July 2, 2018

Letty Schamp, P.E.
City Engineer
City of Upper Arlington
4100 Roberts Rd.
Columbus, OH 43228

RE: Results of the Proposed Swenson's Cemetery Road Traffic Access Study

Ms. Schamp:

We have completed the traffic access study for the proposed Swenson's restaurant located in the City of Hilliard. The methods and results of this analysis are summarized below. A Memorandum of Understanding, approved by the City of Hilliard, can be found in **Attachment A**.

Background

The proposed site is located on the northwest corner of Cemetery Road and the J.W. Reason Elementary School Access (J.W. Reason Drive). Figure 1 shows the location of the proposed site in Hilliard.

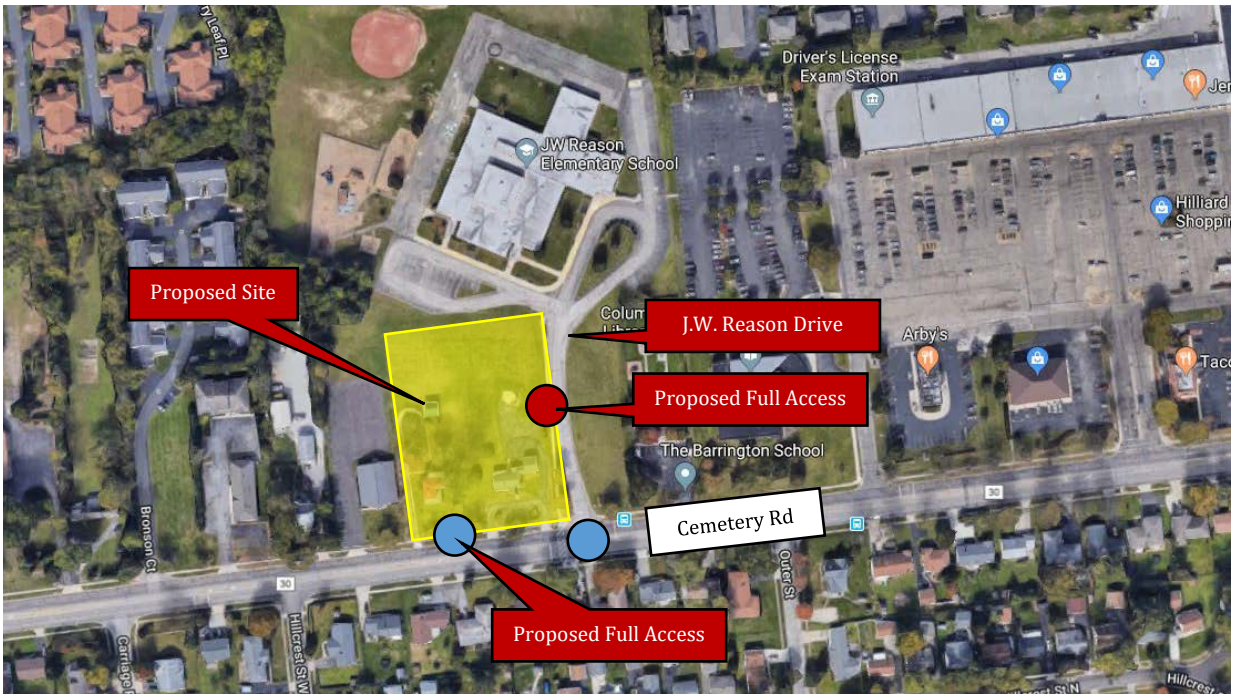

Figure 1—Location of the Proposed Site in Hilliard (Yellow Shading)[1]

[1] Intersections shown as blue circles are considered "study intersections" and were included in the analysis of this study. The intersection of the proposed full access drive with J.W. Reason Drive was not analyzed since there is no background traffic on J.W. Reason Drive during the PM peak.

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The site is proposed to include a Swenson's Drive-In restaurant approximately 1,800 SF in size. There is one proposed full-access point along the existing driveway for the J.W. Reason Elementary School. It is proposed that this drive will be gated off during the end of school day peak from 3:00 - 4:00 PM. The J.W. Reason Drive intersection with Cemetery Road is signalized. Another full-access drive is proposed along Cemetery Road. It is anticipated that Cemetery Road access will be restricted to right-in, right-out movements, per the request of the developer. However, it has been analyzed as a full-access drive to produce more conservative results. The site plan for the proposed development can be found in **Attachment A**.

Projected Traffic

For analysis, the Opening Year of the development is 2019 and the Design or Horizon Year is 2029. AM and PM peak turning movement counts were collected at the intersection of Cemetery Road and J.W. Reason Drive from 7:00-9:00 AM and from 2:30-6:00 PM on August 30, 2017 while school was in session. A linear, annual growth rate of 0.5%, provided by the Mid-Ohio Regional Planning Commission (MORPC), was applied to the count data to project Opening and Horizon Year Background traffic volumes. Volume calculations were developed to show both proposed site drives open as well as only the Cemetery Road drive open. Count data and MORPC correspondence can be seen in **Attachment B**.

Trips for the proposed site development were generated using standard Institute of Transportation Engineers (ITE) practices and the *Trip Generation Manual*, 10th edition, data via the OTISS program[2]. Land Use Code (*LUC) 933 – Fast Food Restaurant without Drive-Through Window* was used to generate trips for the proposed development. Standard ITE pass-by rates were applied. Internal capture does not apply to this proposed development. **Table 1** shows the trip generation of the proposed development. The full trip generation analysis can be found in **Attachment C.**

Table 1 – Proposed Site Trip Generation Summary

Land Use	Size	PM Peak of Adjacent Street Traffic		PM Peak of Generator[3]		Weekday	
		Entry	Exit	Entry	Exit	Entry	Exit
933 - Fast-Food Restaurant without Drive-Through Window	1,800 SF Gross Floor Area	26	25	44	44	312	311
Internal		0	0	0	0	0	0
Pass-By		11	11	19	19	0	0
Non-Pass-By		15	14	25	25	312	311

Non-pass-by site traffic was distributed to/from the site assuming a general distribution of 50% to/from the east and west. Site traffic was added to the Background traffic to produce Build traffic for the proposed development. The full volume calculations, including site drive traffic assignment, can be found in **Attachment D**.

[2] Online Traffic Impact Study Software developed by ITE and Transoft Solutions.
[3] PM Peak of Generator trip generation is included per a City of Hilliard request. It was not, however, utilized in the analysis.

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Analysis

The HCM module of Synchro Version 10 software was used to analyze capacity at all study intersections shown in Figure 1. A minimum Level of Service (LOS) of D for the overall intersection and for each individual movement was considered acceptable at each intersection. If an intersection fell below these criteria, mitigation strategies were developed to bring each movement back to an acceptable LOS. Video review of the Cemetery Road and J.W. Reason Drive intersection was conducted and it was determined that default lane utilization factors would be applicable for use in the analysis. Peak hour factors (PHF) determined from count data were utilized in the analysis.

A queuing analysis was performed at all study intersections using the SimTraffic module of Synchro Version 10 software. If any queue lengths exceeded available storage space or were unreasonably long, mitigation strategies were developed to reduce the queue lengths. Single trip entries into a private driveway on the south side of Cemetery Road were evaluated in SimTraffic as an unsignalized stop-controlled access to model the impact the proposed Swenson's traffic has on utilization of the existing two-way left turn lane (TWLTL) and the impact on westbound through vehicles during the PM Peak. Existing queueing on Cemetery Road was documented during the PM peak hour in the westbound lanes along the site frontage.

Turn lane length calculations were conducted at the Cemetery Road and J.W. Reason Drive intersection using methodologies from the ODOT Location & Design Manual.

Results & Conclusions

Results of capacity analysis can be seen in Table 2 below. Acceptable LOS is obtained in the Horizon Year PM Build condition for both the Cemetery Road & J.W. Reason Drive intersection and the Cemetery Road & Cemetery Road Site Access Drive intersection. The full capacity analysis can be found in **Attachment E**.

Table 2 - Summary of Horizon Year Capacity Analysis (LOS/delay)

Intersection	Approach	PM No Build	PM Build
Cemetery Road & J.W. Reason Drive	Eastbound	A/1.9	A/2.1
	Westbound	A/5.1	A/5.7
	Southbound	C/27.6	C/28.9
	Total	***A/4.2***	***A/4.9***
Cemetery Road & Cemetery Road Site Access Drive	Eastbound		A/0.0
	Westbound		A/0.0
	Southbound		D/30.9
	Total[4]		***D/30.9***

[4] The total for unsignalized intersections is represented by the worst approach.

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Results of the queuing analysis for the proposed site drives can be seen in Table 3 below. The average and 95th percentile queue length for each approach is shown. If an approach has multiple lanes, the longest queue on that leg is shown in the table. The full queuing analysis, as well as a schematic showing these queues, can be seen in **Attachment E**.

Table 3 - Summary of Horizon Year Queuing Analysis

Intersection	Approach	Movement	PM Build	
			AVG	95th
Cemetery Road & J.W. Reason Drive	Eastbound	Through	42'	99'
		Left	12'	38'
	Westbound	Through	64'	135'
		Through-Right	37'	95'
	Southbound	Left/Right	33'	66'
Cemetery Road & Cemetery Road Site Access Drive	Eastbound	Left	2'	15'
	Southbound	Left/Right	7'	28'

As seen in Tables 2 and 3, capacity and queuing analysis results are acceptable for both study intersections.

Per the approved MOU, single-trip entries and exits were evaluated for the single-family homes on the south side of Cemetery Road to determine the impact of the TWLTL in this area. Synchro SimTraffic software does not have the capability to show TWLTL interaction, so westbound entering vehicles into the single-family homes were shown turning from the southernmost westbound through lane. These vehicles could make the turn safely with almost no delay. Additionally, the eastbound left turn queues at both the Cemetery Drive and J.W. Reason Drive were no more than 1-2 cars long, as shown in Table 3. It is anticipated that TWLTL lane conflicts will be minimal and likely no different than Cemetery Road in its current condition. Observation of the SimTraffic simulation showed that nearly every time a westbound vehicle was turning left into a single-family home on the south side of Cemetery Road, the TWLTL was not occupied. The SimTraffic simulations utilized for this analysis can be provided if requested.

Video review of the Cemetery Road and J.W. Reason Drive intersection was conducted from 3:30 - 4:00 PM to determine the level of pedestrian and bus traffic as well as the impact the proposed Swenson's will have on school departure[5]. As previously noted, the Swenson's access drive onto J.W. Reason Drive will be closed from 3:00 - 4:00 PM on days when school is in session. Early afternoon is typically a slower time of day for restaurants as it is between typical lunch and dinner hours. It is expected that trips generated by the Swenson's restaurant during this time will be significantly less than the ITE trip generation during the PM Peak hour. The majority of pedestrians were observed crossing Cemetery Road at the signalized intersection. Few pedestrians were observed walking westbound in the sidewalk

[5] Capacity and queuing analysis for a single site access along Cemetery Road was not conducted as per the request of the developer. This was requested since Swenson's trip generation during this time is expected to be much less than the PM Peak hour. It is anticipated that the Cemetery Road Access Drive would have similar results as what is displayed in the analysis for two access drives.

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along Cemetery Road and the proposed site frontage. Heavy pedestrian and bus traffic only occurred for a period of about 5 minutes between 3:35pm and 3:40pm.

Westbound queuing was observed during the PM Peak hour to determine how the queuing at the signalized intersection west of the proposed site (Cemetery Road & Berry Leaf Lane/Westbrook Drive) would affect the proposed site. During this observation, westbound queuing extended to the J.W. Reason Drive only a few times. Traffic along Cemetery Road appeared to be free flowing. The free-flowing nature of Cemetery Road during the PM peak Hour, along with higher volumes, would make a left turn out of the Cemetery Road Access Drive difficult during the peak. It is expected that Swenson's customers will be aware of peak hour traffic along Cemetery Road and will choose to exit at the J.W. Reason signal to travel eastbound. Additionally, if the Cemetery Drive is right-in, right-out restricted (as requested by the developer), it is anticipated that customers will only violate the restriction during off-peak hours when Cemetery Road volumes are much lower. Most customers will choose to make protected left turns out of the site using the J.W. Reason Drive. From 3:00 - 4:00 PM, when the access drive on J.W. Reason Drive is closed, traffic along the site frontage of Cemetery Road will be traveling at 20 MPH due to the school zone speed limit. Lowered speeds coupled with added actuation at the J.W. Reason Drive signal creating gaps in traffic makes exiting the Cemetery Road Access Drive much easier. Peak hour video utilized for this observational analysis can be provided if requested.

Turn lane lengths were calculated for the eastbound left turning movements at both the Cemetery Road Access Drive and the J.W. Reason Drive using ODOT methodology. Based on the results, dedicated left turn lanes would need to be 125' for the Cemetery Road Access Drive and 165' for the J.W. Reason Drive, both inclusive of a 50' diverging taper. The full turn lane length calculations can be found in **Attachment E**.

Hilliard's Access Management Plan was reviewed with respect to the proposed access points for the Swenson's development. Based on this plan, the proposed Cemetery Road Access Drive will be classified as a Commercial, Low Volume Driveway and Cemetery Road would be classified as a Category F roadway. Since Cemetery Road is a 35 MPH roadway, minimum access spacing is 250'. This distance will not be met by the proposed Cemetery Road Access Drive as the access drive will be approximately 175' from the J.W. Reason Drive. However, redevelopment of the subject property will reduce the number of access points along Cemetery Road from three to one. The reduction in access points will lead to lesser conflict points, a potential reduction in crashes, and safer ingress/egress. Additionally, the table shown on Page 64 of the Hilliard Thoroughfare Plan shows that minimum access spacing for a Category F, Low-Volume Driveway is based on stopping sight distance and intersection sight distance. Cemetery Road in this area is relatively flat with no curvature, so issues with sight distance are not expected.

Recommendations

Based on the results of the capacity analysis, queuing analysis, SimTraffic observations, and video observations, it is recommended that the proposed Swenson's Development be

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permitted as shown in the site plan in **Attachment A**. It is recommended that the Cemetery Road Access Drive be restricted to right-in, right-out movements by signage only. A "porkchop" right-in, right-out driveway design would increase the driveway footprint and have a negative impact to pedestrian traffic. If customers choose to violate the signed restriction, the capacity and queuing analysis shows acceptable results for left turns in and out of this access.

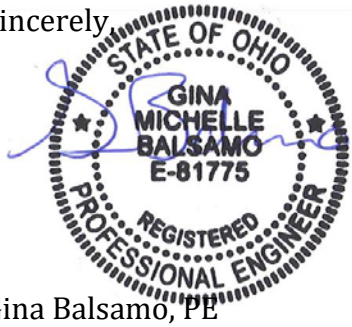
School departure will not be impacted by the Swenson's development. Swenson's traffic will not be utilizing the J.W. Reason Drive from the hours of 3:00 - 4:00 PM. Additionally, it is expected that trips generated by the Swenson's during this time will be minimal. A reduced speed limit of 20 MPH during school departure coupled with added actuation at the J.W. Reason Drive signal creating gaps in traffic will also assist with ingress and egress for Swenson's customers that need to utilize the Cemetery Drive during the closure of the J.W. Reason Drive.

It is recommended that the TWLTL along the site frontage be maintained as a TWLTL in lieu of dedicated left turn lanes. This will enable westbound vehicles entering the single-family homes to the south to utilize the TWLTL, which the analysis shows will be unoccupied most of the time.

Although the proposed Cemetery Road Access Drive does not meet Hilliard's driveway spacing requirements, the reduction in access points with the redevelopment of the proposed site will lead to less conflict points and increased safety in the area. The proposed Swenson's development is a relatively low trip generator for a restaurant use. There are other uses that could be developed on the proposed site, such as office or retail, that would have a much bigger impact to the transportation network, especially uses that produce AM Peak traffic.

If I can help in any way, do not hesitate to contact me at gbalsamo@cmtran.com or 614.656.2429 anytime.

Sincerely,



Gina Balsamo, PE
Project Engineer
Carpenter Marty Transportation

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Attachment A
MOU & Site Plan

Attachment A

CARPENTER MARTY transportation

MOU Attachments not included

CARPENTER MARTY transportation

MEMORANDUM OF UNDERSTANDING

BETWEEN:
The City of Hilliard & Carpenter Marty Transportation

REGARDING:
Scope for a Traffic Impact Study pertaining to the proposed Swenson's Restaurant along Cemetery Road in Hilliard, Ohio

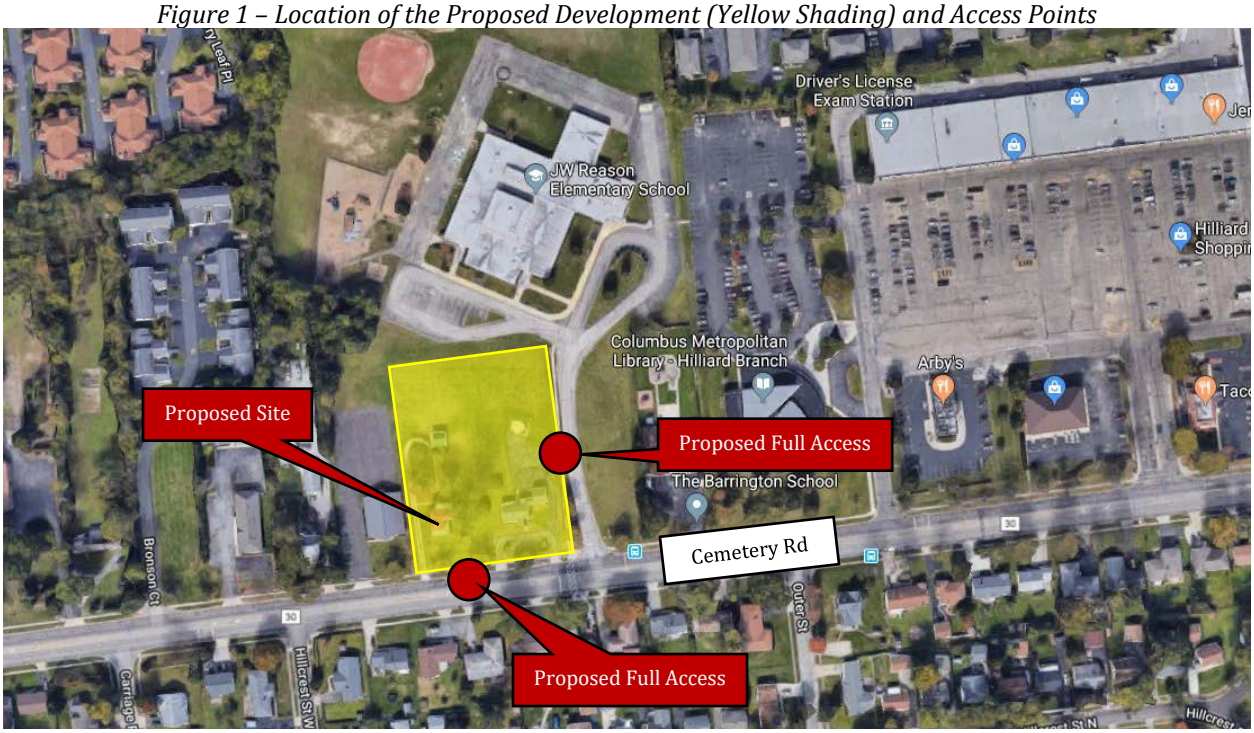
I. Purpose

The purpose of this Memorandum of Understanding (MOU) is to establish a mutually agreeable scope for a Traffic Impact Study (TIS) covering the proposed Swenson's restaurant along Cemetery Road in Hilliard, Ohio. **Figure 1** shows the location of the proposed development and proposed access points.

The intersections under study are the following:

1. Cemetery Road & J.W. Reason Elementary School Access
2. J.W. Reason Elementary School Access & Proposed Full Access
3. Cemetery Road & Proposed Full Access.

Figure 1 – Location of the Proposed Development (Yellow Shading) and Access Points



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II. Proposed Development

The site is proposed to include a Swenson's Drive-In restaurant approximately 1,800 SF in size. There is one proposed full-access point along the existing driveway for the J.W. Reason Elementary School. It is proposed that this drive will be gated off during the end of school day peak. The elementary school driveway intersection with Cemetery Road is signalized. Another full-access drive is proposed along Cemetery Road. Two scenarios will be evaluated in this traffic study. The first will include both proposed access points. The second will omit the proposed full-access point along the existing driveway for the J.W. Reason Elementary School to reflect operations when this drive is gated off. The preliminary site plan can be found in **Attachment A**.

III. Volume Development

For analysis, the Opening Year of the development is 2019 and the Design or Horizon Year is 2029. AM and PM peak turning movement counts were collected at the intersection of Cemetery Road and the J.W. Reason Elementary school drive from 7-9 AM and from 2:30-6 PM on August 30, 2017 while school was in session. A linear, annual growth rate of 0.5%, provided by the Mid-Ohio Regional Planning Commission (MORPC), will be applied to the count data to project Opening and Horizon Year Background traffic volumes. As previously mentioned, volume calculations will be developed for two site drive scenarios. Additionally, analysis will be conducted for the end of school day peak and the traditional PM Peak. No AM Peak analysis will be conducted as Swenson's does not open until 11:00am. The count data and MORPC correspondence can be found in **Attachment B**.

Trips for the proposed site development were generated using standard Institute of Transportation Engineers (ITE) practices and the *Trip Generation Manual*, 10th edition, data via the OTISS program[1]. Land Use Code (*LUC) 933 – Fast Food Restaurant without Drive-Through Window* was used to generate trips for the proposed development. Standard ITE pass-by rates were applied. Internal capture does not apply to this proposed development. **Table 1** shows the trip generation of the proposed development. The full trip generation analysis can be found in **Attachment C.**

Table 1 – Proposed Site Trip Generation Summary

Land Use	Size	PM Peak of Adjacent Street Traffic		PM Peak of Generator		Weekday	
		Entry	Exit	Entry	Exit	Entry	Exit
933 - Fast-Food Restaurant without Drive-Through Window	1,800 SF Gross Floor Area	26	25	44	44	312	311
Internal		0	0	0	0	0	0
Pass-By		11	11	19	19	0	0
Non-Pass-By		15	14	25	25	312	311

[1] Online Traffic Impact Study Software developed by ITE and Transoft Solutions.

Please use 50%/50% directional distribution for non-pass by trips

All new trips will be distributed to/from the site assuming a general distribution of 61% to/from the east and 39% to/from the west. This general distribution was determined based on count data, knowledge of the surrounding area, and engineering judgment. As previously mentioned, distributions will be developed for two site drive scenarios. Site traffic will be added to the Background (No Build) traffic to produce Build traffic.

IV. Analysis

The HCM module of Synchro Version 10 software will be used to analyze capacity at all study intersections shown in **Figure 1**. A minimum Level of Service (LOS) of D for the overall intersection and for each individual movement will be considered acceptable at each intersection. If an intersection falls below these criteria, mitigation strategies will be developed to bring each movement back to an acceptable LOS. Lane utilization percentages will be verified and reflected in the analysis. Peak hour factors (PHF) determined from count data will be utilized in the analysis.

A queuing analysis will be performed at all study intersections using the SimTraffic module of Synchro Version 10 software. If any queue lengths exceed available storage space or are unreasonably long, mitigation strategies will be developed to reduce the queue lengths. Single trip entries into each private driveway on the south side of Cemetery Road will be evaluated in SimTraffic as an unsignalized stop-controlled access to model the impact the proposed Swenson's traffic has on utilization of the existing two-way left turn lane (TWLTL) and the impact on westbound through vehicles during the PM Peak. Existing queueing on Cemetery Road will be documented during the PM peak hour in the westbound lanes along the site frontage. A discussion of the impact that the proposed development will have on utilization of the TWLTL for entry of south side properties during PM peak will be provided. Schematics of anticipated left turn lane storage for all accesses utilizing the TWLTL along the proposed site frontage will be provided.

Turn lane length calculations will be conducted at the Cemetery Road and J.W. Reason Elementary School Drive intersection using methodologies from the ODOT Location & Design Manual.

A general analysis of the impacts to properties on the south side of Cemetery Road will be conducted. This will include any diagrams or discussions related to safety, sight distance, capacity, queuing, etc. Recommendations will be provided based on results.

Discussion and documentation will be provided that analyzes the existing school driveway operations during normal school arrival and dismissal. Queuing, pedestrian activity, and safety will all be evaluated, in general, to determine if Swenson's traffic will influence school traffic. Since school will be out of session during the time this study is being conducted,

Miovision video documentation of the intersection collected in August 2017 will be utilized for this task.

As previously mentioned in this MOU, the traffic study will include analysis and results for access scenarios with and without the full-access point along the existing driveway for the J.W. Reason Elementary School.

Discussion of the proposed access points with respect to Hilliard's Access Management Plan (Technical Appendix of Hilliard's Thoroughfare Plan), specifically the "Driveway Locations and Spacing" and "Access Management Standards" sections of the plan, will be provided.

V. Report

A report will be produced that includes tables, figures, appendices, etc. This report will document the analysis, results, and recommendations for the public roadway system surrounding the development. These recommendations will be divided into both Build and No Build improvements required to mitigate the anticipated traffic.

Please signify your concurrence with this Memorandum of Understanding by signing below. If you have any questions or comments, please contact Drew Laurent at 614-656-2421 or dlaurent@cmtran.com.

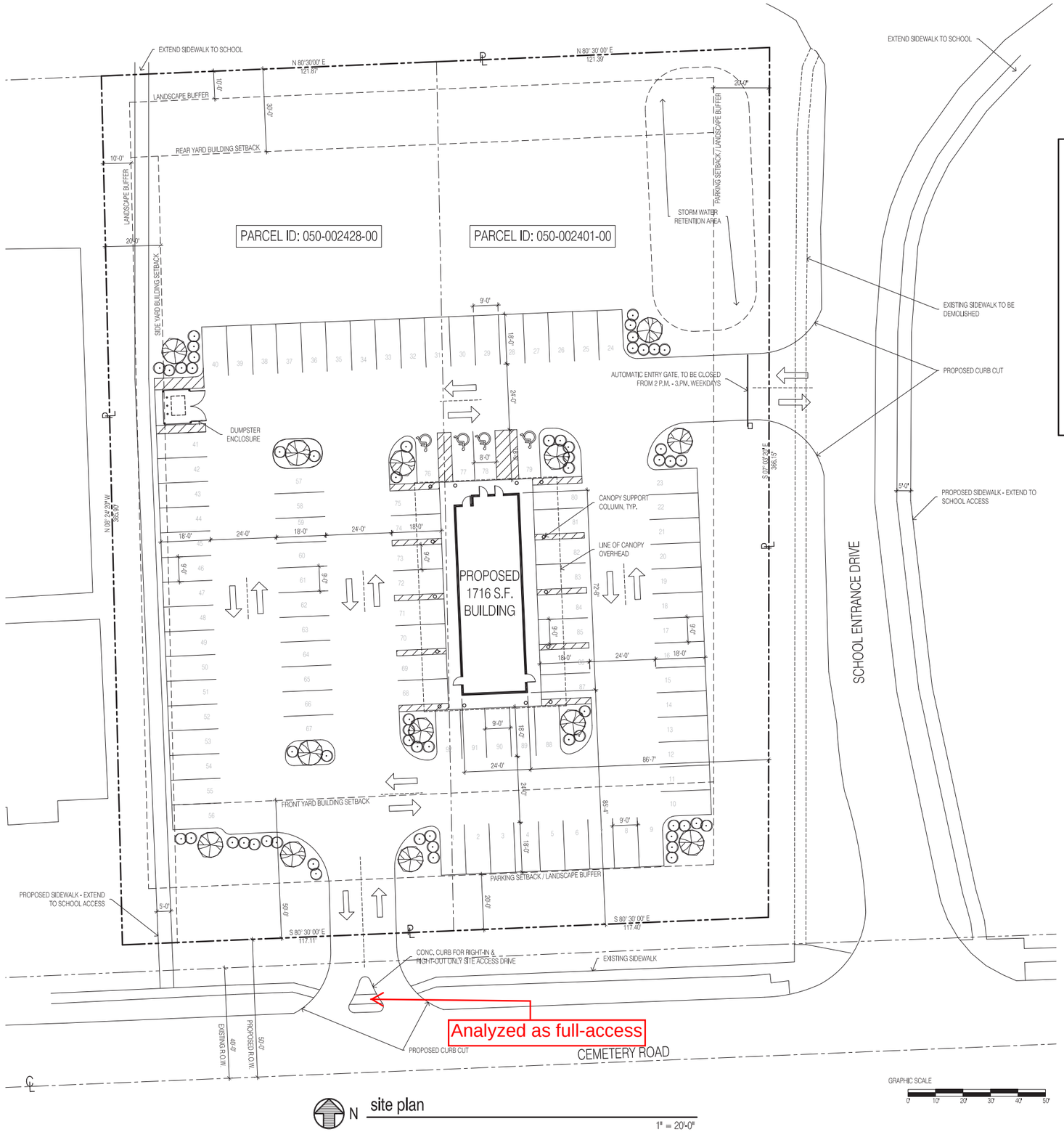
Sincerely,

Gina Balsamo, PE
Project Engineer
Carpenter Marty Transportation Inc.

City of Hilliard (or their Representative)

Signature: _____ **Date:** 6-22-2018

approved as noted on page 3



N site plan

1" = 20'-0"

PROPERTY ZONING DATA

EXISTING ZONING: B-3 OFFICE / INSTITUTIONAL DISTRICT
PROPOSED ZONING: PUD PLANNED UNIT DEVELOPMENT DISTRICT

EXISTING RIGHT OF WAY: 40'-0"
PROPOSED RIGHT OF WAY: 50'-0" (PER HILLIARD THOROUGHFARE PLAN)

LOT COVERAGE CALCULATIONS:

PARCEL 050-002428-00= 0.90 ACRES (39,204 S.F.)
PARCEL 050-002401-00= 0.90 ACRES (39,204 S.F.)

TOTAL SITE AREA: 1.80 ACRES (78,408 S.F.)

BUILDING AREA: 1,716 S.F.
PARKING LOT / SIDEWALK AREA: 35,644 S.F.
TOTAL IMPERVIOUS SURFACE AREA: 37,360 S.F.

TOTAL LOT COVERAGE: 47.6%

MAXIMUM ALLOWABLE BUILDING HEIGHT: 45'-0"
PROPOSED BUILDING HEIGHT: 19'-0"

PROPERTY SETBACK INFORMATION:
REQUIRED BUILDING FRONT YARD: 93'-0"
PROPOSED BUILDING FRONT YARD: 86'-7"
REQUIRED FRONT YARD PARKING: 20'-0"
PROPOSED FRONT YARD PARKING: 20'-0"
REQUIRED BUILDING SIDE YARD: 20'-0"
PROPOSED BUILDING SIDE YARD: 88'-7" / 105'-0"
REQUIRED BUILDING REAR YARD: 30'-0"
PROPOSED BUILDING REAR YARD: 147'-1"

PARKING CALCULATIONS:

STANDARD RESTAURANT
1 SPACE / 75 U.F.A. = 23 SPACES REQUIRED
MAXIMUM PARKING SPACES ALLOWED: 26 SPACES

TOTAL PARKING PROVIDED: 92 SPACES
NO BICYCLE PARKING PROVIDED

CARNEY • RANKER
ARCHITECTS LTD
5925 Wilcox Place, Suite E Dublin, OH 43016
Ph. 614-792-1000 Fax 614-792-1001
mail@carneyranker.com

A New Building For
Swensons
4810 Cemetery Road
Hilliard, OH

CRA Proj. No.: 18-010
Drawn by: HCA
Checked By: AWN
Date: 5/31/18
Revisions

SP.01

N vicinity plan

1" = 80'-0"

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ARCHITECTS LTD
5925 Wilcox Place, Suite E Dublin, OH 43016
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Date: 5/31/18
Revisions

SP.01

Attachment B
Count Data & MORPC Corespondence

Attachment B

CARPENTER MARTY transportation

Cemetery and JW Reason Site Drive - TMC
Wed Aug 30, 2017
Full Length (7AM-9AM, 2:30PM-6PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 441621, Location: 40.031296, -83.144775, Site Code: TRA17039

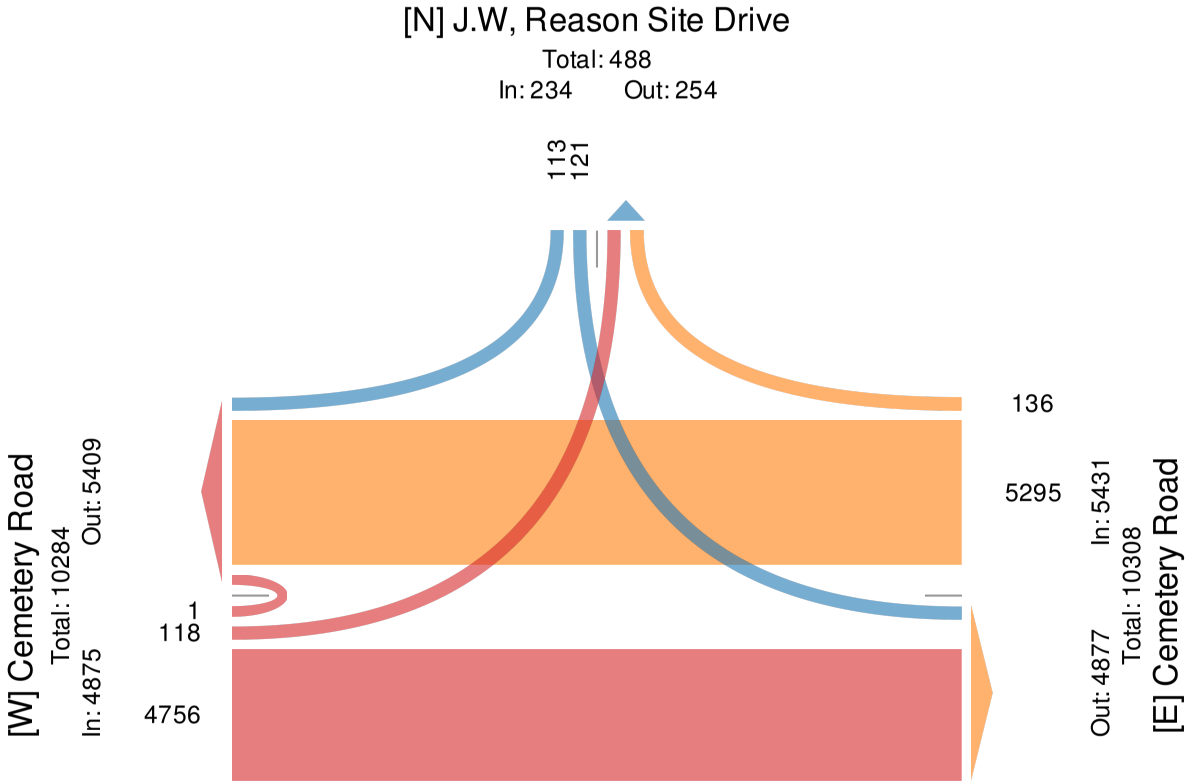
Provided by: Carpenter Marty (CM) Transportation Inc.
6612 Singletree Drive, Columbus, OH, 43229, US

Leg / Direction	Cemetery Road Eastbound				Cemetery Road Westbound				J.W, Reason Site Drive Southbound				
Time	L	T	U	**App**	T	R	U	**App**	L	R	U	**App**	**Int**
2017-08-30 7:00AM	4	238	0	**242**	107	4	0	**111**	6	1	0	**7**	**360**
7:15AM	6	272	0	**278**	120	3	0	**123**	6	0	0	**6**	**407**
7:30AM	14	274	0	**288**	122	12	0	**134**	6	1	0	**7**	**429**
7:45AM	12	277	0	**289**	123	12	0	**135**	6	2	0	**8**	**432**
Hourly Total	36	1061	0	**1097**	472	31	0	**503**	24	4	0	**28**	**1628**
8:00AM	7	265	0	**272**	130	1	0	**131**	1	2	0	**3**	**406**
8:15AM	1	223	0	**224**	151	3	0	**154**	4	1	0	**5**	**383**
8:30AM	8	223	0	**231**	132	15	0	**147**	4	3	0	**7**	**385**
8:45AM	22	245	0	**267**	164	23	0	**187**	25	32	0	**57**	**511**
Hourly Total	38	956	0	**994**	577	42	0	**619**	34	38	0	**72**	**1685**
2:30PM	1	142	0	**143**	266	3	0	**269**	1	1	0	**2**	**414**
2:45PM	4	228	0	**232**	259	4	0	**263**	4	1	0	**5**	**500**
Hourly Total	5	370	0	**375**	525	7	0	**532**	5	2	0	**7**	**914**
3:00PM	7	229	0	**236**	302	4	0	**306**	0	1	0	**1**	**543**
3:15PM	8	173	0	**181**	286	8	0	**294**	2	1	0	**3**	**478**
3:30PM	3	184	0	**187**	283	13	0	**296**	17	28	0	**45**	**528**
3:45PM	0	200	0	**200**	320	0	0	**320**	5	8	0	**13**	**533**
Hourly Total	18	786	0	**804**	1191	25	0	**1216**	24	38	0	**62**	**2082**
4:00PM	1	207	0	**208**	299	1	0	**300**	2	6	0	**8**	**516**
4:15PM	0	195	0	**195**	327	4	0	**331**	6	2	0	**8**	**534**
4:30PM	1	214	0	**215**	349	3	0	**352**	3	3	0	**6**	**573**
4:45PM	2	199	0	**201**	329	2	0	**331**	4	2	0	**6**	**538**
Hourly Total	4	815	0	**819**	1304	10	0	**1314**	15	13	0	**28**	**2161**
5:00PM	0	229	0	**229**	315	9	0	**324**	6	3	0	**9**	**562**
5:15PM	2	204	1	**207**	318	0	0	**318**	2	2	0	**4**	**529**
5:30PM	2	167	0	**169**	327	8	0	**335**	2	1	0	**3**	**507**
5:45PM	13	168	0	**181**	266	4	0	**270**	9	12	0	**21**	**472**
Hourly Total	17	768	1	**786**	1226	21	0	**1247**	19	18	0	**37**	**2070**
Total	118	4756	1	**4875**	5295	136	0	**5431**	121	113	0	**234**	**10540**
% Approach	2.4%	97.6%	0%	-	97.5%	2.5%	0%	-	51.7%	48.3%	0%	-	-
% Total	1.1%	45.1%	0%	**46.3%**	50.2%	1.3%	0%	**51.5%**	1.1%	1.1%	0%	**2.2%**	-
Lights	105	4620	1	**4726**	5179	114	0	**5293**	111	88	0	**199**	10218
% Lights	89.0%	97.1%	100%	**96.9%**	97.8%	83.8%	0%	**97.5%**	91.7%	77.9%	0%	**85.0%**	96.9%
Articulated Trucks and Single-Unit Trucks	1	92	0	**93**	82	0	0	**82**	0	1	0	**1**	176
% Articulated Trucks and Single-Unit Trucks	0.8%	1.9%	0%	**1.9%**	1.5%	0%	0%	**1.5%**	0%	0.9%	0%	**0.4%**	1.7%
Buses	12	44	0	**56**	34	22	0	**56**	10	24	0	**34**	146
% Buses	10.2%	0.9%	0%	**1.1%**	0.6%	16.2%	0%	**1.0%**	8.3%	21.2%	0%	**14.5%**	1.4%

*L: Left, R: Right, T: Thru, U: U-Turn

Cemetery and JW Reason Site Drive - TMC
Wed Aug 30, 2017
Full Length (7AM-9AM, 2:30PM-6PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 441621, Location: 40.031296, -83.144775, Site Code: TRA17039

Provided by: Carpenter Marty (CM) Transportation Inc.
6612 Singletree Drive, Columbus, OH, 43229, US



Cemetery and JW Reason Site Drive - TMC
Wed Aug 30, 2017
AM Peak (8AM - 9AM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 441621, Location: 40.031296, -83.144775, Site Code: TRA17039

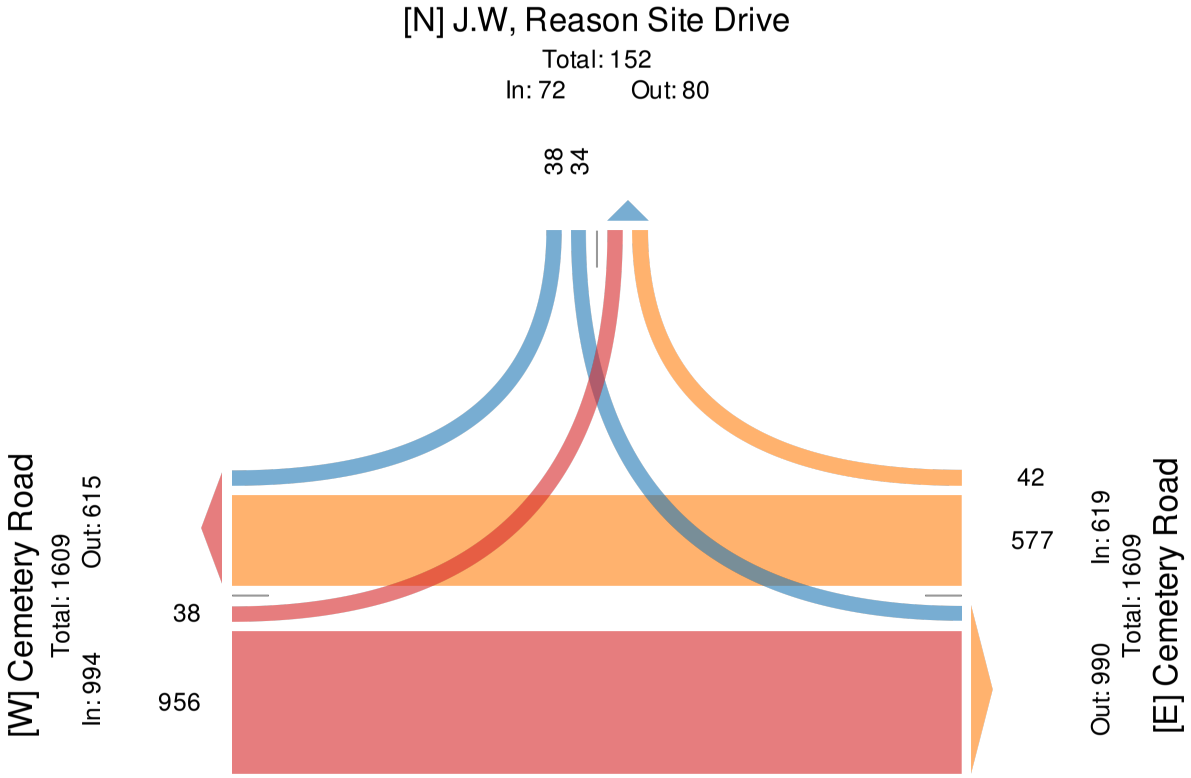
Provided by: Carpenter Marty (CM) Transportation Inc.
6612 Singletree Drive, Columbus, OH, 43229, US

Leg Direction	Cemetery Road Eastbound				Cemetery Road Westbound				J.W, Reason Site Drive Southbound				
Time	L	T	U	**App**	T	R	U	**App**	L	R	U	**App**	**Int**
2017-08-30 8:00AM	7	265	0	**272**	130	1	0	**131**	1	2	0	**3**	**406**
8:15AM	1	223	0	**224**	151	3	0	**154**	4	1	0	**5**	**383**
8:30AM	8	223	0	**231**	132	15	0	**147**	4	3	0	**7**	**385**
8:45AM	22	245	0	**267**	164	23	0	**187**	25	32	0	**57**	**511**
Total	38	956	0	**994**	577	42	0	**619**	34	38	0	**72**	**1685**
% Approach	3.8%	96.2%	0%	-	93.2%	6.8%	0%	-	47.2%	52.8%	0%	-	-
% Total	2.3%	56.7%	0%	**59.0%**	34.2%	2.5%	0%	**36.7%**	2.0%	2.3%	0%	**4.3%**	-
PHF	0.432	0.902	-	**0.914**	0.880	0.457	-	**0.828**	0.340	0.297	-	**0.316**	0.824
Lights	34	913	0	**947**	547	28	0	**575**	28	26	0	**54**	1576
% Lights	89.5%	95.5%	0%	**95.3%**	94.8%	66.7%	0%	**92.9%**	82.4%	68.4%	0%	**75.0%**	93.5%
Articulated Trucks and Single-Unit Trucks	0	32	0	**32**	24	0	0	**24**	0	0	0	**0**	56
% Articulated Trucks and Single-Unit Trucks	0%	3.3%	0%	**3.2%**	4.2%	0%	0%	**3.9%**	0%	0%	0%	**0%**	3.3%
Buses	4	11	0	**15**	6	14	0	**20**	6	12	0	**18**	53
% Buses	10.5%	1.2%	0%	**1.5%**	1.0%	33.3%	0%	**3.2%**	17.6%	31.6%	0%	**25.0%**	3.1%

* L: Left, R: Right, T: Thru, U: U-Turn

Cemetery and JW Reason Site Drive - TMC
Wed Aug 30, 2017
AM Peak (8AM - 9AM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 441621, Location: 40.031296, -83.144775, Site Code: TRA17039

Provided by: Carpenter Marty (CM) Transportation Inc.
6612 Singletree Drive, Columbus, OH, 43229, US



Cemetery and JW Reason Site Drive - TMC
Wed Aug 30, 2017
PM Peak (4:15PM - 5:15PM) - Overall Peak Hour
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 441621, Location: 40.031296, -83.144775, Site Code: TRA17039

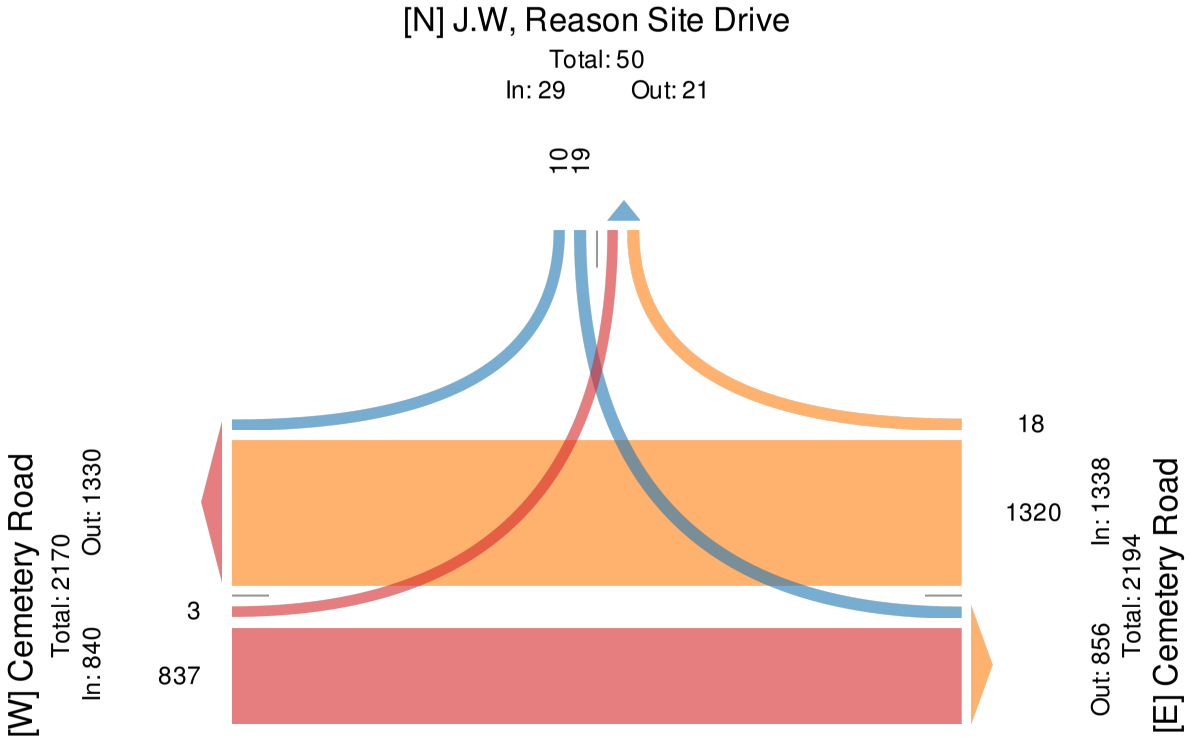
Provided by: Carpenter Marty (CM) Transportation Inc.
6612 Singletree Drive, Columbus, OH, 43229, US

Leg Direction	Cemetery Road Eastbound				Cemetery Road Westbound				J.W, Reason Site Drive Southbound				
Time	L	T	U	**App**	T	R	U	**App**	L	R	U	**App**	**Int**
2017-08-30 4:15PM	0	195	0	**195**	327	4	0	**331**	6	2	0	**8**	**534**
4:30PM	1	214	0	**215**	349	3	0	**352**	3	3	0	**6**	**573**
4:45PM	2	199	0	**201**	329	2	0	**331**	4	2	0	**6**	**538**
5:00PM	0	229	0	**229**	315	9	0	**324**	6	3	0	**9**	**562**
Total	3	837	0	**840**	1320	18	0	**1338**	19	10	0	**29**	**2207**
% Approach	0.4%	99.6%	0%	-	98.7%	1.3%	0%	-	65.5%	34.5%	0%	-	-
% Total	0.1%	37.9%	0%	**38.1%**	59.8%	0.8%	0%	**60.6%**	0.9%	0.5%	0%	**1.3%**	-
PHF	0.375	0.914	-	**0.917**	0.946	0.500	-	**0.950**	0.792	0.833	-	**0.806**	0.963
Lights	3	818	0	**821**	1307	18	0	**1325**	19	10	0	**29**	2175
% Lights	100%	97.7%	0%	**97.7%**	99.0%	100%	0%	**99.0%**	100%	100%	0%	**100%**	98.6%
Articulated Trucks and Single-Unit Trucks	0	13	0	**13**	8	0	0	**8**	0	0	0	**0**	21
% Articulated Trucks and Single-Unit Trucks	0%	1.6%	0%	**1.5%**	0.6%	0%	0%	**0.6%**	0%	0%	0%	**0%**	1.0%
Buses	0	6	0	**6**	5	0	0	**5**	0	0	0	**0**	11
% Buses	0%	0.7%	0%	**0.7%**	0.4%	0%	0%	**0.4%**	0%	0%	0%	**0%**	0.5%

* L: Left, R: Right, T: Thru, U: U-Turn

Cemetery and JW Reason Site Drive - TMC
Wed Aug 30, 2017
PM Peak (4:15PM - 5:15PM) - Overall Peak Hour
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 441621, Location: 40.031296, -83.144775, Site Code: TRA17039

Provided by: Carpenter Marty (CM) Transportation Inc.
6612 Singletree Drive, Columbus, OH, 43229, US



From:	Gina Balsamo
To:	Drew Laurent
Subject:	FW: Growth Rate Request for Cemetery Road at JW Reason
Date:	Monday, June 11, 2018 11:15:36 AM
Attachments:	image001.png

Gina Balsamo, P.E.

Carpenter Marty Transportation
614.656.2429

From: Hwashik Jang [mailto:hjang@morpc.org]
Sent: Monday, June 11, 2018 11:09 AM
To: Gina Balsamo <gbalsamo@cmtran.com>
Cc: Nick Gill <ngill@morpc.org>; Zhuojun Jiang <zjiang@morpc.org>
Subject: RE: Growth Rate Request for Cemetery Road at JW Reason

Gina,

We have completed processing growth rates on Cemetery Rd at JW Reason Dr.
Please use an overall **0.5%** linear annual growth rate for the study intersection.

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: Gina Balsamo [mailto:gbalsamo@cmtran.com]
Sent: Friday, June 1, 2018 3:18 PM
To: Hwashik Jang <hjang@morpc.org>; Nick Gill <ngill@morpc.org>; Zhuojun Jiang <zjiang@morpc.org>
Subject: Growth Rate Request for Cemetery Road at JW Reason

Good Afternoon,

We would like to request a growth rate for Cemetery Road at JW Reason Elementary School. Count

data at the intersection is attached. We will be conducting a TIS for a proposed Swenson's at the NW corner of this intersection. Please see attached site plan. The opening year will be 2019 with a 10 year horizon. The study will be reviewed by the City of Hilliard.

Please let me know if you have questions.

Thanks,

Gina Balsamo, P.E.
Traffic Engineer
CARPENTER MARTY transportation
6612 Singletree Drive | Columbus, Ohio 43229
614.656.2429 | www.cmtran.com

Attachment C
Trip Generation

Attachment C

CARPENTER MARTY transportation

Project Information	
Project Name:	Swensons Cemetery Road
No:	
Date:	6/4/2018
City:	
State/Province:	
Zip/Postal Code:	
Country:	
Client Name:	
Analyst's Name:	
Edition:	ITE-TGM 10th Edition

Land Use	Size	PM Peak of Generator		PM Peak of Adjacent Street Traffic		Weekday	
		Entry	Exit	Entry	Exit	Entry	Exit
933 - Fast-Food Restaurant without Drive-Through Window (General Urban/Suburban)	1.8 1000 Sq. Ft. GFA	44	44	26	25	312	311
Reduction		0	0	0	0	0	0
Internal		0	0	0	0	0	0
Pass-by		19	19	11	11	0	0
Non-pass-by		25	25	15	14	312	311
Total		44	44	26	25	312	311
Total Reduction		0	0	0	0	0	0
Total Internal		0	0	0	0	0	0
Total Pass-by		19	19	11	11	0	0
Total Non-pass-by		25	25	15	14	312	311

PERIOD SETTING

Analysis Name :	PM Peak of Adjacent Street Traffic		
Project Name :	Swensons Cemetery Road	**No :**	
Date:	6/4/2018	**City:**	
State/Province:		**Zip/Postal Code:**	
Country:		**Client Name:**	
Analyst's Name:		**Edition:**	ITE-TGM 10th Edition

Land Use	Independent Variable	Size	Time Period	Method	Entry	Exit	Total
933 - Fast-Food Restaurant without Drive-Through Window (General Urban/Suburban)	1000 Sq. Ft. GFA	1.8(0)	Weekday, Peak Hour of Adjacent Street Traffic, One Hour Between 4 and 6 p.m.	Average 28.34	26 51%	25 49%	51

(0) indicates size out of range.

TRAFFIC REDUCTIONS

Land Use	Entry Reduction	Adjusted Entry	Exit Reduction	Adjusted Exit
933 - Fast-Food Restaurant without Drive-Through Window	0 %	26	0 %	25

EXTERNAL TRIPS

Land Use	External Trips	Pass-by%	Pass-by Trips	Non-pass-by Trips
933 - Fast-Food Restaurant without Drive-Through Window	51	43	22	29

ITE DEVIATION DETAILS

Weekday, Peak Hour of Adjacent Street Traffic, One Hour Between 4 and 6 p.m.

Landuse — No deviations from ITE.

Methods — No deviations from ITE.

External Trips — 933 - Fast-Food Restaurant without Drive-Through Window (General Urban/Suburban)
ITE does not recommend a particular pass-by% for this case.

SUMMARY

Total Entering	26
Total Exiting	25
Total Entering Reduction	0
Total Exiting Reduction	0
Total Entering Internal Capture Reduction	0
Total Exiting Internal Capture Reduction	0
Total Entering Pass-by Reduction	11
Total Exiting Pass-by Reduction	11
Total Entering Non-Pass-by Trips	15
Total Exiting Non-Pass-by Trips	14

PERIOD SETTING

Analysis Name :	PM Peak of Generator		
Project Name :	Swensons Cemetery Road	**No :**	
Date:	6/4/2018	**City:**	
State/Province:		**Zip/Postal Code:**	
Country:		**Client Name:**	
Analyst's Name:		**Edition:**	ITE-TGM 10th Edition

Land Use	Independent Variable	Size	Time Period	Method	Entry	Exit	Total
933 - Fast-Food Restaurant without Drive-Through Window (General Urban/Suburban)	1000 Sq. Ft. GFA	1.8	Weekday, PM Peak Hour of Generator	Average 48.7	44 50%	44 50%	88

TRAFFIC REDUCTIONS

Land Use	Entry Reduction	Adjusted Entry	Exit Reduction	Adjusted Exit
933 - Fast-Food Restaurant without Drive-Through Window	0 %	44	0 %	44

EXTERNAL TRIPS

Land Use	External Trips	Pass-by%	Pass-by Trips	Non-pass-by Trips
933 - Fast-Food Restaurant without Drive-Through Window	88	43	38	50

ITE DEVIATION DETAILS

Weekday, PM Peak Hour of Generator

Landuse No deviations from ITE.

Methods No deviations from ITE.

External Trips 933 - Fast-Food Restaurant without Drive-Through Window (General Urban/Suburban)
ITE does not recommend a particular pass-by% for this case.

SUMMARY

Total Entering	44
Total Exiting	44
Total Entering Reduction	0
Total Exiting Reduction	0
Total Entering Internal Capture Reduction	0
Total Exiting Internal Capture Reduction	0
Total Entering Pass-by Reduction	19
Total Exiting Pass-by Reduction	19
Total Entering Non-Pass-by Trips	25
Total Exiting Non-Pass-by Trips	25

PERIOD SETTING

Analysis Name :	Weekday		
Project Name :	Swensons Cemetery Road	**No :**	
Date:	6/4/2018	**City:**	
State/Province:		**Zip/Postal Code:**	
Country:		**Client Name:**	
Analyst's Name:		**Edition:**	ITE-TGM 10th Edition

Land Use	Independent Variable	Size	Time Period	Method	Entry	Exit	Total
933 - Fast-Food Restaurant without Drive-Through Window (General Urban/Suburban)	1000 Sq. Ft. GFA	1.8	Weekday	Average 346.23	312(0) 50%	311(0) 50%	623(0)

(0) indicates small sample size, use carefully.

TRAFFIC REDUCTIONS

Land Use	Entry Reduction	Adjusted Entry	Exit Reduction	Adjusted Exit
933 - Fast-Food Restaurant without Drive-Through Window	0 %	312	0 %	311

EXTERNAL TRIPS

Land Use	External Trips	Pass-by%	Pass-by Trips	Non-pass-by Trips
933 - Fast-Food Restaurant without Drive-Through Window	623	0	0	623

ITE DEVIATION DETAILS

Weekday

Landuse	No deviations from ITE.
Methods	No deviations from ITE.
External Trips	933 - Fast-Food Restaurant without Drive-Through Window (General Urban/Suburban) ITE does not recommend a particular pass-by% for this case.

SUMMARY

Total Entering	312
Total Exiting	311
Total Entering Reduction	0
Total Exiting Reduction	0
Total Entering Internal Capture Reduction	0
Total Exiting Internal Capture Reduction	0
Total Entering Pass-by Reduction	0
Total Exiting Pass-by Reduction	0
Total Entering Non-Pass-by Trips	312
Total Exiting Non-Pass-by Trips	311

Attachment D
Volume Calculations

Attachment D

CARPENTER MARTY transportation

CARPENTER MARTY transportation	Year	Period	Scenario	Plate
		PM	Non-Pass-By Distribution	

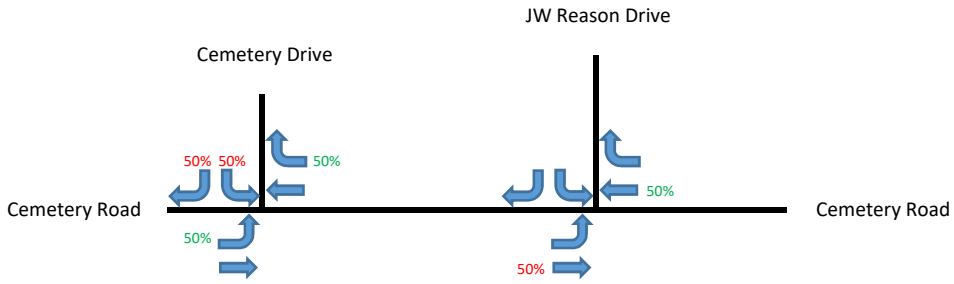
^
N

The majority of eastbound, entering site traffic was placed at the J.W. Reason Drive to produce more conservative queuing results at the signal. It is understood that this may not represent true driver behavior as more drivers coming from the west may choose to enter at the Cemetery Road Drive.

CARPENTER MARTY transportation	Year	Period	Scenario	Plate
		PM	Non-Pass-By Distribution (Gate Closed)*	

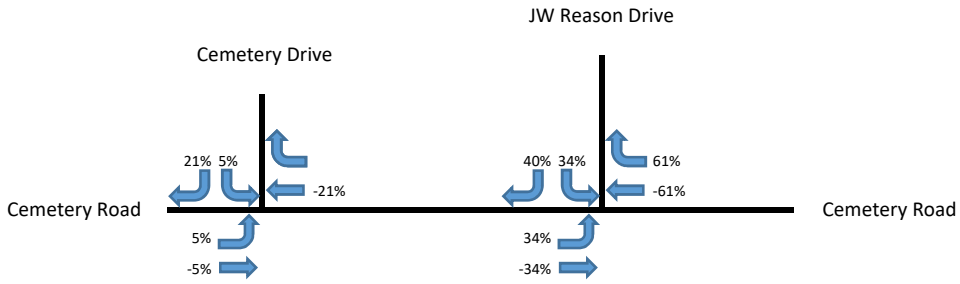
*Shown for reference only

^
N



CARPENTER MARTY transportation	Year	Period	Scenario	Plate
		PM	Pass-By Distribution	

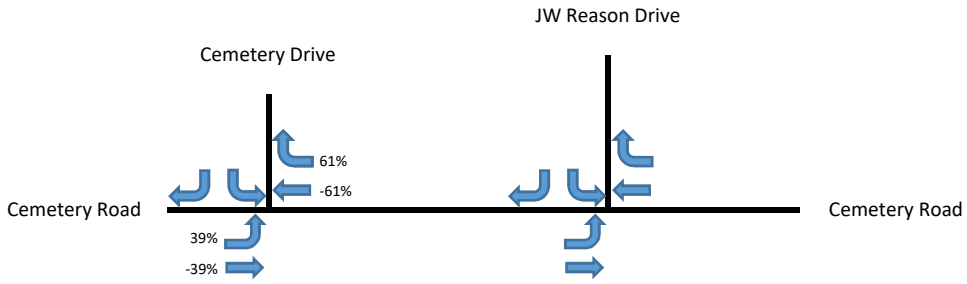
^
N



CARPENTER MARTY transportation	Year	Period	Scenario	Plate
		PM	Pass-By Distribution (Gate Closed)*	

*Shown for reference only

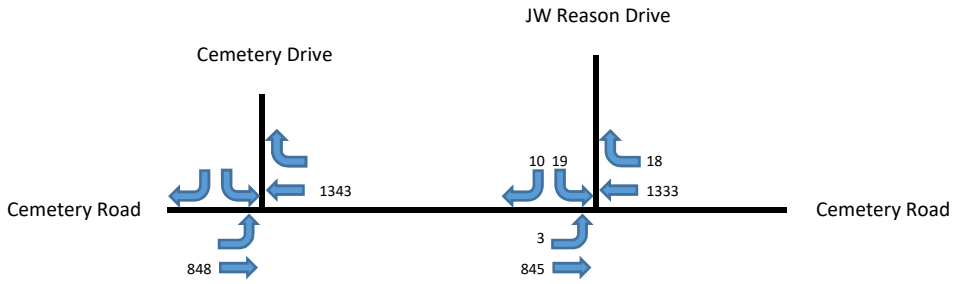
^
N



CARPENTER MARTY transportation	Year	Period	Scenario	Plate
	2019	PM	Background	A

^
N

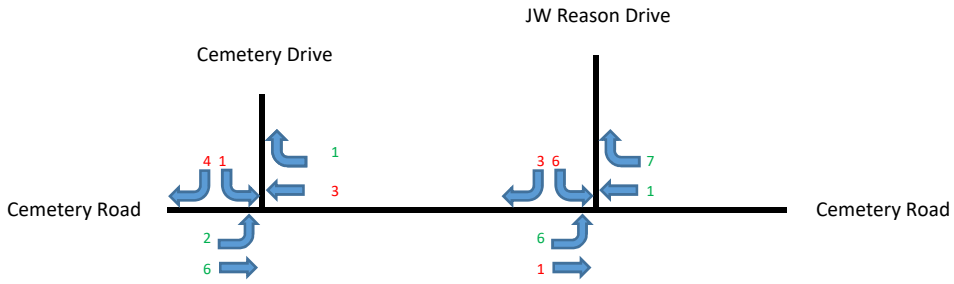
Growth Rate 0.50%



CARPENTER MARTY transportation	Year	Period	Scenario	Plate
		PM	Non-Pass-By	B

^
N

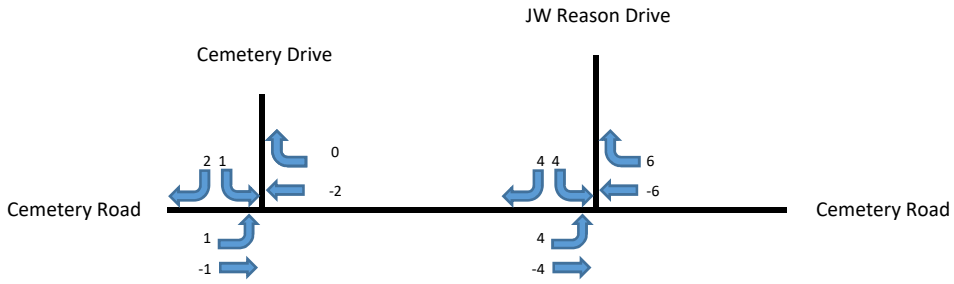
Entry 15
Exit 14



CARPENTER MARTY transportation	Year	Period	Scenario	Plate
		PM	Pass-By	C

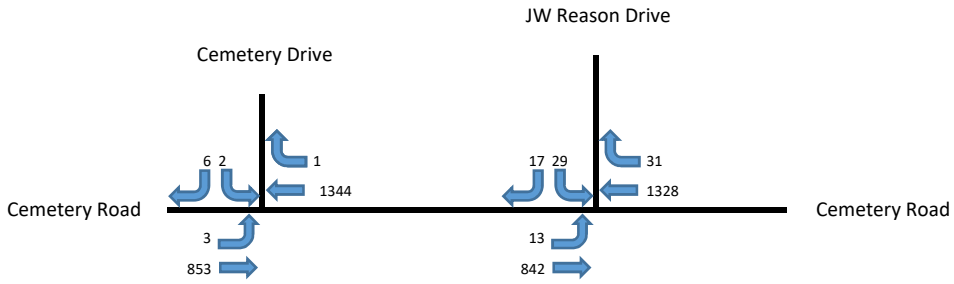
^
N

Entry	11
Exit	11
Balanced	11



	Year	Period	Scenario	Plate
CARPENTER MARTY transportation	2019	PM	Build Traffic	D = A + B + C

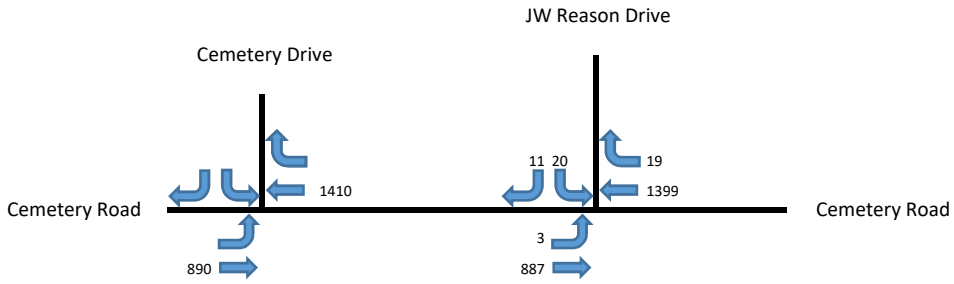
^
N



CARPENTER MARTY transportation	Year	Period	Scenario	Plate
	2029	PM	Background	E

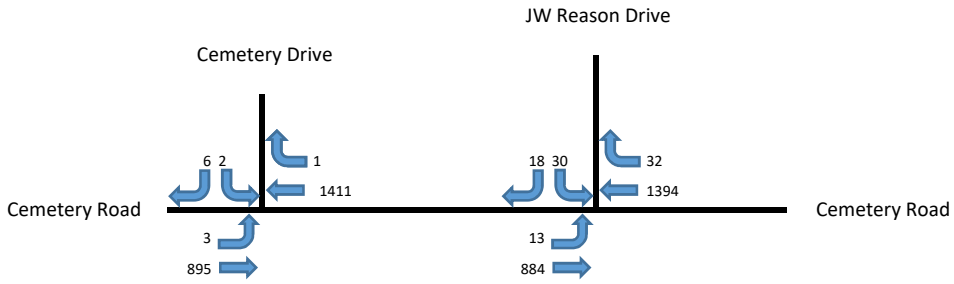
^
N

Growth Rate 0.50%



CARPENTER MARTY transportation	Year	Period	Scenario	Plate
	2029	PM	Build Traffic	F = E + B + C

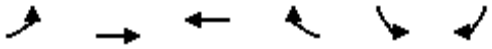
^
N



Attachment E
Capacity, Queuing, & Turn Lane Length Analysis

Attachment E

CARPENTER MARTY transportation



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	3	887	1399	19	20	11
Future Volume (veh/h)	3	887	1399	19	20	11
Number	5	2	6	16	7	14
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1900	1863	1900
Adj Flow Rate, veh/h	3	964	1473	20	25	14
Adj No. of Lanes	1	2	2	0	0	0
Peak Hour Factor	0.92	0.92	0.95	0.95	0.81	0.81
Percent Heavy Veh, %	2	2	2	2	0	0
Cap, veh/h	311	2695	2359	32	46	26
Arrive On Green	0.00	0.76	0.66	0.66	0.04	0.04
Sat Flow, veh/h	1774	3632	3668	49	1065	596
Grp Volume(v), veh/h	3	964	729	764	40	0
Grp Sat Flow(s),veh/h/ln	1774	1770	1770	1854	1704	0
Q Serve(g_s), s	0.0	4.1	11.0	11.0	1.1	0.0
Cycle Q Clear(g_c), s	0.0	4.1	11.0	11.0	1.1	0.0
Prop In Lane	1.00			0.03	0.62	0.35
Lane Grp Cap(c), veh/h	311	2695	1168	1223	74	0
V/C Ratio(X)	0.01	0.36	0.62	0.62	0.54	0.00
Avail Cap(c_a), veh/h	515	7021	3127	3276	720	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	3.8	1.8	4.5	4.5	21.6	0.0
Incr Delay (d2), s/veh	0.0	0.1	0.6	0.5	6.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	1.9	5.2	5.7	0.6	0.0
LnGrp Delay(d),s/veh	3.8	1.9	5.1	5.1	27.6	0.0
LnGrp LOS	A	A	A	A	C	
Approach Vol, veh/h		967	1493		40	
Approach Delay, s/veh		1.9	5.1		27.6	
Approach LOS		A	A		C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		
Phs Duration (G+Y+Rc), s		39.6		6.5	4.7	34.9		
Change Period (Y+Rc), s		4.5		4.5	4.5	4.5		
Max Green Setting (Gmax), s		91.5		19.5	5.5	81.5		
Max Q Clear Time (g_c+I1), s		6.1		3.1	2.0	13.0		
Green Ext Time (p_c), s		9.1		0.1	0.0	17.4		

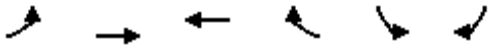
Intersection Summary	
HCM 2010 Ctrl Delay	4.2
HCM 2010 LOS	A

Notes

Phase Number	2	4	5	6
Movement	EBTL	SBL	EBL	WBT
Lead/Lag			Lead	Lag
Lead-Lag Optimize			Yes	Yes
Recall Mode	None	None	None	None
Maximum Split (s)	96	24	10	86
Maximum Split (%)	80.0%	20.0%	8.3%	71.7%
Minimum Split (s)	22.5	22.5	9.5	22.5
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	1	1	1	1
Minimum Initial (s)	5	5	5	5
Vehicle Extension (s)	3	3	3	3
Minimum Gap (s)	3	3	3	3
Time Before Reduce (s)	0	0	0	0
Time To Reduce (s)	0	0	0	0
Walk Time (s)	7	7		7
Flash Dont Walk (s)	11	11		11
Dual Entry	Yes	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	0	96	0	10
End Time (s)	96	0	10	96
Yield/Force Off (s)	91.5	115.5	5.5	91.5
Yield/Force Off 170(s)	80.5	104.5	5.5	80.5
Local Start Time (s)	110	86	110	0
Local Yield (s)	81.5	105.5	115.5	81.5
Local Yield 170(s)	70.5	94.5	115.5	70.5

Intersection Summary	
Cycle Length	120
Control Type	Semi Act-Uncoord
Natural Cycle	70

Splits and Phases: 3: Cemetery Road & JW Reason Drive



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	13	884	1394	32	30	18
Future Volume (veh/h)	13	884	1394	32	30	18
Number	5	2	6	16	7	14
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1900	1863	1900
Adj Flow Rate, veh/h	14	961	1467	34	37	22
Adj No. of Lanes	1	2	2	0	0	0
Peak Hour Factor	0.92	0.92	0.95	0.95	0.81	0.81
Percent Heavy Veh, %	2	2	2	2	0	0
Cap, veh/h	318	2687	2297	53	60	36
Arrive On Green	0.02	0.76	0.65	0.65	0.06	0.06
Sat Flow, veh/h	1774	3632	3629	82	1049	623
Grp Volume(v), veh/h	14	961	733	768	60	0
Grp Sat Flow(s),veh/h/ln	1774	1770	1770	1848	1700	0
Q Serve(g_s), s	0.1	4.4	12.1	12.2	1.7	0.0
Cycle Q Clear(g_c), s	0.1	4.4	12.1	12.2	1.7	0.0
Prop In Lane	1.00			0.04	0.62	0.37
Lane Grp Cap(c), veh/h	318	2687	1149	1201	97	0
V/C Ratio(X)	0.04	0.36	0.64	0.64	0.62	0.00
Avail Cap(c_a), veh/h	486	6616	2946	3077	677	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	4.2	1.9	5.1	5.1	22.6	0.0
Incr Delay (d2), s/veh	0.1	0.1	0.6	0.6	6.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	2.0	5.9	6.2	1.0	0.0
LnGrp Delay(d),s/veh	4.3	2.0	5.7	5.7	28.9	0.0
LnGrp LOS	A	A	A	A	C	
Approach Vol, veh/h		975	1501		60	
Approach Delay, s/veh		2.1	5.7		28.9	
Approach LOS		A	A		C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		
Phs Duration (G+Y+Rc), s		41.7		7.3	5.4	36.3		
Change Period (Y+Rc), s		4.5		4.5	4.5	4.5		
Max Green Setting (Gmax), s		91.5		19.5	5.5	81.5		
Max Q Clear Time (g_c+I1), s		6.4		3.7	2.1	14.2		
Green Ext Time (p_c), s		9.1		0.1	0.0	17.6		

Intersection Summary	
HCM 2010 Ctrl Delay	4.9
HCM 2010 LOS	A

Notes

Phase Number	2	4	5	6
Movement	EBTL	SBL	EBL	WBT
Lead/Lag			Lead	Lag
Lead-Lag Optimize			Yes	Yes
Recall Mode	None	None	None	None
Maximum Split (s)	96	24	10	86
Maximum Split (%)	80.0%	20.0%	8.3%	71.7%
Minimum Split (s)	22.5	22.5	9.5	22.5
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	1	1	1	1
Minimum Initial (s)	5	5	5	5
Vehicle Extension (s)	3	3	3	3
Minimum Gap (s)	3	3	3	3
Time Before Reduce (s)	0	0	0	0
Time To Reduce (s)	0	0	0	0
Walk Time (s)	7	7		7
Flash Dont Walk (s)	11	11		11
Dual Entry	Yes	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	0	96	0	10
End Time (s)	96	0	10	96
Yield/Force Off (s)	91.5	115.5	5.5	91.5
Yield/Force Off 170(s)	80.5	104.5	5.5	80.5
Local Start Time (s)	110	86	110	0
Local Yield (s)	81.5	105.5	115.5	81.5
Local Yield 170(s)	70.5	94.5	115.5	70.5

Intersection Summary	
Cycle Length	120
Control Type	Semi Act-Uncoord
Natural Cycle	70

Splits and Phases: 3: Cemetery Road & JW Reason Drive

Intersection	
Int Delay, s/veh	0.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	3	895	1411	1	2	6
Future Vol, veh/h	3	895	1411	1	2	6
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	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	95	95	81	81
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	3	973	1485	1	2	7

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	1486	0	-	0	1979	743
Stage 1	-	-	-	-	1486	-
Stage 2	-	-	-	-	493	-
Critical Hdwy	4.14	-	-	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	2.22	-	-	-	3.52	3.32
Pot Cap-1 Maneuver	448	-	-	-	54	358
Stage 1	-	-	-	-	174	-
Stage 2	-	-	-	-	579	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	448	-	-	-	54	358
Mov Cap-2 Maneuver	-	-	-	-	54	-
Stage 1	-	-	-	-	173	-
Stage 2	-	-	-	-	579	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	30.9
HCM LOS			D

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	448	-	-	-	149
HCM Lane V/C Ratio	0.007	-	-	-	0.066
HCM Control Delay (s)	13.1	-	-	-	30.9
HCM Lane LOS	B	-	-	-	D
HCM 95th %tile Q(veh)	0	-	-	-	0.2

Intersection: 3: Cemetery Road & JW Reason Drive

Movement	EB	EB	EB	WB	WB	SB
Directions Served	L	T	T	T	TR	LR
Maximum Queue (ft)	39	118	104	159	131	88
Average Queue (ft)	12	42	17	64	37	33
95th Queue (ft)	38	99	58	135	95	66
Link Distance (ft)		155	155	608	608	548
Upstream Blk Time (%)		0	0			
Queuing Penalty (veh)		0	0			
Storage Bay Dist (ft)	125					
Storage Blk Time (%)		0				
Queuing Penalty (veh)		0				

Intersection: 5: Cemetery Road & Cemetery Drive

Movement	EB	SB
Directions Served	L	LR
Maximum Queue (ft)	31	31
Average Queue (ft)	2	7
95th Queue (ft)	15	28
Link Distance (ft)	239	324
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 0


Cemetery Drive
Drive
Cemetery Road
Queue Lengths
All Intervals
Color
Queue Type
Average
95th Percentile
Max Observed

Left Turn Lane Length Calculations

AM Peak (N/A)	Design Speed		mph
	Traffic Control		
	Cycle Length		
	Cycles Per Hour		*Error*
	Turn Lane Volume		VPH
	Advancing Traffic		VPH
	Left Turn Percentage		
	Location Type		
	Condition		
	Vehicles/Cycle		
	Turn Lane Length		
	Offset Width		
	Approach Taper		
PM Peak	Design Speed	40	mph
	Traffic Control	Unsignalized	
	Cycle Length	Unsignalized	
	Cycles Per Hour	60	*Assume 60*
	Turn Lane Volume	3	VPH
	Advancing Traffic	898	VPH
	Left Turn Percentage	0%	
	Location Type	Through Road	
	Condition	B	
	Vehicles/Cycle	1	
	Turn Lane Length	125	
	Offset Width	12	
	Approach Taper	320	

Left Turn Lane Length Calculations

AM Peak (N/A)	Design Speed		mph
	Traffic Control		
	Cycle Length		
	Cycles Per Hour		*Error*
	Turn Lane Volume		VPH
	Advancing Traffic		VPH
	Left Turn Percentage		
	Location Type		
	Condition		
	Vehicles/Cycle		
	Turn Lane Length		#DIV/0!
	Offset Width		
	Approach Taper		
PM Peak	Design Speed	40	mph
	Traffic Control	Signalized - 3 Phase	
	Cycle Length	Known	
	Cycles Per Hour	30	*Enter Cycles Per Hour*
	Turn Lane Volume	13	VPH
	Advancing Traffic	897	VPH
	Left Turn Percentage	1%	
	Location Type	Intersection	
	Condition	B or C	
	Vehicles/Cycle	1	
	Turn Lane Length	See Column to Right	165
	Offset Width	12	
	Approach Taper	320	