopping Center which is 2,600-sf) and 932 (High Turnover (Sit-Down) Restaurant of 5,700 sf). (It should be noted that land use code 720 was applied to all office space to provide estimates of the highest potential traffic volumes generated by this component. If any of the space is occupied by typical general office tenants, the volume of traffic generated by these uses would be less than that of a comparably-sized medical/dental component). In addition, trip rates associated with “high turnover restaurant” were applied during both AM and PM peak hours even though actual restaurants occupying the space may not be open during both commuter peak hours.

The *ITE Trip Generation Manual (3rd Edition)* provides average AM and PM pass-by rates for all the various land use codes. A certain proportion of the trips generated by the development can be attributed to pass-by and diverted link trips. These are not new trips that are added to the “no- build” traffic, but are trips made to and from the site by drivers that are already traveling on the adjacent street system. These drivers stop at the development and then return to their original path. All the land uses in this development generated only new trips during all time

FILE NAME: X:\Active ISO Projects\OH Office Projects\GALZAD Gallos Zadeh\16140 Viking Commerce Center\Drawings\Created\Figure 3 - Current Traffic Volumes.dgn



NOTE: 2016 count data was used to represent 2017 volumes



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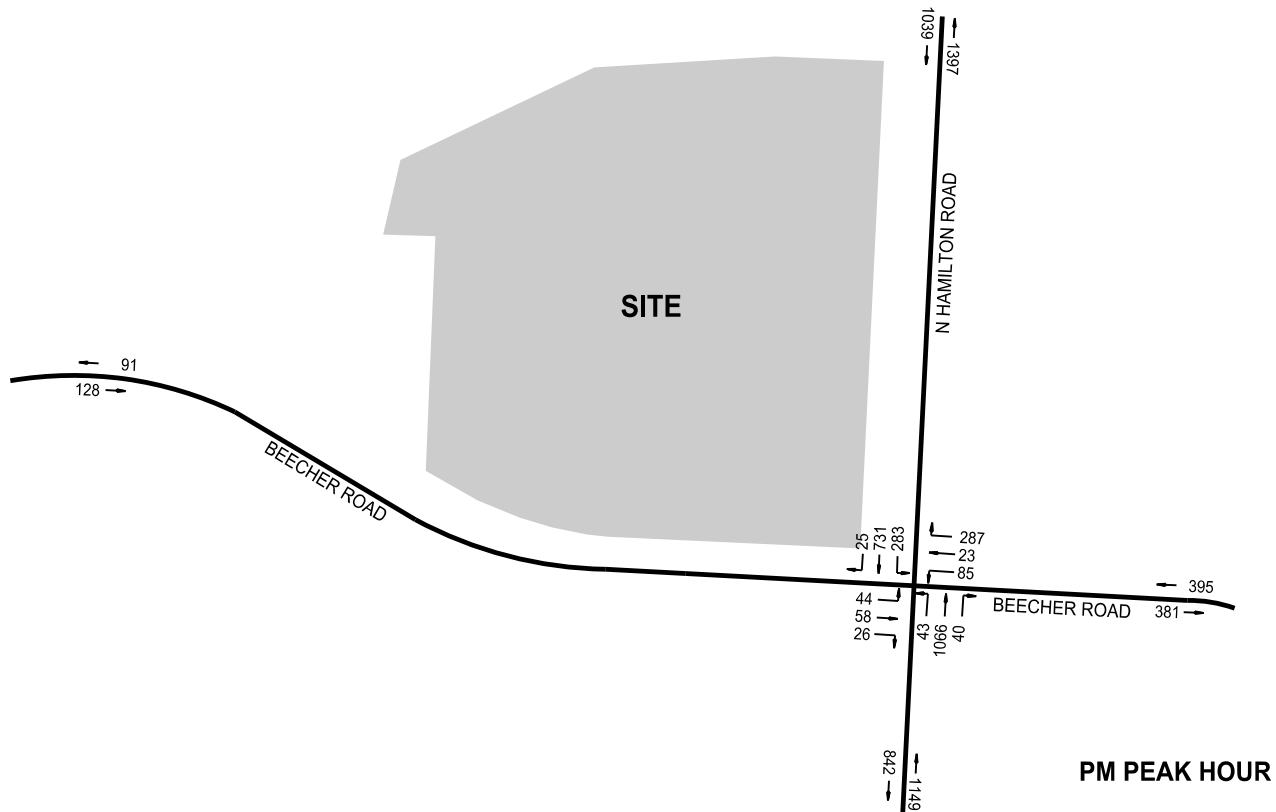
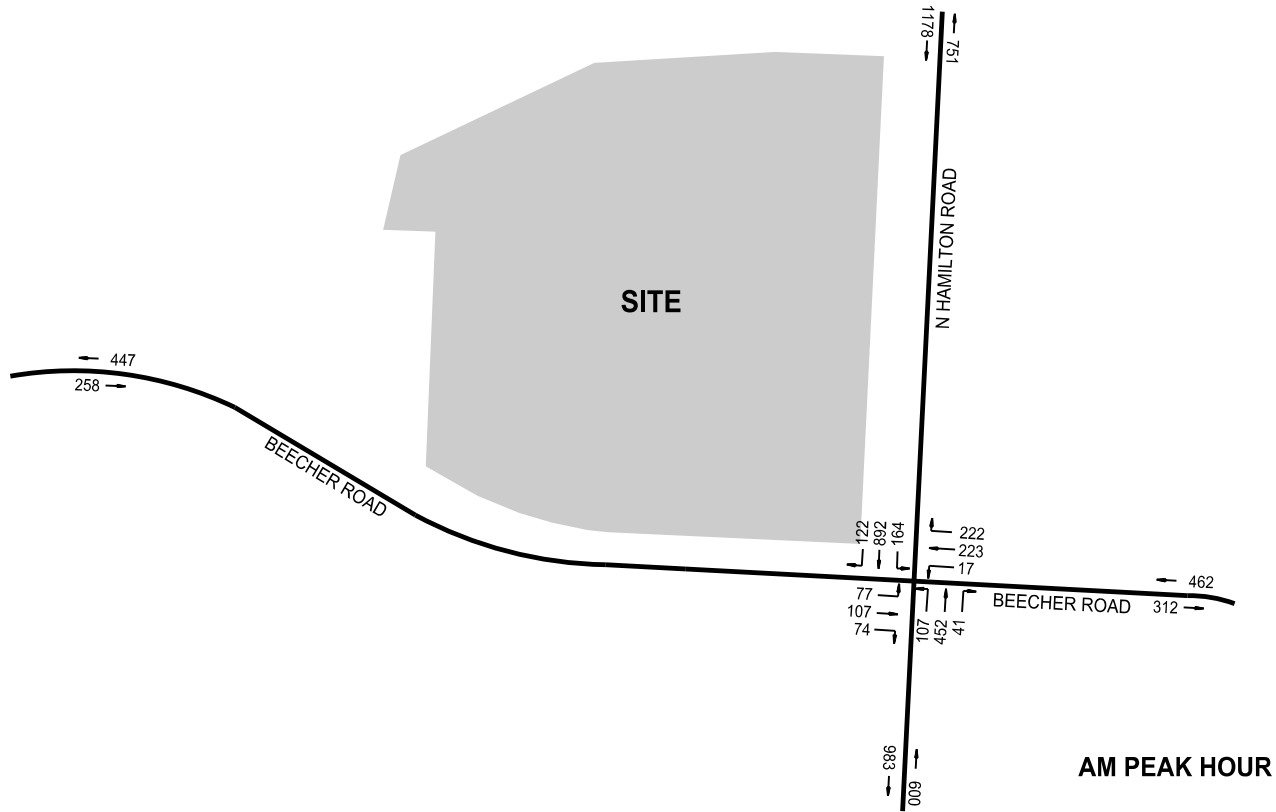
TITLE: **OPENING YEAR (2017) TRAFFIC
VOLUMES**

FIGURE

3

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D.B. SA
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FILE NAME: X:\Active ISO Projects\OH Office Projects\GALZAD Gallos Zadeh\16140 Viking Commerce Center\Drawings\Created\Figure 4 - Proj BG Traffic Volume.dgn



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PROJECT NO. GALZAD - 16140
 PROJECT: VIKING COMMERCE CENTER
 N HAMILTON @ BEECHER
 TITLE: PROJECTED (2037)
 BACKGROUND TRAFFIC VOLUMES

FIGURE

4

DATE 10/18/16
 D.B. SA
 C.B. DRC
 REV. _____

periods except the High Turnover (Sit Down) Restaurant which had a pass-by percentage of 43% during the PM peak period. The calculations of trip generation are presented in Tables 1 and 2.

Trip Distribution

The distribution of primary (new) trips was established using the current distribution of traffic that enters the study area from the north and south directions on North Hamilton Road and from the east and west directions on Beecher Road. The AM distribution was applied for both peak periods since it generally indicates where people live. The complete distribution of primary trips is as follows:

- 50% to/from the north on Hamilton Road
- 25% to/from the south on Hamilton Road
- 20% to/from the east on Beecher Road
- 5% to/from the west on Beecher Road

The current PM peak directional distribution of traffic at Hamilton Road and Beecher Road was used to distribute the pass-by trips.

Trip Assignment

Trips arriving at the proposed Viking Commerce Center were split with 35% using the right-in/right-out access on North Hamilton Road and the remainder entering through the Beecher Road full access point. Trips leaving the development were split with 5% going south from the North Hamilton Road access point, 5% to westbound Beecher Road and 90% to eastbound Beecher Road from the Beecher full access drive.

The total 2037 “build” traffic volumes were obtained by adding the site generated traffic volumes to the projected background traffic volumes. The resulting total traffic volumes are illustrated in Figure 5. Negative values represent those vehicles that are diverted from their original path to visit the development (pass-by trips). A detailed trip assignment worksheet for each peak hour can be found in Appendix D.

Turn Lane Warrants

Turn lane warrant analyses were performed at the two access drives to the Viking Commerce Center development in accordance with Figures 401-5bE and 401-6bE of the ODOT Location and Design Manual, Volume 1 using the total 2037 “build” projected traffic volumes.

It was determined from the turn lane warrant analyses that neither the North Hamilton Road right-in/right-out access nor the Beecher Road full access required any exclusive turn lanes to the development. All turn lane warrant analyses worksheets are contained in Appendix E.

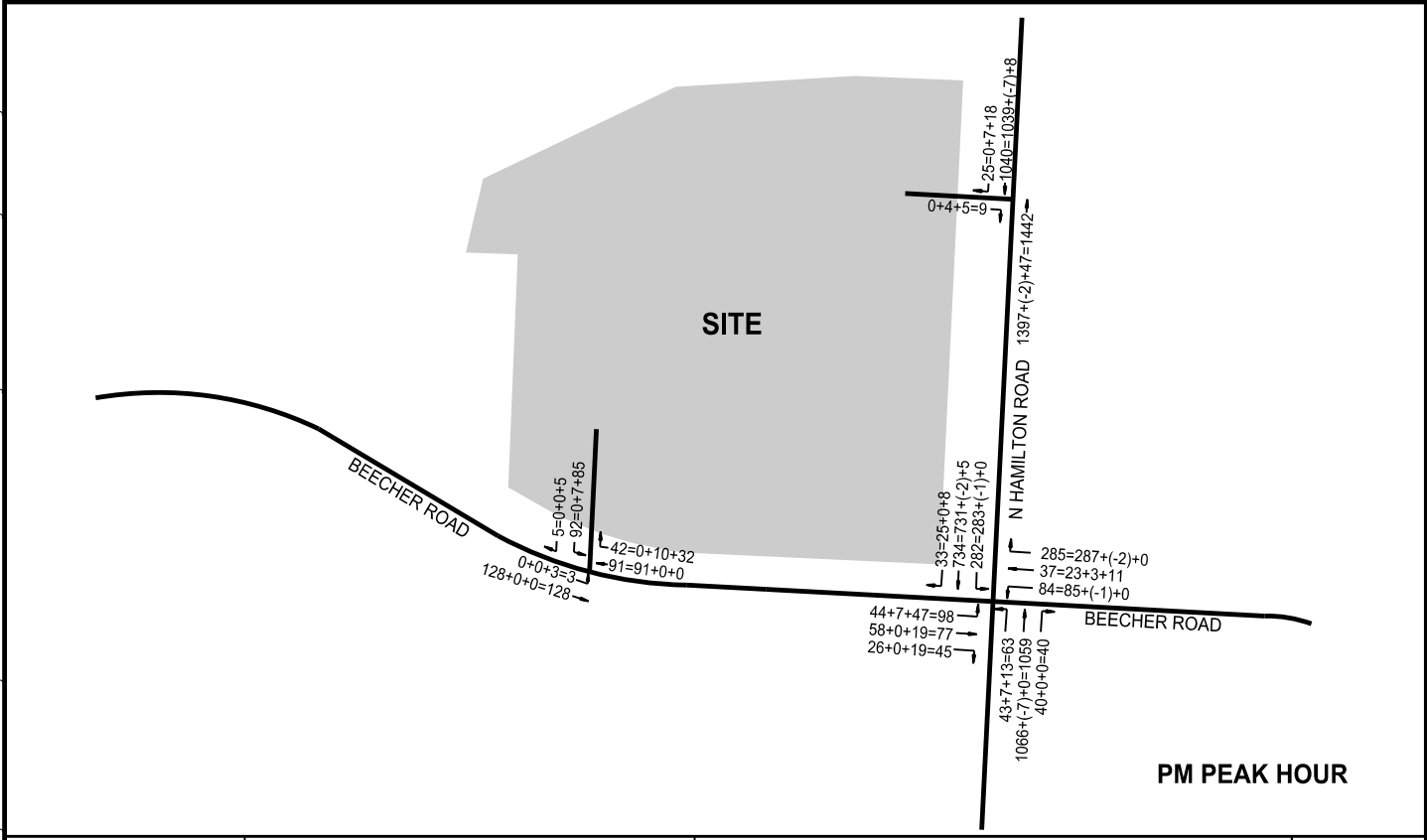
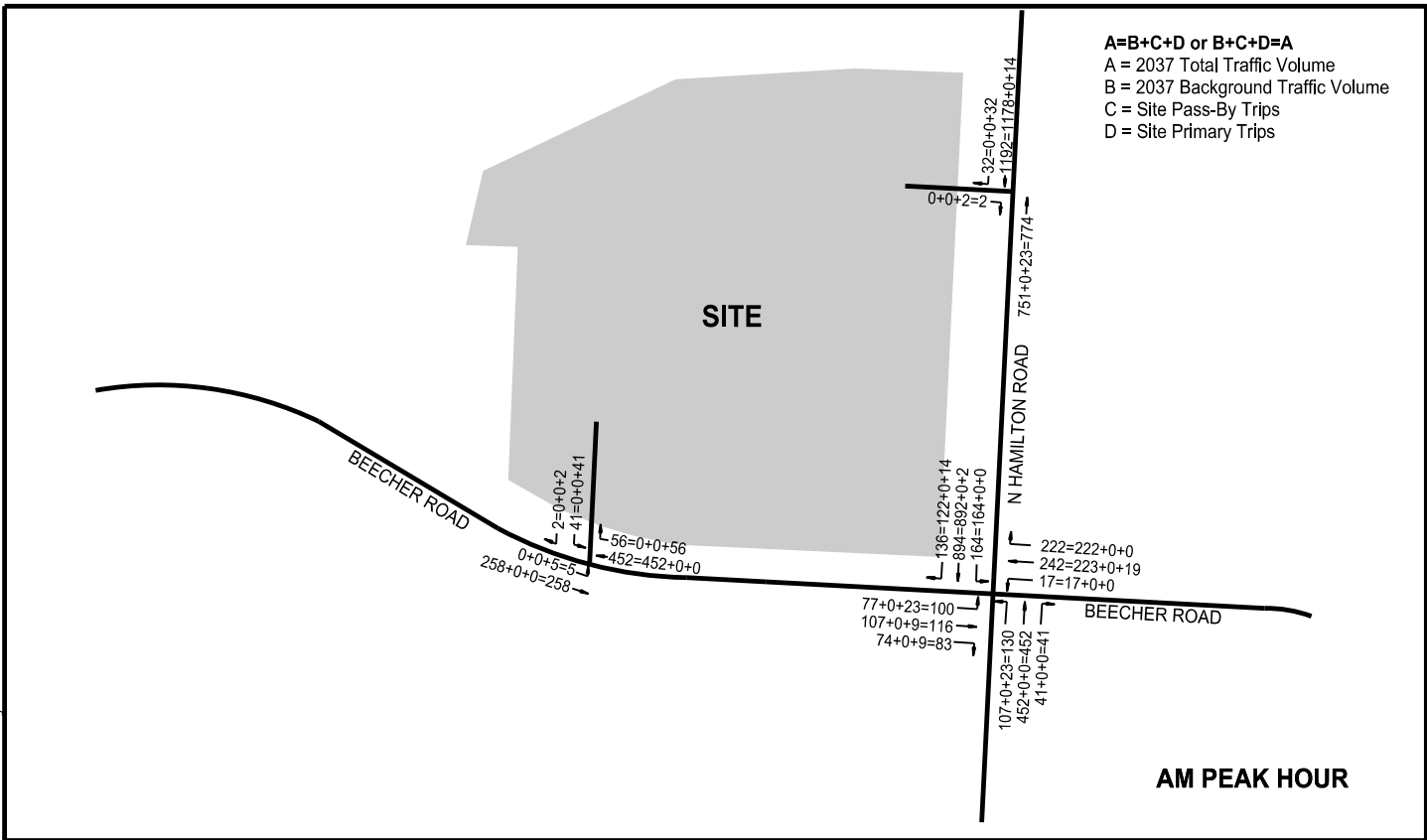
Table 1. Trip Generation Data, AM Peak

Land Use	Independent Variable	Weekday AM Peak Hour			
820 - Shopping Center	2,600 sf	Directional Distribution		Total	Pass-By 0%
		Total		2	100%
		Entering	62%	1	0
		Exiting	38%	1	1
932 - High-Turnover (Sit-Down) Restaurant	5,700 sf	Directional Distribution		Total	Pass-By 0%
		Total		62	100%
		Entering	55%	34	0
		Exiting	45%	28	34
720 - Medical-Dental Office Building	18,000 sf	Directional Distribution		Total	Pass-By 0%
		Total		43	100%
		Entering	79%	34	0
		Exiting	21%	9	34
720 - Medical-Dental Office Building	13,000 sf	Directional Distribution		Total	Pass-By 0%
		Total		31	100%
		Entering	79%	24	0
		Exiting	21%	7	24
Total		Directional Distribution		Total	Pass-By 0%
		Total		138	100%
		Entering	67%	93	0
		Exiting	33%	45	93

Table 2. Trip Generation Data, PM Peak

Land Use	Independent Variable	Weekday PM Peak Hour			
820 - Shopping Center	2,600 sf	Directional Distribution		Total	Pass-By 34%
		Total		10	66%
		Entering	48%	5	4
		Exiting	52%	5	3
932 - High-Turnover (Sit-Down) Restaurant	5,700 sf	Directional Distribution		Total	Pass-By 43%
		Total		56	57%
		Entering	60%	34	24
		Exiting	40%	22	15
720 - Medical-Dental Office Building	18,000 sf	Directional Distribution		Total	Pass-By 0%
		Total		64	100%
		Entering	28%	18	0
		Exiting	72%	46	18
720 - Medical-Dental Office Building	13,000 sf	Directional Distribution		Total	Pass-By 0%
		Total		46	100%
		Entering	28%	13	0
		Exiting	72%	33	13
Total		Directional Distribution		Total	Pass-By 16%
		Total		176	84%
		Entering	40%	70	28
		Exiting	60%	106	17

FILE NAME: X:\Active ISO Projects\OH Office Projects\GALZAD Gallos Zadeh\16140 Viking Commerce Center\Drawings\Created\Figure 5 - Total Traffic Volumes.dgn



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		PROJECT: VIKING COMMERCE CENTER N HAMILTON @ BEECHER	
		TITLE: PROJECTED (2037) TOTAL TRAFFIC VOLUMES	

SCALE: N.T.S.

Turn Lane Length Requirements

At the intersection of North Hamilton Road and Beecher Road, storage lengths of the affected turn lanes were checked for adequacy (Figures 401-9E and 401-10E of the ODOT Location and Design Manual, Volume 1) under 2037 AM and PM peak period “no-build” and “build” conditions. The turn lane length calculation worksheets are contained in Appendix F, and a summary of the results is found in Table 3. For the purpose of estimating turn lane requirements, a cycle length of 90 seconds was used at the signal. The existing northbound left turn lane is roughly 325 feet in length, which is adequate for both the “no-build” and “build” conditions.

The existing eastbound left turn lane, however, is technically not long enough for the AM and PM “build” conditions. The calculated storage requirement for this lane is 20 feet longer than the existing turn lane length. As shown in the appendix worksheets, a storage length of 150 feet is called for in the ODOT manual -- even though the average number of vehicles to be stored each signal cycle is three. These 3 vehicles may consume only 75 feet of the 130-foot storage lane. This indicates that the current lane length is adequate to accommodate the projected left turning traffic volumes.

Potential queues in the eastbound through/right lane were also evaluated to see if they might interfere with egress from the proposed site driveway. According to the ODOT manual, a through/right queue might reach 200 feet in length -- which would not block the driveway. Further, average queues of 5 vehicles per cycle (equaling about 125 feet queue length) would not block the left turn lane.

Thus, no modifications are recommended.

Table 3. 2037 Turn Lane Length Requirements, North Hamilton Road @ Beecher Road

Approach	Lane	*Existing Length	No Build		Build	
AM Peak						
Eastbound	Left	130'	*Required Length	100'	*Required Length	150'
			Through Queue Backup	200'	Through Queue Backup	200'
			*Recommended Length	130'	*Recommended Length	130'
Northbound	Left	325'	*Required Length	150'	*Required Length	175'
			Through Queue Backup	250'	Through Queue Backup	250'
			*Recommended Length	325'	*Recommended Length	325'
PM Peak						
Eastbound	Left	130'	*Required Length	100'	*Required Length	150'
			Through Queue Backup	150'	Through Queue Backup	175'
			*Recommended Length	130'	*Recommended Length	130'
Northbound	Left	325'	*Required Length	100'	*Required Length	100'
			Through Queue Backup	500'	Through Queue Backup	500'
			*Recommended Length	325'	*Recommended Length	325'

*Excludes diverging taper

Sight Distance Evaluation

The ODOT Location and Design Manual provides recommended Intersection Sight Distances (ISD) for a passenger car driver completing left and right turns from an intersection approach. At a design speed of 30 mph, the ISD is 335 feet. The sight distance was plotted on the site map for the Viking Commerce Center as shown in Appendix G. As can be seen, a driver looking to the right would have unobstructed view of vehicles approaching from the west. Looking to the left, a driver would also have an unobstructed view of vehicles approaching from the east.

Capacity Analyses and Results

Capacity analyses were performed using Synchro 8 Software. The analyses were based on Highway Capacity Manual (HCM) 2010 methodologies.

The quality of traffic flow was determined for 2037 “no-build” and “build” conditions. The standard criterion used to define the quality of traffic flow is the level of service, which is a measure of effectiveness of the operation of an intersection. The level of service value is based on the procedure defined in the Highway Capacity Manual (HCM) and the associated Highway Capacity Software (HCS). This is a qualitative assessment of factors such as speed, volume, geometry, delays, and ease of maneuvering. All analysis techniques specify the quality of operations as a letter with respect to the amount of delay at the intersection, and the resulting level of service criteria are shown in Table 4. A level of service ‘D’ is typically acceptable during peak periods of operation. No individual movement should operate below level of service ‘E’, and no approach should be below ‘D’.

Table 4. HCM Level of Service Criteria for Intersections

Level of Service	Average Delay (sec/veh)	
	Unsignalized Intersections	Signalized Intersections
A	≤ 10.0	≤ 10.0
B	> 10.0 and ≤ 15.0	> 10.0 and ≤ 20.0
C	> 15.0 and ≤ 25.0	> 20.0 and ≤ 35.0
D	> 25.0 and ≤ 35.0	> 35.0 and ≤ 55.0
E	> 35.0 and ≤ 50.0	> 55.0 and ≤ 80.0
F	> 50.0	> 80.0

Source: Transportation Research Board, *Highway Capacity Manual*, Special Report 209, National Research Council, Washington, DC, 2010.

The HCM 2010 analyzes T-intersections as Two Way Stop Controlled (TWSC) and the North Hamilton Road and Beecher Road access points were analyzed as such. HCM analysis of a stop controlled intersection does not provide an overall intersection LOS for three reasons:

1. Major-street through vehicles are assumed to experience zero delay.
2. The disproportionate number of major-street through vehicles at a typical TWSC intersection skews the weighted average of all movements, resulting in a very low overall average delay for all vehicles.
3. The resulting low delay can mask important LOS deficiencies for minor movements.

A summary of the intersection lane LOS for the design year (2037) build and no-build scenarios are shown in Tables 5 and 6 and detailed software outputs are contained in Appendix H.

The results in Table 5 show that the signalized intersection approaches operate at the same acceptable level of service for both “build” and “no-build” conditions during all time periods under consideration. The overall intersection level of service changed from “B” during the AM “no build” to LOS “C” during the AM “build” condition as a result of an increase in delay from 19.0 sec/veh to 21.1 sec/veh which is 2.1 sec into LOS C. Similarly, during the evening peak period, though all the approaches maintained the same LOS during the “build” scenario, the overall intersection LOS changed from “B” to “C” due to a 3.7 sec/veh increase in delay.

Table 5. 2037 HCM Level of Service (Delay), North Hamilton Road & Beecher Road

Approach	AM Peak Hour		PM Peak Hour	
	No Build	Build	No Build	Build
Eastbound	B (19.9)	B (19.8)	C (23.5)	C (25.1)
Westbound	B (18.4)	B (19.6)	C (20.6)	C (25.9)
Northbound	B (14.0)	B (14.9)	C (21.2)	C (24.3)
Southbound	C (21.6)	C (25.3)	B (14.8)	B (18.8)
Overall	B (19.0)	C (21.1)	B (18.8)	C (22.5)

Table 6. 2037 HCM Lane Level of Service (Delay), Beecher Rd and Full Access Drive

Lane	Delay, sec/veh (HCM 2010 Level of Service)	
	Build	
	AM Peak Hour	PM Peak Hour
Eastbound Left Turn	8.6 (A)	7.5 (A)
Southbound Left Turn	16.8 (C)	10.8 (B)

The values in Table 6 show that the full access drive on Beecher Road will operate at a high performance level. The southbound left turn at Beecher Road, will operate at LOS “C” during the “build” AM peak hour with a delay of 16.8 sec/veh which is just 1.8 sec into level of service C.

Conclusions and Recommendations

Based on the results from the “no-build” and “build” analyses, the likely impacts associated with the construction of the proposed Viking Commerce Center on the operation of the North Hamilton Road and Beecher Road signalized intersection, as well as operations at each of the access points, were determined.

No exclusive turn lanes will be required on Beecher Road at the Beecher Road full access drive. Also, the North Hamilton Road right-in/right-out access drive will not require an exclusive right turn lane on North Hamilton Road.

The analyses of the signalized intersection and the access points show that, with the construction of the Viking Commerce Center, all the approaches at the intersection will continue to operate effectively with no significant increase in delay even with the addition of access points on North Hamilton Road and Beecher Road.

With the barrier median on Hamilton Road, access to and from the site via Hamilton Road is limited to right turns in and out. As such, a full access drive on Beecher Road is essential. Since the subject property has a right of access on Beecher Road, it is recommended that a site driveway be provided as far west as possible from the Hamilton Road intersection. The current site plan shows this driveway located 325 feet (centerline to centerline) west of Hamilton Road. Based on the studies presented in this report, the proposed access point will operate safely and efficiently. In addition, projected eastbound traffic queues on Beecher Road will not interfere with traffic operations at the proposed site access drive.

Beyond providing general site access, the driveway on Beecher Road provides a convenient and safe point of access for fire and emergency services.

The available sight distances are adequate for safe turns from the full access drive onto Beecher Road.

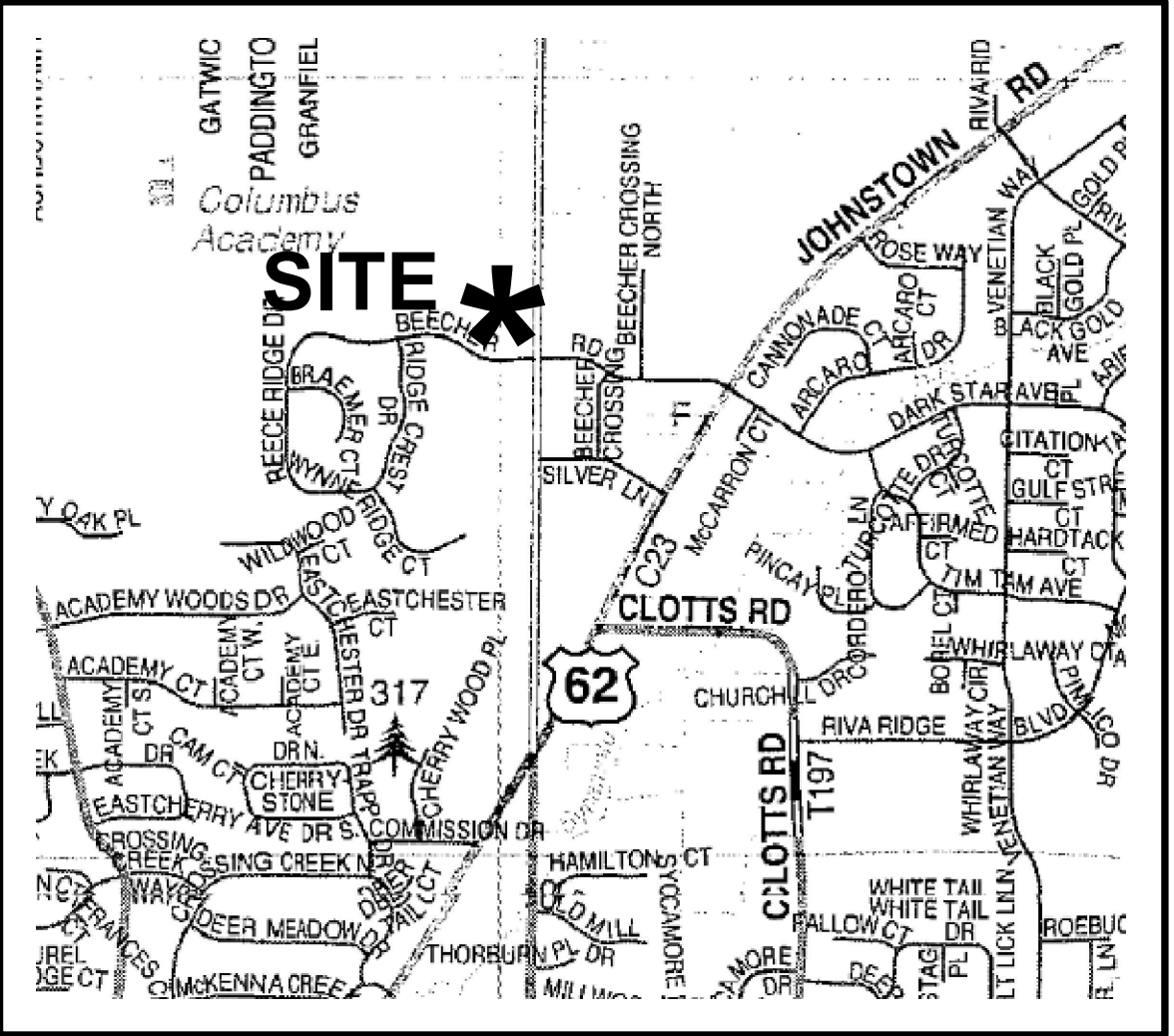
In order to advise drivers exiting the site onto Beecher Road that Beecher Road west of the Ravine is basically limited to neighborhood or school traffic, it is recommended that signage be provided just west of the drive stating "Local Traffic" or "No Outlet". Further, it is recommended that a "No Left Turn" signage be installed at the right-in/right-out access drive for eastbound left turn prohibition onto Hamilton Road.

It should be noted that this traffic study was performed assuming the maximum potential intensity of development on the site. High trip generation rates were assumed for land-uses in order to allow testing of potential worst-case conditions. The analyses showed that the planned site access system, as well as the area roadway system, will operate safely and efficiently. Conditions will be even better if what is actually built on the site is less intense than that used as bases for this study.

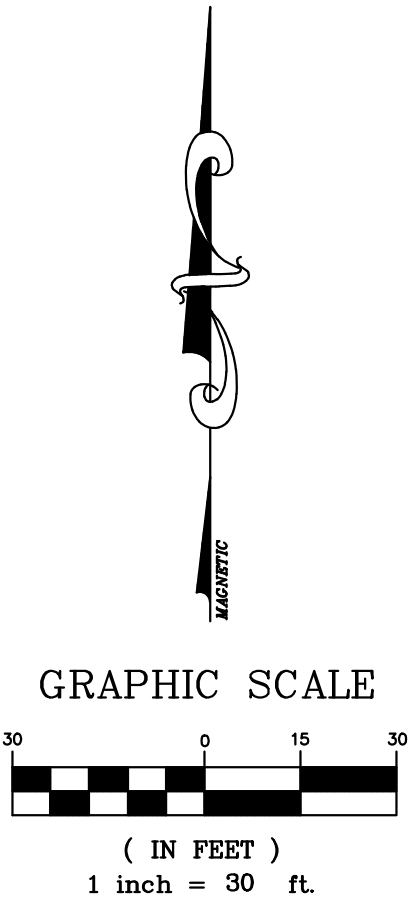
Appendices

Appendix A. Site Plan

Z:\15-0023-412\DWG\PRODUCTION DRAWINGS\EXHIBIT\Traffic Study Site Exhibit.dwg layout1 Sep 01, 2016 10:43:49am twaner



LOCATION MAP
NO SCALE



CITY OF GAHANNA, OHIO
PRELIMINARY SITE PLAN
FOR
VIKING COMMERCE CENTER

PLAN PREPARED BY:

**ADVANCED**
CIVIL DESIGN
ENGINEERS SURVEYORS

422 BEECHER ROAD
Gahanna, Ohio 43230
ph 614.428.7750
fax 614.428.7755

SCALE: 1"=30'
DATE: 08/02/2016

SHEET 1 / 1

Appendix B. Traffic Count Data



**Transportation Solutions for
Today and Tomorrow**

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Phone: (614) 459-7930

Counter: 4264
Counted By: SA
Weather: Clear
Other:

File Name : Beecher Road
Site Code : 00000000
Start Date : 5/17/2016
Page No : 1

Groups Printed- Passenger Vehicles - Trucks

	BEECHER ROAD Eastbound					BEECHER ROAD Westbound					N HAMILTON RD Northbound					N HAMILTON ROAD Southbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
06:45 AM	0	0	5	0	5	1	5	22	0	28	5	53	2	0	60	17	129	8	0	154	247
Total	0	0	5	0	5	1	5	22	0	28	5	53	2	0	60	17	129	8	0	154	247
07:00 AM	8	6	11	0	25	3	21	36	0	60	8	58	4	0	70	20	150	12	0	182	337
07:15 AM	8	9	9	0	26	4	20	42	0	66	16	72	9	0	97	30	185	17	0	232	421
07:30 AM	10	14	16	0	40	5	97	42	0	144	27	78	11	0	116	31	210	35	0	276	576
07:45 AM	35	46	18	0	99	2	72	50	0	124	27	103	9	0	139	30	169	29	0	228	590
Total	61	75	54	0	190	14	210	170	0	394	78	311	33	0	422	111	714	93	0	918	1924
08:00 AM	17	30	17	0	64	3	7	51	0	61	2	124	5	0	131	46	179	7	0	232	488
*** BREAK ***																					
Total	17	30	17	0	64	3	7	51	0	61	2	124	5	0	131	46	179	7	0	232	488
*** BREAK ***																					
02:30 PM	1	5	3	0	9	10	4	50	2	66	3	142	10	0	155	54	146	9	0	209	439
02:45 PM	12	2	9	0	23	10	25	30	0	65	16	148	10	0	174	43	166	16	0	225	487
Total	13	7	12	0	32	20	29	80	2	131	19	290	20	0	329	97	312	25	0	434	926
03:00 PM	5	6	4	2	17	16	15	36	0	67	9	137	13	0	159	49	130	4	0	183	426
03:15 PM	20	48	6	0	74	12	11	33	1	57	9	118	7	2	136	44	152	9	0	205	472
03:30 PM	10	23	12	0	45	12	11	55	0	78	6	185	14	0	205	64	163	7	0	234	562
03:45 PM	5	7	6	0	18	12	12	48	0	72	9	198	16	0	223	53	144	8	0	205	518
Total	40	84	28	2	154	52	49	172	1	274	33	638	50	2	723	210	589	28	0	827	1978
04:00 PM	10	10	5	0	25	15	8	36	0	59	8	214	19	0	241	59	159	5	0	223	548
04:15 PM	10	5	5	0	20	13	5	45	0	63	6	169	9	0	184	58	130	3	0	191	458
04:30 PM	7	11	4	0	22	15	3	46	0	64	5	201	8	0	214	55	130	2	2	189	489
04:45 PM	8	9	7	0	24	22	3	64	4	93	6	213	12	0	231	70	150	4	0	224	572
Total	35	35	21	0	91	65	19	191	4	279	25	797	48	0	870	242	569	14	2	827	2067
05:00 PM	8	11	5	0	24	21	5	86	0	112	7	239	4	0	250	47	157	5	0	209	595
05:15 PM	6	7	3	0	16	15	6	44	0	65	9	208	10	0	227	64	153	5	0	222	530
05:30 PM	18	26	9	0	53	13	5	45	2	65	14	228	7	0	249	55	149	7	0	211	578
05:45 PM	4	7	2	0	13	4	12	38	0	54	10	207	6	0	223	73	164	6	0	243	533
Total	36	51	19	0	106	53	28	213	2	296	40	882	27	0	949	239	623	23	0	885	2236
06:00 PM	8	10	13	0	31	5	13	52	1	71	10	216	5	0	231	70	175	6	0	251	584



**Transportation Solutions for
Today and Tomorrow**

941 Chatham Lane, Suite 319, Columbus, OH 43221
Phone: (614) 459-7930

File Name : Beecher Road
Site Code : 00000000
Start Date : 5/17/2016
Page No : 2

Groups Printed- Passenger Vehicles - Trucks

	BEECHER ROAD Eastbound					BEECHER ROAD Westbound					N HAMILTON RD Northbound					N HAMILTON ROAD Southbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
06:15 PM	3	8	2	0	13	13	2	28	0	43	4	188	6	0	198	59	145	14	0	218	472
06:30 PM	4	7	3	0	14	13	3	27	0	43	3	179	4	0	186	65	131	5	0	201	444
Grand Total	217	307	174	2	700	239	365	1006	10	1620	219	3678	200	2	4099	1156	3566	223	2	4947	11366
Apprch %	31	43.9	24.9	0.3		14.8	22.5	62.1	0.6		5.3	89.7	4.9	0		23.4	72.1	4.5	0		
Total %	1.9	2.7	1.5	0	6.2	2.1	3.2	8.9	0.1	14.3	1.9	32.4	1.8	0	36.1	10.2	31.4	2	0	43.5	
Passenger Vehicles	217	306	174	2	699	238	365	1006	10	1619	219	3668	200	2	4089	1155	3557	223	1	4936	11343
% Passenger Vehicles	100	99.7	100	100	99.9	99.6	100	100	100	99.9	100	99.7	100	100	99.8	99.9	99.7	100	50	99.8	99.8
Trucks	0	1	0	0	1	1	0	0	0	1	0	10	0	0	10	1	9	0	1	11	23
% Trucks	0	0.3	0	0	0.1	0.4	0	0	0	0.1	0	0.3	0	0	0.2	0.1	0.3	0	50	0.2	0.2

	BEECHER ROAD Eastbound					BEECHER ROAD Westbound					N HAMILTON RD Northbound					N HAMILTON ROAD Southbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:45 AM to 11:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:15 AM																					
07:15 AM	8	9	9	0	26	4	20	42	0	66	16	72	9	0	97	30	185	17	0	232	421
07:30 AM	10	14	16	0	40	5	97	42	0	144	27	78	11	0	116	31	210	35	0	276	576
07:45 AM	35	46	18	0	99	2	72	50	0	124	27	103	9	0	139	30	169	29	0	228	590
08:00 AM	17	30	17	0	64	3	7	51	0	61	2	124	5	0	131	46	179	7	0	232	488
Total Volume	70	99	60	0	229	14	196	185	0	395	72	377	34	0	483	137	743	88	0	968	2075
% App. Total	30.6	43.2	26.2	0		3.5	49.6	46.8	0		14.9	78.1	7	0		14.2	76.8	9.1	0		
PHF	.500	.538	.833	.000	.578	.700	.505	.907	.000	.686	.667	.760	.773	.000	.869	.745	.885	.629	.000	.877	.879



**Transportation Solutions for
Today and Tomorrow**

941 Chatham Lane, Suite 319, Columbus, OH 43221
Phone: (614) 459-7930

File Name : Beecher Road
Site Code : 00000000
Start Date : 5/17/2016
Page No : 3

	BEECHER ROAD Eastbound					BEECHER ROAD Westbound					N HAMILTON RD Northbound					N HAMILTON ROAD Southbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 12:00 PM to 06:30 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:45 PM																					
04:45 PM	8	9	7	0	24	22	3	64	4	93	6	213	12	0	231	70	150	4	0	224	572
05:00 PM	8	11	5	0	24	21	5	86	0	112	7	239	4	0	250	47	157	5	0	209	595
05:15 PM	6	7	3	0	16	15	6	44	0	65	9	208	10	0	227	64	153	5	0	222	530
05:30 PM	18	26	9	0	53	13	5	45	2	65	14	228	7	0	249	55	149	7	0	211	578
Total Volume	40	53	24	0	117	71	19	239	6	335	36	888	33	0	957	236	609	21	0	866	2275
% App. Total	34.2	45.3	20.5	0		21.2	5.7	71.3	1.8		3.8	92.8	3.4	0		27.3	70.3	2.4	0		
PHF	.556	.510	.667	.000	.552	.807	.792	.695	.375	.748	.643	.929	.688	.000	.957	.843	.970	.750	.000	.967	.956

Counter: 4264
Counted By: SA
Weather: Clear
Other:

File Name : New Beecher Rd Count
Site Code : 00000000
Start Date : 10/4/2016
Page No : 1

Groups Printed- Passenger Vehicles - Trucks

	BEECHER RD Eastbound					BEECHER RD Westbound					N HAMILTON RD Northbound					N HAMILTON RD Southbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
07:15 AM	10	8	17	0	35	0	34	0	0	34	19	0	0	0	19	0	0	13	0	13	101
07:30 AM	12	20	15	0	47	0	64	0	0	64	35	0	0	0	35	0	0	39	0	39	185
07:45 AM	31	43	19	0	93	0	83	0	0	83	29	0	0	0	29	0	0	47	0	47	252
Total	53	71	51	0	175	0	181	0	0	181	83	0	0	0	83	0	0	99	0	99	538
08:00 AM	17	26	16	0	59	0	5	0	0	5	6	0	0	0	6	0	0	3	0	3	73
Grand Total	70	97	67	0	234	0	186	0	0	186	89	0	0	0	89	0	0	102	0	102	611
Apprch %	29.9	41.5	28.6	0		0	100	0	0		100	0	0	0		0	0	100	0		
Total %	11.5	15.9	11	0	38.3	0	30.4	0	0	30.4	14.6	0	0	0	14.6	0	0	16.7	0	16.7	
Passenger Vehicles	70	97	67	0	234	0	186	0	0	186	89	0	0	0	89	0	0	102	0	102	611
% Passenger Vehicles	100	100	100	0	100	0	100	0	0	100	100	0	0	0	100	0	0	100	0	100	100
Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	BEECHER RD Eastbound					BEECHER RD Westbound					N HAMILTON RD Northbound					N HAMILTON RD Southbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:15 AM to 08:00 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:15 AM																					
07:15 AM	10	8	17	0	35	0	34	0	0	34	19	0	0	0	19	0	0	13	0	13	101
07:30 AM	12	20	15	0	47	0	64	0	0	64	35	0	0	0	35	0	0	39	0	39	185
07:45 AM	31	43	19	0	93	0	83	0	0	83	29	0	0	0	29	0	0	47	0	47	252
08:00 AM	17	26	16	0	59	0	5	0	0	5	6	0	0	0	6	0	0	3	0	3	73
Total Volume	70	97	67	0	234	0	186	0	0	186	89	0	0	0	89	0	0	102	0	102	611
% App. Total	29.9	41.5	28.6	0		0	100	0	0		100	0	0	0		0	0	100	0		
PHF	.565	.564	.882	.000	.629	.000	.560	.000	.000	.560	.636	.000	.000	.000	.636	.000	.000	.543	.000	.543	.606

Appendix C. MORPC Growth Rate Information

From: [Hwashik Jang](#)
To: [Simon Addei](#)
Cc: [Nick Gill](#); [Zhuojun Jiang](#)
Subject: RE: Growth Rate Request - N. Hamilton Road and Beecher Road
Date: Thursday, June 02, 2016 2:41:32 PM
Attachments: [image001.jpg](#)

Simon,

We have completed growth rate for N. Hamilton Road and Beecher Road intersection.
Please use a linear annual growth rates as summarized in the following table below.

<u>Location</u>	<u>Linear Annual Growth Rate</u>
Beecher Rd e/o Hamilton Rd	1.00%
Hamilton Rd n/o Beecher Rd	1.00%
Beecher Rd w/o Hamilton Rd	0.50%
Hamilton Rd s/o Beecher Rd	1.00%

Note: This is planning level analysis based on MORPC regional travel demand model.
If you have any other questions, please let me know.

Thanks,

-Hwashik

Hwashik Jang | hjang@morpc.org | MORPC
Tel 614.233.4145 | Fax 614.233.4245

From: Nick Gill
Sent: Wednesday, May 18, 2016 11:52 AM
To: Hwashik Jang
Cc: nickgill5+dpjlwd79ukyuvqdzlgu@boards.trello.com; Zhuojun Jiang
Subject: FW: Growth Rate Request - N. Hamilton Road and Beecher Road

From: Simon Addei [<mailto:AddeiS@transassociates.com>]
Sent: Wednesday, May 18, 2016 11:26 AM
To: Nick Gill
Cc: Mark Mann
Subject: Growth Rate Request - N. Hamilton Road and Beecher Road

Hi Nick,

We are working on a traffic study near the intersection of N. Hamilton Road and Beecher Road in Gahanna. Would you be able to assist us in providing the appropriate traffic growth rates to apply to the current volumes at this intersection?

I have attached AM and PM peak hour traffic count data at the intersection. Also attached is the most current site plan. The site will contain 16,000 -sf of general office space, 11,500-sf of Dental/Medical Office, 4,200-sf of restaurant, and, 3,900-sf. of retail space.

Our opening year is 2017 and the design year is 2027. We are not considering any significant road network improvements for the design year. The study will be approved by Robert Priestas of the City of Gahanna.

Should you have any questions, please contact me. Thank you in advance.

Simon Addei, E. I. T.

Traffic Engineer



941 Chatham Lane, Suite 319

Columbus, OH, 43221

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Appendix D. Trip Assignment

AM Peak Hour Trip Assignments
Viking Commerce Center - North Hamilton Road @ Beecher Road

Linear Annual Growth Rate (%)	Varies
Current Year	2016
Opening Year	2017
Design Year	2037

		Weekday AM Peak Hour (7:15 - 8:15 AM)												
Intersection	Lane Group	Current Traffic Volumes (2016)	No Build Traffic Volumes		Site Generated Traffic Volumes								Build Traffic Volumes	
					Pass-By				Pass-By		Primary			
			Opening Year (2017)	Design Year (2037)	Entering		Exiting		Pass-By		Primary		Opening Year (2017)	Design Year (2037)
					Distribution	Trips	Distribution	Trips	Distribution	Trips	Distribution	Trips		
N Hamilton Rd @ Beecher Rd	EBL	70	70	77	0%	0	0%	0	0%	0	50%	23	93	100
	EBT	97	97	107	0%	0	0%	0	0%	0	20%	9	106	116
	EBR	67	67	74	0%	0	0%	0	0%	0	20%	9	76	83
	WBL	14	14	17	0%	0	0%	0	0%	0			14	17
	WBT	186	186	223	0%	0	0%	0	0%	0	20%	19	205	242
	WBR	185	185	222	0%	0	0%	0	0%	0			185	222
	NBL	89	89	107	0%	0	0%	0	0%	0	25%	23	112	130
	NBT	377	377	452	0%	0	0%	0	0%	0			377	452
	NBR	34	34	41	0%	0	0%	0	0%	0			34	41
	SBL	137	137	164	0%	0	0%	0	0%	0			137	164
	SBT	743	743	892	0%	0	0%	0	0%	0	5%	2	745	894
	SBR	102	102	122	0%	0	0%	0	0%	0	15%	14	116	136
N Hamiton @ Site Access	EBL												0	0
	EBT												0	0
	EBR	0	0	0	0%	0					5%	2	2	2
	WBL												0	0
	WBT												0	0
	WBR												0	0
	NBL												0	0
	NBT	632	632	751	0%	0			0%	0	50%	23	655	774
	NBR												0	0
	SBL												0	0
	SBT	982	982	1178	0%	0			0%		15%	14	996	1192
	SBR	0	0	0	0%	0			0%		35%	32	32	32
Beecher Rd @ Site Access	EBL	0	0	0	0%	0	0%	0	0%	0	5%	5	5	5
	EBT	234	234	258	0%	0	0%	0	0%	0			234	258
	EBR												0	0
	WBL												0	0
	WBT	377	377	452	0%	0	0%	0	0%	0			377	452
	WBR	0	0	0	0%	0	0%	0	0%	0	60%	56	56	56
	NBL												0	0
	NBT												0	0
	NBR												0	0
	SBL	0	0	0	0%	0	0%	0	0%	0	90%	41	41	41
	SBT												0	0
	SBR	0	0	0	0%						5%	2	2	2

PM Peak Hour Trip Assignments
Viking Commerce Center - North Hamilton Road @ Beecher Road

Linear Annual Growth Rate (%)	Varies
Current Year	2016
Opening Year	2017
Design Year	2037

		Weekday PM Peak Hour (4:45 - 5:45 PM)												
Intersection	Lane Group	Current Traffic Volumes (2016)	No Build Traffic Volumes		Site Generated Traffic Volumes								Build Traffic Volumes	
					Pass-By				Pass-By					
			Opening Year (2017)	Design Year (2037)	Entering		Exiting		Pass-By		Primary		Opening Year (2017)	Design Year (2037)
					Distribution	Trips	Distribution	Trips	Distribution	Trips	Distribution	Trips		
N Hamilton Rd @ Beecher Rd	EBL	40	40	44	-2%	0	50%	7	48%	7	50%	47	94	98
	EBT	53	53	58	-2%	0			-2%	0	20%	19	72	77
	EBR	24	24	26	-1%	0			-1%	0	20%	19	43	45
	WBL	71	71	85	-3%	-1			-3%	-1			70	84
	WBT	19	19	23	14%	3			14%	3	20%	11	33	37
	WBR	239	239	287	-11%	-2			-11%	-2			237	285
	NBL	36	36	43	41%	7			41%	7	25%	13	56	63
	NBT	888	888	1066	-39%	-7			-39%	-7			881	1059
	NBR	33	33	40	-1%	0			-1%	0			33	40
	SBL	236	236	283	-10%	-2	10%	1	0%	-1			235	282
	SBT	609	609	731	-27%	-5	27%	3	0%	-2	5%	5	612	734
	SBR	21	21	25	-1%	0	1%	0	0%	0	15%	8	29	33
N Hamiton @ Site Access	EBL								0%	0			0	0
	EBT												0	0
	EBR	0			0%		38%	4	38%	4	5%	5	9	9
	WBL								0%	0			0	0
	WBT								0%	0			0	0
	WBR								0%	0			0	0
	NBL								0%	0			0	0
	NBT	1167	1167	1397	-51%	-9	50%	7	-2%	-2	50%	47	1212	1442
	NBR								0%	0			0	0
	SBL								0%	0			0	0
	SBT	866	866	1039	-38%	-7			-38%	-7	15%	8	867	1040
	SBR	0	0	0	38%	7			38%	7	35%	18	25	25
Beecher Rd @ Site Access	EBL	0	0	0	5%	0			5%	0	5%	3	3	3
	EBT	117	117	128	-5%	0			0%	0			117	128
	EBR								0%	0			0	0
	WBL								0%	0			0	0
	WBT	76	76	91	-2%	0			-2%	0			76	91
	WBR	0	0	0	57%	10			57%	10	60%	32	42	42
	NBL								0%	0			0	0
	NBT								0%	0			0	0
	NBR								0%	0			0	0
	SBL	0	0	0	0%		59%	7	59%	7	90%	85	92	92
	SBT								0%	0			0	0
	SBR	0	0	0	0%		3%	0	3%	0	5%	5	5	5

Appendix E. Turn Lane Warrants

RIGHT TURN LANE WARRANT WORKSHEET

Project Name Viking Commerce Center
 Project # GALZAD - 16140
 Compiled By: SA - Trans Associates
 Intersection Hamilton Rd & RIRO Access Dr

Approach SB
 Year Analyzed 2037
 Condition Build
 Peak Hour(s) AM and PM

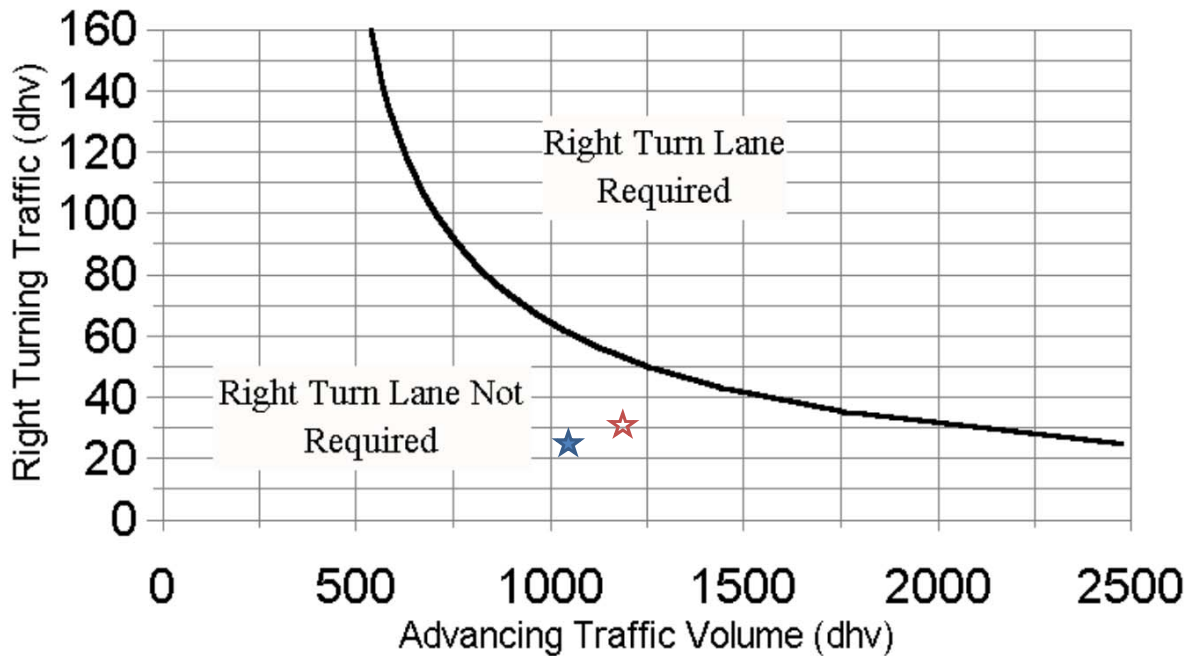
Right Turning traffic
 Advancing Traffic
 Warrant Met?

AM	PM
32	25
1,224	1,065
NO	NO



General Information:

4 Lane Highway Right Turn Lane Warrant (= <40 mph or 70 kph Posted Speed)



Source: ODOT Location & Design Manual - Volume I (January 2006)
 401-6cE

10/20/2016

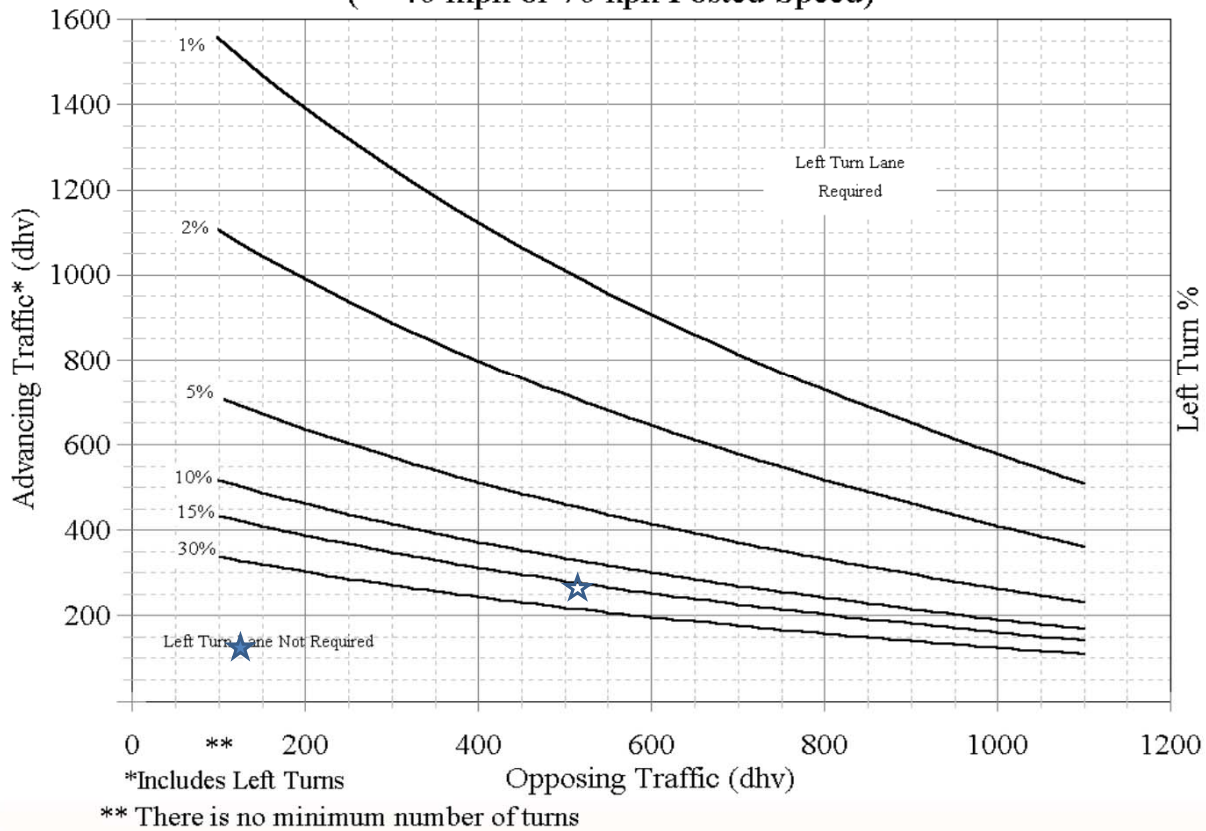
LEFT TURN LANE WARRANT WORKSHEET

Intersection	<u>Beecher Road Full Access Drive</u>	Approach	<u>EB</u>
Project Name	<u>Viking Commerce Center</u>	Year Analyzed	<u>2037</u>
Project #	<u>GALZAD - 16140</u>	Condition	<u>Build</u>
Analyst	<u>SA - Trans Associates</u>	Peak Hour(s)	<u>AM and PM</u>

	AM	PM
Advancing Traffic	263	131
Opposing Traffic	508	133
Left Turn %	2%	2%
Warrant Met?	NO	NO
	★	★

General Information:

2-Lane Highway Left Turn Lane Warrant (=<40 mph or 70 kph Posted Speed)



Source: ODOT Location & Design Manual -Volume I (January 2006)
 401-5aE

10/20/2016

RIGHT TURN LANE WARRANT WORKSHEET

Intersection Beecher Road Full Access Drive
Project Name Viking Commerce Center
Project # GALZAD - 16140
Analyst SA - Trans Associates

Approach WB
Year Analyzed 2037
Condition Build
Peak Hour(s) AM and PM

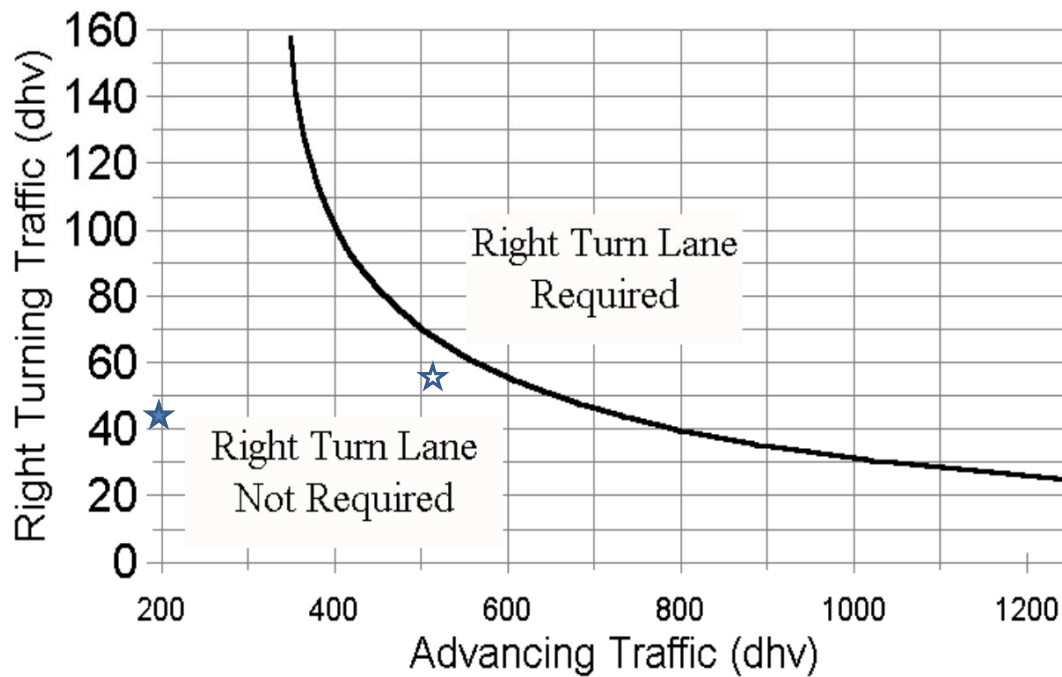
Right Turning traffic
 Advancing Traffic
 Warrant Met?

AM	PM
56	42
508	133
NO	NO



General Information:

2-Lane Highway Right Turn Lane Warrant =< 40 mph or 70 kph Posted Speed



Source: ODOT Location & Design Manual - Volume I (January 2006)
 401-6aE

10/20/2016

Appendix F. Turn Lane Length Calculation Worksheets

Turn Lane Length Computation Worksheet (Based on ODOT's Location Design Manual)

Project Name: Viking Commerce Center
Project Number: GALZAD - 16140
Compiled By: SA - Trans Associates

Intersection: Hamilton Road @ Beecher Road
Year: 2037
Condition: No Build

General Information:

Approach	NB	EB
Movement	Left	Left
Peak Hour	AM	AM

Type of Traffic Control

Signalized	YES	YES
Unsignalized Stopped Crossroad	NO	NO
Unsignalized Through Road	NO	NO

Design Parameters

Design Speed	35	25
Turn Volume (vph)	107	77
Approach Volume (vph)	600	258
Turn Percentage	18%	30%
High or Low	HIGH	HIGH
Applicable Design Condition (A, B or C)	A	A
Cycle Length (sec)	90	90
Cycles/Hour	40	40
Average Number of Vehicles/Cycle	3	2
Storage Length (ft)	150	100

Design Method

Condition A (Storage Only)	Taper	50	50
	Storage	150	100
	Total	200	150
Condition B (High Speed Decel Only)	Taper	-	-
	Decel Length	-	-
	Total	-	-
Condition C (Moderate Speed Deceleration & Storage)	Taper	-	-
	Decel Length	-	-
	Storage	-	-
	Total	-	-

Required Storage and/or Decel Length (ft/lane) =	150	100
Required Turn Lane Length, including 50' taper (ft/lane) =	200	150

Note: EB - Eastbound, WB - Westbound, NB - Northbound, SB - Southbound

Source: January 2006 ODOT L & D Manual-Volume I: 401 - 9E, 401 -10E

Turn Lane Length Computation Worksheet (Based on ODOT's Location Design Manual)

Project Name: Viking Commerce Center
Project Number: GALZAD - 16140
Compiled By: SA - Trans Associates

Intersection: Hamilton Road @ Beecher Road
Year: 2037
Condition: Build

General Information:

Approach	NB	EB
Movement	Left	Left
Peak Hour	AM	AM

Type of Traffic Control

Signalized	YES	YES
Unsignalized Stopped Crossroad	NO	NO
Unsignalized Through Road	NO	NO

Design Parameters

Design Speed	35	25
Turn Volume (vph)	130	100
Approach Volume (vph)	623	299
Turn Percentage	21%	33%
High or Low	HIGH	HIGH
Applicable Design Condition (A, B or C)	A	A
Cycle Length (sec)	90	90
Cycles/Hour	40	40
Average Number of Vehicles/Cycle	4	3
Storage Length (ft)	175	150

Design Method

Condition A (Storage Only)	Taper	50	50
	Storage	175	150
	Total	225	200
Condition B (High Speed Decel Only)	Taper	-	-
	Decel Length	-	-
	Total	-	-
Condition C (Moderate Speed Deceleration & Storage)	Taper	-	-
	Decel Length	-	-
	Storage	-	-
	Total	-	-

Required Storage and/or Decel Length (ft/lane) =	175	150
Required Turn Lane Length, including 50' taper (ft/lane) =	225	200

Note: EB - Eastbound, WB - Westbound, NB - Northbound, SB - Southbound

Source: January 2006 ODOT L & D Manual-Volume I: 401 - 9E, 401 -10E

Turn Lane Length Computation Worksheet (Based on ODOT's Location Design Manual)

Project Name: Viking Commerce Center
Project Number: GALZAD - 16140
Compiled By: SA - Trans Associates

Intersection: Hamilton Road @ Beecher Road
Year: 2037
Condition: No Build

General Information:

Approach	NB	EB
Movement	Left	Left
Peak Hour	PM	PM

Type of Traffic Control

Signalized	YES	YES
Unsignalized Stopped Crossroad	NO	NO
Unsignalized Through Road	NO	NO

Design Parameters

Design Speed	35	25
Turn Volume (vph)	43	44
Approach Volume (vph)	1149	128
Turn Percentage	4%	34%
High or Low	LOW	HIGH
Applicable Design Condition (A, B or C)	A	A
Cycle Length (sec)	90	90
Cycles/Hour	40	40
Average Number of Vehicles/Cycle	2	2
Storage Length (ft)	100	100

Design Method

Condition A (Storage Only)	Taper	50	50
	Storage	100	100
	Total	150	150
Condition B (High Speed Decel Only)	Taper	-	-
	Decel Length	-	-
	Total	-	-
Condition C (Moderate Speed Deceleration & Storage)	Taper	-	-
	Decel Length	-	-
	Storage	-	-
	Total	-	-

Required Storage and/or Decel Length (ft/lane) =	100	100
Required Turn Lane Length, including 50' taper (ft/lane) =	150	150

Note: EB - Eastbound, WB - Westbound, NB - Northbound, SB - Southbound

Source: January 2006 ODOT L & D Manual-Volume I: 401 - 9E, 401 -10E

Turn Lane Length Computation Worksheet (Based on ODOT's Location Design Manual)

Project Name: Viking Commerce Center
Project Number: GALZAD - 16140
Compiled By: SA - Trans Associates

Intersection: Hamilton Road @ Beecher Road
Year: 2037
Condition: Build

General Information:

Approach	NB	EB
Movement	Left	Left
Peak Hour	PM	PM

Type of Traffic Control

Signalized	YES	YES
Unsignalized Stopped Crossroad	NO	NO
Unsignalized Through Road	NO	NO

Design Parameters

Design Speed	35	25
Turn Volume (vph)	63	98
Approach Volume (vph)	1162	220
Turn Percentage	5%	45%
High or Low	LOW	HIGH
Applicable Design Condition (A, B or C)	A	A
Cycle Length (sec)	90	90
Cycles/Hour	40	40
Average Number of Vehicles/Cycle	2	3
Storage Length (ft)	100	150

Design Method

Condition A (Storage Only)	Taper	50	50
	Storage	100	150
	Total	150	200
Condition B (High Speed Decel Only)	Taper	-	-
	Decel Length	-	-
	Total	-	-
Condition C (Moderate Speed Deceleration & Storage)	Taper	-	-
	Decel Length	-	-
	Storage	-	-
	Total	-	-

Required Storage and/or Decel Length (ft/lane) =	100	150
Required Turn Lane Length, including 50' taper (ft/lane) =	150	200

Note: EB - Eastbound, WB - Westbound, NB - Northbound, SB - Southbound

Source: January 2006 ODOT L & D Manual-Volume I: 401 - 9E, 401 -10E

Through Lane Backup Computation Worksheet (Based on ODOT's Location Design Manual)

Project Name: Viking Commerce Center
Project Number: GALZAD - 16140
Compiled By: SA - Trans Associates

Intersection: Hamilton Road @ Beecher Road
Year: 2037
Condition: No Build

General Information:

Approach	NB	EB
Number of Through Lanes	2	1

AM Peak Hour:

Through Volume (vph)	452	181
Cycle Length (sec)	90	90
Cycles/Hour	40	40
Average Number of Vehicles/Cycle	12	5
Average Number of Vehicles/Cycle/Lane	6	5
Through Queue Backup (ft)	250	200

PM Peak Hour:

Through Volume (vph)	1066	84
Cycle Length (sec)	90	90
Cycles/Hour	40	40
Average Number of Vehicles/Cycle	27	3
Average Number of Vehicles/Cycle/Lane	14	3
Through Queue Backup (ft)	500	150

Through Queue Backup Length (ft/lane) = **500** **200**

Note: EB - Eastbound, WB - Westbound, NB - Northbound, SB - Southbound

Source: January 2006 ODOT L&D Manual-Volume I: 401 - 9E, 401 -10E

Through Lane Backup Computation Worksheet (Based on ODOT's Location Design Manual)

Project Name: Viking Commerce Center
Project Number: GALZAD - 16140
Compiled By: SA - Trans Associates

Intersection: Hamilton Road @ Beecher Road
Year: 2037
Condition: Build

General Information:

Approach	NB	EB
Number of Through Lanes	2	1

AM Peak Hour:

Through Volume (vph)	452	199
Cycle Length (sec)	90	90
Cycles/Hour	40	40
Average Number of Vehicles/Cycle	12	5
Average Number of Vehicles/Cycle/Lane	6	5
Through Queue Backup (ft)	250	200

PM Peak Hour:

Through Volume (vph)	1059	122
Cycle Length (sec)	90	90
Cycles/Hour	40	40
Average Number of Vehicles/Cycle	27	4
Average Number of Vehicles/Cycle/Lane	14	4
Through Queue Backup (ft)	500	175

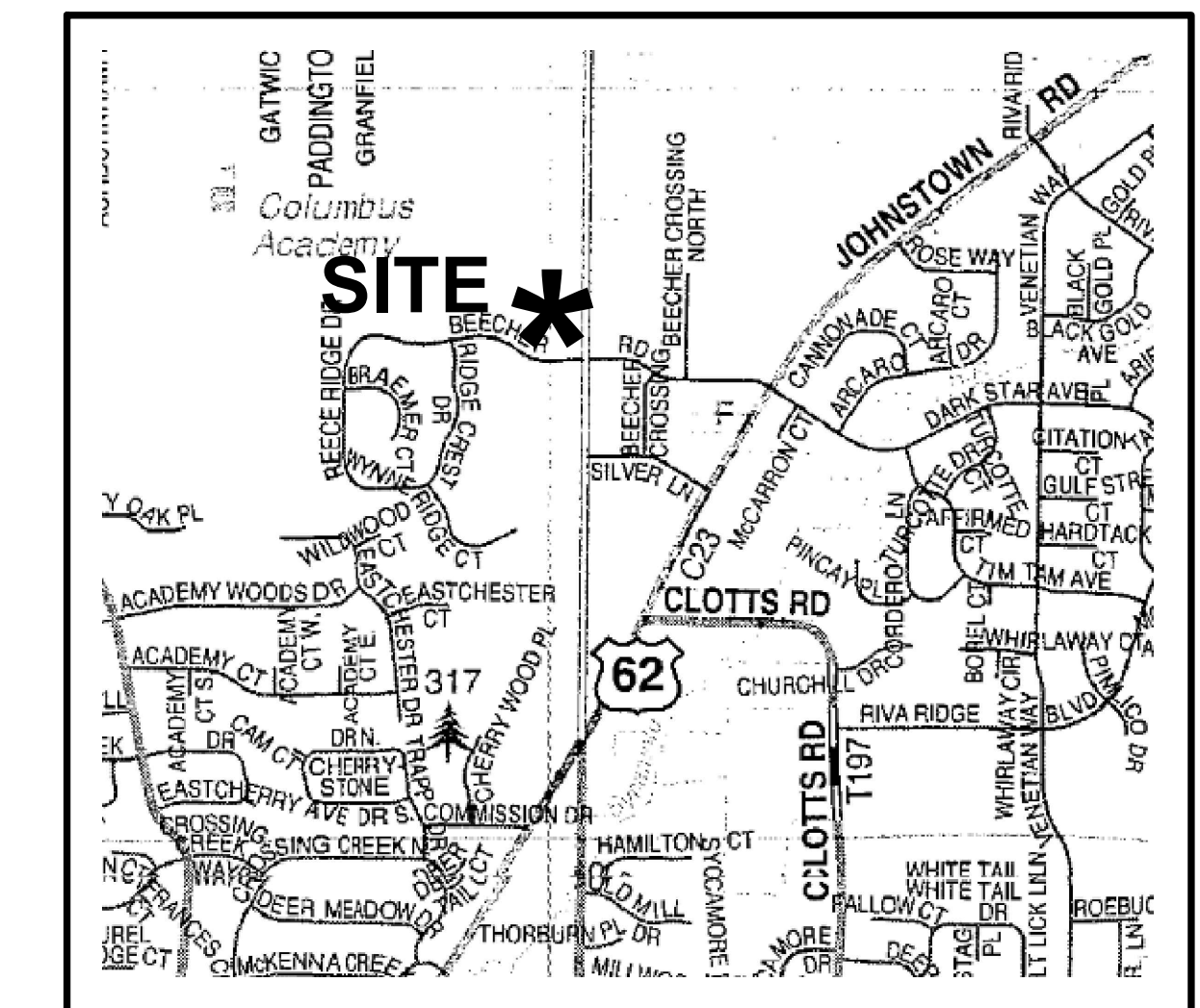
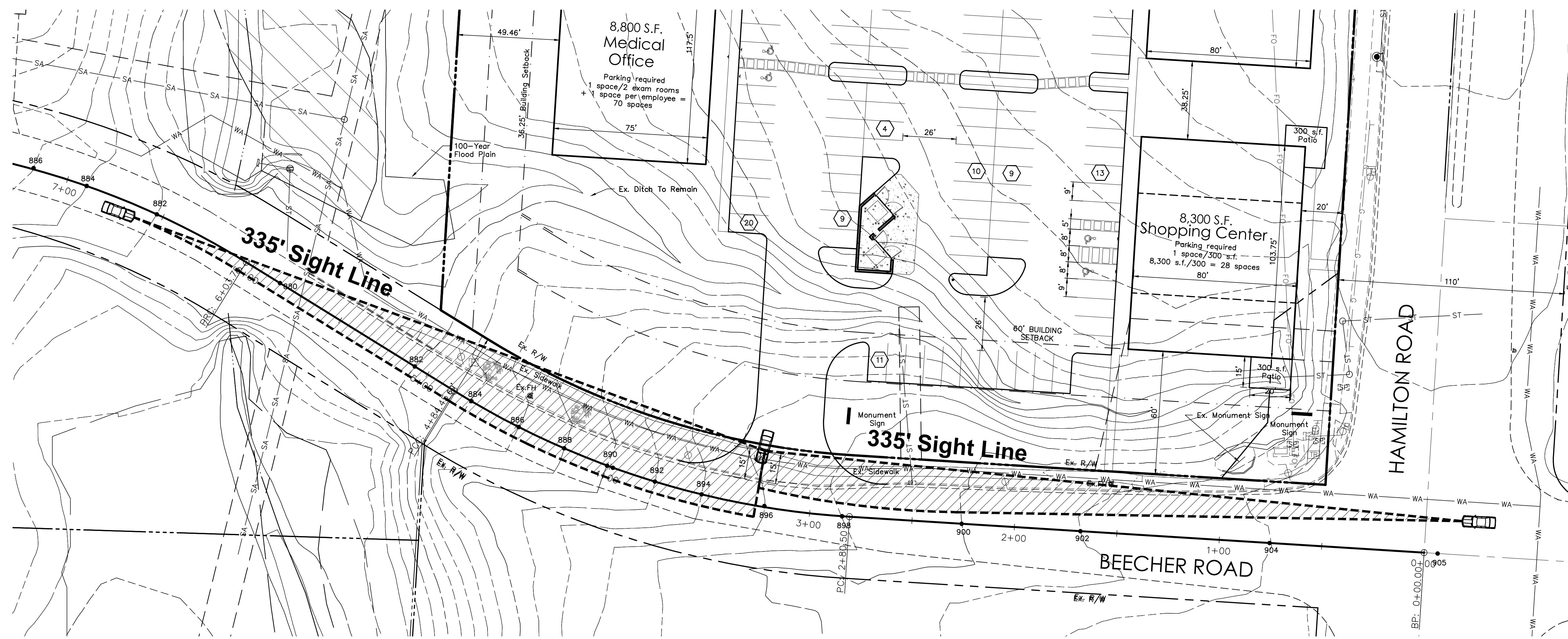
Through Queue Backup Length (ft/lane) =

500	200
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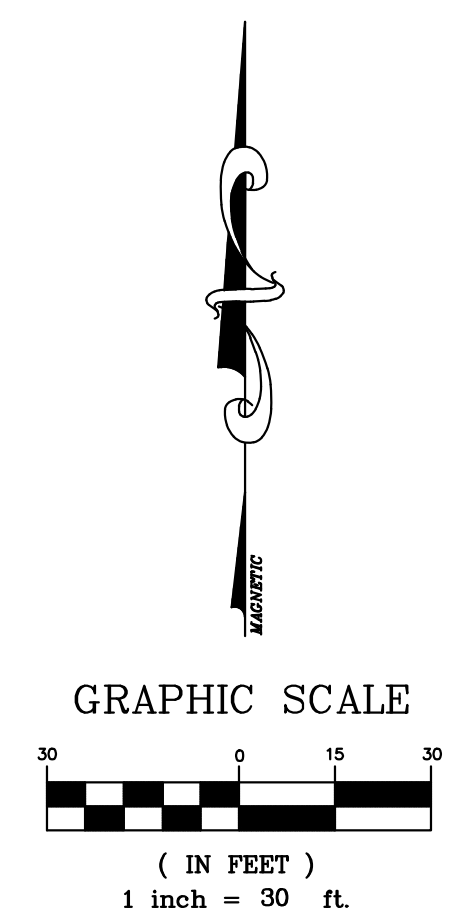
Note: EB - Eastbound, WB - Westbound, NB - Northbound, SB - Southbound

Source: January 2006 ODOT L&D Manual-Volume I: 401 - 9E, 401 -10E

Appendix G. Sight Distance

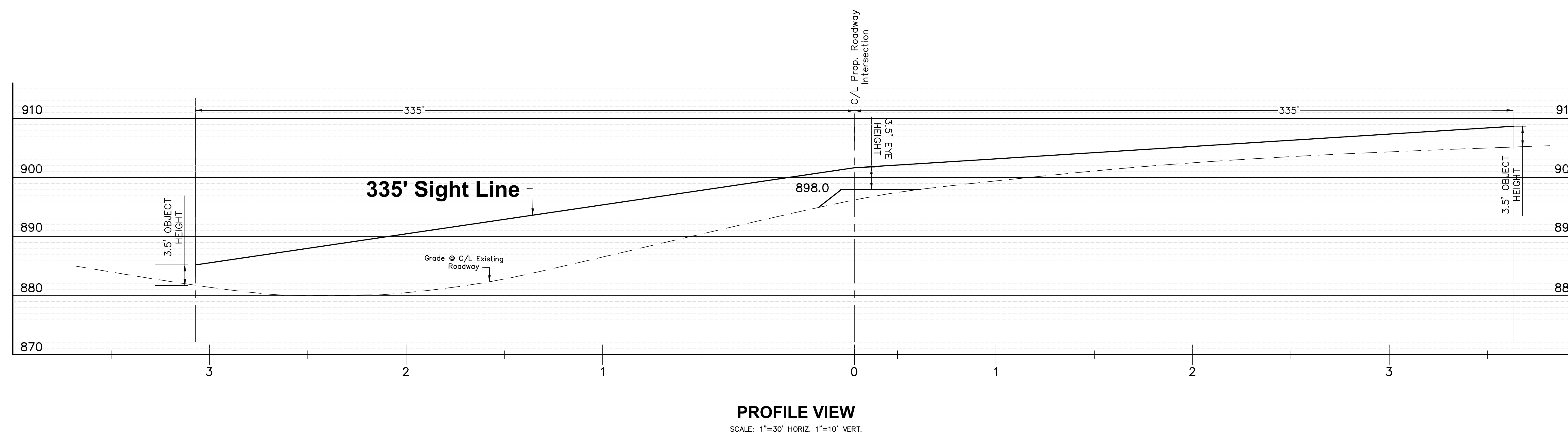


LOCATION MAP
NO SCALE



Spd Limit 25 MPH
Design Speed = 30 MPH
Sight Distance = 335'

Reference:
General Policy And Procedure
Sight Distance At Intersections
Department of Public Service
Division Of Planning And Operations
City Of Columbus, Ohio
Effective Date: 01/01/2014



CITY OF GAHANNA, OHIO
SIGHT DISTANCE EXHIBIT
FOR
VIKING COMMERCE CENTER



ADVANCED
CIVIL DESIGN
ENGINEERS

PLAN PREPARED BY:

422 BEECHER ROAD
Gahanna, Ohio 43230
ph 614.428.7750
fax 614.428.7755

SCALE: 1"=30'
DATE: 11/03/2016
























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Appendix H. Capacity Analyses and Results

HCM 2010 Signalized Intersection Summary

3: Hamilton Rd & Beecher Rd
























No Build 2037 - AM
Viking Commerce Center (GALZAD-16140)

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	77	107	74	17	223	222	107	452	41	164	892	122
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1863	1863	1863	1863	1863	1863	1900
Adj Flow Rate, veh/h	84	116	80	18	242	241	116	491	45	178	970	133
Adj No. of Lanes	1	1	0	1	1	1	1	2	1	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	320	207	143	129	412	502	290	1200	537	503	1159	159
Arrive On Green	0.05	0.20	0.20	0.07	0.22	0.22	0.06	0.34	0.34	0.10	0.37	0.37
Sat Flow, veh/h	1774	1028	709	1774	1863	1583	1774	3539	1583	1774	3128	429
Grp Volume(v), veh/h	84	0	196	18	242	241	116	491	45	178	549	554
Grp Sat Flow(s),veh/h/ln	1774	0	1738	1774	1863	1583	1774	1770	1583	1774	1770	1787
Q Serve(g_s), s	2.0	0.0	5.6	0.5	6.4	6.8	2.3	5.9	1.1	3.5	15.6	15.6
Cycle Q Clear(g_c), s	2.0	0.0	5.6	0.5	6.4	6.8	2.3	5.9	1.1	3.5	15.6	15.6
Prop In Lane	1.00		0.41	1.00		1.00	1.00		1.00	1.00		0.24
Lane Grp Cap(c), veh/h	320	0	350	129	412	502	290	1200	537	503	656	662
V/C Ratio(X)	0.26	0.00	0.56	0.14	0.59	0.48	0.40	0.41	0.08	0.35	0.84	0.84
Avail Cap(c_a), veh/h	387	0	504	515	913	928	304	1200	537	686	739	746
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	16.3	0.0	19.8	23.9	19.2	15.1	12.7	14.0	12.4	10.2	15.8	15.8
Incr Delay (d2), s/veh	0.4	0.0	1.4	0.5	1.3	0.7	0.9	0.2	0.1	0.4	7.6	7.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.0	0.0	2.8	0.3	3.4	3.0	1.2	2.9	0.5	1.7	8.8	8.9
LnGrp Delay(d),s/veh	16.8	0.0	21.2	24.4	20.6	15.9	13.6	14.2	12.5	10.6	23.4	23.4
LnGrp LOS	B		C	C	C	B	B	B	B	B	C	C
Approach Vol, veh/h		280			501			652			1281	
Approach Delay, s/veh		19.9			18.4			14.0			21.6	
Approach LOS		B			B			B			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	9.3	22.7	8.0	15.1	7.6	24.4	6.9	16.2				
Change Period (Y+Rc), s	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0				
Max Green Setting (Gmax), s	11.0	16.0	16.0	16.0	4.0	23.0	5.0	27.0				
Max Q Clear Time (g_c+I1), s	5.5	7.9	2.5	7.6	4.3	17.6	4.0	8.8				
Green Ext Time (p_c), s	0.2	5.7	0.0	2.4	0.0	2.8	0.0	3.4				
Intersection Summary												
HCM 2010 Ctrl Delay			19.0									
HCM 2010 LOS			B									

HCM 2010 Signalized Intersection Summary

3: Hamilton Rd & Beecher Rd
























Build 2037 - AM
Viking Commerce Center (GALZAD-16140)

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	100	116	83	17	242	222	130	452	41	164	894	136
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1863	1863	1863	1863	1863	1863	1900
Adj Flow Rate, veh/h	109	126	90	18	263	241	141	491	45	178	972	148
Adj No. of Lanes	1	1	0	1	1	1	1	2	1	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	329	225	161	122	417	505	282	1196	535	493	1123	171
Arrive On Green	0.07	0.22	0.22	0.07	0.22	0.22	0.07	0.34	0.34	0.10	0.36	0.36
Sat Flow, veh/h	1774	1012	723	1774	1863	1583	1774	3539	1583	1774	3081	469
Grp Volume(v), veh/h	109	0	216	18	263	241	141	491	45	178	558	562
Grp Sat Flow(s),veh/h/ln	1774	0	1735	1774	1863	1583	1774	1770	1583	1774	1770	1780
Q Serve(g_s), s	2.7	0.0	6.4	0.6	7.4	7.1	3.0	6.2	1.1	3.7	17.0	17.0
Cycle Q Clear(g_c), s	2.7	0.0	6.4	0.6	7.4	7.1	3.0	6.2	1.1	3.7	17.0	17.0
Prop In Lane	1.00		0.42	1.00		1.00	1.00		1.00	1.00		0.26
Lane Grp Cap(c), veh/h	329	0	386	122	417	505	282	1196	535	493	645	649
V/C Ratio(X)	0.33	0.00	0.56	0.15	0.63	0.48	0.50	0.41	0.08	0.36	0.87	0.87
Avail Cap(c_a), veh/h	393	0	478	489	834	860	282	1196	535	660	701	705
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	16.1	0.0	20.1	25.4	20.4	15.9	13.9	14.8	13.1	10.8	17.1	17.1
Incr Delay (d2), s/veh	0.6	0.0	1.3	0.5	1.6	0.7	1.4	0.2	0.1	0.4	10.4	10.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.3	0.0	3.2	0.3	4.0	3.1	1.5	3.0	0.5	1.8	10.1	10.2
LnGrp Delay(d),s/veh	16.7	0.0	21.3	26.0	22.0	16.6	15.3	15.0	13.2	11.2	27.5	27.6
LnGrp LOS	B		C	C	C	B	B	B	B	B	C	C
Approach Vol, veh/h		325			522			677			1298	
Approach Delay, s/veh		19.8			19.6			14.9			25.3	
Approach LOS		B			B			B			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	9.5	23.6	8.0	16.9	8.0	25.2	7.9	17.0				
Change Period (Y+Rc), s	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0				
Max Green Setting (Gmax), s	11.0	16.0	16.0	16.0	4.0	23.0	6.0	26.0				
Max Q Clear Time (g_c+I1), s	5.7	8.2	2.6	8.4	5.0	19.0	4.7	9.4				
Green Ext Time (p_c), s	0.2	5.5	0.0	2.4	0.0	2.1	0.0	3.6				
Intersection Summary												
HCM 2010 Ctrl Delay			21.1									
HCM 2010 LOS			C									

HCM 2010 Signalized Intersection Summary

3: Hamilton Rd & Beecher Rd
























No Build 2037 - PM
Viking Commerce Center (GALZAD-16140)

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	44	58	26	85	23	287	43	1066	40	283	731	25
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1863	1863	1863	1863	1863	1863	1900
Adj Flow Rate, veh/h	48	63	28	92	25	312	47	1159	43	308	795	27
Adj No. of Lanes	1	1	0	1	1	1	1	2	1	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	355	219	97	385	377	521	394	1412	632	380	1714	58
Arrive On Green	0.04	0.18	0.18	0.06	0.20	0.20	0.03	0.40	0.40	0.13	0.49	0.49
Sat Flow, veh/h	1774	1223	544	1774	1863	1583	1774	3539	1583	1774	3493	119
Grp Volume(v), veh/h	48	0	91	92	25	312	47	1159	43	308	403	419
Grp Sat Flow(s),veh/h/ln	1774	0	1767	1774	1863	1583	1774	1770	1583	1774	1770	1842
Q Serve(g_s), s	1.5	0.0	3.0	2.8	0.7	11.1	1.0	19.8	1.1	6.3	10.1	10.1
Cycle Q Clear(g_c), s	1.5	0.0	3.0	2.8	0.7	11.1	1.0	19.8	1.1	6.3	10.1	10.1
Prop In Lane	1.00		0.31	1.00		1.00	1.00		1.00	1.00		0.06
Lane Grp Cap(c), veh/h	355	0	316	385	377	521	394	1412	632	380	868	904
V/C Ratio(X)	0.14	0.00	0.29	0.24	0.07	0.60	0.12	0.82	0.07	0.81	0.46	0.46
Avail Cap(c_a), veh/h	398	0	419	386	442	576	438	1468	657	445	918	955
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	21.4	0.0	24.0	20.8	21.8	18.9	11.2	18.1	12.5	13.7	11.3	11.3
Incr Delay (d2), s/veh	0.2	0.0	0.5	0.3	0.1	1.4	0.1	3.7	0.0	9.4	0.4	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	0.0	1.5	1.4	0.4	5.0	0.5	10.2	0.5	4.0	5.0	5.2
LnGrp Delay(d),s/veh	21.6	0.0	24.5	21.1	21.8	20.4	11.4	21.9	12.6	23.1	11.7	11.7
LnGrp LOS	C		C	C	C	C	B	C	B	C	B	B
Approach Vol, veh/h		139			429			1249			1130	
Approach Delay, s/veh		23.5			20.6			21.2			14.8	
Approach LOS		C			C			C			B	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	12.5	30.9	8.0	16.1	6.3	37.1	6.4	17.7				
Change Period (Y+Rc), s	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0				
Max Green Setting (Gmax), s	11.0	28.0	4.0	16.0	4.0	35.0	4.0	16.0				
Max Q Clear Time (g_c+I1), s	8.3	21.8	4.8	5.0	3.0	12.1	3.5	13.1				
Green Ext Time (p_c), s	0.3	5.2	0.0	1.4	0.0	14.7	0.0	0.5				
Intersection Summary												
HCM 2010 Ctrl Delay			18.8									
HCM 2010 LOS			B									

HCM 2010 Signalized Intersection Summary

3: Hamilton Rd & Beecher Rd

Build 2037 - PM
Viking Commerce Center (GALZAD-16140)

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	98	77	45	84	37	285	63	1059	40	282	734	33
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1863	1863	1863	1863	1863	1863	1900
Adj Flow Rate, veh/h	107	84	49	91	40	310	68	1151	43	307	798	36
Adj No. of Lanes	1	1	0	1	1	1	1	2	1	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	409	219	128	138	392	530	373	1381	618	360	1637	74
Arrive On Green	0.07	0.20	0.20	0.08	0.21	0.21	0.04	0.39	0.39	0.12	0.47	0.47
Sat Flow, veh/h	1774	1105	644	1774	1863	1583	1774	3539	1583	1774	3449	156
Grp Volume(v), veh/h	107	0	133	91	40	310	68	1151	43	307	409	425
Grp Sat Flow(s),veh/h/ln	1774	0	1749	1774	1863	1583	1774	1770	1583	1774	1770	1835
Q Serve(g_s), s	3.6	0.0	5.0	3.8	1.3	12.4	1.7	22.5	1.3	7.4	12.1	12.1
Cycle Q Clear(g_c), s	3.6	0.0	5.0	3.8	1.3	12.4	1.7	22.5	1.3	7.4	12.1	12.1
Prop In Lane	1.00		0.37	1.00		1.00	1.00		1.00	1.00		0.08
Lane Grp Cap(c), veh/h	409	0	347	138	392	530	373	1381	618	360	840	871
V/C Ratio(X)	0.26	0.00	0.38	0.66	0.10	0.59	0.18	0.83	0.07	0.85	0.49	0.49
Avail Cap(c_a), veh/h	431	0	366	371	633	735	418	1435	642	394	856	888
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	22.0	0.0	26.6	34.3	24.4	21.1	13.1	21.1	14.6	15.8	13.7	13.7
Incr Delay (d2), s/veh	0.3	0.0	0.7	5.3	0.1	1.0	0.2	4.3	0.0	15.4	0.4	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.8	0.0	2.5	2.1	0.7	5.6	0.9	11.7	0.6	5.1	5.9	6.2
LnGrp Delay(d),s/veh	22.4	0.0	27.3	39.6	24.5	22.1	13.4	25.3	14.7	31.3	14.2	14.2
LnGrp LOS	C		C	D	C	C	B	C	B	C	B	B
Approach Vol, veh/h		240			441			1262			1141	
Approach Delay, s/veh		25.1			25.9			24.3			18.8	
Approach LOS		C			C			C			B	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	13.5	33.9	9.9	19.2	7.1	40.3	9.0	20.1				
Change Period (Y+Rc), s	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0				
Max Green Setting (Gmax), s	11.0	31.0	16.0	16.0	5.0	37.0	6.0	26.0				
Max Q Clear Time (g_c+I1), s	9.4	24.5	5.8	7.0	3.7	14.1	5.6	14.4				
Green Ext Time (p_c), s	0.2	5.4	0.1	1.5	0.0	14.7	0.0	1.7				
Intersection Summary												
HCM 2010 Ctrl Delay			22.5									
HCM 2010 LOS			C									

Intersection

Int Delay, s/veh 1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	5	258	452	56	41	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	280	491	61	45	2

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	552	0	813
Stage 1	-	-	522
Stage 2	-	-	291
Critical Hdwy	4.12	-	6.42
Critical Hdwy Stg 1	-	-	5.42
Critical Hdwy Stg 2	-	-	5.42
Follow-up Hdwy	2.218	-	3.518
Pot Cap-1 Maneuver	1018	-	348
Stage 1	-	-	595
Stage 2	-	-	759
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	1018	-	346
Mov Cap-2 Maneuver	-	-	346
Stage 1	-	-	595
Stage 2	-	-	754

Approach	EB	WB	SB
HCM Control Delay, s	0.2	0	16.8
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1018	-	-	-	352
HCM Lane V/C Ratio	0.005	-	-	-	0.133
HCM Control Delay (s)	8.6	0	-	-	16.8
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0	-	-	-	0.5

Intersection

Int Delay, s/veh 3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	3	128	91	42	92	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	3	139	99	46	100	5

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	145	0	268
Stage 1	-	-	122
Stage 2	-	-	146
Critical Hdwy	4.12	-	6.42
Critical Hdwy Stg 1	-	-	5.42
Critical Hdwy Stg 2	-	-	5.42
Follow-up Hdwy	2.218	-	3.518
Pot Cap-1 Maneuver	1437	-	721
Stage 1	-	-	903
Stage 2	-	-	881
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	1437	-	720
Mov Cap-2 Maneuver	-	-	720
Stage 1	-	-	903
Stage 2	-	-	879

Approach	EB	WB	SB
HCM Control Delay, s	0.2	0	10.8
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1437	-	-	-	728
HCM Lane V/C Ratio	0.002	-	-	-	0.145
HCM Control Delay (s)	7.5	0	-	-	10.8
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.5