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Traffic Engineering and Planning

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"BISHOP TUBE"
228-UNIT RESIDENTIAL
TOWNHOUSE DEVELOPMENT

TRANSPORTATION IMPACT ASSESSMENT

East Whiteland Township

Chester County, Pennsylvania

prepared for submission to:

EAST WHITELAND TOWNSHIP

prepared by:

F. TAVANI AND ASSOCIATES, INC.

25 AUGUST 2015

Frank Tavani, P.E., PTOE
Pennsylvania License # 052846-E

FTA JOB NUMBER 214-004

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EXECUTIVE SUMMARY

The purpose of this transportation impact assessment is to examine the potential traffic impact associated with a proposed 228-unit residential development located along the south side of the existing Conrail line near the intersection of Route 30 and Malin Road in East Whiteland Township. The housing is proposed to be comprised entirely of market-rate semi-attached townhouse dwellings. The project – and the results of this study – are summarized as follows:

- The site is a former industrial site. The project includes an adaptive reuse featuring 228 semi-attached houses (townhouses) and is targeted to be fully occupied by about 2021.
- The project will generate 100 new weekday morning peak hour trips and 119 new weekday afternoon peak hour trips.
- Three signalized intersections were studied: Route 30 (aka Lincoln Highway) and Malin Road; Route 30 and Route 401 (Conestoga Road); & Route 401 and Malin Road/ Swedesford Road. Traffic counts were conducted in February 2014.
- The site includes one point of access – namely an existing driveway which connects to the existing NB approach of the signalized intersection of Route 30 and Malin Road. No new driveway construction (for ordinary traffic) is proposed.
- A second, emergency-only access is proposed at the east end of the site. This access leads to Village Way – an existing residential street in the Township.
- A conservative background growth rate (2.00% per year) was applied for 7 years to 2021 No Build conditions and found mostly minor changes in overall levels of service.
- With site traffic added, overall intersection delays do not increase more than 10 seconds during either peak hour, except at the intersection of Route 30 and Malin Road, though even at that intersection, overall intersection performance remains a C during the AM peak hour and a B during the PM peak hour. Level of service comparison tables follow on the next page.
- The study assumes "split" north-south phasing along Malin Road (which is currently a shared phase). Split north-south phasing helps overcome some non-ideal intersection approach alignment issues. It is primarily the "lost time" (i.e., signal inefficiencies) associated with this change in phasing – not the addition of site traffic – which results in the small increased overall delay noted previously.
- There is no need for a new auxiliary EB right-turn lane at the Malin Road intersection. Exclusive left-turn lanes already exist (in both directions) at the studied Route 30 intersections. No road improvements are needed to mitigate site traffic.
- The project includes no new access along Route 30 and will not require an HOP from PennDOT.
- Though not absolutely necessary from a transportation perspective, there is a benefit to providing a pedestrian connection which connects the site and the Route 30/Malin intersection under the Conrail line. The applicant is willing to construct this improvement, but requires township and Conrail assistance to facilitate construction, especially under the rail line and in the SE corner of the intersection.
- The Township Traffic Engineer previously issued a review letter in 2014 (see **Appendix A**) and the applicant has indicated a willingness to abide by the recommendations in that letter, even though the site has reduced in size by about 30% since that review.

LEVEL OF SERVICE COMPARISON TABLE

1. Route 30 & Malin Rd							
Direction	Movement	AM Peak Hour			PM Peak Hour		
Route 30		Existing	Future No Build	Future Build	Existing	Future No Build	Future Build
Eastbound	L	B	B	D	B	B	B
	T/TR	A	A	C	A	A	B
Westbound	L	B	B	C	A	A	A
	T/TR	B	B	B	A	A	A
Malin Rd							
Northbound	LTR	C	C	D	B	B	D
Southbound	LTR	C	C	D	C	C	D
	OVERALL:	B 10	B 11	C 29	B 11	B 11	B 15

2. Route 30 & Route 401							
Direction	Movement	AM Peak Hour			PM Peak Hour		
Route 30		Existing	Future No Build	Future Build	Existing	Future No Build	Future Build
Eastbound	L	A	A	A	A	A	A
	T/TR	B	B	B	A	A	B
Westbound	L	A	A	A	A	A	A
	TT	A	A	A	A	A	A
	R	A	A	A	B	B	B
Route 401							
Northbound	LTR	A	A	A	A	A	D
Southbound	LT	D	D	D	D	D	D
	R	A	A	A	A	A	A
OVERALL:		B 13	A 9	A 9	B 13	B 14	B 15

3. Route 401 & Malin Rd / Swedesford Rd							
Direction	Movement	AM Peak Hour			PM Peak Hour		
Route 401		Existing	Future No Build	Future Build	Existing	Future No Build	Future Build
Eastbound	L	C	C	C	B	C	C
	TR	A	A	A	A	A	A
Westbound	L	C	C	C	A	A	A
	TR	C	C	C	C	C	C
Malin Rd / Swedesford Rd							
Northbound	LTR	E	F 107	F 144	F 94	F 123	F 170
Southbound	R	A	A	A	A	A	A
	LT	D	D	D	D	D	D
	OVERALL:	C 27	C 33	D 39	C 31	C 38	D 47

INTRODUCTION

Constitution Drive Partners, L.P. proposes construction of a new residential development on land which is currently a former industrial site in East Whiteland Township.

The site is known as "Bishop Tube" and will feature 228 attached houses (townhouses) and is targeted to be fully occupied by approximately 2021. The study area and the project location are shown in **Figures 1 and 2**. An excerpt of the site plan is shown in **Figure 3**. All figures are provided in order following all text and tables.

The site will access a roadway which is not an SR (State Roadway) and so no HOP (Highway Occupancy Permit) is required from PennDOT. This assessment was, however, prepared in general accordance with PennDOT Strike Off Letter (SOL) 470-09-4 which outlines traffic report requirements.

EXISTING ROAD NETWORK

A field review of the existing roadway system in the study area was conducted. The existing roadway characteristics are summarized in **Table 1**. Photographs of the study area are provided in **Appendix B**. PennDOT iTMS data of the study area is provided in **Appendix C**.

TABLE 1
ROADWAY CHARACTERISTICS WITHIN STUDY AREA

Roadway Name	Route #	Smart Trans. Guidelines Roadway Class/Type	Directional Orientation	Posted Speed Limit	AADT per iTMS (collected 08/2015)
Lincoln Highway	SR 0030	Urban Major Arterial	E-W	45	20,772
Conestoga Road	SR 0401	Urban Minor Arterial	E-W	35	7,608
Malin Road	G 377	Urban Collector	N-S	30	5,100

EXISTING TRAFFIC VOLUMES

The site will generate traffic at various times throughout the day, though typical weekday commuter peak periods (i.e., 7:00-9:00 AM and 4:00-6:00 PM) are when the demands of the site plus existing traffic at study area intersections will be at a combined maximum. Data collection for this study was scheduled reflective of this and was performed by FTA in February 2014. This week was a 'normal' week for local schools' classes and no local construction or detours were noted during the counts. Weather events were also normal during the week, as confirmed with the Township Traffic Engineer.

Counts were conducted at the following three locations:

1) Route 30 (Lincoln Highway) and Malin Road,
2) Route 30 and Route 401 (Conestoga Road), and
3) Route 401 and Malin Road/Swedesford Road.

The analyzed morning peak hour was 7:45 to 8:45 AM. For the afternoon peak period, the analyzed peak hour was from 5:00 to 6:00 PM.

Queues on all approaches at all intersections in the study area were observed during the traffic counts. At no time during any of the counts were any queues observed to be excessive except for the EB left-turn from Conestoga Road to Swedesford Road (i.e., 'away' from the site) during the AM peak hour. Site traffic will not contribute any added traffic to this turning movement. Even this queue, which was at times in excess of 10 vehicles in length, often had a 'rolling' (i.e., non-static) quality.

Turning movement peak hour volumes are presented in **Figure 4**. Additional information regarding existing traffic volumes (count data) is provided in **Appendix D**.

BASE CONDITIONS

The targeted full-occupancy date of the project is 2021, or approximately seven years from the date of the data collection of the site (2014). The currently-recommended annual background growth rate as promulgated by PennDOT for all of Chester County is 1.80% per annum. No nearby developments were identified as being approved and significant enough to include as a separate generator of automobile-based traffic, and so no separate "other development traffic" was included, but 2.00% was used as the background growth rate for added conservative measure. In all, 14.87% (2.00% per year compounded for 7 years) was incorporated in this effort. More information about background growth is provided in **Appendix E**.

2021 No Build Condition turning movement peak hour volumes are presented in **Figure 5**.

PROJECT DESCRIPTION

The project includes 228 attached (townhouses) dwelling units and is located along the south side of the existing Conrail line near the intersection of Route 30 and Malin Road in East Whiteland Township. The site is a former industrial site. The project includes an adaptive reuse featuring 228 semi-attached houses (townhouses) and is targeted to be fully occupied by about 2021. The site includes one point of access – namely an existing driveway which connects to the existing NB approach of the signalized intersection of Route 30 and Malin Road. No new driveway construction (for ordinary traffic) is proposed. A second, emergency-only access is proposed at the east end of the site. This access leads to Village Way – an existing residential street in the Township.

TRIP GENERATION

Trip generation activity for many land uses can be investigated utilizing the Institute of Transportation Engineers' (ITE) publication entitled Trip Generation Manual and land use code (LUC) 230 (Residential Condominium / Townhouse) is the appropriate LUC. Two different methodologies are available to determine trip generation for this LUC and the highest (most

conservative) methodology was selected. More details about trip generation are provided in **Appendix E** and are summarized in **Table 2** below.

TABLE 2
TRIP GENERATION

Variable	AM Peak Hour			PM Peak Hour		
	IN	OUT	TOTAL	IN	OUT	TOTAL
228 Townhomes	17	83	100	80	39	119

TRIP DISTRIBUTION

These new trips were assigned relative to existing proportionality of turning movements at adjacent intersections. They are also reflective of multiple existing Route 202 highway interchanges in the vicinity of the site, paths of least resistance/delay, and overall site placement relative to other regional population and employment centers. **Figure 6** reveals the model and related peak hour individual turning movement assignment of site traffic.

The combination of site traffic with 2021 No Build volumes yield 2021 Build peak hour volumes as seen in **Figure 7**.

CAPACITY ANALYSIS METHODOLOGY

Capacity analyses were conducted at study area intersections. These analyses were conducted according to the methodologies contained in the 2010 *Highway Capacity Manual* using *Synchro* software except for the Route 30 and Route 401 location, which utilized a combination of 2010 HCM and percentile delay methods. The following conditions were analyzed:

- 2014 Existing Conditions,
- 2021 No Build Conditions, and
- 2021 Build Conditions.

In addition, capacity analyses were conducted at the proposed site driveway intersections under the 2021 Build scenarios. *Synchro* outputs are provided in **Appendix F**.

PennDOT's transportation impact study guidelines outlined in SOL 470-09-4, dated February 2009 last updated December 2013 contain the following criteria regarding levels of service:

> Page 29 of the Guidelines describes that if evaluation of the Base Condition to the Projected Condition results in an *overall* level of service increase greater than 10 seconds then the Applicant will be required to mitigate the impact.

It should be noted that although a shopping center in the NE corner of the intersection of Route 30 and Malin Road is currently believed to be offering construction a new exclusive SB right-turn lane (on Malin Road), this improvement was not reflected in either the Future No Build or the Future Build scenarios of this study, to be conservative.

LEVELS OF SERVICE IN THE STUDY AREA

Levels of service (LOS) at the study area intersections for the weekday AM and PM peak hours are summarized in tables found in the **Executive Summary**. As revealed in the tables, all levels of service at the study area intersections generally comply with the requirements outlined in the PennDOT SOL, the only exception is the Malin Road intersection. This intersection features an overall intersection delay which increases from B (11) to C (29) during the AM peak hour and from B (11) to B (15) during the PM peak hour. The reason for this increase is generally due to the introduction of new 'split' phasing on the NB and SB approaches. This phasing was discussed with the Township, which seems to generally support the notion of split phasing, especially due to the slight physical offset of the two approaches.

All other intersections feature an overall intersection delay which is less than 10 seconds longer when comparing Build with No Build conditions. All turning movement levels of service at the Malin Road intersection are D or better during both Build peak hours.

No roadway improvements are needed to offset the impact of the site.

TURN LANE WARRANT ANALYSIS

The need for a new EB right-turn auxiliary turn lanes at the Malin Road intersection was investigated and was based on PennDOT SOL 470-08-4 as well as PennDOT *Publication 46* Chapter 11 page 11-46 ("Turn Lane Warrants"). No new lane is warranted/needed at the proposed site access. More details are included in **Appendix G**.

CONCLUSIONS

Based on the results of this transportation impact study, FTA offers the following conclusions:

- The site will generate a relatively modest amount of new traffic – about 100 new trips during a typical weekday AM peak hour and about 119 new trips during a typical weekday PM peak hour.
- Level of service investigations were prepared for existing and projected conditions with and without site traffic. No deficiencies (per standard PennDOT practice) were identified. No roadway improvements are needed to offset the impact of the site.
- The need for a new auxiliary EB right-turn lane along Route 30 at the proposed site access was investigated and is not warranted or needed. Auxiliary left-turn lanes already exist in both directions along Route 30. No road improvements are needed to mitigate site traffic.
- The study assumes "split" north-south phasing along Malin Road (which is currently a shared 4+8 phase). Split north-south phasing helps overcome some non-ideal intersection approach alignment issues.
- The project includes no new access along Route 30 and will not require an HOP from PennDOT.
- Though not absolutely necessary from a transportation perspective, there is a benefit to providing a pedestrian connection which connects the site and the Route 30/Malin intersection under the Conrail line. The applicant is willing to construct this

improvement, but requires township and Conrail assistance to facilitate construction, especially under the rail line and in the SE corner of the intersection.

- The Township Traffic Engineer previously issued a review letter in 2014 (see **Appendix A**) and the applicant has indicated a willingness to abide by the recommendations in that letter, even though the site has reduced in size by about 30% since that review.
- The study was conducted conservatively in that in did not incorporate what appear to be planned improvements by others, namely a new SB right-turn lane at the intersection of Route 30 and Malin Road.

LEVEL OF SERVICE AND EXPECTED DELAY FOR SIGNALIZED INTERSECTIONS*

LEVEL OF SERVICE	DESCRIPTION	CONTROL DELAY PER VEHICLE (IN SECONDS)
A	Very short delay, good progression; most vehicles do not stop at intersection.	≤ 10.0
B	Generally good signal progression and/or short cycle length; more vehicles stop at intersection than Level of Service A.	10.1 to 20.0
C	Fair progression and/or longer cycle length; significant number of vehicles stop at intersection.	20.1 to 35.0
D	Congestion becomes noticeable; individual cycle failures; longer delays from unfavorable progression, long cycle length, or high volume/ capacity ratios; most vehicles stop at intersection.	35.1 to 55.0
E	Usually considered limit of acceptable delay indication of poor progression, long cycle length, or high volume/ capacity ratio; frequent individual cycle failures.	55.1 to 80.0
F	Could be considered excessive delay in some areas, frequently an indication of saturation (i.e., arrival flow exceeds capacity), or very long cycle lengths with minimal side street "green" time. Capacity is not necessarily exceeded under this level of service.	> 80.0

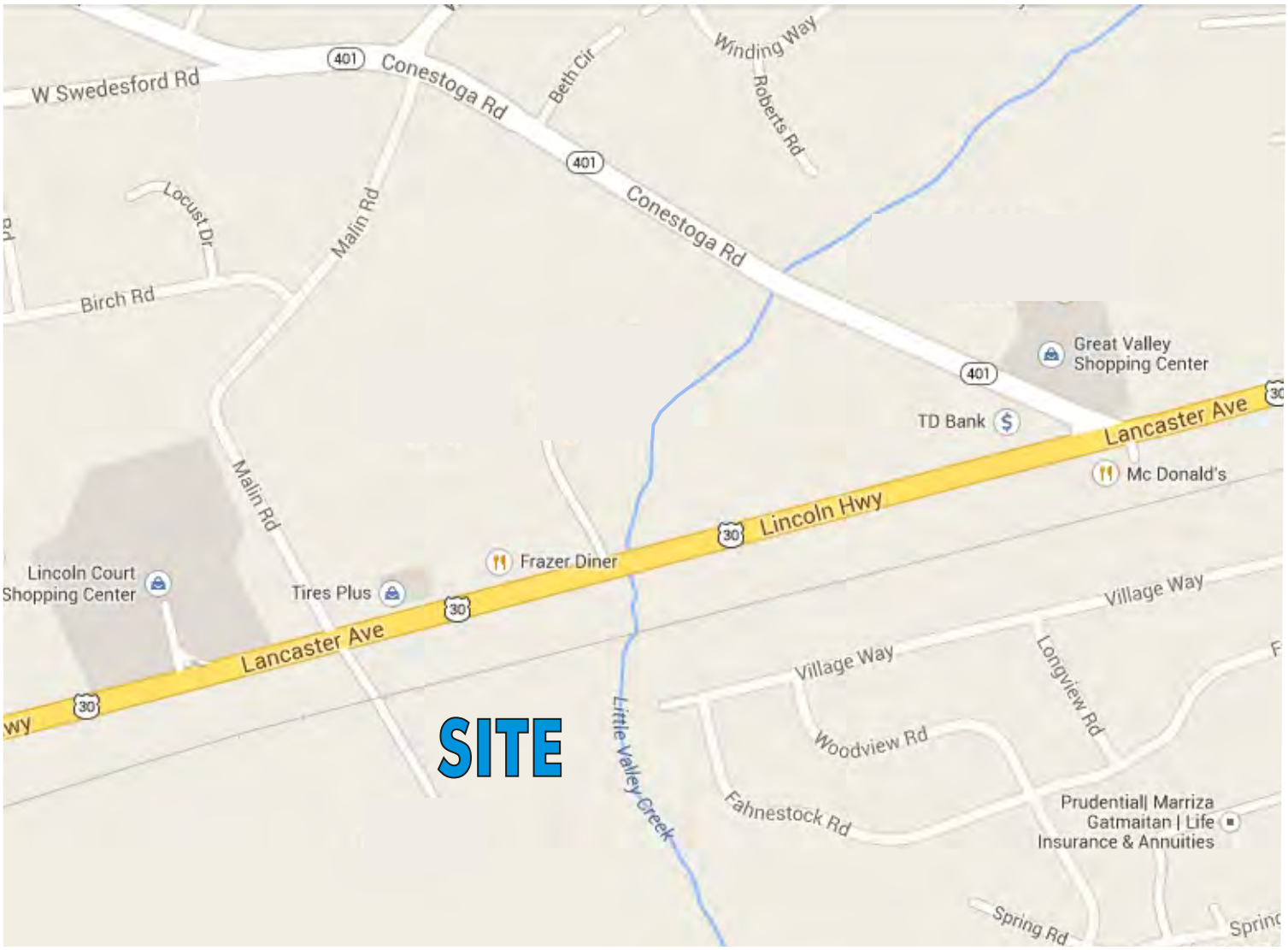
* Transportation Research Board's Highway Capacity Manual

Figure 1

Site and Surrounding Area

Bishop Tube Site – Route 30 & Malin Road
East Whiteland Township,
Chester County, Pennsylvania

August 2015*



* These figures were prepared as of this date. See report for data collection date(s).

Figure 2

Aerial Image

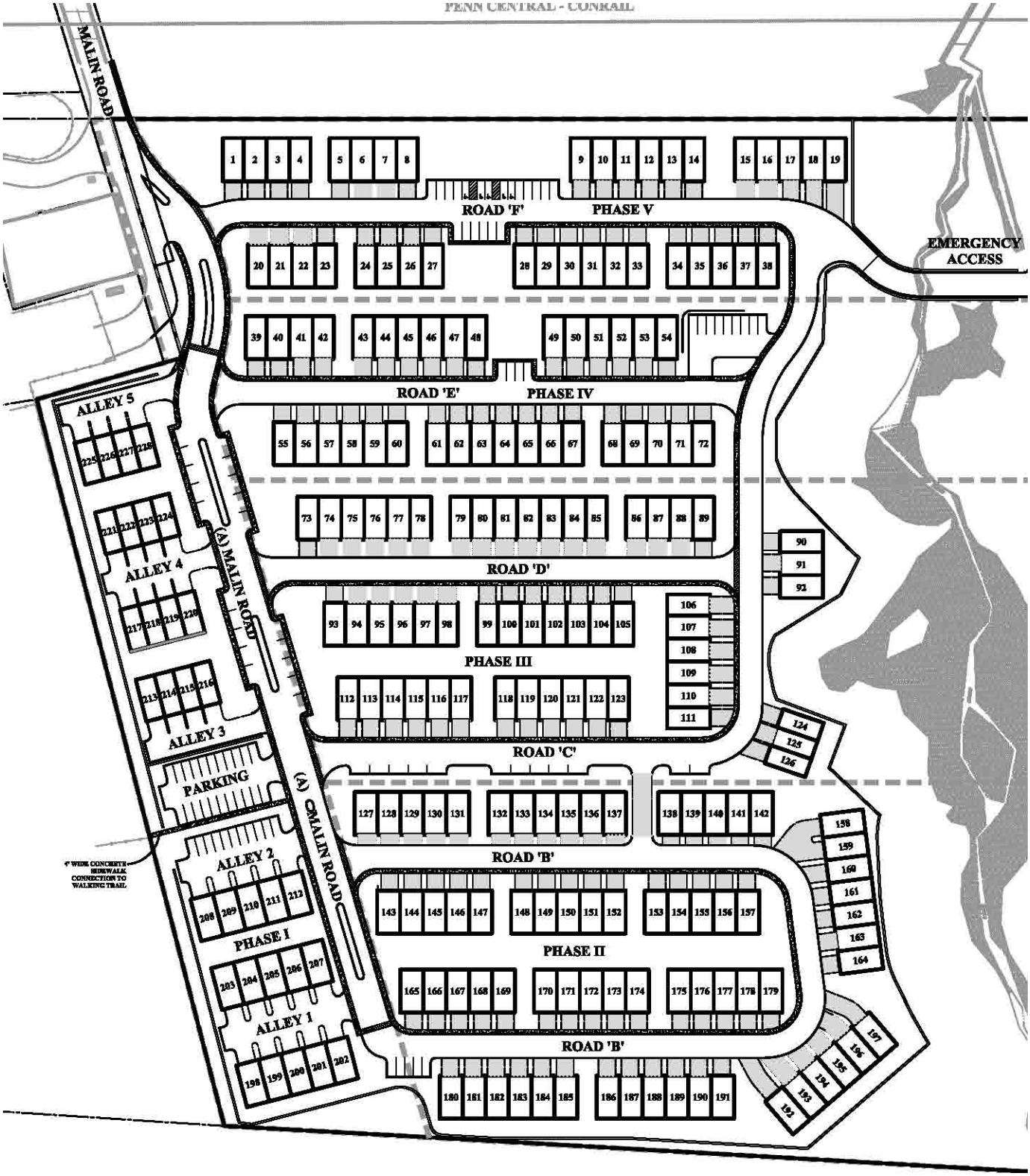
Bishop Tube Site – Route 30 & Malin Road
East Whiteland Township,
Chester County, Pennsylvania

August 2015

Site Plan Excerpt

Bishop Tube Site – Route 30 & Malin Road
East Whiteland Township,
Chester County, Pennsylvania

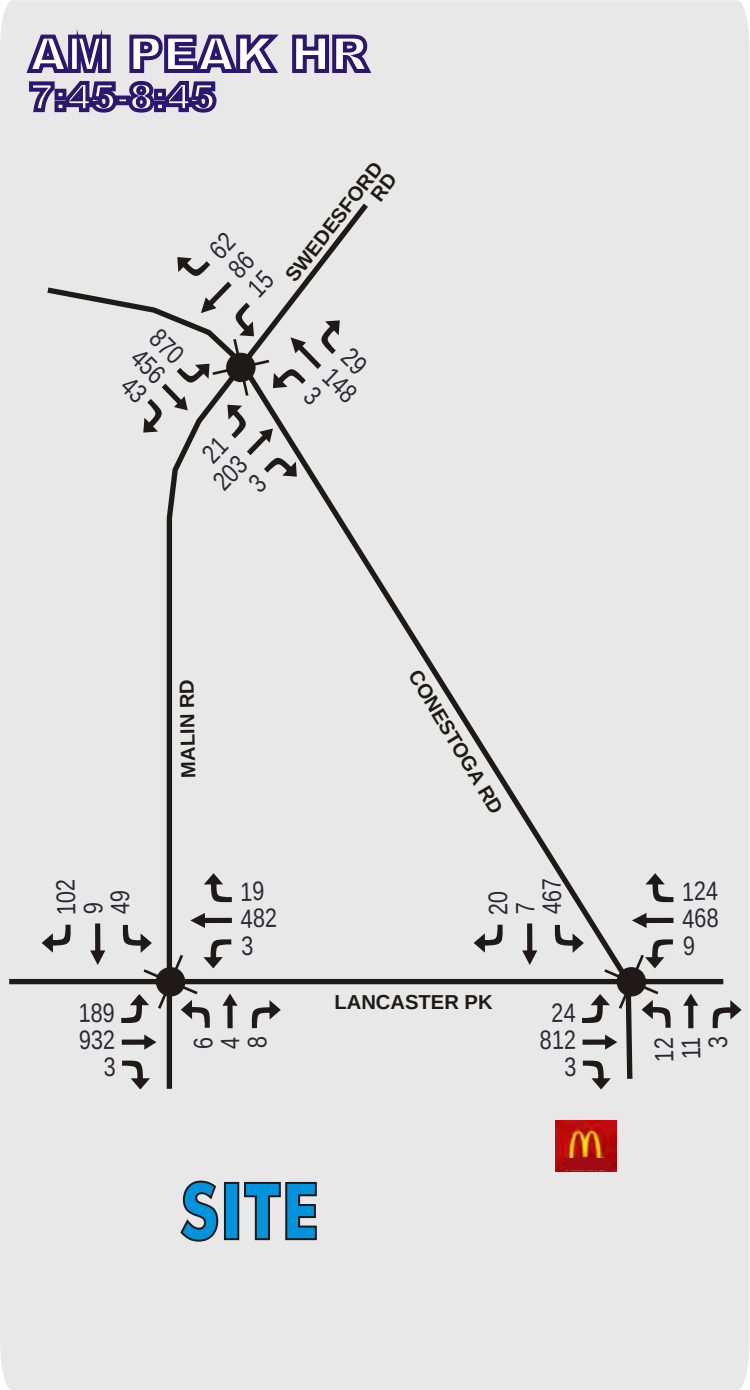
August 2015

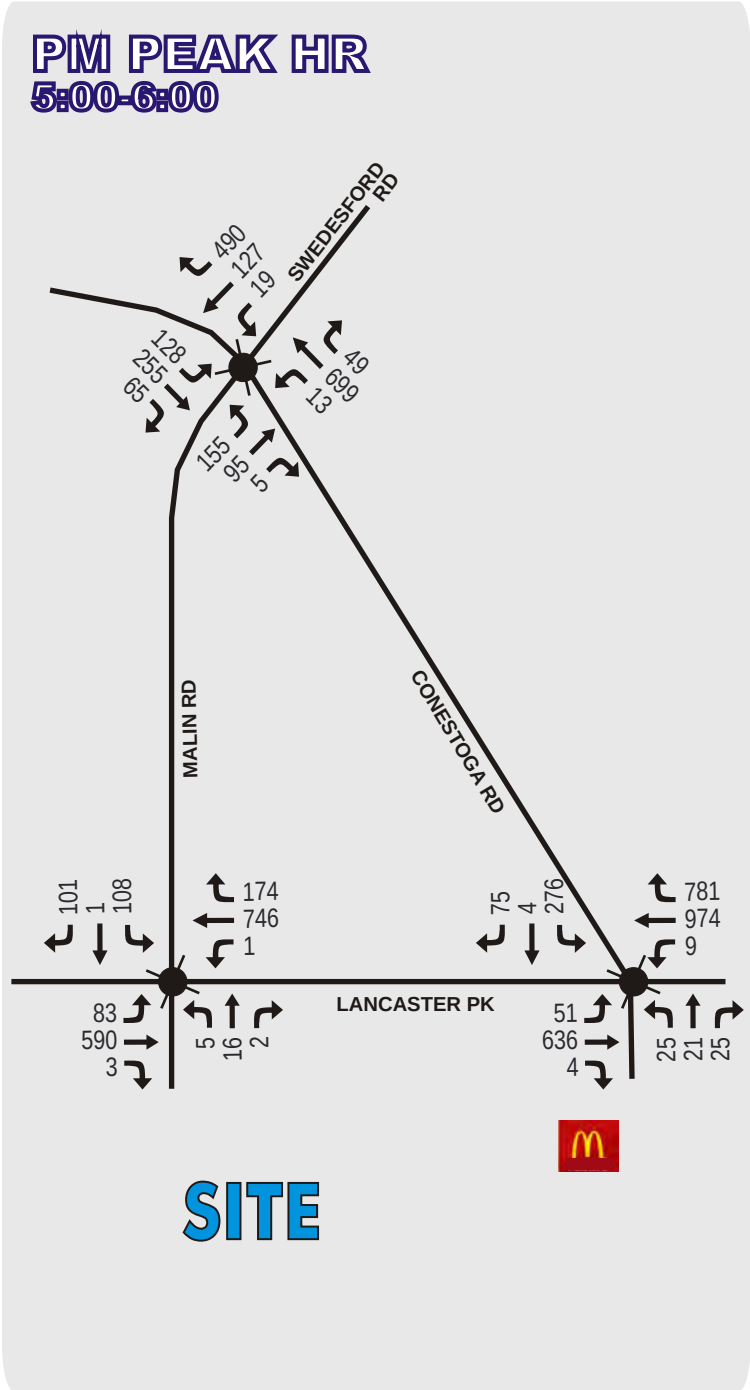


Existing Peak Hour Traffic Volumes

Bishop Tube Site – Route 30 & Malin Road
East Whiteland Township,
Chester County, Pennsylvania

August 2015



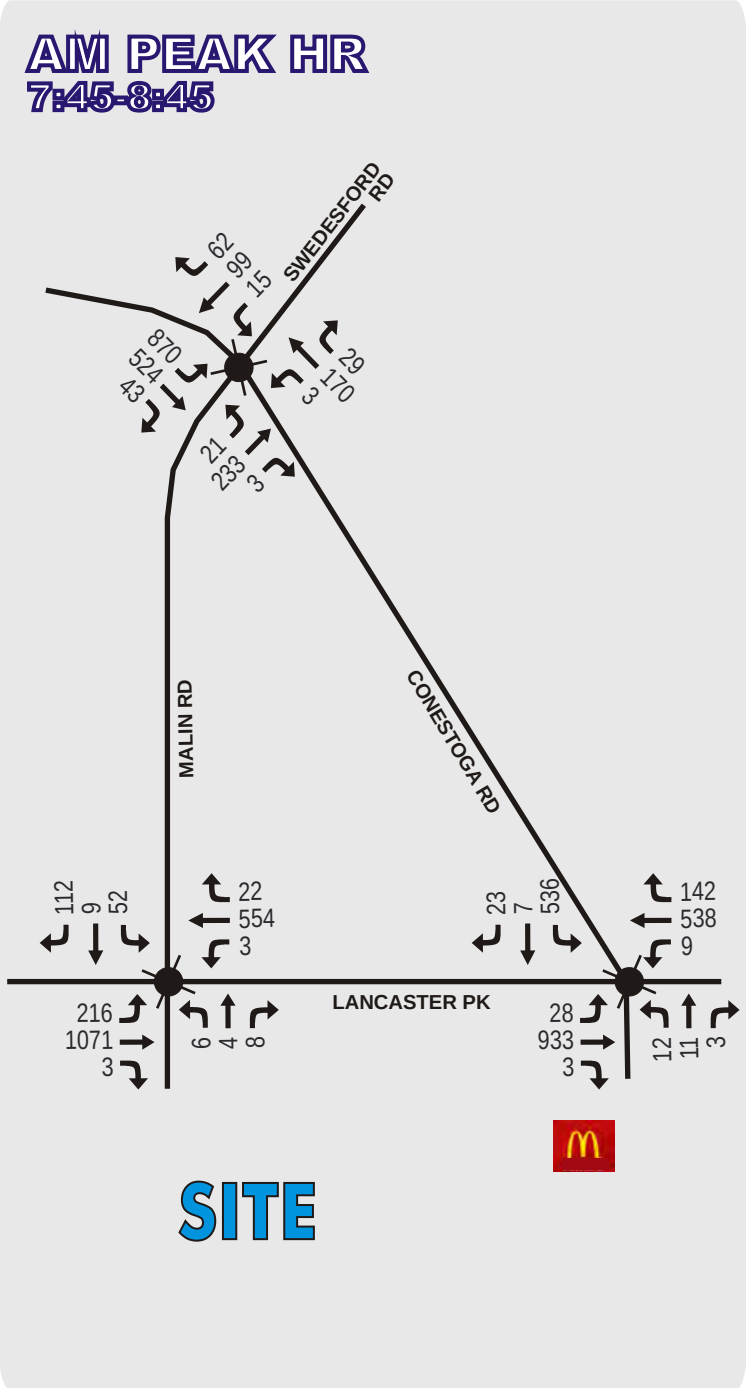


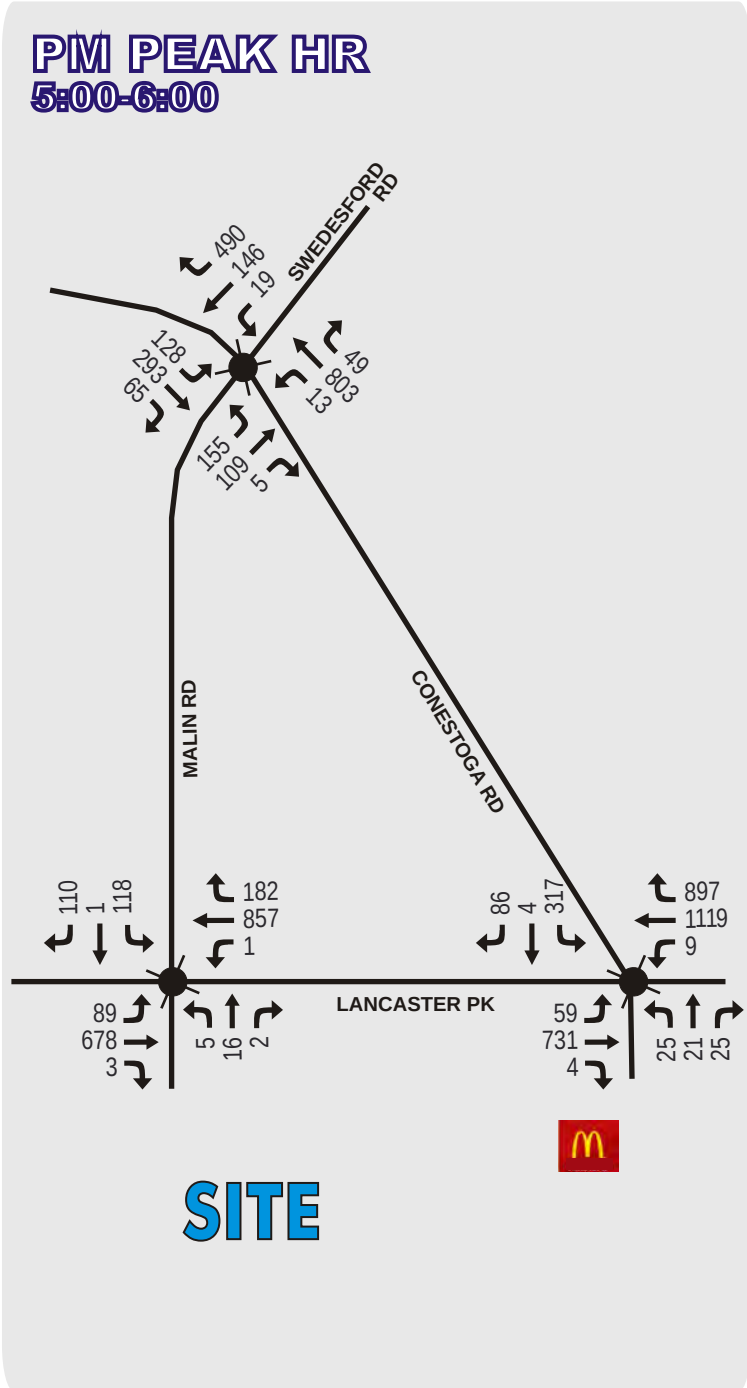
Signalized Intersection

Future No Build Peak Hour Traffic Volumes

Bishop Tube Site – Route 30 & Malin Road
East Whiteland Township,
Chester County, Pennsylvania

August 2015



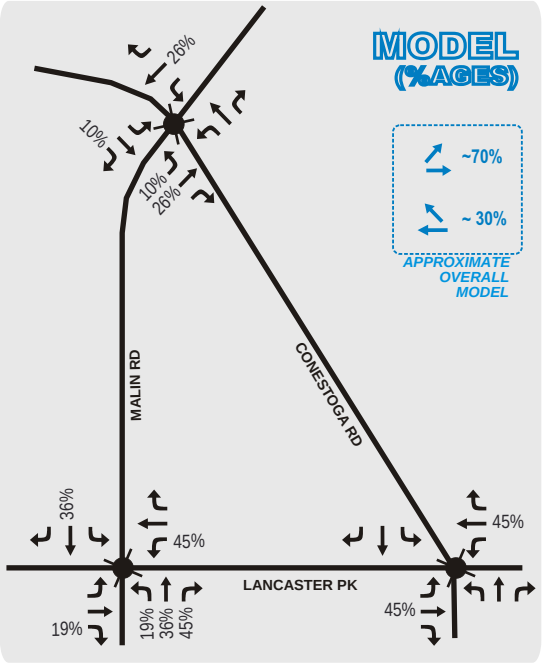


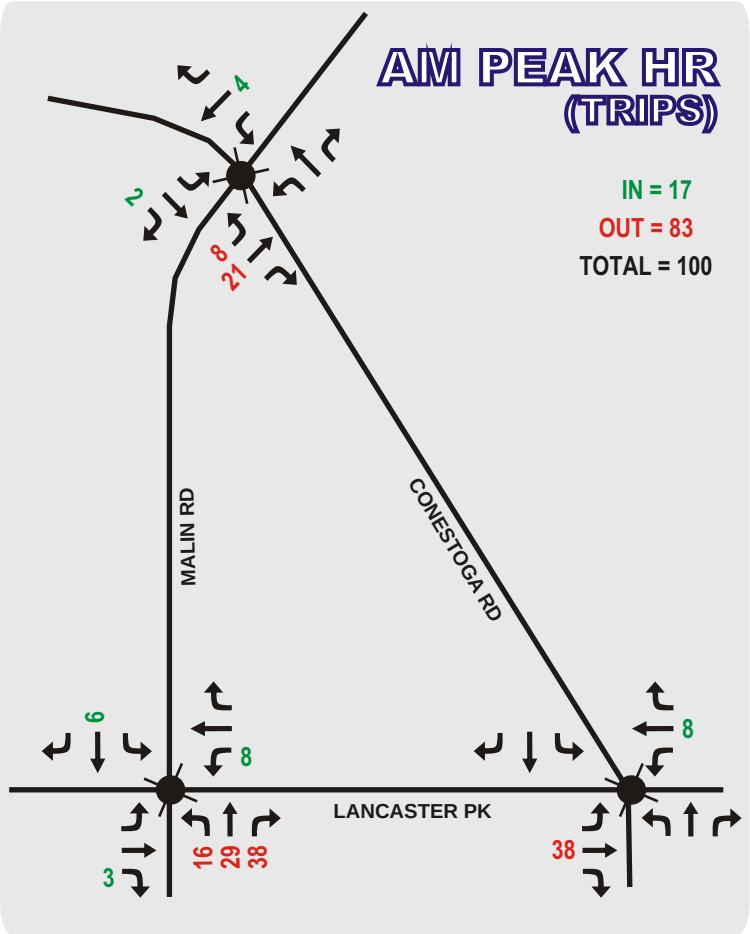
Signalized Intersection

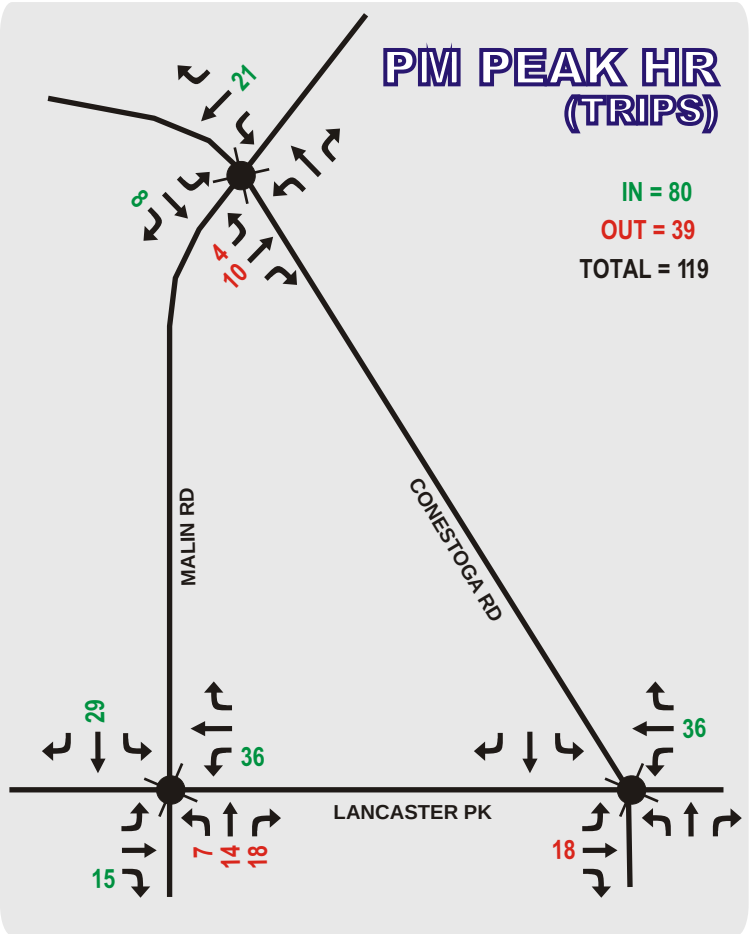
Projected Site Peak Hour Traffic Volumes

Bishop Tube Site – Route 30 & Malin Road
East Whiteland Township,
Chester County, Pennsylvania

August 2015



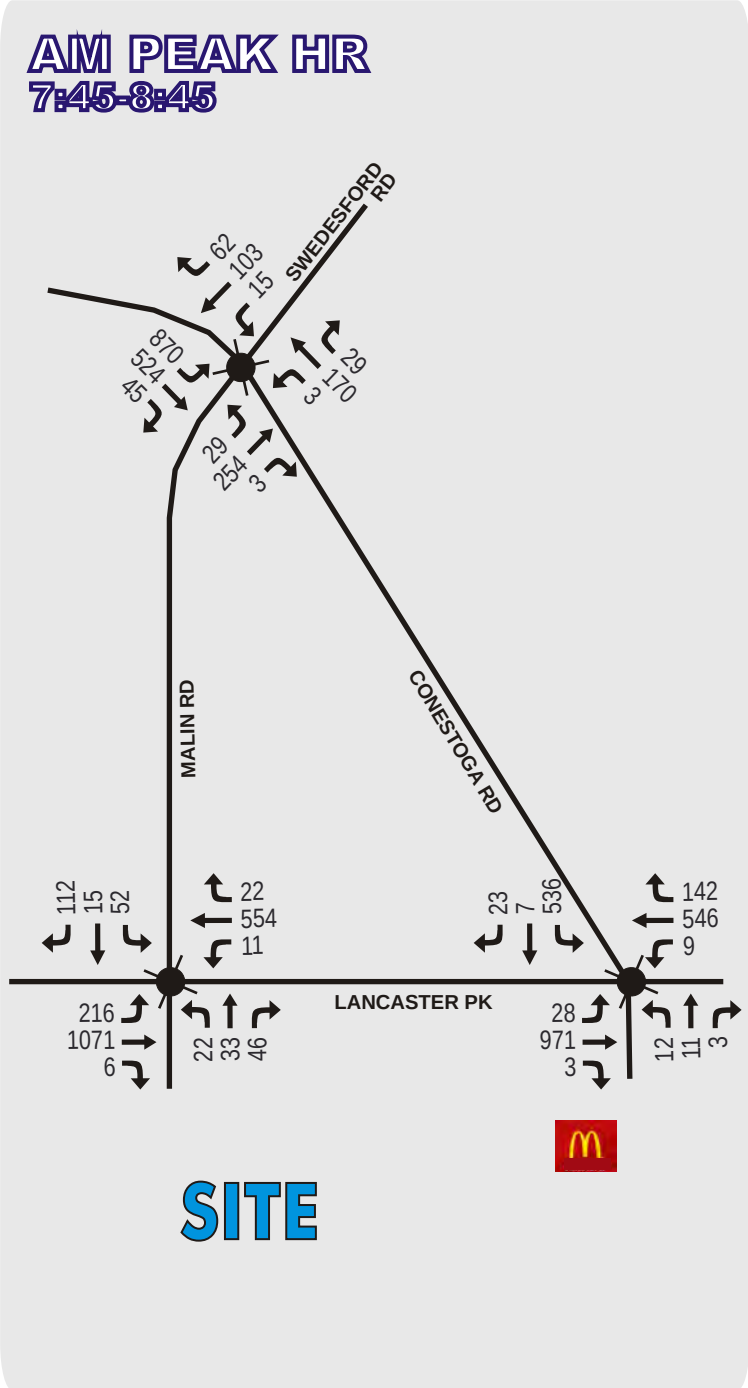


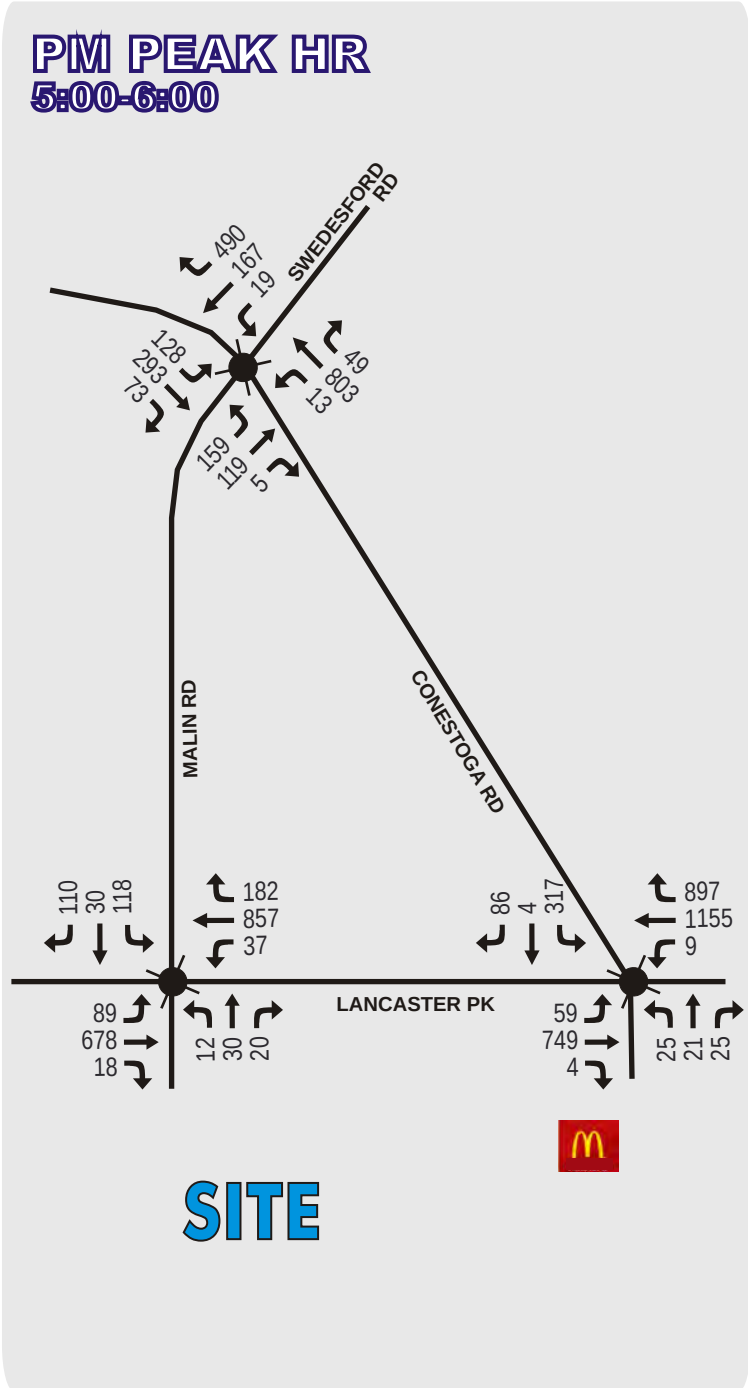


Future Build Peak Hour Traffic Volumes

Bishop Tube Site – Route 30 & Malin Road
East Whiteland Township,
Chester County, Pennsylvania

August 2015





Signalized Intersection

APPENDIX A

Project Correspondence

McMAHON
TRANSPORTATION ENGINEERS & PLANNERS

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Matthew M. Kozsuch, P.E.

May 23, 2014

Ms. Terry H. Woodman
Township Manager
East Whiteland Township
209 Conestoga Road
Frazer, PA 19355-1699

RE: Bishop Tube Site – Townhouse Development
East Whiteland Township, Chester County
McMahon Project No. 814098.11

Dear Ms. Woodman:

McMahon Associates, Inc. has conducted a review of the traffic study for the proposed rezoning of the Bishop Tube Property for 305 townhouses. This review is based on the traffic study prepared by F. Tavani and Associates, Inc. dated April 17, 2014. The Bishop Tube Property consists of approximately 23 acres of land located just south of the existing rail line and south of the intersection of Lancaster Avenue (S.R. 0030) and Malin Road. Access to the site is proposed via a connection to Malin Road. Malin Road intersects with Lancaster Avenue at a signalized intersection. The site does not have frontage along Lancaster Avenue.

According to the traffic study, and based on trip generation projections from the Institute of Transportation Engineers publication, *Trip Generation, Ninth Edition*, the proposed townhomes will generate 135 total trips during the weekday morning commuter peak hour and 163 total trips during the weekday afternoon peak hour.

Based on our review of the traffic study only, we offer the following comments for the Township's consideration.

1. The Malin Road approaches to the intersection of Lancaster Avenue are offset. Traditionally, offset intersections operate with split signal phasing (separate signal phases) on the side street approaches due to the misaligned traffic movements. However, the intersection currently does not operate with split signal phasing, which we estimate may be due to the low volume of traffic currently exiting the south leg of Malin Road. However, with the added traffic associated with the proposed townhouses, it may be necessary to implement split signal phasing. Please review the crash history at the intersection, and revise the traffic analysis to examine the use of split signal phasing.

2. Not withstanding the above comment, according to the traffic study, the study intersections operate at acceptable overall levels of service currently (as well as for most

individual movements), and will continue to do so in the future with background traffic growth and with the added site traffic. Only the intersection of Conestoga Road and Swedesford Road/Malin Road operates with delay (LOS E and F) on the northbound Malin Road approach today. Without improvements, similar delays will continue or worsen in the future with the added background traffic growth and site traffic.

3. The traffic study concludes no physical road widening/capacity improvements are needed for mitigation of the site's traffic impact; however, the study recommends signal timing modifications to accommodate the added traffic at the following intersections:
    a. Lancaster Avenue (S.R. 0030) and Malin Road
    b. Conestoga Road (S.R. 0401) and Swedesford Road/Malin Road

4. Based on the conclusions of the traffic study, traffic signal timing upgrades are needed to accommodate the added traffic. However, in lieu of completing the traffic signal timing improvements and follow-up monitoring of the signal timing adjustments, including a post-occupancy study, it is recommended the applicant fund other traffic signal upgrades that are needed within the vicinity of the site to improve traffic flows. The applicant should fund the following traffic signal upgrades.
    a. An adaptive signal system for the intersections along Lancaster Avenue at Malin Road, Deerfield Lane, and Conestoga Road. These three intersections are currently part of interconnected system and any timing changes at the intersection of Lancaster Avenue and Malin Road will have an effect on this system. As part of the adaptive system, the applicant should provide new controller cabinets at each intersection meeting East Whiteland Township specifications. Coordinate with the Township for adaptive system specifications prior to bidding.
    b. A new controller cabinet at the intersection of Conestoga Road and Swedesford/Malin Road with a new cabinet meeting East Whiteland Township specifications.
    c. Internally illuminated street name signs at the intersection of Lancaster Avenue and Malin Road.
    d. A new generator as per requirements in the Township traffic signal specifications.

5. In 2010, Malvern Borough and East Whiteland Township completed the *Malin Road Extension Feasibility Study.* This study examined an extension of Malin Road from its intersection with Lancaster Avenue south to Warren Avenue in Malvern Borough. The northern portion of this new road extension traverses through this property. Therefore, consistent with the recommendations of this study, it is strongly recommended to reserve the right-of-way to accommodate this road for future planning purposes. Missing an opportunity to reserve the necessary right-of-way within the development will seriously impede the likelihood of ever building this road in the future.

6. With the attraction of commercial land uses along the Lancaster Avenue corridor in very close proximity to the site, and in order to reduce vehicle trips where possible, it is recommended to provide a pedestrian connection between the site along Malin Road to Lancaster Avenue. We understand the rail line underpass is an impediment to a pedestrian connection; however, all feasible measures should be investigated to complete this connection, including reduced lane widths, or the use of traffic control devices (pedestrian signal) on either side of the bridge.

7. With the addition of pedestrians in this area from the proposed residential community, the pedestrian crossing facilities at the intersection of Lancaster Avenue and Malin Road should be upgraded for ADA compliance.

If there are any questions regarding any of the above comments, please do not hesitate to contact our office.

Sincerely,

Christopher J. Williams, P.E.
Vice President & General Manager – Exton

CJW/ab

I:\eng\814098\correspondence\out\ltr_5-23-14_Woodman_East Whiteland.docx

APPENDIX B

Study Area Photographs

Road name (# of pages)

1. Lancaster Pike and Malin Road (2)
2. Lancaster Pike and Conestoga Road (2)
3. Malin Road/Swedesford Road and Conestoga Road (2)

Photo # 1 - Description: Eastbound on Lancaster Pike (approaching intersection)

Photo # 2 - Description: Westbound on Lancaster Pike (approaching intersection)

Photo # 3 - Description: Northbound on Malin Road (approaching intersection)

Photo # 4 - Description: Southbound on Malin Road (approaching intersection)

Photo # 1 - Description: Eastbound on Lancaster Pike (approaching intersection)

Photo # 2 - Description: Westbound on Lancaster Pike (approaching intersection)

Photo # 3 - Description: Northbound on McDonalds driveway (approaching intersection)

Photo # 4 - Description: Southbound on Conestoga Road (approaching intersection)

Photo # 1 - Description: Eastbound on Conestoga Road (approaching intersection)

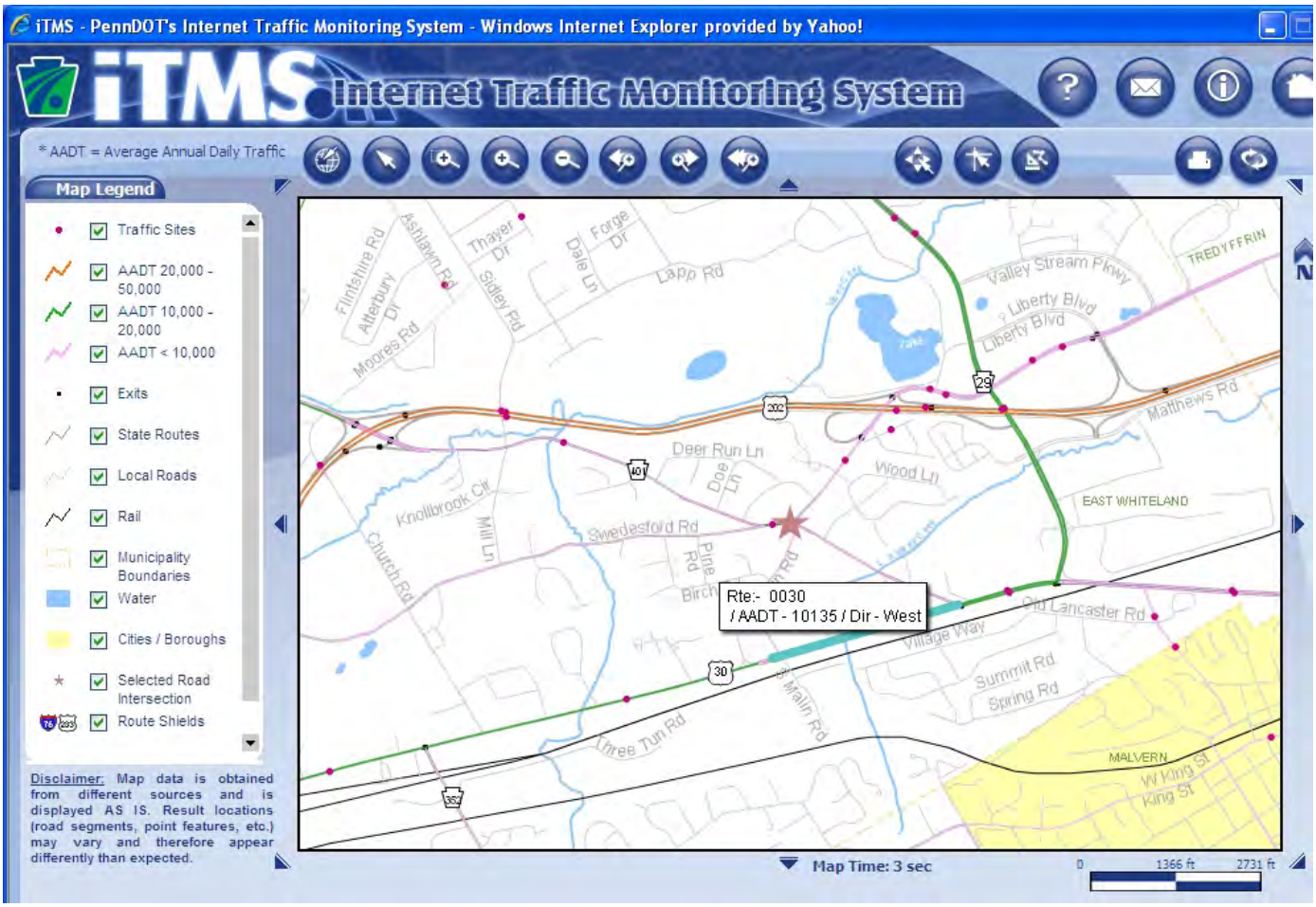
Photo # 2 - Description: Westbound on Conestoga Road (approaching intersection)

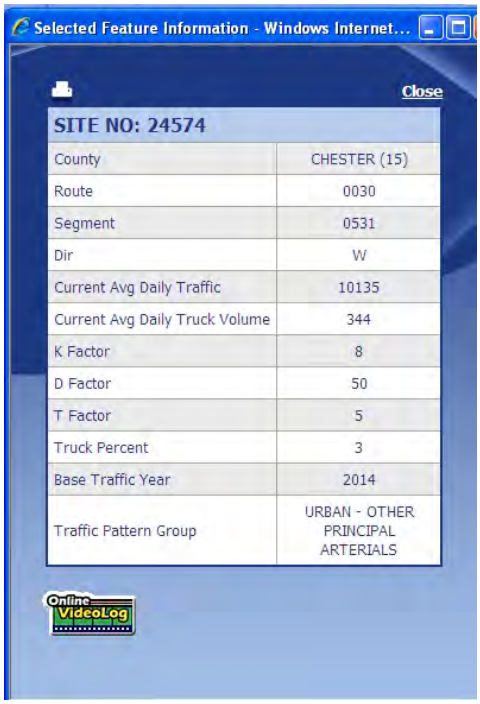
Photo # 3 - Description: Northbound on Malin Road (approaching intersection)

Photo # 4 - Description: Southbound on Swedesford Road (approaching intersection)

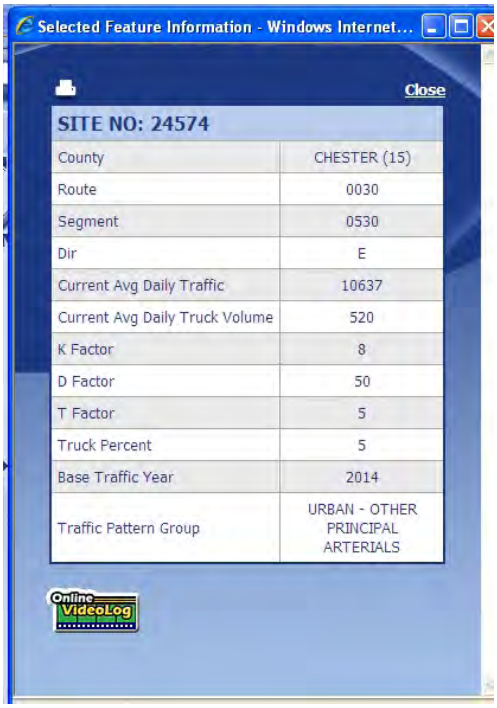
APPENDIX C

iTMS Data



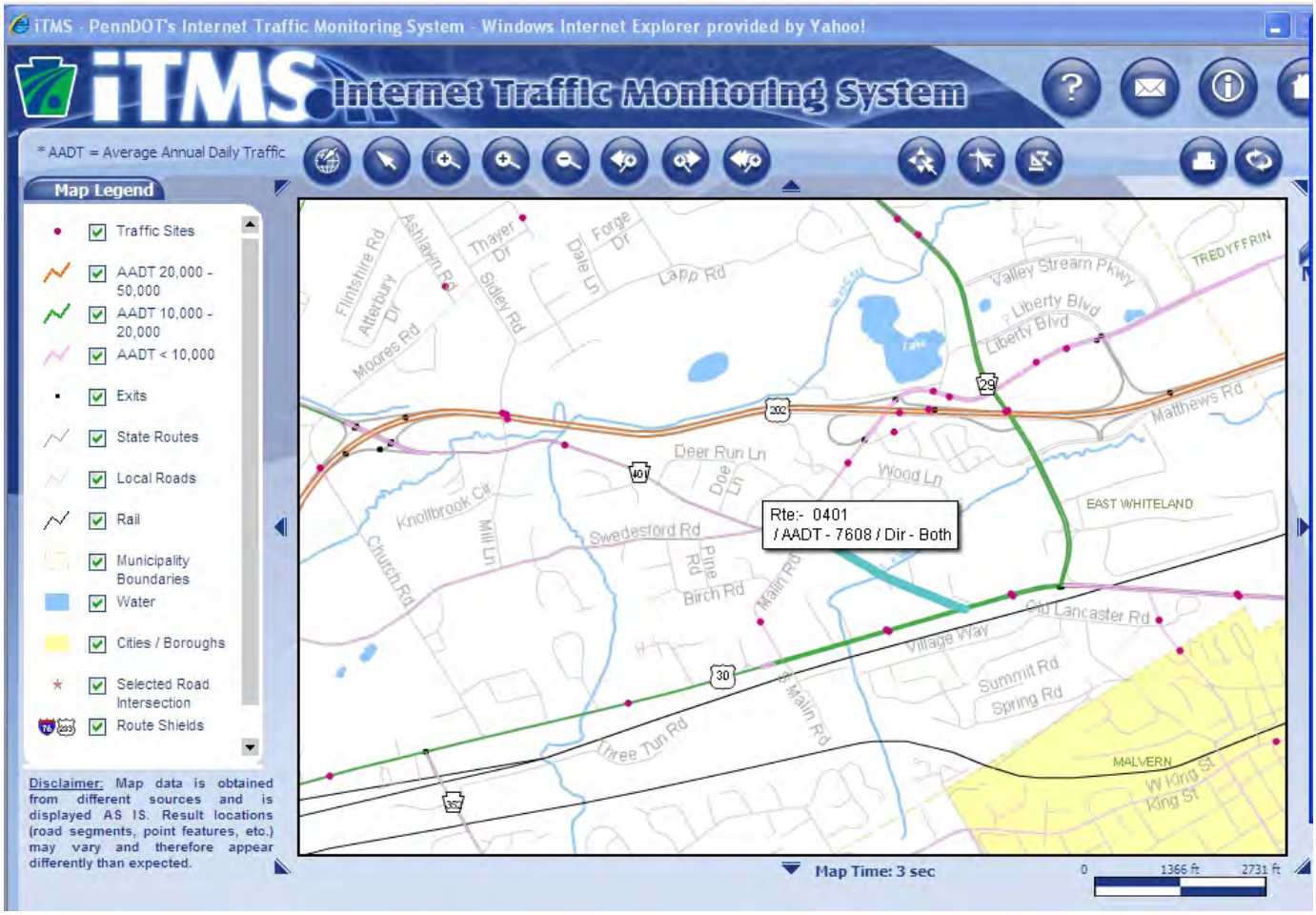


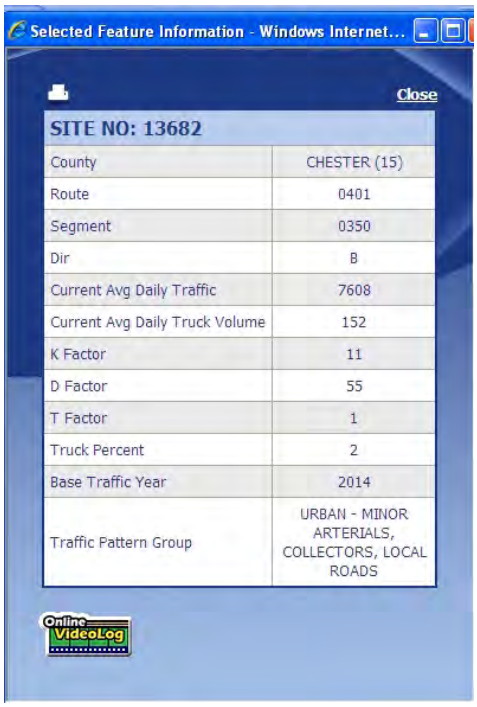
SITE NO: 24574	
County	CHESTER (15)
Route	0030
Segment	0531
Dir	W
Current Avg Daily Traffic	10135
Current Avg Daily Truck Volume	344
K Factor	8
D Factor	50
T Factor	5
Truck Percent	3
Base Traffic Year	2014
Traffic Pattern Group	URBAN - OTHER PRINCIPAL ARTERIALS



SITE NO: 24574	
County	CHESTER (15)
Route	0030
Segment	0530
Dir	E
Current Avg Daily Traffic	10637
Current Avg Daily Truck Volume	520
K Factor	8
D Factor	50
T Factor	5
Truck Percent	5
Base Traffic Year	2014
Traffic Pattern Group	URBAN - OTHER PRINCIPAL ARTERIALS

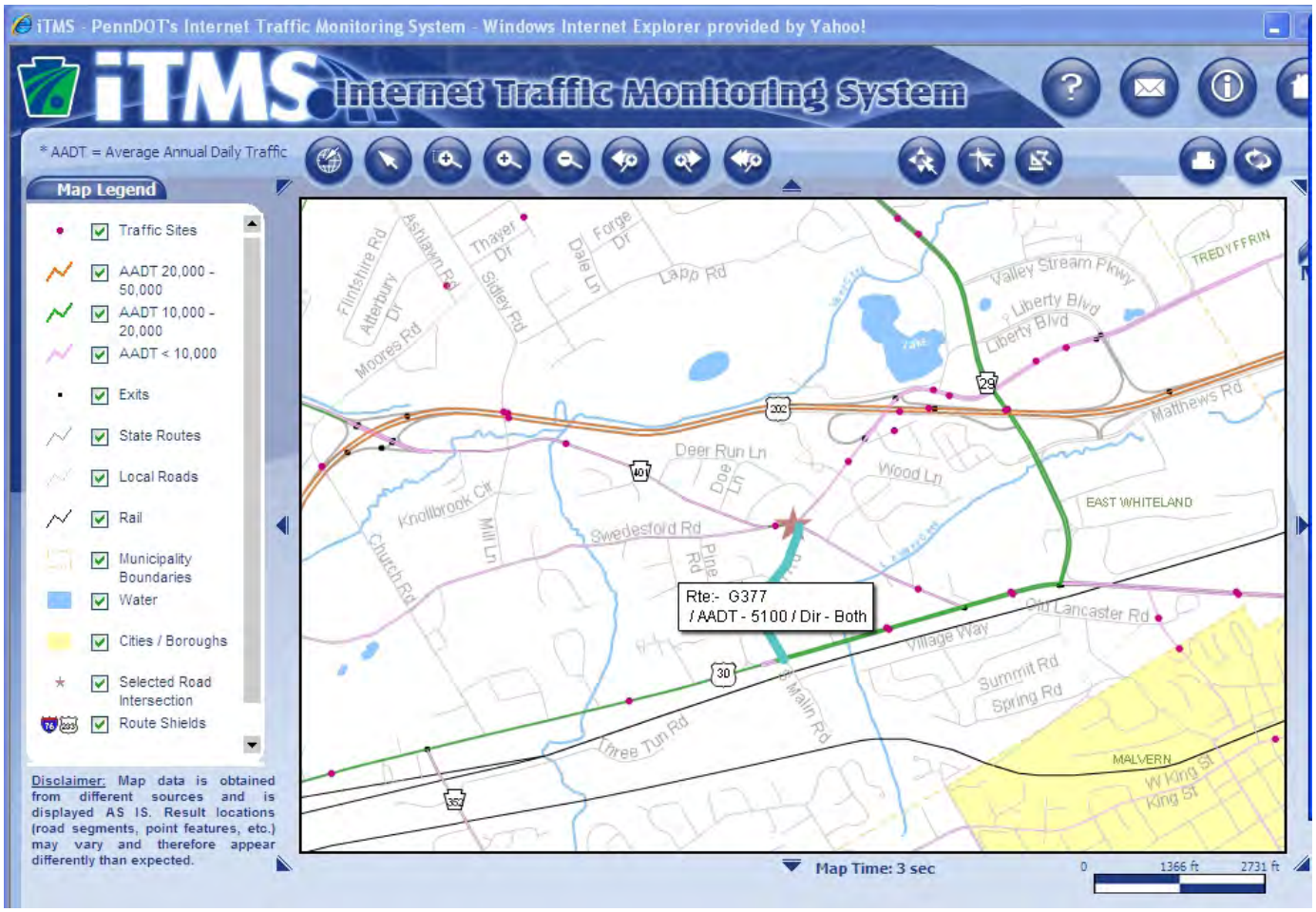
Lincoln Highway

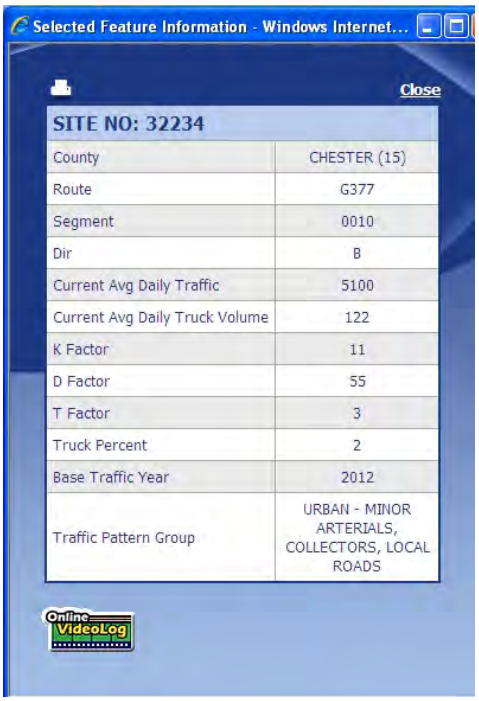




SITE NO: 13682	
County	CHESTER (15)
Route	0401
Segment	0350
Dir	B
Current Avg Daily Traffic	7608
Current Avg Daily Truck Volume	152
K Factor	11
D Factor	55
T Factor	1
Truck Percent	2
Base Traffic Year	2014
Traffic Pattern Group	URBAN - MINOR ARTERIALS, COLLECTORS, LOCAL ROADS

Conestoga Road


iTMS - PennDOT's Internet Traffic Monitoring System - Windows Internet Explorer provided by Yahoo!
iTMS Internet Traffic Monitoring System
* AADT = Average Annual Daily Traffic
Map Legend
Traffic Sites
AADT 20,000 - 50,000
AADT 10,000 - 20,000
AADT < 10,000
Exits
State Routes
Local Roads
Rail
Municipality Boundaries
Water
Cities / Boroughs
Selected Road Intersection
Route Shields
Disclaimer: Map data is obtained from different sources and is displayed AS IS. Result locations (road segments, point features, etc.) may vary and therefore appear differently than expected.
Rte:- G377
/ AADT - 5100 / Dir - Both
Deer Run Ln
Swedesford Rd
Lapp Rd
Valley Stream Pkwy
Liberty Blvd
Matthews Rd
Wood Ln
EAST WHITELAND
Old Lancaster Rd
Village Way
Summit Rd
Spring Rd
Three Tun Rd
Malin Rd
MALVERN
W King St
King St
TREDYFFRIN
Map Time: 3 sec
0
1366 ft
2731 ft


Selected Feature Information - Windows Internet...
Close
SITE NO: 32234
County CHESTER (15)
Route G377
Segment 0010
Dir B
Current Avg Daily Traffic 5100
Current Avg Daily Truck Volume 122
K Factor 11
D Factor 55
T Factor 3
Truck Percent 2
Base Traffic Year 2012
Traffic Pattern Group URBAN - MINOR ARTERIALS, COLLECTORS, LOCAL ROADS
Online VideoLog

Malin Road

APPENDIX D

Data Collection

F. Tavani and Associates, Inc.

105 Kenilworth Street
Philadelphia, PA 19147

intersection: Rt 30 (Lancaster Avenue) &
Rt 401 (Conestoga Road)/McDonalds access

counter: MH

File Name : 30ConsAM
Site Code : 00000000
Start Date : 2/11/2014
Page No : 1

Groups Printed- cars - HV

	Conestoga Road Southbound					Lancaster Avenue Westbound					McDonalds access Northbound					Lancaster Avenue Eastbound					
Start Time		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
07:00 AM	97	1	1	0	99	0	73	76	0	149	3	2	0	0	5	1	188	0	0	189	442
07:15 AM	96	0	5	0	101	1	108	77	0	186	0	1	0	0	1	9	180	0	0	189	477
07:30 AM	118	1	3	0	122	0	91	37	0	128	0	4	0	0	4	5	168	0	0	173	427
07:45 AM	144	3	3	0	150	2	134	27	0	163	3	7	1	0	11	2	218	0	0	220	544
Total	455	5	12	0	472	3	406	217	0	626	6	14	1	0	21	17	754	0	0	771	1890
08:00 AM	117	1	3	0	121	1	106	33	0	140	2	1	0	0	3	5	206	0	0	211	475
08:15 AM	107	2	3	0	112	2	113	34	0	149	4	2	1	0	7	12	188	0	0	200	468
08:30 AM	99	1	11	0	111	4	115	30	0	149	3	1	1	0	5	5	200	3	0	208	473
08:45 AM	105	6	13	0	124	1	126	31	0	158	5	1	3	0	9	11	210	0	0	221	512
Total	428	10	30	0	468	8	460	128	0	596	14	5	5	0	24	33	804	3	0	840	1928
Grand Total	883	15	42	0	940	11	866	345	0	1222	20	19	6	0	45	50	1558	3	0	1611	3818
Apprch %	93.9	1.6	4.5	0		0.9	70.9	28.2	0		44.4	42.2	13.3	0		3.1	96.7	0.2	0		
Total %	23.1	0.4	1.1	0	24.6	0.3	22.7	9	0	32	0.5	0.5	0.2	0	1.2	1.3	40.8	0.1	0	42.2	
cars	863	15	41	0	919	11	839	326	0	1176	20	19	6	0	45	45	1515	3	0	1563	3703
% cars	97.7	100	97.6	0	97.8	100	96.9	94.5	0	96.2	100	100	100	0	100	90	97.2	100	0	97	97
HV	20	0	1	0	21	0	27	19	0	46	0	0	0	0	0	5	43	0	0	48	115
% HV	2.3	0	2.4	0	2.2	0	3.1	5.5	0	3.8	0	0	0	0	0	10	2.8	0	0	3	3

	Conestoga Road Southbound				Lancaster Avenue Westbound				McDonalds access Northbound				Lancaster Avenue Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:45 AM																	
07:45 AM	144	3	3	150	2	134	27	163	3	7	1	11	2	218	0	220	544
08:00 AM	117	1	3	121	1	106	33	140	2	1	0	3	5	206	0	211	475
08:15 AM	107	2	3	112	2	113	34	149	4	2	1	7	12	188	0	200	468
08:30 AM	99	1	11	111	4	115	30	149	3	1	1	5	5	200	3	208	473
Total Volume	467	7	20	494	9	468	124	601	12	11	3	26	24	812	3	839	1960
% App. Total	94.5	1.4	4		1.5	77.9	20.6		46.2	42.3	11.5		2.9	96.8	0.4		
PHF	.811	.583	.455	.823	.563	.873	.912	.922	.750	.393	.750	.591	.500	.931	.250	.953	.901
cars	458	7	19	484	9	455	118	582	12	11	3	26	21	795	3	819	1911
% cars	98.1	100	95.0	98.0	100	97.2	95.2	96.8	100	100	100	100	87.5	97.9	100	97.6	97.5
HV	9	0	1	10	0	13	6	19	0	0	0	0	3	17	0	20	49
% HV	1.9	0	5.0	2.0	0	2.8	4.8	3.2	0	0	0	0	12.5	2.1	0	2.4	2.5

F. Tavani and Associates, Inc.

105 Kenilworth Street
Philadelphia, PA 19147

intersection: Rt 30 (Lancaster Avenue) & Malin Road

counter: TL

File Name : 30MalAM
Site Code : 00000000
Start Date : 2/11/2014
Page No : 1

Groups Printed- cars - HV

	Malin Road Southbound					Lancaster Avenue Westbound					Malin Road Northbound					Lancaster Avenue Eastbound					
Start Time		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
07:00 AM	3	4	23	0	30	2	68	0	1	71	0	0	3	0	3	28	196	3	0	227	331
07:15 AM	8	2	17	0	27	3	83	1	0	87	0	0	1	0	1	38	163	3	0	204	319
07:30 AM	6	0	22	0	28	2	74	2	0	78	0	1	4	0	5	35	179	1	0	215	326
07:45 AM	11	0	30	0	41	1	112	5	0	118	0	1	3	0	4	56	227	1	0	284	447
Total	28	6	92	0	126	8	337	8	1	354	0	2	11	0	13	157	765	8	0	930	1423
08:00 AM	13	2	26	0	41	0	118	3	0	121	1	0	0	0	1	49	238	1	0	288	451
08:15 AM	8	5	20	0	33	1	126	8	0	135	2	1	1	0	4	42	239	0	0	281	453
08:30 AM	17	2	26	0	45	1	126	3	0	130	3	2	4	0	9	42	228	1	0	271	455
08:45 AM	15	2	24	0	41	1	131	3	0	135	1	1	1	0	3	40	226	0	0	266	445
Total	53	11	96	0	160	3	501	17	0	521	7	4	6	0	17	173	931	2	0	1106	1804
Grand Total	81	17	188	0	286	11	838	25	1	875	7	6	17	0	30	330	1696	10	0	2036	3227
Apprch %	28.3	5.9	65.7	0		1.3	95.8	2.9	0.1		23.3	20	56.7	0		16.2	83.3	0.5	0		
Total %	2.5	0.5	5.8	0	8.9	0.3	26	0.8	0	27.1	0.2	0.2	0.5	0	0.9	10.2	52.6	0.3	0	63.1	
cars	73	15	182	0	270	9	793	15	1	818	5	5	10	0	20	326	1620	7	0	1953	3061
% cars	90.1	88.2	96.8	0	94.4	81.8	94.6	60	100	93.5	71.4	83.3	58.8	0	66.7	98.8	95.5	70	0	95.9	94.9
HV	8	2	6	0	16	2	45	10	0	57	2	1	7	0	10	4	76	3	0	83	166
% HV	9.9	11.8	3.2	0	5.6	18.2	5.4	40	0	6.5	28.6	16.7	41.2	0	33.3	1.2	4.5	30	0	4.1	5.1

	Malin Road Southbound				Lancaster Avenue Westbound				Malin Road Northbound				Lancaster Avenue Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:30 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:45 AM																	
07:45 AM	11	0	30	41	1	112	5	118	0	1	3	4	56	227	1	284	447
08:00 AM	13	2	26	41	0	118	3	121	1	0	0	1	49	238	1	288	451
08:15 AM	8	5	20	33	1	126	8	135	2	1	1	4	42	239	0	281	453
08:30 AM	17	2	26	45	1	126	3	130	3	2	4	9	42	228	1	271	455
Total Volume	49	9	102	160	3	482	19	504	6	4	8	18	189	932	3	1124	1806
% App. Total	30.6	5.6	63.8		0.6	95.6	3.8		33.3	22.2	44.4		16.8	82.9	0.3		
PHF	.721	.450	.850	.889	.750	.956	.594	.933	.500	.500	.500	.500	.844	.975	.750	.976	.992
cars	45	7	99	151	2	456	11	469	4	3	5	12	188	890	2	1080	1712
% cars	91.8	77.8	97.1	94.4	66.7	94.6	57.9	93.1	66.7	75.0	62.5	66.7	99.5	95.5	66.7	96.1	94.8
HV	4	2	3	9	1	26	8	35	2	1	3	6	1	42	1	44	94
% HV	8.2	22.2	2.9	5.6	33.3	5.4	42.1	6.9	33.3	25.0	37.5	33.3	0.5	4.5	33.3	3.9	5.2

F. Tavani and Associates, Inc.

105 Kenilworth Street
Philadelphia, PA 19147

intersection: Rt 401 (Conestoga Road) & Malin/Swedesford Roads

counter: DA

File Name : 401MalAM
Site Code : 00000000
Start Date : 2/11/2014
Page No : 1

Groups Printed- cars - HV

	Swedesford Road Southbound					Conestoga Road Westbound					Malin Road Northbound					Conestoga Road Eastbound					
Start Time		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
07:00 AM	2	18	18	0	38	0	61	6	0	67	5	30	0	0	35	83	95	12	0	190	330
07:15 AM	3	15	33	0	51	1	83	8	0	92	5	39	3	0	47	155	99	9	0	263	453
07:30 AM	3	28	16	0	47	1	38	2	0	41	5	54	1	0	60	181	113	11	0	305	453
07:45 AM	4	20	11	0	35	1	41	10	0	52	10	54	1	0	65	210	145	8	0	363	515
Total	12	81	78	0	171	3	223	26	0	252	25	177	5	0	207	629	452	40	0	1121	1751
08:00 AM	5	16	19	0	40	0	31	11	0	42	3	51	0	0	54	222	112	17	0	351	487
08:15 AM	3	25	14	0	42	1	38	5	0	44	5	47	0	0	52	197	99	7	0	303	441
08:30 AM	3	25	18	0	46	1	38	3	0	42	3	51	2	0	56	241	100	11	0	352	496
08:45 AM	8	22	19	0	49	0	27	9	0	36	8	49	3	0	60	210	113	21	0	344	489
Total	19	88	70	0	177	2	134	28	0	164	19	198	5	0	222	870	424	56	0	1350	1913
Grand Total	31	169	148	0	348	5	357	54	0	416	44	375	10	0	429	1499	876	96	0	2471	3664
Apprch %	8.9	48.6	42.5	0		1.2	85.8	13	0		10.3	87.4	2.3	0		60.7	35.5	3.9	0		
Total %	0.8	4.6	4	0	9.5	0.1	9.7	1.5	0	11.4	1.2	10.2	0.3	0	11.7	40.9	23.9	2.6	0	67.4	
cars	31	162	142	0	335	5	330	52	0	387	41	370	10	0	421	1490	850	92	0	2432	3575
% cars	100	95.9	95.9	0	96.3	100	92.4	96.3	0	93	93.2	98.7	100	0	98.1	99.4	97	95.8	0	98.4	97.6
HV	0	7	6	0	13	0	27	2	0	29	3	5	0	0	8	9	26	4	0	39	89
% HV	0	4.1	4.1	0	3.7	0	7.6	3.7	0	7	6.8	1.3	0	0	1.9	0.6	3	4.2	0	1.6	2.4

	Swedesford Road Southbound				Conestoga Road Westbound				Malin Road Northbound				Conestoga Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:45 AM																	
07:45 AM	4	20	11	35	1	41	10	52	10	54	1	65	210	145	8	363	515
08:00 AM	5	16	19	40	0	31	11	42	3	51	0	54	222	112	17	351	487
08:15 AM	3	25	14	42	1	38	5	44	5	47	0	52	197	99	7	303	441
08:30 AM	3	25	18	46	1	38	3	42	3	51	2	56	241	100	11	352	496
Total Volume	15	86	62	163	3	148	29	180	21	203	3	227	870	456	43	1369	1939
% App. Total	9.2	52.8	38		1.7	82.2	16.1		9.3	89.4	1.3		63.6	33.3	3.1		
PHF	.750	.860	.816	.886	.750	.902	.659	.865	.525	.940	.375	.873	.902	.786	.632	.943	.941
cars	15	82	61	158	3	135	27	165	18	202	3	223	865	446	41	1352	1898
% cars	100	95.3	98.4	96.9	100	91.2	93.1	91.7	85.7	99.5	100	98.2	99.4	97.8	95.3	98.8	97.9
HV	0	4	1	5	0	13	2	15	3	1	0	4	5	10	2	17	41
% HV	0	4.7	1.6	3.1	0	8.8	6.9	8.3	14.3	0.5	0	1.8	0.6	2.2	4.7	1.2	2.1

F. Tavani and Associates, Inc.

105 Kenilworth Street
Philadelphia, PA 19147

intersection: Rt 30 (Lancaster Avenue) &
Rt 401 (Conestoga Road)/McDonalds access

counter: JL

File Name : 30ConsPM
Site Code : 00000000
Start Date : 2/11/2014
Page No : 1

Groups Printed- cars - HV

	Conestoga Road Southbound					Lancaster Avenue Westbound					McDonalds Access Northbound					Lancaster Avenue Eastbound					
Start Time		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
04:00 PM	72	2	18	0	92	5	205	120	11	341	9	7	3	0	19	26	149	3	0	178	630
04:15 PM	74	2	20	0	96	8	163	142	0	313	4	4	5	0	13	25	152	0	0	177	599
04:30 PM	99	0	22	0	121	9	206	144	0	359	7	2	5	0	14	22	147	2	0	171	665
04:45 PM	70	1	15	0	86	5	199	159	0	363	3	3	0	0	6	9	151	5	0	165	620
Total	315	5	75	0	395	27	773	565	11	1376	23	16	13	0	52	82	599	10	0	691	2514
05:00 PM	62	0	12	0	74	0	228	199	0	427	4	7	5	0	16	16	180	0	0	196	713
05:15 PM	84	0	18	0	102	5	216	226	0	447	3	2	2	0	7	8	162	2	0	172	728
05:30 PM	61	0	25	0	86	1	274	185	0	460	10	6	13	1	30	20	128	0	0	148	724
05:45 PM	69	4	20	0	93	3	256	171	1	431	8	6	5	0	19	7	166	2	0	175	718
Total	276	4	75	0	355	9	974	781	1	1765	25	21	25	1	72	51	636	4	0	691	2883
Grand Total	591	9	150	0	750	36	1747	1346	12	3141	48	37	38	1	124	133	1235	14	0	1382	5397
Apprch %	78.8	1.2	20	0		1.1	55.6	42.9	0.4		38.7	29.8	30.6	0.8		9.6	89.4	1	0		
Total %	11	0.2	2.8	0	13.9	0.7	32.4	24.9	0.2	58.2	0.9	0.7	0.7	0	2.3	2.5	22.9	0.3	0	25.6	
cars	578	9	145	0	732	35	1700	1316	12	3063	48	37	38	1	124	127	1205	14	0	1346	5265
% cars	97.8	100	96.7	0	97.6	97.2	97.3	97.8	100	97.5	100	100	100	100	100	95.5	97.6	100	0	97.4	97.6
HV	13	0	5	0	18	1	47	30	0	78	0	0	0	0	0	6	30	0	0	36	132
% HV	2.2	0	3.3	0	2.4	2.8	2.7	2.2	0	2.5	0	0	0	0	0	4.5	2.4	0	0	2.6	2.4

	Conestoga Road Southbound				Lancaster Avenue Westbound				McDonalds Access Northbound				Lancaster Avenue Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 05:00 PM																	
05:00 PM	62	0	12	74	0	228	199	427	4	7	5	16	16	180	0	196	713
05:15 PM	84	0	18	102	5	216	226	447	3	2	2	7	8	162	2	172	728
05:30 PM	61	0	25	86	1	274	185	460	10	6	13	29	20	128	0	148	723
05:45 PM	69	4	20	93	3	256	171	430	8	6	5	19	7	166	2	175	717
Total Volume	276	4	75	355	9	974	781	1764	25	21	25	71	51	636	4	691	2881
% App. Total	77.7	1.1	21.1		0.5	55.2	44.3		35.2	29.6	35.2		7.4	92	0.6		
PHF	.821	.250	.750	.870	.450	.889	.864	.959	.625	.750	.481	.612	.638	.883	.500	.881	.989
cars	273	4	71	348	9	954	768	1731	25	21	25	71	48	629	4	681	2831
% cars	98.9	100	94.7	98.0	100	97.9	98.3	98.1	100	100	100	100	94.1	98.9	100	98.6	98.3
HV	3	0	4	7	0	20	13	33	0	0	0	0	3	7	0	10	50
% HV	1.1	0	5.3	2.0	0	2.1	1.7	1.9	0	0	0	0	5.9	1.1	0	1.4	1.7

F. Tavani and Associates, Inc.

105 Kenilworth Street
Philadelphia, PA 19147

intersection: Rt 30 (Lancaster Avenue) & Malin Road

counter: SC

File Name : 30MalPM
Site Code : 00000000
Start Date : 2/11/2014
Page No : 1

Groups Printed- cars - HV

	Malin Road Southbound					Lancaster Avenue Westbound					Malin Road Northbound					Lancaster Avenue Eastbound					
Start Time		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
04:00 PM	28	1	30	0	59	0	206	13	1	220	2	4	3	0	9	26	133	1	0	160	448
04:15 PM	36	0	29	0	65	3	212	14	0	229	3	3	3	0	9	29	142	0	0	171	474
04:30 PM	26	2	40	0	68	1	135	39	0	175	5	1	2	0	8	18	147	2	0	167	418
04:45 PM	23	1	27	0	51	1	176	28	0	205	0	1	3	0	4	38	127	3	0	168	428
Total	113	4	126	0	243	5	729	94	1	829	10	9	11	0	30	111	549	6	0	666	1768
05:00 PM	36	1	28	0	65	0	165	43	1	209	3	5	0	0	8	23	134	1	0	158	440
05:15 PM	21	0	32	0	53	0	192	32	0	224	2	2	0	0	4	21	153	0	0	174	455
05:30 PM	24	0	24	0	48	0	166	54	4	224	0	7	1	0	8	21	150	0	0	171	451
05:45 PM	27	0	17	0	44	1	223	45	0	269	0	2	1	0	3	18	153	2	0	173	489
Total	108	1	101	0	210	1	746	174	5	926	5	16	2	0	23	83	590	3	0	676	1835
Grand Total	221	5	227	0	453	6	1475	268	6	1755	15	25	13	0	53	194	1139	9	0	1342	3603
Apprch %	48.8	1.1	50.1	0		0.3	84	15.3	0.3		28.3	47.2	24.5	0		14.5	84.9	0.7	0		
Total %	6.1	0.1	6.3	0	12.6	0.2	40.9	7.4	0.2	48.7	0.4	0.7	0.4	0	1.5	5.4	31.6	0.2	0	37.2	
cars	221	3	219	0	443	4	1440	265	6	1715	14	24	9	0	47	184	1109	2	0	1295	3500
% cars	100	60	96.5	0	97.8	66.7	97.6	98.9	100	97.7	93.3	96	69.2	0	88.7	94.8	97.4	22.2	0	96.5	97.1
HV	0	2	8	0	10	2	35	3	0	40	1	1	4	0	6	10	30	7	0	47	103
% HV	0	40	3.5	0	2.2	33.3	2.4	1.1	0	2.3	6.7	4	30.8	0	11.3	5.2	2.6	77.8	0	3.5	2.9

	Malin Road Southbound				Lancaster Avenue Westbound				Malin Road Northbound				Lancaster Avenue Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 05:00 PM																	
05:00 PM	36	1	28	65	0	165	43	208	3	5	0	8	23	134	1	158	439
05:15 PM	21	0	32	53	0	192	32	224	2	2	0	4	21	153	0	174	455
05:30 PM	24	0	24	48	0	166	54	220	0	7	1	8	21	150	0	171	447
05:45 PM	27	0	17	44	1	223	45	269	0	2	1	3	18	153	2	173	489
Total Volume	108	1	101	210	1	746	174	921	5	16	2	23	83	590	3	676	1830
% App. Total	51.4	0.5	48.1		0.1	81	18.9		21.7	69.6	8.7		12.3	87.3	0.4		
PHF	.750	.250	.789	.808	.250	.836	.806	.856	.417	.571	.500	.719	.902	.964	.375	.971	.936
cars	108	0	96	204	0	733	173	906	4	15	1	20	79	579	0	658	1788
% cars	100	0	95.0	97.1	0	98.3	99.4	98.4	80.0	93.8	50.0	87.0	95.2	98.1	0	97.3	97.7
HV	0	1	5	6	1	13	1	15	1	1	1	3	4	11	3	18	42
% HV	0	100	5.0	2.9	100	1.7	0.6	1.6	20.0	6.3	50.0	13.0	4.8	1.9	100	2.7	2.3

F. Tavani and Associates, Inc.

105 Kenilworth Street
Philadelphia, PA 19147

intersection: Rt 401 (Conestoga Road) & Malin/Swedesford Roads

counter: DA

File Name : 401MalPM
Site Code : 00000000
Start Date : 2/11/2014
Page No : 1

Groups Printed- cars - HV

	Swedesford Road Southbound					Conestoga Road Westbound					Malin Road Northbound					Conestoga Road Eastbound					
Start Time		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
04:00 PM	3	38	90	0	131	2	131	12	0	145	32	29	3	0	64	23	65	18	0	106	446
04:15 PM	7	36	113	0	156	5	181	13	0	199	38	20	2	0	60	26	63	12	0	101	516
04:30 PM	8	30	119	0	157	5	174	10	0	189	44	28	1	0	73	29	82	13	0	124	543
04:45 PM	2	20	123	0	145	2	184	16	0	202	37	25	1	0	63	36	64	26	0	126	536
Total	20	124	445	0	589	14	670	51	0	735	151	102	7	0	260	114	274	69	0	457	2041
05:00 PM	2	41	136	0	179	1	160	10	0	171	36	22	1	0	59	37	46	14	0	97	506
05:15 PM	7	31	109	0	147	0	186	6	0	192	44	15	0	0	59	42	48	9	0	99	497
05:30 PM	3	29	107	0	139	0	193	9	0	202	29	16	0	0	45	31	57	10	0	98	484
05:45 PM	2	36	104	0	142	1	156	15	0	172	30	10	1	0	41	31	45	10	0	86	441
Total	14	137	456	0	607	2	695	40	0	737	139	63	2	0	204	141	196	43	0	380	1928
Grand Total	34	261	901	0	1196	16	1365	91	0	1472	290	165	9	0	464	255	470	112	0	837	3969
Apprch %	2.8	21.8	75.3	0		1.1	92.7	6.2	0		62.5	35.6	1.9	0		30.5	56.2	13.4	0		
Total %	0.9	6.6	22.7	0	30.1	0.4	34.4	2.3	0	37.1	7.3	4.2	0.2	0	11.7	6.4	11.8	2.8	0	21.1	
cars	32	256	895	0	1183	16	1339	86	0	1441	286	161	9	0	456	245	456	109	0	810	3890
% cars	94.1	98.1	99.3	0	98.9	100	98.1	94.5	0	97.9	98.6	97.6	100	0	98.3	96.1	97	97.3	0	96.8	98
HV	2	5	6	0	13	0	26	5	0	31	4	4	0	0	8	10	14	3	0	27	79
% HV	5.9	1.9	0.7	0	1.1	0	1.9	5.5	0	2.1	1.4	2.4	0	0	1.7	3.9	3	2.7	0	3.2	2

	Swedesford Road Southbound				Conestoga Road Westbound				Malin Road Northbound				Conestoga Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:15 PM																	
04:15 PM	7	36	113	156	5	181	13	199	38	20	2	60	26	63	12	101	516
04:30 PM	8	30	119	157	5	174	10	189	44	28	1	73	29	82	13	124	543
04:45 PM	2	20	123	145	2	184	16	202	37	25	1	63	36	64	26	126	536
05:00 PM	2	41	136	179	1	160	10	171	36	22	1	59	37	46	14	97	506
Total Volume	19	127	491	637	13	699	49	761	155	95	5	255	128	255	65	448	2101
% App. Total	3	19.9	77.1		1.7	91.9	6.4		60.8	37.3	2		28.6	56.9	14.5		
PHF	.594	.774	.903	.890	.650	.950	.766	.942	.881	.848	.625	.873	.865	.777	.625	.889	.967
cars	19	124	487	630	13	685	46	744	154	92	5	251	122	245	64	431	2056
% cars	100	97.6	99.2	98.9	100	98.0	93.9	97.8	99.4	96.8	100	98.4	95.3	96.1	98.5	96.2	97.9
HV	0	3	4	7	0	14	3	17	1	3	0	4	6	10	1	17	45
% HV	0	2.4	0.8	1.1	0	2.0	6.1	2.2	0.6	3.2	0	1.6	4.7	3.9	1.5	3.8	2.1

APPENDIX E

Background Growth & Trip Generation

Growth Factors for December 2014 to July 2015				
County	Urban Interstate	Rural Interstate	Urban Non-Interstate	Rural Non-Interstate
ADAMS	*	*	1.77	0.93
ALLEGHENY	1.24	*	0.12	0.53
ARMSTRONG	1.33	*	0.16	0.54
BEAVER	1.23	2.30	0.13	0.52
BEDFORD	*	2.38	*	0.60
BERKS	1.47	2.42	0.64	0.65
BLAIR	0.77	1.89	0.00	0.36
BRADFORD	1.31	*	0.28	0.50
BUCKS	2.02	2.60	1.36	0.80
BUTLER	1.92	2.83	1.00	0.83
CAMBRIA	0.37	*	0.00	0.23
CAMERON	*	*	*	0.32
CARBON	1.91	2.82	1.18	0.84
CENTRE	1.95	2.63	1.22	0.82
CHESTER	2.50	3.02	1.80	1.02
CLARION	1.34	2.29	0.40	0.55
CLEARFIELD	*	2.52	0.10	0.57
CLINTON	1.38	2.10	0.59	0.54
COLUMBIA	1.76	2.23	1.18	0.68
CRAWFORD	1.04	2.20	0.00	0.47
CUMBERLAND	1.69	2.09	1.29	0.68
DAUPHIN	1.43	2.28	0.68	0.61
DELAWARE	1.33	*	0.44	*
ELK	*	*	0.04	0.41
ERIE	0.93	1.84	0.08	0.41
FAYETTE	1.08	*	0.03	0.48
FOREST	*	*	*	0.70
FRANKLIN	2.44	2.74	1.90	0.97
FULTON	*	2.54	*	0.79
GREENE	0.98	2.10	0.00	0.44
HUNTINGDON	*	2.19	0.28	0.51
INDIANA	1.61	*	0.53	0.65
JEFFERSON	*	2.60	0.17	0.61
JUNIATA	*	*	*	0.70
LACKAWANNA	1.27	2.35	0.13	0.52
LANCASTER	2.00	2.51	1.34	0.81
LAWRENCE	1.21	2.26	0.11	0.50
LEBANON	*	2.41	1.02	0.70
LEHIGH	1.90	2.94	1.05	0.85
LUZERNE	1.26	2.36	0.12	0.53
LYCOMING	1.01	1.71	0.21	0.39
MCKEAN	1.04	*	0.04	0.44
MERCER	1.04	1.92	0.13	0.42
MIFFLIN	1.26	*	0.15	0.54
MONROE	2.29	2.88	1.78	0.98
MONTGOMERY	1.49	2.38	0.67	0.63
MONTOUR	*	3.00	1.38	0.92
NORTHAMPTON	2.15	*	1.47	0.94
NORTHUMBERLAND	1.20	1.94	0.19	0.43
PERRY	*	*	1.83	0.82
PHILADELPHIA	1.06	*	0.00	*
PIKE	*	3.11	*	1.14
POTTER	*	*	*	0.44
SCHUYLKILL	*	2.03	0.08	0.44
SNYDER	1.57	*	0.93	0.61
SOMERSET	1.03	2.05	0.04	0.45
SULLIVAN	*	*	*	0.51
SUSQUEHANNA	1.51	2.49	0.59	0.64
TIOGA	*	*	*	0.46
UNION	*	2.36	1.44	0.75
VENANGO	1.06	1.89	0.14	0.42
WARREN	*	*	0.04	0.53
WASHINGTON	1.48	2.79	0.24	0.66
WAYNE	*	2.48	1.09	0.75
WESTMORELAND	1.35	2.43	0.27	0.57
WYOMING	*	*	0.45	0.46
YORK	1.93	2.45	1.43	0.79

* = Functional Class Doesn't Exist in County

Questions? Please contact Andrew O'Neill at the Bureau of Planning and Research, 717-346-3250 or andoneill@pa.gov

NOTE: The projected growth factors are derived using historical VMT (Vehicle Miles Traveled) data (1994 to 2013), as well as Woods and Poole demographic and economic data. The factors should not be used to project traffic beyond a 20-year period. Please be aware that these factors are estimates, and unforeseen events (opening of shopping centers, fast food franchises, gas stations, etc) could cause growth to change over time.

pennsylvania
DEPARTMENT OF TRANSPORTATION

Background Growth Investigations for OPG Bishop Tube Site **214-004**
Appendix Material **18 August 2015**

BACKGROUND

- The current Chester County growth rate promulgated by PennDOT is 1.80% per year.
- There is one development in the immediate vicinity of the site – a small (~16k) expansion of a nearby shopping center. No traffic study was prepared for this project. The expansion is estimated to be about 5-10% of total floor area of the site. A shopping center of this size draws about 30-40% of its activity from existing traffic (i.e., passby traffic).
- FTA has historic traffic counts at one of the current study area intersections (Route 30 and Route 401) available from 2005.

ANALYSIS

- The table below summarizes the results of actual background growth investigations over the last 9 years along Route 30 at Route 401.
- Three comparisons were made: Route 30 'slice' (segment) comparisons, total intersection (peak hourly) comparisons, and total intersection (overall count period) comparisons.
- Raw count data follows this page.

		05/2005	02/2014	Delta, total	~%Δ Annually
AM	SEGMENT	1534	1339	-195	0%
	TOTAL, HOURLY	2242	1960	-282	0%
	TOTAL, COUNT	4392	3818	-689	0%
PM	SEGMENT	1736	1765	+29	<1%
	TOTAL, HOURLY	2971	2881	-90	0%
	TOTAL, COUNT	5496	5397	-99	0%

CONCLUSIONS

- Background growth in the vicinity of the site appears to be significantly less than the background growth rate suggested by PennDOT.
- Since PennDOT growth rates are county-wide, they account for an average growth rate which reflects not only pseudo-rapidly developing areas (such as the 322 corridor) but also more mature and stable areas (such as the Business Route 30 corridor), so the findings described above 'make sense'.

METHODOLOGY FOR BISHOP TUBE

- FTA incorporated a growth rate of 2.00% per annum – more than the current PennDOT recommendation (which is 1.80%).
- This was chosen in abundance of caution and also to reflect some of the smaller, traffic-study-less developments in the immediate vicinity of the site, such as the one mentioned above.
- A time period of 7 years for entitlements, construction, and sales/occupancy of the site is based on past experience at similar communities.
- The resultant rate is 14.9% and was applied to through movements along Route 401 and Route 30 in both the No Build and Build scenarios.

Trip Generation Investigation

The tables below compare and contrast site trip generation potential using rates and equations methodologies for applicable site land use codes. For equations methodologies, a 'straight rate' equivalent is reverse-calculated at the specific unit count point cited below. This permits a direct comparison to the rates methodology equivalent and demonstrates to the reader how the more conservative approach was utilized.

Land Use		AM Peak Hour			PM Peak Hour		
Code	**Methodology**	**In**	**Out**	**Total**	**In**	**Out**	**Total**
		17%	83%		67%	33%	
"230"	Rates	0.07	0.36	0.44	0.35	0.17	0.53
		17	**83**	**100**	**80**	**39**	**119**
228 Townhouses	Equations	0.07	0.36	0.44	0.35	0.17	0.52
		17	**83**	**100**	**80**	**39**	**119**

Land Use		AM Peak Hour			PM Peak Hour		
Code	**Methodology**	**In**	**Out**	**Total**	**In**	**Out**	**Total**
"Site Total"	Rates	17	83	100	80	39	119

APPENDIX F

Capacity Analyses

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	189	932	3	3	482	19	6	4	8	49	9	102
Number	5	2	12	1	6	16	7	4	14	3	8	18
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	1836	1836	1986	1767	1767	1890	1996	1501	1996	1872	1766	1872
Adj Flow Rate, veh/h	193	951	3	3	518	20	12	8	16	55	10	115
Adj No. of Lanes	1	2	0	1	2	0	0	1	0	0	1	0
Peak Hour Factor	0.98	0.98	0.98	0.93	0.93	0.93	0.50	0.50	0.50	0.89	0.89	0.89
Percent Heavy Veh, %	4	4	4	7	7	7	33	33	33	6	6	6
Cap, veh/h	556	2251	7	407	2080	80	129	74	93	137	29	142
Arrive On Green	0.63	0.63	0.63	0.21	0.21	0.21	0.15	0.15	0.15	0.15	0.15	0.15
Sat Flow, veh/h	851	3567	11	556	3296	127	279	490	615	344	190	945
Grp Volume(v), veh/h	193	465	489	3	263	275	36	0	0	180	0	0
Grp Sat Flow(s),veh/h/ln	851	1744	1834	556	1678	1744	1384	0	0	1479	0	0
Q Serve(g_s), s	8.1	7.4	7.4	0.2	7.2	7.2	0.0	0.0	0.0	4.6	0.0	0.0
Cycle Q Clear(g_c), s	15.3	7.4	7.4	7.6	7.2	7.2	1.2	0.0	0.0	6.4	0.0	0.0
Prop In Lane	1.00		0.01	1.00		0.07	0.33		0.44	0.31		0.64
Lane Grp Cap(c), veh/h	556	1101	1157	407	1059	1101	296	0	0	308	0	0
V/C Ratio(X)	0.35	0.42	0.42	0.01	0.25	0.25	0.12	0.00	0.00	0.58	0.00	0.00
Avail Cap(c_a), veh/h	556	1101	1157	407	1059	1101	334	0	0	353	0	0
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	0.89	0.89	0.89	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	8.9	5.1	5.1	14.1	10.9	10.9	20.4	0.0	0.0	22.5	0.0	0.0
Incr Delay (d2), s/veh	1.7	1.2	1.1	0.0	0.5	0.5	0.2	0.0	0.0	1.9	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	3.9	6.9	7.3	0.1	6.3	6.5	0.9	0.0	0.0	5.1	0.0	0.0
LnGrp Delay(d),s/veh	10.6	6.3	6.2	14.2	11.4	11.4	20.5	0.0	0.0	24.4	0.0	0.0
LnGrp LOS	B	A	A	B	B	B	C			C		
Approach Vol, veh/h		1147			541			36			180	
Approach Delay, s/veh		7.0			11.4			20.5			24.4	
Approach LOS		A			B			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		40.7		14.3		40.7		14.3
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s		33.0		10.0		33.0		10.0
Max Q Clear Time (g_c+I1), s		17.3		3.2		9.6		8.4
Green Ext Time (p_c), s		8.7		0.6		10.9		0.2

Intersection Summary	
HCM 2010 Ctrl Delay	10.1
HCM 2010 LOS	B

Phase Number	2	4	6	8
Movement	EBTL	NBTL	WBTL	SBTL
Lead/Lag				
Lead-Lag Optimize				
Recall Mode	C-Max	None	Max	None
Maximum Split (s)	39	16	39	16
Maximum Split (%)	70.9%	29.1%	70.9%	29.1%
Minimum Split (s)	22	16	22	16
Yellow Time (s)	4	3	4	3
All-Red Time (s)	2	3	2	3
Minimum Initial (s)	4	4	4	4
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)				
Flash Dont Walk (s)				
Dual Entry	Yes	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	22	6	22	6
End Time (s)	6	22	6	22
Yield/Force Off (s)	0	16	0	16
Yield/Force Off 170(s)	0	16	0	16
Local Start Time (s)	0	39	0	39
Local Yield (s)	33	49	33	49
Local Yield 170(s)	33	49	33	49

Intersection Summary	
Cycle Length	55
Control Type	Actuated-Coordinated
Natural Cycle	40
Offset: 22 (40%), Referenced to phase 2:EBTL, Start of Green	

Splits and Phases: 3: Site/Malin & Rt 30

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	870	456	43	3	148	29	21	203	3	15	86	62
Number	1	6	16	5	2	12	3	8	18	7	4	14
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	1891	1891	1910	1724	1724	1862	1890	1853	1890	1910	1854	1854
Adj Flow Rate, veh/h	926	485	46	3	170	33	24	233	3	17	97	0
Adj No. of Lanes	1	1	0	1	1	0	0	1	0	0	1	1
Peak Hour Factor	0.94	0.94	0.94	0.87	0.87	0.87	0.87	0.87	0.87	0.89	0.89	0.89
Percent Heavy Veh, %	1	1	1	8	8	8	2	2	2	3	3	3
Cap, veh/h	1002	1276	121	340	478	93	51	233	3	56	218	219
Arrive On Green	0.35	0.75	0.75	0.34	0.34	0.34	0.14	0.14	0.14	0.14	0.14	0.00
Sat Flow, veh/h	1801	1701	161	804	1404	272	105	1681	21	130	1572	1576
Grp Volume(v), veh/h	926	0	531	3	0	203	260	0	0	114	0	0
Grp Sat Flow(s),veh/h/ln	1801	0	1862	804	0	1676	1807	0	0	1702	0	1576
Q Serve(g_s), s	32.8	0.0	10.8	0.3	0.0	9.8	8.9	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	32.8	0.0	10.8	0.3	0.0	9.8	15.0	0.0	0.0	6.1	0.0	0.0
Prop In Lane	1.00		0.09	1.00		0.16	0.09		0.01	0.15		1.00
Lane Grp Cap(c), veh/h	1002	0	1397	340	0	570	287	0	0	275	0	219
V/C Ratio(X)	0.92	0.00	0.38	0.01	0.00	0.36	0.90	0.00	0.00	0.42	0.00	0.00
Avail Cap(c_a), veh/h	1198	0	1397	340	0	570	287	0	0	275	0	219
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	0.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	11.8	0.0	4.7	23.6	0.0	26.7	46.7	0.0	0.0	42.7	0.0	0.0
Incr Delay (d2), s/veh	10.8	0.0	0.8	0.0	0.0	1.7	29.9	0.0	0.0	1.0	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	26.1	0.0	9.7	0.1	0.0	8.4	15.3	0.0	0.0	5.8	0.0	0.0
LnGrp Delay(d),s/veh	22.6	0.0	5.5	23.6	0.0	28.5	76.6	0.0	0.0	43.7	0.0	0.0
LnGrp LOS	C		A	C		C	E			D		
Approach Vol, veh/h		1457			206			260			114	
Approach Delay, s/veh		16.3			28.4			76.6			43.7	
Approach LOS		B			C			E			D	

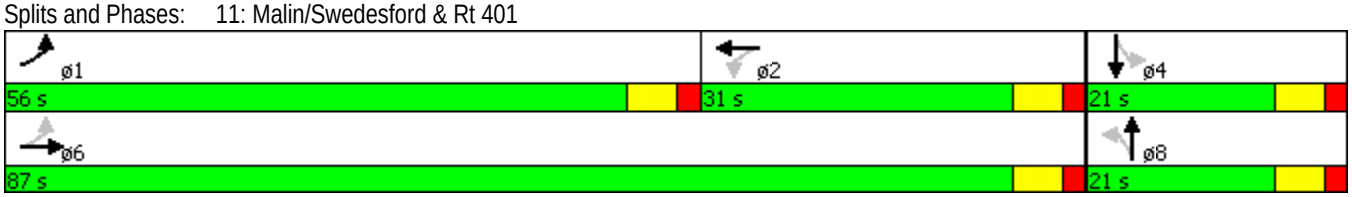
Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		8
Phs Duration (G+Y+Rc), s	44.2	42.8		21.0		87.0		21.0
Change Period (Y+Rc), s	6.0	6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s	50.0	25.0		15.0		81.0		15.0
Max Q Clear Time (g_c+I1), s	34.8	11.8		8.1		12.8		17.0
Green Ext Time (p_c), s	3.4	3.8		1.2		5.4		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	26.8
HCM 2010 LOS	C

Phase Number	1	2	4	6	8
Movement	EBL	WBTL	SBTL	EBTL	NBTL
Lead/Lag	Lead	Lag			
Lead-Lag Optimize	Yes	Yes			
Recall Mode	None	Max	None	Max	None
Maximum Split (s)	56	31	21	87	21
Maximum Split (%)	51.9%	28.7%	19.4%	80.6%	19.4%
Minimum Split (s)	10	22	15	22	15
Yellow Time (s)	4	4	4	4	4
All-Red Time (s)	2	2	2	2	2
Minimum Initial (s)	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0
Walk Time (s)					
Flash Dont Walk (s)					
Dual Entry	No	Yes	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	56	87	0	87
End Time (s)	56	87	0	87	0
Yield/Force Off (s)	50	81	102	81	102
Yield/Force Off 170(s)	50	81	102	81	102
Local Start Time (s)	52	0	31	52	31
Local Yield (s)	102	25	46	25	46
Local Yield 170(s)	102	25	46	25	46

Intersection Summary	
Cycle Length	108
Control Type	Actuated-Uncoordinated
Natural Cycle	90

Splits and Phases: 11: Malin/Swedesford & Rt 401



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL2	NBL	NBR	SEL	SER	SER2
Lane Configurations												
Volume (veh/h)	24	812	3	9	468	124	12	11	3	467	7	20
Number	1	6	16	5	2	12	3	3	18	7	14	14
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	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	1845	1845	1845	1900	1900	1900	1788	1788	1788
Adj Flow Rate, veh/h	25	855	3	10	509	135	20	20	5	570	0	0
Adj No. of Lanes	1	2	0	1	2	1	0	0	0	1	1	1
Peak Hour Factor	0.95	0.95	0.95	0.92	0.92	0.92	0.59	0.59	0.59	0.82	0.82	0.82
Percent Heavy Veh, %	2	2	2	3	3	3	0	0	0	2	2	2
Cap, veh/h	661	2779	10	449	2658	1238	26	26	6	0	0	0
Arrive On Green	0.01	0.25	0.25	0.01	0.76	0.76	0.03	0.03	0.03	0.00	0.00	0.00
Sat Flow, veh/h	1774	3617	13	1757	3505	1568	828	828	207	0		
Grp Volume(v), veh/h	25	418	440	10	509	135	44	44	0	0.0		
Grp Sat Flow(s),veh/h/ln	1774	1770	1861	1757	1752	1568	1822	1822	0			
Q Serve(g_s), s	0.4	21.0	21.0	0.1	4.5	2.2	2.6	2.6	0.0			
Cycle Q Clear(g_c), s	0.4	21.0	21.0	0.1	4.5	2.2	2.6	2.6	0.0			
Prop In Lane	1.00		0.01	1.00		1.00	0.45	0.45	0.11			
Lane Grp Cap(c), veh/h	661	1360	1429	449	2658	1238	57	57	0			
V/C Ratio(X)	0.04	0.31	0.31	0.02	0.19	0.11	0.77	0.77	0.00			
Avail Cap(c_a), veh/h	724	1360	1429	528	2658	1238	116	116	0			
HCM Platoon Ratio	0.33	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.92	0.92	0.92	1.00	1.00	1.00	1.00	1.00	0.00			
Uniform Delay (d), s/veh	2.9	17.4	17.4	4.8	3.8	2.7	52.9	52.9	0.0			
Incr Delay (d2), s/veh	0.0	0.5	0.5	0.0	0.2	0.2	19.5	19.5	0.0			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(95%),veh/ln	0.3	15.6	16.3	0.1	3.9	2.1	3.0	3.0	0.0			
LnGrp Delay(d),s/veh	2.9	17.9	17.9	4.8	3.9	2.8	72.4	72.4	0.0			
LnGrp LOS	A	B	B	A	A	A						
Approach Vol, veh/h		883			654		44	44				
Approach Delay, s/veh		17.5			3.7		72.4	72.4				
Approach LOS		B			A							

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2			5	6		8
Phs Duration (G+Y+Rc), s	9.1	90.4			8.1	91.5		10.4
Change Period (Y+Rc), s	7.0	7.0			7.0	7.0		7.0
Max Green Setting (Gmax), s	6.0	18.0			6.0	18.0		7.0
Max Q Clear Time (g_c+I1), s	2.4	6.5			2.1	23.0		4.6
Green Ext Time (p_c), s	0.0	6.3			0.0	0.0		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	13.3
HCM 2010 LOS	B

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL2	NBL	NBR	SEL	SER	SER2
Protected Phases	1	6		5	2	4	8	8		4		
Permitted Phases	6			2		2						Free
Detector Phase	1	6		5	2	4	8	8		4		
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0		
Minimum Split (s)	11.0	20.0		11.0	20.0	20.0	14.0	14.0		20.0		
Total Split (s)	13.0	25.0		13.0	25.0	58.0	14.0	14.0		58.0		
Total Split (%)	11.8%	22.7%		11.8%	22.7%	52.7%	12.7%	12.7%		52.7%		
Maximum Green (s)	6.0	18.0		6.0	18.0	51.0	7.0	7.0		51.0		
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0		
All-Red Time (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0		
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0		0.0		0.0		
Total Lost Time (s)	7.0	7.0		7.0	7.0	7.0		7.0		7.0		
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0		
Recall Mode	None	Max		None	C-Max	None	None	None		None		
Act Effct Green (s)	40.6	39.1		37.2	33.4	85.9		5.5		44.1		110.0
Actuated g/C Ratio	0.37	0.36		0.34	0.30	0.78		0.05		0.40		1.00
v/c Ratio	0.09	0.71		0.06	0.48	0.11		0.17		0.88		0.02
Control Delay	23.5	33.9		27.7	37.8	1.2		1.4		45.4		0.0
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0		0.0		0.0
Total Delay	23.5	33.9		27.7	37.8	1.2		1.4		45.4		0.0
LOS								A		D		A
Approach Delay		33.6			30.0			1.4		43.6		
Approach LOS								A		D		
Queue Length 50th (ft)	10	279		5	173	0		0		363		0
Queue Length 95th (ft)	m25	#576		18	#281	18		0		406		0
Internal Link Dist (ft)		2838			866			119		2809		
Turn Bay Length (ft)	100			100								400
Base Capacity (vph)	271	1214		164	1064	1299		281		762		1520
Starvation Cap Reductn	0	0		0	0	0		0		0		0
Spillback Cap Reductn	0	0		0	0	0		0		0		0
Storage Cap Reductn	0	0		0	0	0		0		0		0
Reduced v/c Ratio	0.09	0.71		0.06	0.48	0.10		0.16		0.76		0.02

Intersection Summary

Area Type: Other
Cycle Length: 110
Actuated Cycle Length: 110
Offset: 80 (73%), Referenced to phase 2:WBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.88
Intersection Signal Delay: 34.7 Intersection LOS: C
Intersection Capacity Utilization 69.7% ICU Level of Service C
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Phase Number	1	2	4	5	6	8
Movement	EBL	WBTL	SEL	WBL	EBTL	NBL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize	Yes	Yes		Yes	Yes	
Recall Mode	None	C-Max	None	None	Max	None
Maximum Split (s)	13	25	58	13	25	14
Maximum Split (%)	11.8%	22.7%	52.7%	11.8%	22.7%	12.7%
Minimum Split (s)	11	20	20	11	20	14
Yellow Time (s)	4	4	4	4	4	4
All-Red Time (s)	3	3	3	3	3	3
Minimum Initial (s)	4	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)						
Flash Dont Walk (s)						
Dual Entry	No	Yes	No	No	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	67	80	105	67	80	53
End Time (s)	80	105	53	80	105	67
Yield/Force Off (s)	73	98	46	73	98	60
Yield/Force Off 170(s)	73	98	46	73	98	60
Local Start Time (s)	97	0	25	97	0	83
Local Yield (s)	103	18	76	103	18	90
Local Yield 170(s)	103	18	76	103	18	90

Intersection Summary	
Cycle Length	110
Control Type	Actuated-Coordinated
Natural Cycle	90
Offset: 80 (73%), Referenced to phase 2:WBTL, Start of Green	

Splits and Phases: 12: McD & Rt 30 & Rt 401

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	83	590	3	1	746	174	5	16	2	108	1	101
Number	5	2	12	1	6	16	7	4	14	3	8	18
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	1854	1854	1986	1853	1853	1890	1996	1766	1996	1872	1817	1872
Adj Flow Rate, veh/h	86	608	3	1	867	202	7	22	3	133	1	125
Adj No. of Lanes	1	2	0	1	2	0	0	1	0	0	1	0
Peak Hour Factor	0.97	0.97	0.97	0.86	0.86	0.86	0.72	0.72	0.72	0.81	0.81	0.81
Percent Heavy Veh, %	3	3	3	2	2	2	13	13	13	3	3	3
Cap, veh/h	331	2104	10	522	1661	387	117	286	34	235	17	151
Arrive On Green	0.59	0.59	0.59	0.59	0.59	0.59	0.21	0.21	0.21	0.21	0.21	0.21
Sat Flow, veh/h	523	3594	18	803	2837	661	203	1332	159	674	80	703
Grp Volume(v), veh/h	86	298	313	1	538	531	32	0	0	259	0	0
Grp Sat Flow(s),veh/h/ln	523	1761	1851	803	1761	1737	1694	0	0	1457	0	0
Q Serve(g_s), s	7.0	5.1	5.1	0.0	10.9	11.0	0.0	0.0	0.0	9.0	0.0	0.0
Cycle Q Clear(g_c), s	18.0	5.1	5.1	5.1	10.9	11.0	0.9	0.0	0.0	10.1	0.0	0.0
Prop In Lane	1.00		0.01	1.00		0.38	0.22		0.09	0.51		0.48
Lane Grp Cap(c), veh/h	331	1031	1084	522	1031	1017	436	0	0	403	0	0
V/C Ratio(X)	0.26	0.29	0.29	0.00	0.52	0.52	0.07	0.00	0.00	0.64	0.00	0.00
Avail Cap(c_a), veh/h	331	1031	1084	522	1031	1017	571	0	0	526	0	0
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	1.00	1.00	0.63	0.63	0.63	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	12.8	6.2	6.2	7.5	7.4	7.4	18.9	0.0	0.0	22.4	0.0	0.0
Incr Delay (d2), s/veh	1.9	0.7	0.7	0.0	1.2	1.2	0.1	0.0	0.0	1.7	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(-26165%),veh/ln	1.2	2.6	2.7	0.0	5.6	5.5	0.4	0.0	0.0	4.3	0.0	0.0
LnGrp Delay(d),s/veh	14.7	6.9	6.9	7.5	8.6	8.6	18.9	0.0	0.0	24.1	0.0	0.0
LnGrp LOS	B	A	A	A	A	A	B			C		
Approach Vol, veh/h		697			1070			32			259	
Approach Delay, s/veh		7.9			8.6			18.9			24.1	
Approach LOS		A			A			B			C	

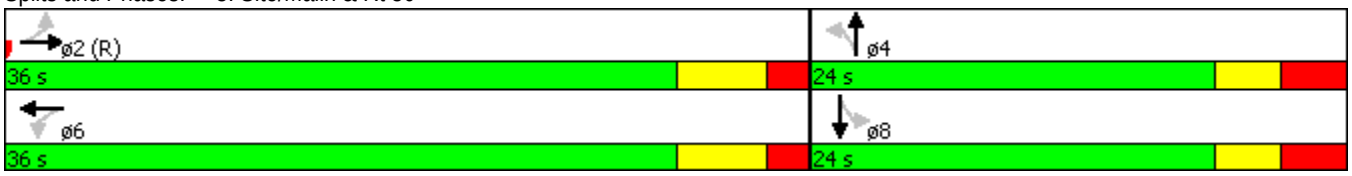
Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		41.1		18.9		41.1		18.9
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s		30.0		18.0		30.0		18.0
Max Q Clear Time (g_c+I1), s		20.0		2.9		13.0		12.1
Green Ext Time (p_c), s		6.9		1.5		10.0		0.8

Intersection Summary	
HCM 2010 Ctrl Delay	10.5
HCM 2010 LOS	B

Phase Number	2	4	6	8
Movement	EBTL	NBTL	WBTL	SBTL
Lead/Lag				
Lead-Lag Optimize				
Recall Mode	C-Max	None	Max	None
Maximum Split (s)	36	24	36	24
Maximum Split (%)	60.0%	40.0%	60.0%	40.0%
Minimum Split (s)	22	16	22	16
Yellow Time (s)	4	3	4	3
All-Red Time (s)	2	3	2	3
Minimum Initial (s)	4	4	4	4
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)				
Flash Dont Walk (s)				
Dual Entry	Yes	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	57	33	57	33
End Time (s)	33	57	33	57
Yield/Force Off (s)	27	51	27	51
Yield/Force Off 170(s)	27	51	27	51
Local Start Time (s)	0	36	0	36
Local Yield (s)	30	54	30	54
Local Yield 170(s)	30	54	30	54

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	50
Offset: 57 (95%), Referenced to phase 2:EBTL, Start of Green	

Splits and Phases: 3: Site/Malin & Rt 30



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	128	255	65	13	699	49	155	95	5	19	127	490
Number	1	6	16	5	2	12	3	8	18	7	4	14
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	1836	1836	1910	1825	1825	1862	1890	1853	1890	1910	1891	1891
Adj Flow Rate, veh/h	144	287	73	14	744	52	178	109	6	21	143	0
Adj No. of Lanes	1	1	0	1	1	0	0	1	0	0	1	1
Peak Hour Factor	0.89	0.89	0.89	0.94	0.94	0.94	0.87	0.87	0.87	0.89	0.89	0.89
Percent Heavy Veh, %	4	4	4	2	2	2	2	2	2	1	1	1
Cap, veh/h	337	989	252	660	1006	70	202	91	5	61	322	307
Arrive On Green	0.05	0.70	0.70	0.60	0.60	0.60	0.19	0.19	0.19	0.19	0.19	0.00
Sat Flow, veh/h	1749	1413	359	997	1687	118	781	478	26	128	1689	1607
Grp Volume(v), veh/h	144	0	360	14	0	796	293	0	0	164	0	0
Grp Sat Flow(s),veh/h/ln	1749	0	1773	997	0	1805	1286	0	0	1817	0	1607
Q Serve(g_s), s	3.3	0.0	8.4	0.6	0.0	35.0	12.5	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	3.3	0.0	8.4	0.6	0.0	35.0	21.0	0.0	0.0	8.5	0.0	0.0
Prop In Lane	1.00		0.20	1.00		0.07	0.61		0.02	0.13		1.00
Lane Grp Cap(c), veh/h	337	0	1241	660	0	1076	298	0	0	384	0	307
V/C Ratio(X)	0.43	0.00	0.29	0.02	0.00	0.74	0.98	0.00	0.00	0.43	0.00	0.00
Avail Cap(c_a), veh/h	411	0	1241	660	0	1076	298	0	0	384	0	307
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	0.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	14.7	0.0	6.2	9.1	0.0	16.0	46.7	0.0	0.0	39.4	0.0	0.0
Incr Delay (d2), s/veh	0.9	0.0	0.6	0.1	0.0	4.6	47.3	0.0	0.0	0.8	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(-26165%),veh/ln	1.9	0.0	4.3	0.2	0.0	18.6	12.8	0.0	0.0	4.5	0.0	0.0
LnGrp Delay(d),s/veh	15.6	0.0	6.8	9.1	0.0	20.6	94.1	0.0	0.0	40.2	0.0	0.0
LnGrp LOS	B		A	A		C	F			D		
Approach Vol, veh/h		504			810			293			164	
Approach Delay, s/veh		9.3			20.4			94.1			40.2	
Approach LOS		A			C			F			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		8
Phs Duration (G+Y+Rc), s	11.4	71.6		27.0		83.0		27.0
Change Period (Y+Rc), s	6.0	6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s	10.0	61.0		21.0		77.0		21.0
Max Q Clear Time (g_c+I1), s	5.3	37.0		10.5		10.4		23.0
Green Ext Time (p_c), s	0.1	8.8		2.0		10.9		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	31.3
HCM 2010 LOS	C

Phase Number	1	2	4	6	8
Movement	EBL	WBTL	SBTL	EBTL	NBTL
Lead/Lag	Lead	Lag			
Lead-Lag Optimize	Yes	Yes			
Recall Mode	None	Max	None	Max	None
Maximum Split (s)	16	67	27	83	27
Maximum Split (%)	14.5%	60.9%	24.5%	75.5%	24.5%
Minimum Split (s)	10	22	15	22	15
Yellow Time (s)	4	4	4	4	4
All-Red Time (s)	2	2	2	2	2
Minimum Initial (s)	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0
Walk Time (s)					
Flash Dont Walk (s)					
Dual Entry	No	Yes	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	16	83	0	83
End Time (s)	16	83	0	83	0
Yield/Force Off (s)	10	77	104	77	104
Yield/Force Off 170(s)	10	77	104	77	104
Local Start Time (s)	94	0	67	94	67
Local Yield (s)	104	61	88	61	88
Local Yield 170(s)	104	61	88	61	88

Intersection Summary	
Cycle Length	110
Control Type	Actuated-Uncoordinated
Natural Cycle	90

Splits and Phases: 11: Malin/Swedesford & Rt 401

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL2	NBL	NBR	SEL	SER	SER2
Lane Configurations												
Volume (veh/h)	51	636	4	9	974	781	25	21	25	276	4	75
Number	1	6	16	5	2	12	3	3	18	7	14	14
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	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	1881	1881	1900	1863	1863	1863	1900	1900	1900	1788	1788	1788
Adj Flow Rate, veh/h	58	723	5	9	1015	814	41	41	41	317	0	0
Adj No. of Lanes	1	2	0	1	2	1	0	0	0	1	1	1
Peak Hour Factor	0.88	0.88	0.88	0.96	0.96	0.96	0.61	0.61	0.61	0.87	0.87	0.87
Percent Heavy Veh, %	1	1	1	2	2	2	0	0	0	2	2	2
Cap, veh/h	277	2515	17	541	2357	1160	41	41	41	0	0	0
Arrive On Green	0.03	0.69	0.69	0.01	0.67	0.67	0.07	0.07	0.07	0.00	0.00	0.00
Sat Flow, veh/h	1792	3639	25	1774	3539	1583	622	622	622	0		
Grp Volume(v), veh/h	58	355	373	9	1015	814	116	116	0	0.0		
Grp Sat Flow(s),veh/h/ln	1792	1787	1877	1774	1770	1583	1759	1759	0			
Q Serve(g_s), s	0.9	6.9	6.9	0.1	12.1	25.5	5.9	5.9	0.0			
Cycle Q Clear(g_c), s	0.9	6.9	6.9	0.1	12.1	25.5	5.9	5.9	0.0			
Prop In Lane	1.00		0.01	1.00		1.00	0.35	0.35	0.35			
Lane Grp Cap(c), veh/h	277	1235	1297	541	2357	1160	117	117	0			
V/C Ratio(X)	0.21	0.29	0.29	0.02	0.43	0.70	0.99	0.99	0.00			
Avail Cap(c_a), veh/h	336	1235	1297	643	2357	1160	117	117	0			
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.96	0.96	0.96	1.00	1.00	1.00	1.00	1.00	0.00			
Uniform Delay (d), s/veh	5.2	5.4	5.4	4.9	7.0	6.6	42.0	42.0	0.0			
Incr Delay (d2), s/veh	0.4	0.6	0.5	0.0	0.6	3.6	79.5	79.5	0.0			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(-26165%),veh/ln	0.4	3.5	3.7	0.1	6.0	14.7	5.5	5.5	0.0			
LnGrp Delay(d),s/veh	5.6	5.9	5.9	4.9	7.6	10.2	121.5	121.5	0.0			
LnGrp LOS	A	A	A	A	A	B						
Approach Vol, veh/h		786			1838		116	116				
Approach Delay, s/veh		5.9			8.7		121.5	121.5				
Approach LOS		A			A							

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2			5	6		8
Phs Duration (G+Y+Rc), s	10.1	66.9			7.8	69.2		13.0
Change Period (Y+Rc), s	7.0	7.0			7.0	7.0		7.0
Max Green Setting (Gmax), s	6.0	26.0			6.0	26.0		6.0
Max Q Clear Time (g_c+I1), s	2.9	27.5			2.1	8.9		7.9
Green Ext Time (p_c), s	0.0	0.0			0.0	12.7		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	12.7
HCM 2010 LOS	B

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL2	NBL	NBR	SEL	SER	SER2
Protected Phases	1	6		5	2	4	8	8		4		
Permitted Phases	6			2		2						Free
Detector Phase	1	6		5	2	4	8	8		4		
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0		
Minimum Split (s)	11.0	20.0		11.0	20.0	20.0	13.0	13.0		20.0		
Total Split (s)	13.0	33.0		13.0	33.0	31.0	13.0	13.0		31.0		
Total Split (%)	14.4%	36.7%		14.4%	36.7%	34.4%	14.4%	14.4%		34.4%		
Maximum Green (s)	6.0	26.0		6.0	26.0	24.0	6.0	6.0		24.0		
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0		
All-Red Time (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0		
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0		0.0		0.0		
Total Lost Time (s)	7.0	7.0		7.0	7.0	7.0		7.0		7.0		
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0		
Recall Mode	None	Max		None	C-Max	None	None	None		None		
Act Effct Green (s)	42.8	41.5		38.2	33.4	63.6		5.5		21.8		90.0
Actuated g/C Ratio	0.48	0.46		0.42	0.37	0.71		0.06		0.24		1.00
v/c Ratio	0.29	0.46		0.03	0.77	0.64		0.37		0.81		0.06
Control Delay	18.7	20.3		14.9	33.7	5.5		3.4		48.7		0.1
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0		0.0		0.0
Total Delay	18.7	20.3		14.9	33.7	5.5		3.4		48.7		0.1
LOS								A		D		A
Approach Delay		20.2			21.1			3.4		38.4		
Approach LOS								A		D		
Queue Length 50th (ft)	19	150		3	301	61		0		167		0
Queue Length 95th (ft)	40	253		11	#440	171		0		#257		0
Internal Link Dist (ft)		2838			866			119		2809		
Turn Bay Length (ft)	100			100								400
Base Capacity (vph)	201	1592		314	1315	1286		320		438		1520
Starvation Cap Reductn	0	0		0	0	0		0		0		0
Spillback Cap Reductn	0	0		0	0	0		0		0		0
Storage Cap Reductn	0	0		0	0	0		0		0		0
Reduced v/c Ratio	0.29	0.46		0.03	0.77	0.63		0.36		0.74		0.06

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 62 (69%), Referenced to phase 2:WBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.81
Intersection Signal Delay: 22.5 Intersection LOS: C
Intersection Capacity Utilization 73.2% ICU Level of Service D
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Phase Number	1	2	4	5	6	8
Movement	EBL	WBTL	SEL	WBL	EBTL	NBL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize	Yes	Yes		Yes	Yes	
Recall Mode	None	C-Max	None	None	Max	None
Maximum Split (s)	13	33	31	13	33	13
Maximum Split (%)	14.4%	36.7%	34.4%	14.4%	36.7%	14.4%
Minimum Split (s)	11	20	20	11	20	13
Yellow Time (s)	4	4	4	4	4	4
All-Red Time (s)	3	3	3	3	3	3
Minimum Initial (s)	4	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)						
Flash Dont Walk (s)						
Dual Entry	No	Yes	Yes	No	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	49	62	5	49	62	36
End Time (s)	62	5	36	62	5	49
Yield/Force Off (s)	55	88	29	55	88	42
Yield/Force Off 170(s)	55	88	29	55	88	42
Local Start Time (s)	77	0	33	77	0	64
Local Yield (s)	83	26	57	83	26	70
Local Yield 170(s)	83	26	57	83	26	70

Intersection Summary	
Cycle Length	90
Control Type	Actuated-Coordinated
Natural Cycle	80
Offset: 62 (69%), Referenced to phase 2:WBTL, Start of Green	

Splits and Phases: 12: McD & Rt 30 & Rt 401

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	216	1071	3	3	554	22	6	4	8	52	9	112
Number	5	2	12	1	6	16	7	4	14	3	8	18
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	1836	1836	1986	1767	1767	1890	1996	1501	1996	1872	1766	1872
Adj Flow Rate, veh/h	220	1093	3	3	596	24	12	8	16	58	10	126
Adj No. of Lanes	1	2	0	1	2	0	0	1	0	0	1	0
Peak Hour Factor	0.98	0.98	0.98	0.93	0.93	0.93	0.50	0.50	0.50	0.89	0.89	0.89
Percent Heavy Veh, %	4	4	4	7	7	7	33	33	33	6	6	6
Cap, veh/h	501	2219	6	352	2046	82	133	77	99	139	29	154
Arrive On Green	0.62	0.62	0.62	0.21	0.21	0.21	0.16	0.16	0.16	0.16	0.16	0.16
Sat Flow, veh/h	789	3569	10	486	3290	132	287	484	616	336	182	961
Grp Volume(v), veh/h	220	534	562	3	304	316	36	0	0	194	0	0
Grp Sat Flow(s),veh/h/ln	789	1744	1834	486	1678	1743	1387	0	0	1479	0	0
Q Serve(g_s), s	11.3	9.2	9.2	0.3	8.4	8.4	0.0	0.0	0.0	5.0	0.0	0.0
Cycle Q Clear(g_c), s	19.7	9.2	9.2	9.5	8.4	8.4	1.2	0.0	0.0	6.9	0.0	0.0
Prop In Lane	1.00		0.01	1.00		0.08	0.33		0.44	0.30		0.65
Lane Grp Cap(c), veh/h	501	1085	1141	352	1044	1084	309	0	0	322	0	0
V/C Ratio(X)	0.44	0.49	0.49	0.01	0.29	0.29	0.12	0.00	0.00	0.60	0.00	0.00
Avail Cap(c_a), veh/h	501	1085	1141	352	1044	1084	336	0	0	353	0	0
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	0.77	0.77	0.77	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	10.8	5.7	5.7	15.9	11.6	11.6	19.9	0.0	0.0	22.3	0.0	0.0
Incr Delay (d2), s/veh	2.8	1.6	1.5	0.0	0.5	0.5	0.2	0.0	0.0	2.5	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(-26165%),veh/ln	2.8	4.8	5.0	0.0	4.1	4.2	0.5	0.0	0.0	3.1	0.0	0.0
LnGrp Delay(d),s/veh	13.6	7.3	7.2	16.0	12.2	12.1	20.1	0.0	0.0	24.7	0.0	0.0
LnGrp LOS	B	A	A	B	B	B	C			C		
Approach Vol, veh/h		1316			623			36			194	
Approach Delay, s/veh		8.3			12.2			20.1			24.7	
Approach LOS		A			B			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		40.2		14.8		40.2		14.8
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s		33.0		10.0		33.0		10.0
Max Q Clear Time (g_c+I1), s		21.7		3.2		11.5		8.9
Green Ext Time (p_c), s		7.9		0.7		12.4		0.1

Intersection Summary	
HCM 2010 Ctrl Delay	11.1
HCM 2010 LOS	B

Phase Number	2	4	6	8
Movement	EBTL	NBTL	WBTL	SBTL
Lead/Lag				
Lead-Lag Optimize				
Recall Mode	C-Max	None	Max	None
Maximum Split (s)	39	16	39	16
Maximum Split (%)	70.9%	29.1%	70.9%	29.1%
Minimum Split (s)	22	16	22	16
Yellow Time (s)	4	3	4	3
All-Red Time (s)	2	3	2	3
Minimum Initial (s)	4	4	4	4
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)				
Flash Dont Walk (s)				
Dual Entry	Yes	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	22	6	22	6
End Time (s)	6	22	6	22
Yield/Force Off (s)	0	16	0	16
Yield/Force Off 170(s)	0	16	0	16
Local Start Time (s)	0	39	0	39
Local Yield (s)	33	49	33	49
Local Yield 170(s)	33	49	33	49

Intersection Summary	
Cycle Length	55
Control Type	Actuated-Coordinated
Natural Cycle	45
Offset: 22 (40%), Referenced to phase 2:EBTL, Start of Green	

Splits and Phases: 3: Site/Malin & Rt 30

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	870	524	43	3	170	29	21	233	3	15	99	62
Number	1	6	16	5	2	12	3	8	18	7	4	14
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	1891	1891	1910	1724	1724	1862	1890	1853	1890	1910	1854	1854
Adj Flow Rate, veh/h	926	557	46	3	195	33	24	268	3	17	111	0
Adj No. of Lanes	1	1	0	1	1	0	0	1	0	0	1	1
Peak Hour Factor	0.94	0.94	0.94	0.87	0.87	0.87	0.87	0.87	0.87	0.89	0.89	0.89
Percent Heavy Veh, %	1	1	1	8	8	8	2	2	2	3	3	3
Cap, veh/h	980	1292	107	323	489	83	49	236	3	54	222	219
Arrive On Green	0.35	0.75	0.75	0.34	0.34	0.34	0.14	0.14	0.14	0.14	0.14	0.00
Sat Flow, veh/h	1801	1723	142	753	1438	243	93	1703	18	118	1597	1576
Grp Volume(v), veh/h	926	0	603	3	0	228	295	0	0	128	0	0
Grp Sat Flow(s),veh/h/ln	1801	0	1865	753	0	1681	1814	0	0	1715	0	1576
Q Serve(g_s), s	32.8	0.0	12.9	0.3	0.0	11.2	8.1	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	32.8	0.0	12.9	0.3	0.0	11.2	15.0	0.0	0.0	6.9	0.0	0.0
Prop In Lane	1.00		0.08	1.00		0.14	0.08		0.01	0.13		1.00
Lane Grp Cap(c), veh/h	980	0	1399	323	0	572	288	0	0	276	0	219
V/C Ratio(X)	0.94	0.00	0.43	0.01	0.00	0.40	1.02	0.00	0.00	0.46	0.00	0.00
Avail Cap(c_a), veh/h	1176	0	1399	323	0	572	288	0	0	276	0	219
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	0.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	12.3	0.0	5.0	23.6	0.0	27.2	47.4	0.0	0.0	43.0	0.0	0.0
Incr Delay (d2), s/veh	13.5	0.0	1.0	0.1	0.0	2.1	59.4	0.0	0.0	1.2	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(-26165%),veh/ln	19.6	0.0	6.9	0.1	0.0	5.5	13.3	0.0	0.0	3.6	0.0	0.0
LnGrp Delay(d),s/veh	25.8	0.0	6.0	23.6	0.0	29.3	106.9	0.0	0.0	44.2	0.0	0.0
LnGrp LOS	C		A	C		C	F			D		
Approach Vol, veh/h		1529			231			295			128	
Approach Delay, s/veh		18.0			29.2			106.9			44.2	
Approach LOS		B			C			F			D	

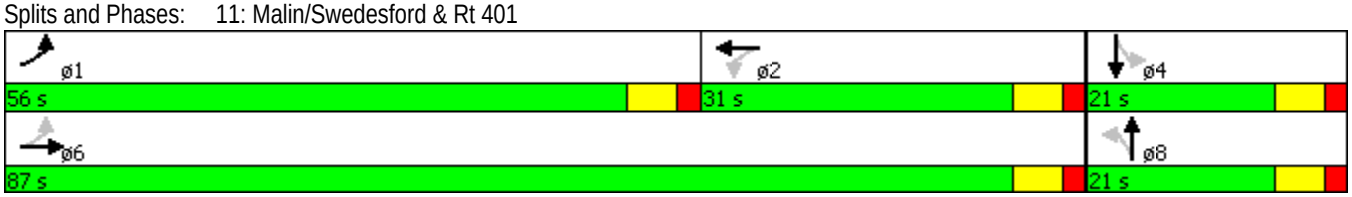
Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		8
Phs Duration (G+Y+Rc), s	44.2	42.8		21.0		87.0		21.0
Change Period (Y+Rc), s	6.0	6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s	50.0	25.0		15.0		81.0		15.0
Max Q Clear Time (g_c+I1), s	34.8	13.2		8.9		14.9		17.0
Green Ext Time (p_c), s	3.4	4.2		1.3		6.4		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	32.7
HCM 2010 LOS	C

Phase Number	1	2	4	6	8
Movement	EBL	WBTL	SBTL	EBTL	NBTL
Lead/Lag	Lead	Lag			
Lead-Lag Optimize	Yes	Yes			
Recall Mode	None	Max	None	Max	None
Maximum Split (s)	56	31	21	87	21
Maximum Split (%)	51.9%	28.7%	19.4%	80.6%	19.4%
Minimum Split (s)	10	22	15	22	15
Yellow Time (s)	4	4	4	4	4
All-Red Time (s)	2	2	2	2	2
Minimum Initial (s)	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0
Walk Time (s)					
Flash Dont Walk (s)					
Dual Entry	No	Yes	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	56	87	0	87
End Time (s)	56	87	0	87	0
Yield/Force Off (s)	50	81	102	81	102
Yield/Force Off 170(s)	50	81	102	81	102
Local Start Time (s)	52	0	31	52	31
Local Yield (s)	102	25	46	25	46
Local Yield 170(s)	102	25	46	25	46

Intersection Summary	
Cycle Length	108
Control Type	Actuated-Uncoordinated
Natural Cycle	90

Splits and Phases: 11: Malin/Swedesford & Rt 401



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL2	NBL	NBR	SEL	SER	SER2
Lane Configurations												
Volume (veh/h)	28	933	3	9	538	142	12	11	3	536	7	23
Number	1	6	16	5	2	12	3	3	18	7	14	14
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	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	1845	1845	1845	1900	1900	1900	1788	1788	1788
Adj Flow Rate, veh/h	29	982	3	10	585	154	20	20	5	654	0	0
Adj No. of Lanes	1	2	0	1	2	1	0	0	0	1	1	1
Peak Hour Factor	0.95	0.95	0.95	0.92	0.92	0.92	0.59	0.59	0.59	0.82	0.82	0.82
Percent Heavy Veh, %	2	2	2	3	3	3	0	0	0	2	2	2
Cap, veh/h	610	2781	8	425	2651	1235	26	26	6	0	0	0
Arrive On Green	0.01	0.51	0.51	0.01	0.76	0.76	0.03	0.03	0.03	0.00	0.00	0.00
Sat Flow, veh/h	1774	3619	11	1757	3505	1568	828	828	207	0		
Grp Volume(v), veh/h	29	480	505	10	585	154	44	44	0	0.0		
Grp Sat Flow(s),veh/h/ln	1774	1770	1861	1757	1752	1568	1822	1822	0			
Q Serve(g_s), s	0.4	17.7	17.7	0.1	5.4	2.5	2.6	2.6	0.0			
Cycle Q Clear(g_c), s	0.4	17.7	17.7	0.1	5.4	2.5	2.6	2.6	0.0			
Prop In Lane	1.00		0.01	1.00		1.00	0.45	0.45	0.11			
Lane Grp Cap(c), veh/h	610	1360	1430	425	2651	1235	57	57	0			
V/C Ratio(X)	0.05	0.35	0.35	0.02	0.22	0.12	0.77	0.77	0.00			
Avail Cap(c_a), veh/h	669	1360	1430	504	2651	1235	116	116	0			
HCM Platoon Ratio	0.67	0.67	0.67	1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.85	0.85	0.85	1.00	1.00	1.00	1.00	1.00	0.00			
Uniform Delay (d), s/veh	2.9	10.5	10.5	4.3	3.9	2.7	52.9	52.9	0.0			
Incr Delay (d2), s/veh	0.0	0.6	0.6	0.0	0.2	0.2	19.5	19.5	0.0			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(-26165%),veh/ln	0.2	8.8	9.3	0.1	2.6	1.3	1.6	1.6	0.0			
LnGrp Delay(d),s/veh	2.9	11.1	11.1	4.3	4.1	3.0	72.4	72.4	0.0			
LnGrp LOS	A	B	B	A	A	A						
Approach Vol, veh/h		1014			749		44	44				
Approach Delay, s/veh		10.8			3.9		72.4	72.4				
Approach LOS		B			A							

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2			5	6		8
Phs Duration (G+Y+Rc), s	9.4	90.2			8.1	91.5		10.4
Change Period (Y+Rc), s	7.0	7.0			7.0	7.0		7.0
Max Green Setting (Gmax), s	6.0	18.0			6.0	18.0		7.0
Max Q Clear Time (g_c+I1), s	2.4	7.4			2.1	19.7		4.6
Green Ext Time (p_c), s	0.0	6.8			0.0	0.0		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	9.5
HCM 2010 LOS	A

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL2	NBL	NBR	SEL	SER	SER2
Protected Phases	1	6		5	2	4	8	8		4		
Permitted Phases	6			2		2						Free
Detector Phase	1	6		5	2	4	8	8		4		
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0		
Minimum Split (s)	11.0	20.0		11.0	20.0	20.0	14.0	14.0		20.0		
Total Split (s)	13.0	25.0		13.0	25.0	58.0	14.0	14.0		58.0		
Total Split (%)	11.8%	22.7%		11.8%	22.7%	52.7%	12.7%	12.7%		52.7%		
Maximum Green (s)	6.0	18.0		6.0	18.0	51.0	7.0	7.0		51.0		
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0		
All-Red Time (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0		
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0		0.0		0.0		
Total Lost Time (s)	7.0	7.0		7.0	7.0	7.0		7.0		7.0		
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0		
Recall Mode	None	Max		None	C-Max	None	None	None		None		
Act Effct Green (s)	36.8	35.3		33.4	29.5	85.8		5.5		47.9		110.0
Actuated g/C Ratio	0.33	0.32		0.30	0.27	0.78		0.05		0.44		1.00
v/c Ratio	0.14	0.90		0.06	0.62	0.12		0.17		0.93		0.02
Control Delay	24.8	44.6		28.7	42.9	1.1		1.4		49.3		0.0
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0		0.0		0.0
Total Delay	24.8	44.6		28.7	42.9	1.1		1.4		49.3		0.0
LOS								A		D		A
Approach Delay		44.1			34.1			1.4		47.3		
Approach LOS								A		D		
Queue Length 50th (ft)	12	362		5	218	0		0		411		0
Queue Length 95th (ft)	m23	#679		18	#345	19		0		498		0
Internal Link Dist (ft)		2838			866			119		2809		
Turn Bay Length (ft)	100			100								400
Base Capacity (vph)	208	1096		160	940	1268		281		762		1520
Starvation Cap Reductn	0	0		0	0	0		0		0		0
Spillback Cap Reductn	0	0		0	0	0		0		0		0
Storage Cap Reductn	0	0		0	0	0		0		0		0
Reduced v/c Ratio	0.14	0.90		0.06	0.62	0.12		0.16		0.87		0.02

Intersection Summary

Area Type: Other
Cycle Length: 110
Actuated Cycle Length: 110
Offset: 80 (73%), Referenced to phase 2:WBTL, Start of Green
Natural Cycle: 120
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.93
Intersection Signal Delay: 41.2 Intersection LOS: D
Intersection Capacity Utilization 76.8% ICU Level of Service D
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Phase Number	1	2	4	5	6	8
Movement	EBL	WBTL	SEL	WBL	EBTL	NBL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize	Yes	Yes		Yes	Yes	
Recall Mode	None	C-Max	None	None	Max	None
Maximum Split (s)	13	25	58	13	25	14
Maximum Split (%)	11.8%	22.7%	52.7%	11.8%	22.7%	12.7%
Minimum Split (s)	11	20	20	11	20	14
Yellow Time (s)	4	4	4	4	4	4
All-Red Time (s)	3	3	3	3	3	3
Minimum Initial (s)	4	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)						
Flash Dont Walk (s)						
Dual Entry	No	Yes	Yes	No	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	67	80	105	67	80	53
End Time (s)	80	105	53	80	105	67
Yield/Force Off (s)	73	98	46	73	98	60
Yield/Force Off 170(s)	73	98	46	73	98	60
Local Start Time (s)	97	0	25	97	0	83
Local Yield (s)	103	18	76	103	18	90
Local Yield 170(s)	103	18	76	103	18	90

Intersection Summary	
Cycle Length	110
Control Type	Actuated-Coordinated
Natural Cycle	120
Offset: 80 (73%), Referenced to phase 2:WBTL, Start of Green	

Splits and Phases: 12: McD & Rt 30 & Rt 401

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	89	678	3	1	857	182	5	16	2	118	1	110
Number	5	2	12	1	6	16	7	4	14	3	8	18
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	1854	1854	1986	1853	1853	1890	1996	1766	1996	1872	1817	1872
Adj Flow Rate, veh/h	92	699	3	1	997	212	7	22	3	146	1	136
Adj No. of Lanes	1	2	0	1	2	0	0	1	0	0	1	0
Peak Hour Factor	0.97	0.97	0.97	0.86	0.86	0.86	0.72	0.72	0.72	0.81	0.81	0.81
Percent Heavy Veh, %	3	3	3	2	2	2	13	13	13	3	3	3
Cap, veh/h	277	2048	9	464	1647	349	121	303	36	249	17	161
Arrive On Green	0.57	0.57	0.57	0.57	0.57	0.57	0.23	0.23	0.23	0.23	0.23	0.23
Sat Flow, veh/h	458	3597	15	738	2892	614	207	1315	157	683	72	699
Grp Volume(v), veh/h	92	342	360	1	606	603	32	0	0	283	0	0
Grp Sat Flow(s),veh/h/ln	458	1761	1851	738	1761	1745	1678	0	0	1455	0	0
Q Serve(g_s), s	9.9	6.2	6.2	0.0	13.6	13.6	0.0	0.0	0.0	10.0	0.0	0.0
Cycle Q Clear(g_c), s	23.6	6.2	6.2	6.3	13.6	13.6	0.9	0.0	0.0	11.1	0.0	0.0
Prop In Lane	1.00		0.01	1.00		0.35	0.22		0.09	0.52		0.48
Lane Grp Cap(c), veh/h	277	1003	1054	464	1003	994	460	0	0	426	0	0
V/C Ratio(X)	0.33	0.34	0.34	0.00	0.60	0.61	0.07	0.00	0.00	0.66	0.00	0.00
Avail Cap(c_a), veh/h	277	1003	1054	464	1003	994	569	0	0	526	0	0
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	1.00	1.00	0.40	0.40	0.40	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	16.2	6.9	6.9	8.6	8.5	8.5	18.1	0.0	0.0	22.0	0.0	0.0
Incr Delay (d2), s/veh	3.2	0.9	0.9	0.0	1.1	1.1	0.1	0.0	0.0	2.3	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(-26165%),veh/ln	1.5	3.2	3.4	0.0	6.7	6.8	0.4	0.0	0.0	4.7	0.0	0.0
LnGrp Delay(d),s/veh	19.5	7.8	7.8	8.6	9.6	9.6	18.2	0.0	0.0	24.2	0.0	0.0
LnGrp LOS	B	A	A	A	A	A	B			C		
Approach Vol, veh/h		794			1210			32			283	
Approach Delay, s/veh		9.2			9.6			18.2			24.2	
Approach LOS		A			A			B			C	

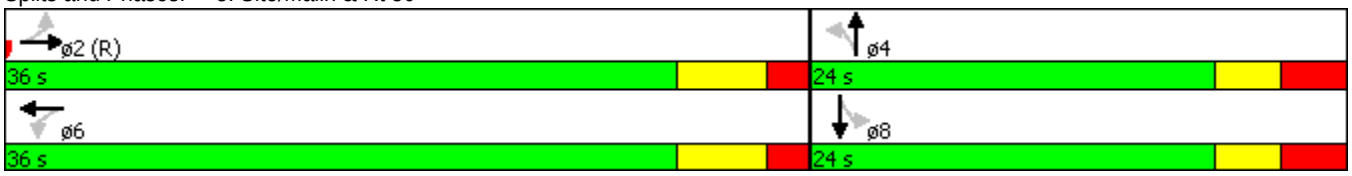
Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		40.2		19.8		40.2		19.8
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s		30.0		18.0		30.0		18.0
Max Q Clear Time (g_c+I1), s		25.6		2.9		15.6		13.1
Green Ext Time (p_c), s		3.7		1.7		10.1		0.8

Intersection Summary	
HCM 2010 Ctrl Delay	11.3
HCM 2010 LOS	B

Phase Number	2	4	6	8
Movement	EBTL	NBTL	WBTL	SBTL
Lead/Lag				
Lead-Lag Optimize				
Recall Mode	C-Max	None	Max	None
Maximum Split (s)	36	24	36	24
Maximum Split (%)	60.0%	40.0%	60.0%	40.0%
Minimum Split (s)	22	16	22	16
Yellow Time (s)	4	3	4	3
All-Red Time (s)	2	3	2	3
Minimum Initial (s)	4	4	4	4
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)				
Flash Dont Walk (s)				
Dual Entry	Yes	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	57	33	57	33
End Time (s)	33	57	33	57
Yield/Force Off (s)	27	51	27	51
Yield/Force Off 170(s)	27	51	27	51
Local Start Time (s)	0	36	0	36
Local Yield (s)	30	54	30	54
Local Yield 170(s)	30	54	30	54

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	50
Offset: 57 (95%), Referenced to phase 2:EBTL, Start of Green	

Splits and Phases: 3: Site/Malin & Rt 30



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	128	293	65	13	803	49	155	109	5	19	146	490
Number	1	6	16	5	2	12	3	8	18	7	4	14
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	1836	1836	1910	1825	1825	1862	1890	1853	1890	1910	1891	1891
Adj Flow Rate, veh/h	144	329	73	14	854	52	178	125	6	21	164	0
Adj No. of Lanes	1	1	0	1	1	0	0	1	0	0	1	1
Peak Hour Factor	0.89	0.89	0.89	0.94	0.94	0.94	0.87	0.87	0.87	0.89	0.89	0.89
Percent Heavy Veh, %	4	4	4	2	2	2	2	2	2	1	1	1
Cap, veh/h	266	1019	226	638	1016	62	187	95	5	58	325	307
Arrive On Green	0.05	0.70	0.70	0.60	0.60	0.60	0.19	0.19	0.19	0.19	0.19	0.00
Sat Flow, veh/h	1749	1456	323	959	1703	104	708	497	24	114	1704	1607
Grp Volume(v), veh/h	144	0	402	14	0	906	309	0	0	185	0	0
Grp Sat Flow(s),veh/h/ln	1749	0	1779	959	0	1807	1229	0	0	1818	0	1607
Q Serve(g_s), s	3.3	0.0	9.6	0.7	0.0	44.6	11.3	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	3.3	0.0	9.6	0.7	0.0	44.6	21.0	0.0	0.0	9.7	0.0	0.0
Prop In Lane	1.00		0.18	1.00		0.06	0.58		0.02	0.11		1.00
Lane Grp Cap(c), veh/h	266	0	1245	638	0	1078	286	0	0	384	0	307
V/C Ratio(X)	0.54	0.00	0.32	0.02	0.00	0.84	1.08	0.00	0.00	0.48	0.00	0.00
Avail Cap(c_a), veh/h	340	0	1245	638	0	1078	286	0	0	384	0	307
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	0.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	19.8	0.0	6.4	9.1	0.0	18.0	47.1	0.0	0.0	39.9	0.0	0.0
Incr Delay (d2), s/veh	1.7	0.0	0.7	0.1	0.0	7.9	76.0	0.0	0.0	0.9	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(-26165%),veh/ln	2.6	0.0	4.9	0.2	0.0	24.5	14.7	0.0	0.0	5.1	0.0	0.0
LnGrp Delay(d),s/veh	21.5	0.0	7.1	9.2	0.0	25.9	123.0	0.0	0.0	40.9	0.0	0.0
LnGrp LOS	C		A	A		C	F			D		
Approach Vol, veh/h		546			920			309			185	
Approach Delay, s/veh		10.9			25.6			123.0			40.9	
Approach LOS		B			C			F			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		8
Phs Duration (G+Y+Rc), s	11.4	71.6		27.0		83.0		27.0
Change Period (Y+Rc), s	6.0	6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s	10.0	61.0		21.0		77.0		21.0
Max Q Clear Time (g_c+I1), s	5.3	46.6		11.7		11.6		23.0
Green Ext Time (p_c), s	0.1	7.9		2.1		13.9		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	38.3
HCM 2010 LOS	D

Phase Number	1	2	4	6	8
Movement	EBL	WBTL	SBTL	EBTL	NBTL
Lead/Lag	Lead	Lag			
Lead-Lag Optimize	Yes	Yes			
Recall Mode	None	Max	None	Max	None
Maximum Split (s)	16	67	27	83	27
Maximum Split (%)	14.5%	60.9%	24.5%	75.5%	24.5%
Minimum Split (s)	10	22	15	22	15
Yellow Time (s)	4	4	4	4	4
All-Red Time (s)	2	2	2	2	2
Minimum Initial (s)	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0
Walk Time (s)					
Flash Dont Walk (s)					
Dual Entry	No	Yes	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	16	83	0	83
End Time (s)	16	83	0	83	0
Yield/Force Off (s)	10	77	104	77	104
Yield/Force Off 170(s)	10	77	104	77	104
Local Start Time (s)	94	0	67	94	67
Local Yield (s)	104	61	88	61	88
Local Yield 170(s)	104	61	88	61	88

Intersection Summary	
Cycle Length	110
Control Type	Actuated-Uncoordinated
Natural Cycle	110

Splits and Phases: 11: Malin/Swedesford & Rt 401

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL2	NBL	NBR	SEL	SER	SER2
Lane Configurations												
Volume (veh/h)	59	731	4	9	1119	897	25	21	25	317	4	86
Number	1	6	16	5	2	12	3	3	18	7	14	14
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	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	1881	1881	1900	1863	1863	1863	1900	1900	1900	1788	1788	1788
Adj Flow Rate, veh/h	67	831	5	9	1166	934	41	41	41	364	0	0
Adj No. of Lanes	1	2	0	1	2	1	0	0	0	1	1	1
Peak Hour Factor	0.88	0.88	0.88	0.96	0.96	0.96	0.61	0.61	0.61	0.87	0.87	0.87
Percent Heavy Veh, %	1	1	1	2	2	2	0	0	0	2	2	2
Cap, veh/h	243	2517	15	488	2350	1157	41	41	41	0	0	0
Arrive On Green	0.04	0.69	0.69	0.01	0.66	0.66	0.07	0.07	0.07	0.00	0.00	0.00
Sat Flow, veh/h	1792	3643	22	1774	3539	1583	622	622	622	0		
Grp Volume(v), veh/h	67	408	428	9	1166	934	116	116	0	0.0		
Grp Sat Flow(s),veh/h/ln	1792	1787	1877	1774	1770	1583	1759	1759	0			
Q Serve(g_s), s	1.0	8.2	8.2	0.2	14.9	34.9	5.9	5.9	0.0			
Cycle Q Clear(g_c), s	1.0	8.2	8.2	0.2	14.9	34.9	5.9	5.9	0.0			
Prop In Lane	1.00		0.01	1.00		1.00	0.35	0.35	0.35			
Lane Grp Cap(c), veh/h	243	1235	1297	488	2350	1157	117	117	0			
V/C Ratio(X)	0.28	0.33	0.33	0.02	0.50	0.81	0.99	0.99	0.00			
Avail Cap(c_a), veh/h	297	1235	1297	591	2350	1157	117	117	0			
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.94	0.94	0.94	1.00	1.00	1.00	1.00	1.00	0.00			
Uniform Delay (d), s/veh	6.1	5.6	5.6	5.0	7.6	8.0	42.0	42.0	0.0			
Incr Delay (d2), s/veh	0.6	0.7	0.6	0.0	0.8	6.1	79.5	79.5	0.0			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(-26165%),veh/ln	0.5	4.2	4.4	0.1	7.4	20.6	5.5	5.5	0.0			
LnGrp Delay(d),s/veh	6.6	6.2	6.2	5.0	8.3	14.1	121.5	121.5	0.0			
LnGrp LOS	A	A	A	A	A	B						
Approach Vol, veh/h		903			2109		116	116				
Approach Delay, s/veh		6.3			10.9		121.5	121.5				
Approach LOS		A			B							

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2			5	6		8
Phs Duration (G+Y+Rc), s	10.3	66.7			7.8	69.2		13.0
Change Period (Y+Rc), s	7.0	7.0			7.0	7.0		7.0
Max Green Setting (Gmax), s	6.0	26.0			6.0	26.0		6.0
Max Q Clear Time (g_c+I1), s	3.0	36.9			2.2	10.2		7.9
Green Ext Time (p_c), s	0.0	0.0			0.0	13.2		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	13.6
HCM 2010 LOS	B

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL2	NBL	NBR	SEL	SER	SER2
Protected Phases	1	6		5	2	4	8	8		4		
Permitted Phases	6			2		2						Free
Detector Phase	1	6		5	2	4	8	8		4		
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0		
Minimum Split (s)	11.0	20.0		11.0	20.0	20.0	13.0	13.0		20.0		
Total Split (s)	13.0	33.0		13.0	33.0	31.0	13.0	13.0		31.0		
Total Split (%)	14.4%	36.7%		14.4%	36.7%	34.4%	14.4%	14.4%		34.4%		
Maximum Green (s)	6.0	26.0		6.0	26.0	24.0	6.0	6.0		24.0		
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0		
All-Red Time (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0		
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0		0.0		0.0		
Total Lost Time (s)	7.0	7.0		7.0	7.0	7.0		7.0		7.0		
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0		
Recall Mode	None	Max		None	C-Max	None	None	None		None		
Act Effct Green (s)	41.6	40.3		36.9	32.2	63.6		5.5		23.0		90.0
Actuated g/C Ratio	0.46	0.45		0.41	0.36	0.71		0.06		0.26		1.00
v/c Ratio	0.34	0.54		0.03	0.92	0.74		0.37		0.88		0.07
Control Delay	19.8	22.3		14.9	44.9	8.8		3.4		55.2		0.1
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0		0.0		0.0
Total Delay	19.8	22.3		14.9	44.9	8.8		3.4		55.2		0.1
LOS								A		E		A
Approach Delay		22.1			28.8			3.4		43.5		
Approach LOS								A		D		
Queue Length 50th (ft)	22	179		3	~412	138		0		198		0
Queue Length 95th (ft)	45	#300		11	#539	322		0		#330		0
Internal Link Dist (ft)		2838			866			119		2809		
Turn Bay Length (ft)	100			100								400
Base Capacity (vph)	200	1544		262	1264	1265		320		438		1520
Starvation Cap Reductn	0	0		0	0	0		0		0		0
Spillback Cap Reductn	0	0		0	0	0		0		0		0
Storage Cap Reductn	0	0		0	0	0		0		0		0
Reduced v/c Ratio	0.34	0.54		0.03	0.92	0.74		0.36		0.84		0.07

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 62 (69%), Referenced to phase 2:WBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.92
Intersection Signal Delay: 28.2 Intersection LOS: C
Intersection Capacity Utilization 79.5% ICU Level of Service D
Analysis Period (min) 15
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

Phase Number	1	2	4	5	6	8
Movement	EBL	WBTL	SEL	WBL	EBTL	NBL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize	Yes	Yes		Yes	Yes	
Recall Mode	None	C-Max	None	None	Max	None
Maximum Split (s)	13	33	31	13	33	13
Maximum Split (%)	14.4%	36.7%	34.4%	14.4%	36.7%	14.4%
Minimum Split (s)	11	20	20	11	20	13
Yellow Time (s)	4	4	4	4	4	4
All-Red Time (s)	3	3	3	3	3	3
Minimum Initial (s)	4	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)						
Flash Dont Walk (s)						
Dual Entry	No	Yes	Yes	No	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	49	62	5	49	62	36
End Time (s)	62	5	36	62	5	49
Yield/Force Off (s)	55	88	29	55	88	42
Yield/Force Off 170(s)	55	88	29	55	88	42
Local Start Time (s)	77	0	33	77	0	64
Local Yield (s)	83	26	57	83	26	70
Local Yield 170(s)	83	26	57	83	26	70

Intersection Summary	
Cycle Length	90
Control Type	Actuated-Coordinated
Natural Cycle	90
Offset: 62 (69%), Referenced to phase 2:WBTL, Start of Green	

Splits and Phases: 12: McD & Rt 30 & Rt 401

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	216	1071	6	11	554	22	22	33	46	52	15	112
Number	5	2	12	1	6	16	7	4	14	3	8	18
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	1836	1836	1986	1767	1767	1890	1996	1501	1996	1872	1766	1872
Adj Flow Rate, veh/h	220	1093	6	12	596	24	44	66	92	58	17	126
Adj No. of Lanes	1	2	0	1	2	0	0	1	0	0	1	0
Peak Hour Factor	0.98	0.98	0.98	0.93	0.93	0.93	0.50	0.50	0.50	0.89	0.89	0.89
Percent Heavy Veh, %	4	4	4	7	7	7	33	33	33	6	6	6
Cap, veh/h	312	1352	7	171	1251	50	50	75	104	69	20	151
Arrive On Green	0.38	0.38	0.38	0.38	0.38	0.38	0.17	0.17	0.17	0.15	0.15	0.15
Sat Flow, veh/h	789	3557	20	485	3290	132	300	449	626	453	133	984
Grp Volume(v), veh/h	220	536	563	12	304	316	202	0	0	201	0	0
Grp Sat Flow(s),veh/h/ln	789	1744	1833	485	1678	1743	1375	0	0	1569	0	0
Q Serve(g_s), s	14.6	16.5	16.5	1.4	8.2	8.2	8.6	0.0	0.0	7.5	0.0	0.0
Cycle Q Clear(g_c), s	22.8	16.5	16.5	17.9	8.2	8.2	8.6	0.0	0.0	7.5	0.0	0.0
Prop In Lane	1.00		0.01	1.00		0.08	0.22		0.46	0.29		0.63
Lane Grp Cap(c), veh/h	312	663	697	171	638	663	229	0	0	240	0	0
V/C Ratio(X)	0.71	0.81	0.81	0.07	0.48	0.48	0.88	0.00	0.00	0.84	0.00	0.00
Avail Cap(c_a), veh/h	312	663	697	171	638	663	229	0	0	262	0	0
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	1.00	1.00	0.77	0.77	0.77	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	23.7	16.6	16.6	24.6	14.1	14.1	24.4	0.0	0.0	24.7	0.0	0.0
Incr Delay (d2), s/veh	12.7	10.2	9.8	0.6	1.9	1.9	30.3	0.0	0.0	19.3	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	8.3	14.9	15.4	0.4	7.1	7.3	8.9	0.0	0.0	8.0	0.0	0.0
LnGrp Delay(d),s/veh	36.3	26.9	26.4	25.2	16.0	16.0	54.7	0.0	0.0	44.0	0.0	0.0
LnGrp LOS	D	C	C	C	B	B	D			D		
Approach Vol, veh/h		1319			632			202			201	
Approach Delay, s/veh		28.2			16.2			54.7			44.0	
Approach LOS		C			B			D			D	

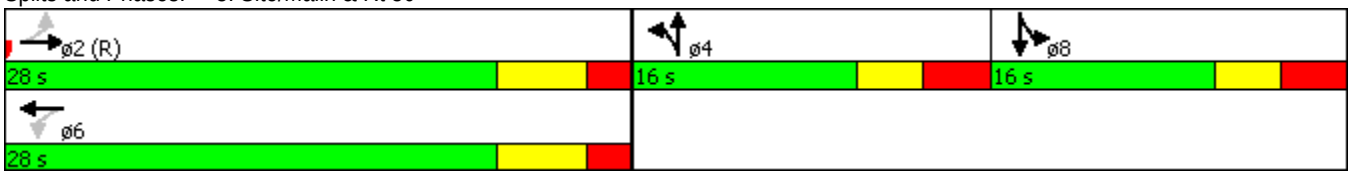
Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		28.8		16.0		28.8		15.2
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s		22.0		10.0		22.0		10.0
Max Q Clear Time (g_c+I1), s		24.8		10.6		19.9		9.5
Green Ext Time (p_c), s		0.0		0.0		1.8		0.1

Intersection Summary	
HCM 2010 Ctrl Delay	28.6
HCM 2010 LOS	C

Phase Number	2	4	6	8
Movement	EBTL	NBTL	WBTL	SBTL
Lead/Lag				
Lead-Lag Optimize				
Recall Mode	C-Max	None	Max	None
Maximum Split (s)	28	16	28	16
Maximum Split (%)	46.7%	26.7%	46.7%	26.7%
Minimum Split (s)	22	16	22	16
Yellow Time (s)	4	3	4	3
All-Red Time (s)	2	3	2	3
Minimum Initial (s)	4	4	4	4
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)				
Flash Dont Walk (s)				
Dual Entry	Yes	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	0	28	0	44
End Time (s)	28	44	28	0
Yield/Force Off (s)	22	38	22	54
Yield/Force Off 170(s)	22	38	22	54
Local Start Time (s)	0	28	0	44
Local Yield (s)	22	38	22	54
Local Yield 170(s)	22	38	22	54

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	60
Offset: 0 (0%), Referenced to phase 2:EBTL, Start of Green	

Splits and Phases: 3: Site/Malin & Rt 30



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	870	524	45	3	170	29	29	254	3	15	103	62
Number	1	6	16	5	2	12	3	8	18	7	4	14
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	1891	1891	1910	1724	1724	1862	1890	1853	1890	1910	1854	1854
Adj Flow Rate, veh/h	926	557	48	3	195	33	33	292	3	17	116	0
Adj No. of Lanes	1	1	0	1	1	0	0	1	0	0	1	1
Peak Hour Factor	0.94	0.94	0.94	0.87	0.87	0.87	0.87	0.87	0.87	0.89	0.89	0.89
Percent Heavy Veh, %	1	1	1	8	8	8	2	2	2	3	3	3
Cap, veh/h	980	1287	111	322	489	83	54	231	2	53	223	219
Arrive On Green	0.35	0.75	0.75	0.34	0.34	0.34	0.14	0.14	0.14	0.14	0.14	0.00
Sat Flow, veh/h	1801	1717	148	751	1438	243	127	1663	17	114	1608	1576
Grp Volume(v), veh/h	926	0	605	3	0	228	328	0	0	133	0	0
Grp Sat Flow(s),veh/h/ln	1801	0	1864	751	0	1681	1807	0	0	1722	0	1576
Q Serve(g_s), s	32.8	0.0	13.0	0.3	0.0	11.2	7.7	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	32.8	0.0	13.0	0.3	0.0	11.2	15.0	0.0	0.0	7.3	0.0	0.0
Prop In Lane	1.00		0.08	1.00		0.14	0.10		0.01	0.13		1.00
Lane Grp Cap(c), veh/h	980	0	1398	322	0	572	288	0	0	277	0	219
V/C Ratio(X)	0.94	0.00	0.43	0.01	0.00	0.40	1.14	0.00	0.00	0.48	0.00	0.00
Avail Cap(c_a), veh/h	1176	0	1398	322	0	572	288	0	0	277	0	219
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	0.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	12.3	0.0	5.0	23.6	0.0	27.2	47.4	0.0	0.0	43.1	0.0	0.0
Incr Delay (d2), s/veh	13.5	0.0	1.0	0.1	0.0	2.1	96.5	0.0	0.0	1.3	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	26.9	0.0	11.3	0.1	0.0	9.4	29.3	0.0	0.0	6.8	0.0	0.0
LnGrp Delay(d),s/veh	25.8	0.0	6.0	23.6	0.0	29.3	143.9	0.0	0.0	44.4	0.0	0.0
LnGrp LOS	C		A	C		C	F			D		
Approach Vol, veh/h		1531			231			328			133	
Approach Delay, s/veh		18.0			29.2			143.9			44.4	
Approach LOS		B			C			F			D	

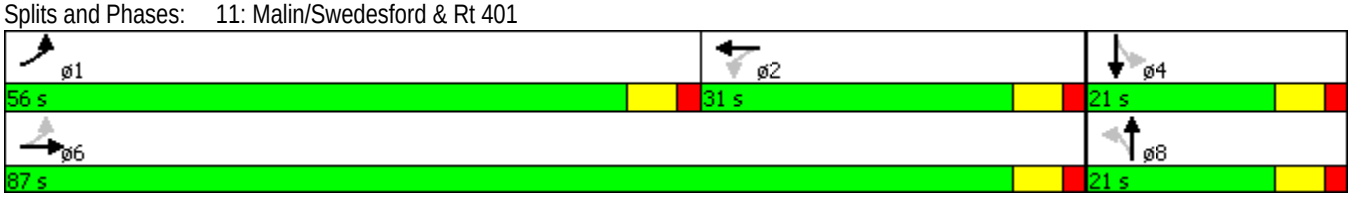
Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		8
Phs Duration (G+Y+Rc), s	44.2	42.8		21.0		87.0		21.0
Change Period (Y+Rc), s	6.0	6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s	50.0	25.0		15.0		81.0		15.0
Max Q Clear Time (g_c+I1), s	34.8	13.2		9.3		15.0		17.0
Green Ext Time (p_c), s	3.4	4.2		1.3		6.4		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	39.3
HCM 2010 LOS	D

Phase Number	1	2	4	6	8
Movement	EBL	WBTL	SBTL	EBTL	NBTL
Lead/Lag	Lead	Lag			
Lead-Lag Optimize	Yes	Yes			
Recall Mode	None	Max	None	Max	None
Maximum Split (s)	56	31	21	87	21
Maximum Split (%)	51.9%	28.7%	19.4%	80.6%	19.4%
Minimum Split (s)	10	22	15	22	15
Yellow Time (s)	4	4	4	4	4
All-Red Time (s)	2	2	2	2	2
Minimum Initial (s)	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0
Walk Time (s)					
Flash Dont Walk (s)					
Dual Entry	No	Yes	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	56	87	0	87
End Time (s)	56	87	0	87	0
Yield/Force Off (s)	50	81	102	81	102
Yield/Force Off 170(s)	50	81	102	81	102
Local Start Time (s)	52	0	31	52	31
Local Yield (s)	102	25	46	25	46
Local Yield 170(s)	102	25	46	25	46

Intersection Summary	
Cycle Length	108
Control Type	Actuated-Uncoordinated
Natural Cycle	90

Splits and Phases: 11: Malin/Swedesford & Rt 401



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL2	NBL	NBR	SEL	SER	SER2
Lane Configurations												
Volume (veh/h)	28	971	3	9	546	142	12	11	3	536	7	23
Number	1	6	16	5	2	12	3	3	18	7	14	14
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	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	1845	1845	1845	1900	1900	1900	1788	1788	1788
Adj Flow Rate, veh/h	29	1022	3	10	593	154	20	20	5	654	0	0
Adj No. of Lanes	1	2	0	1	2	1	0	0	0	1	1	1
Peak Hour Factor	0.95	0.95	0.95	0.92	0.92	0.92	0.59	0.59	0.59	0.82	0.82	0.82
Percent Heavy Veh, %	2	2	2	3	3	3	0	0	0	2	2	2
Cap, veh/h	606	2781	8	450	2651	1235	26	26	6	0	0	0
Arrive On Green	0.02	0.77	0.77	0.01	0.76	0.76	0.03	0.03	0.03	0.00	0.00	0.00
Sat Flow, veh/h	1774	3620	11	1757	3505	1568	828	828	207	0		
Grp Volume(v), veh/h	29	500	525	10	593	154	44	44	0	0.0		
Grp Sat Flow(s),veh/h/ln	1774	1770	1861	1757	1752	1568	1822	1822	0			
Q Serve(g_s), s	0.4	10.0	10.0	0.1	5.5	2.5	2.6	2.6	0.0			
Cycle Q Clear(g_c), s	0.4	10.0	10.0	0.1	5.5	2.5	2.6	2.6	0.0			
Prop In Lane	1.00		0.01	1.00		1.00	0.45	0.45	0.11			
Lane Grp Cap(c), veh/h	606	1360	1430	450	2651	1235	57	57	0			
V/C Ratio(X)	0.05	0.37	0.37	0.02	0.22	0.12	0.77	0.77	0.00			
Avail Cap(c_a), veh/h	665	1360	1430	529	2651	1235	116	116	0			
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.52	0.52	0.52	1.00	1.00	1.00	1.00	1.00	0.00			
Uniform Delay (d), s/veh	2.9	4.1	4.1	3.4	3.9	2.7	52.9	52.9	0.0			
Incr Delay (d2), s/veh	0.0	0.4	0.4	0.0	0.2	0.2	19.5	19.5	0.0			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(95%),veh/ln	0.4	7.6	8.0	0.1	4.9	2.4	3.0	3.0	0.0			
LnGrp Delay(d),s/veh	2.9	4.5	4.5	3.4	4.1	3.0	72.4	72.4	0.0			
LnGrp LOS	A	A	A	A	A	A						
Approach Vol, veh/h		1054			757		44	44				
Approach Delay, s/veh		4.5			3.9		72.4	72.4				
Approach LOS		A			A							

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2			5	6		8
Phs Duration (G+Y+Rc), s	9.4	90.2			8.1	91.5		10.4
Change Period (Y+Rc), s	7.0	7.0			7.0	7.0		7.0
Max Green Setting (Gmax), s	6.0	18.0			6.0	18.0		7.0
Max Q Clear Time (g_c+I1), s	2.4	7.5			2.1	12.0		4.6
Green Ext Time (p_c), s	0.0	6.9			0.0	4.4		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	5.8
HCM 2010 LOS	A

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL2	NBL	NBR	SEL	SER	SER2
Protected Phases	1	6		5	2	4	8	8		4		
Permitted Phases	6			2		2						Free
Detector Phase	1	6		5	2	4	8	8		4		
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0		
Minimum Split (s)	11.0	20.0		11.0	20.0	20.0	14.0	14.0		20.0		
Total Split (s)	13.0	25.0		13.0	25.0	58.0	14.0	14.0		58.0		
Total Split (%)	11.8%	22.7%		11.8%	22.7%	52.7%	12.7%	12.7%		52.7%		
Maximum Green (s)	6.0	18.0		6.0	18.0	51.0	7.0	7.0		51.0		
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0		
All-Red Time (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0		
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0		0.0		0.0		
Total Lost Time (s)	7.0	7.0		7.0	7.0	7.0		7.0		7.0		
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0		
Recall Mode	None	Max		None	C-Max	None	None	None		None		
Act Effct Green (s)	36.8	35.3		33.4	29.5	85.8		5.5		47.9		110.0
Actuated g/C Ratio	0.33	0.32		0.30	0.27	0.78		0.05		0.44		1.00
v/c Ratio	0.14	0.94		0.06	0.63	0.12		0.17		0.93		0.02
Control Delay	29.4	54.1		28.7	43.1	1.1		1.4		49.3		0.0
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0		0.0		0.0
Total Delay	29.4	54.1		28.7	43.1	1.1		1.4		49.3		0.0
LOS	C	D		C	D	A		A		D		A
Approach Delay		53.4			34.4			1.4		47.3		
Approach LOS		D			C			A		D		
Queue Length 50th (ft)	15	~386		5	222	0		0		411		0
Queue Length 95th (ft)	37	#701		18	#351	19		0		498		0
Internal Link Dist (ft)		2838			866			119		2809		
Turn Bay Length (ft)	100			100								400
Base Capacity (vph)	205	1096		160	940	1268		281		762		1520
Starvation Cap Reductn	0	0		0	0	0		0		0		0
Spillback Cap Reductn	0	0		0	0	0		0		0		0
Storage Cap Reductn	0	0		0	0	0		0		0		0
Reduced v/c Ratio	0.14	0.94		0.06	0.63	0.12		0.16		0.87		0.02

Intersection Summary

Area Type: Other
Cycle Length: 110
Actuated Cycle Length: 110
Offset: 80 (73%), Referenced to phase 2:WBTL, Start of Green
Natural Cycle: 130
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.94
Intersection Signal Delay: 45.2 Intersection LOS: D
Intersection Capacity Utilization 77.9% ICU Level of Service D
Analysis Period (min) 15
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

Phase Number	1	2	4	5	6	8
Movement	EBL	WBTL	SEL	WBL	EBTL	NBL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize	Yes	Yes		Yes	Yes	
Recall Mode	None	C-Max	None	None	Max	None
Maximum Split (s)	13	25	58	13	25	14
Maximum Split (%)	11.8%	22.7%	52.7%	11.8%	22.7%	12.7%
Minimum Split (s)	11	20	20	11	20	14
Yellow Time (s)	4	4	4	4	4	4
All-Red Time (s)	3	3	3	3	3	3
Minimum Initial (s)	4	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)						
Flash Dont Walk (s)						
Dual Entry	No	Yes	Yes	No	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	67	80	105	67	80	53
End Time (s)	80	105	53	80	105	67
Yield/Force Off (s)	73	98	46	73	98	60
Yield/Force Off 170(s)	73	98	46	73	98	60
Local Start Time (s)	97	0	25	97	0	83
Local Yield (s)	103	18	76	103	18	90
Local Yield 170(s)	103	18	76	103	18	90

Intersection Summary	
Cycle Length	110
Control Type	Actuated-Coordinated
Natural Cycle	130
Offset: 80 (73%), Referenced to phase 2:WBTL, Start of Green	

Splits and Phases: 12: McD & Rt 30 & Rt 401

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	89	678	18	37	857	182	12	30	20	118	30	110
Number	5	2	12	1	6	16	7	4	14	3	8	18
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	1854	1854	1986	1853	1853	1890	1996	1766	1996	1872	1817	1872
Adj Flow Rate, veh/h	92	699	19	43	997	212	17	42	28	146	37	136
Adj No. of Lanes	1	2	0	1	2	0	0	1	0	0	1	0
Peak Hour Factor	0.97	0.97	0.97	0.86	0.86	0.86	0.72	0.72	0.72	0.81	0.81	0.81
Percent Heavy Veh, %	3	3	3	2	2	2	13	13	13	3	3	3
Cap, veh/h	317	1814	49	369	1497	318	22	53	35	163	41	152
Arrive On Green	0.52	0.52	0.52	1.00	1.00	1.00	0.07	0.07	0.07	0.22	0.22	0.22
Sat Flow, veh/h	458	3503	95	727	2892	614	324	799	533	757	192	705
Grp Volume(v), veh/h	92	351	367	43	606	603	87	0	0	319	0	0
Grp Sat Flow(s),veh/h/ln	458	1761	1837	727	1761	1745	1656	0	0	1655	0	0
Q Serve(g_s), s	10.9	10.8	10.8	1.4	0.0	0.0	4.7	0.0	0.0	16.9	0.0	0.0
Cycle Q Clear(g_c), s	10.9	10.8	10.8	12.2	0.0	0.0	4.7	0.0	0.0	16.9	0.0	0.0
Prop In Lane	1.00		0.05	1.00		0.35	0.20		0.32	0.46		0.43
Lane Grp Cap(c), veh/h	317	912	951	369	912	903	110	0	0	357	0	0
V/C Ratio(X)	0.29	0.39	0.39	0.12	0.66	0.67	0.79	0.00	0.00	0.89	0.00	0.00
Avail Cap(c_a), veh/h	317	912	951	369	912	903	184	0	0	404	0	0
HCM Platoon Ratio	1.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	0.44	0.44	0.44	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	13.1	13.1	13.1	1.4	0.0	0.0	41.4	0.0	0.0	34.3	0.0	0.0
Incr Delay (d2), s/veh	2.3	1.2	1.2	0.3	1.7	1.7	11.8	0.0	0.0	19.9	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(-26165%),veh/ln	1.6	5.6	5.8	0.3	0.4	0.4	2.5	0.0	0.0	9.7	0.0	0.0
LnGrp Delay(d),s/veh	15.4	14.3	14.3	1.7	1.7	1.7	53.2	0.0	0.0	54.2	0.0	0.0
LnGrp LOS	B	B	B	A	A	A	D			D		
Approach Vol, veh/h		810			1252			87			319	
Approach Delay, s/veh		14.4			1.7			53.2			54.2	
Approach LOS		B			A			D			D	

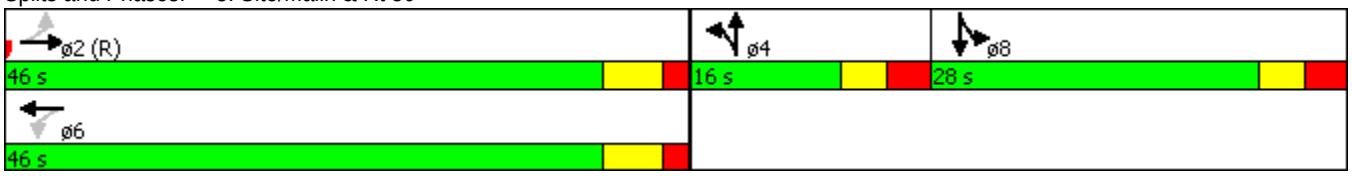
Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		52.6		12.0		52.6		25.4
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s		40.0		10.0		40.0		22.0
Max Q Clear Time (g_c+I1), s		12.9		6.7		14.2		18.9
Green Ext Time (p_c), s		16.0		0.1		15.5		0.6

Intersection Summary	
HCM 2010 Ctrl Delay	14.5
HCM 2010 LOS	B

Phase Number	2	4	6	8
Movement	EBTL	NBTL	WBTL	SBTL
Lead/Lag				
Lead-Lag Optimize				
Recall Mode	C-Max	None	Max	None
Maximum Split (s)	46	16	46	28
Maximum Split (%)	51.1%	17.8%	51.1%	31.1%
Minimum Split (s)	22	16	22	16
Yellow Time (s)	4	3	4	3
All-Red Time (s)	2	3	2	3
Minimum Initial (s)	4	4	4	4
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)				
Flash Dont Walk (s)				
Dual Entry	Yes	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	0	46	0	62
End Time (s)	46	62	46	0
Yield/Force Off (s)	40	56	40	84
Yield/Force Off 170(s)	40	56	40	84
Local Start Time (s)	0	46	0	62
Local Yield (s)	40	56	40	84
Local Yield 170(s)	40	56	40	84

Intersection Summary	
Cycle Length	90
Control Type	Actuated-Coordinated
Natural Cycle	90
Offset: 0 (0%), Referenced to phase 2:EBTL, Start of Green	

Splits and Phases: 3: Site/Malin & Rt 30



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	128	293	73	13	803	49	159	119	5	19	167	490
Number	1	6	16	5	2	12	3	8	18	7	4	14
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	1836	1836	1910	1825	1825	1862	1890	1853	1890	1910	1891	1891
Adj Flow Rate, veh/h	144	329	82	14	854	52	183	137	6	21	188	0
Adj No. of Lanes	1	1	0	1	1	0	0	1	0	0	1	1
Peak Hour Factor	0.89	0.89	0.89	0.94	0.94	0.94	0.87	0.87	0.87	0.89	0.89	0.89
Percent Heavy Veh, %	4	4	4	2	2	2	2	2	2	1	1	1
Cap, veh/h	266	994	248	633	1016	62	174	92	4	55	329	307
Arrive On Green	0.05	0.70	0.70	0.60	0.60	0.60	0.19	0.19	0.19	0.19	0.19	0.00
Sat Flow, veh/h	1749	1420	354	951	1703	104	644	482	21	101	1722	1607
Grp Volume(v), veh/h	144	0	411	14	0	906	326	0	0	209	0	0
Grp Sat Flow(s),veh/h/ln	1749	0	1774	951	0	1807	1147	0	0	1823	0	1607
Q Serve(g_s), s	3.3	0.0	10.0	0.7	0.0	44.6	9.8	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	3.3	0.0	10.0	0.7	0.0	44.6	21.0	0.0	0.0	11.2	0.0	0.0
Prop In Lane	1.00		0.20	1.00		0.06	0.56		0.02	0.10		1.00
Lane Grp Cap(c), veh/h	266	0	1242	633	0	1078	270	0	0	384	0	307
V/C Ratio(X)	0.54	0.00	0.33	0.02	0.00	0.84	1.21	0.00	0.00	0.54	0.00	0.00
Avail Cap(c_a), veh/h	340	0	1242	633	0	1078	270	0	0	384	0	307
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	0.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	19.8	0.0	6.4	9.1	0.0	18.0	47.4	0.0	0.0	40.5	0.0	0.0
Incr Delay (d2), s/veh	1.7	0.0	0.7	0.1	0.0	7.9	122.7	0.0	0.0	1.6	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(-26165%),veh/ln	2.6	0.0	5.0	0.2	0.0	24.5	17.4	0.0	0.0	6.0	0.0	0.0
LnGrp Delay(d),s/veh	21.5	0.0	7.2	9.2	0.0	25.9	170.1	0.0	0.0	42.1	0.0	0.0
LnGrp LOS	C		A	A		C	F			D		
Approach Vol, veh/h		555			920			326			209	
Approach Delay, s/veh		10.9			25.6			170.1			42.1	
Approach LOS		B			C			F			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		8
Phs Duration (G+Y+Rc), s	11.4	71.6		27.0		83.0		27.0
Change Period (Y+Rc), s	6.0	6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s	10.0	61.0		21.0		77.0		21.0
Max Q Clear Time (g_c+I1), s	5.3	46.6		13.2		12.0		23.0
Green Ext Time (p_c), s	0.1	7.9		2.0		14.1		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	46.7
HCM 2010 LOS	D

Phase Number	1	2	4	6	8
Movement	EBL	WBTL	SBTL	EBTL	NBTL
Lead/Lag	Lead	Lag			
Lead-Lag Optimize	Yes	Yes			
Recall Mode	None	Max	None	Max	None
Maximum Split (s)	16	67	27	83	27
Maximum Split (%)	14.5%	60.9%	24.5%	75.5%	24.5%
Minimum Split (s)	10	22	15	22	15
Yellow Time (s)	4	4	4	4	4
All-Red Time (s)	2	2	2	2	2
Minimum Initial (s)	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0
Walk Time (s)					
Flash Dont Walk (s)					
Dual Entry	No	Yes	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	16	83	0	83
End Time (s)	16	83	0	83	0
Yield/Force Off (s)	10	77	104	77	104
Yield/Force Off 170(s)	10	77	104	77	104
Local Start Time (s)	94	0	67	94	67
Local Yield (s)	104	61	88	61	88
Local Yield 170(s)	104	61	88	61	88

Intersection Summary	
Cycle Length	110
Control Type	Actuated-Uncoordinated
Natural Cycle	120

Splits and Phases: 11: Malin/Swedesford & Rt 401

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL2	NBL	NBR	SEL	SER	SER2
Lane Configurations												
Volume (veh/h)	55	715	4	9	1103	845	25	21	25	299	4	81
Number	1	6	16	5	2	12	3	3	18	7	14	14
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	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	1881	1881	1900	1863	1863	1863	1900	1900	1900	1788	1788	1788
Adj Flow Rate, veh/h	62	812	5	9	1149	880	41	41	41	344	0	0
Adj No. of Lanes	1	2	0	1	2	1	0	0	0	1	1	1
Peak Hour Factor	0.88	0.88	0.88	0.96	0.96	0.96	0.61	0.61	0.61	0.87	0.87	0.87
Percent Heavy Veh, %	1	1	1	2	2	2	0	0	0	2	2	2
Cap, veh/h	249	2517	15	463	2354	1158	41	41	41	0	0	0
Arrive On Green	0.02	0.46	0.46	0.01	0.66	0.66	0.07	0.07	0.07	0.00	0.00	0.00
Sat Flow, veh/h	1792	3642	22	1774	3539	1583	622	622	622	0		
Grp Volume(v), veh/h	62	398	419	9	1149	880	116	116	0	0.0		
Grp Sat Flow(s),veh/h/ln	1792	1787	1877	1774	1770	1583	1759	1759	0			
Q Serve(g_s), s	1.0	12.7	12.7	0.1	14.5	30.2	5.9	5.9	0.0			
Cycle Q Clear(g_c), s	1.0	12.7	12.7	0.1	14.5	30.2	5.9	5.9	0.0			
Prop In Lane	1.00		0.01	1.00		1.00	0.35	0.35	0.35			
Lane Grp Cap(c), veh/h	249	1235	1297	463	2354	1158	117	117	0			
V/C Ratio(X)	0.25	0.32	0.32	0.02	0.49	0.76	0.99	0.99	0.00			
Avail Cap(c_a), veh/h	306	1235	1297	565	2354	1158	117	117	0			
HCM Platoon Ratio	0.67	0.67	0.67	1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.92	0.92	0.92	1.00	1.00	1.00	1.00	1.00	0.00			
Uniform Delay (d), s/veh	5.9	10.9	10.9	5.4	7.5	7.3	42.0	42.0	0.0			
Incr Delay (d2), s/veh	0.5	0.6	0.6	0.0	0.7	4.7	79.5	79.5	0.0			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(-26165%),veh/ln	0.5	6.5	6.8	0.1	7.3	17.6	5.5	5.5	0.0			
LnGrp Delay(d),s/veh	6.4	11.5	11.5	5.4	8.2	12.0	121.5	121.5	0.0			
LnGrp LOS	A	B	B	A	A	B						
Approach Vol, veh/h		879			2038		116	116				
Approach Delay, s/veh		11.1			9.8		121.5	121.5				
Approach LOS		B			A							

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2			5	6		8
Phs Duration (G+Y+Rc), s	10.2	66.8			7.8	69.2		13.0
Change Period (Y+Rc), s	7.0	7.0			7.0	7.0		7.0
Max Green Setting (Gmax), s	6.0	26.0			6.0	26.0		6.0
Max Q Clear Time (g_c+I1), s	3.0	32.2			2.1	14.7		7.9
Green Ext Time (p_c), s	0.0	0.0			0.0	9.7		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	14.5
HCM 2010 LOS	B

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL2	NBL	NBR	SEL	SER	SER2
Protected Phases	1	6		5	2	4	8	8		4		
Permitted Phases	6			2		2						Free
Detector Phase	1	6		5	2	4	8	8		4		
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0		
Minimum Split (s)	11.0	20.0		11.0	20.0	20.0	13.0	13.0		20.0		
Total Split (s)	13.0	33.0		13.0	33.0	31.0	13.0	13.0		31.0		
Total Split (%)	14.4%	36.7%		14.4%	36.7%	34.4%	14.4%	14.4%		34.4%		
Maximum Green (s)	6.0	26.0		6.0	26.0	24.0	6.0	6.0		24.0		
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0		
All-Red Time (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0		
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0		0.0		0.0		
Total Lost Time (s)	7.0	7.0		7.0	7.0	7.0		7.0		7.0		
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0		
Recall Mode	None	Max		None	C-Max	None	None	None		None		
Act Effct Green (s)	42.0	40.7		37.3	32.6	63.6		5.5		22.6		90.0
Actuated g/C Ratio	0.47	0.45		0.41	0.36	0.71		0.06		0.25		1.00
v/c Ratio	0.31	0.52		0.03	0.90	0.69		0.37		0.85		0.06
Control Delay	11.7	15.7		14.9	41.9	7.1		3.4		51.7		0.1
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0		0.0		0.0
Total Delay	11.7	15.7		14.9	41.9	7.1		3.4		51.7		0.1
LOS								A		D		A
Approach Delay		15.5			26.8			3.4		40.8		
Approach LOS								A		D		
Queue Length 50th (ft)	9	205		3	~401	97		0		185		0
Queue Length 95th (ft)	m14	311		11	#528	243		0		#302		0
Internal Link Dist (ft)		2838			866			119		2809		
Turn Bay Length (ft)	100			100								400
Base Capacity (vph)	201	1561		272	1281	1275		320		438		1520
Starvation Cap Reductn	0	0		0	0	0		0		0		0
Spillback Cap Reductn	0	0		0	0	0		0		0		0
Storage Cap Reductn	0	0		0	0	0		0		0		0
Reduced v/c Ratio	0.31	0.52		0.03	0.90	0.69		0.36		0.80		0.06

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 62 (69%), Referenced to phase 2:WBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.90
Intersection Signal Delay: 24.9 Intersection LOS: C
Intersection Capacity Utilization 78.0% ICU Level of Service D
Analysis Period (min) 15
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

Phase Number	1	2	4	5	6	8
Movement	EBL	WBTL	SEL	WBL	EBTL	NBL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize	Yes	Yes		Yes	Yes	
Recall Mode	None	C-Max	None	None	Max	None
Maximum Split (s)	13	33	31	13	33	13
Maximum Split (%)	14.4%	36.7%	34.4%	14.4%	36.7%	14.4%
Minimum Split (s)	11	20	20	11	20	13
Yellow Time (s)	4	4	4	4	4	4
All-Red Time (s)	3	3	3	3	3	3
Minimum Initial (s)	4	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)						
Flash Dont Walk (s)						
Dual Entry	No	Yes	Yes	No	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	49	62	5	49	62	36
End Time (s)	62	5	36	62	5	49
Yield/Force Off (s)	55	88	29	55	88	42
Yield/Force Off 170(s)	55	88	29	55	88	42
Local Start Time (s)	77	0	33	77	0	64
Local Yield (s)	83	26	57	83	26	70
Local Yield 170(s)	83	26	57	83	26	70

Intersection Summary	
Cycle Length	90
Control Type	Actuated-Coordinated
Natural Cycle	90
Offset: 62 (69%), Referenced to phase 2:WBTL, Start of Green	

Splits and Phases: 12: McD & Rt 30 & Rt 401

APPENDIX G

Auxiliary Turn Lane Warrant Analyses

Turn Lane Warrant and Length Analysis Workbook

STUDY LOCATION AND ANALYSIS INFORMATION

Municipality:	East Whiteland Township	Analysis Date:	8/15/2015
County:	Chester County	Conducted By:	FT
PennDOT Engineering District:	6	Checked By:	FT
		Agency/Company Name:	FTA, Inc.

Intersection & Approach Description: Route 30 & Malin Road

Analysis Period:	2021 Build	Number of Approach Lanes:	2
Design Hour:	AM Peak Hour	Undivided or Divided Highway:	Undivided
Intersection Control:	Signalized		
Posted Speed Limit (MPH):	45		Type of Analysis
Type of Terrain:	Level	Left or Right-Turn Lane Analysis?:	Right Turn Lane

VOLUME CALCULATIONS

Left Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left	Yes	0	0.0%	N/A
	Through	-	0	0.0%	N/A
	Right	Yes	0	0.0%	N/A
Opposing	Left	Yes	0	0.0%	N/A
	Through	-	0	0.0%	N/A
	Right	Yes	0	0.0%	N/A

Advancing Volume:	N/A
Opposing Volume:	N/A
Left Turn Volume:	N/A
% Left Turns in Advancing Volume:	N/A

Right Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left	Yes	216	10.0%	227
	Through	-	1071	10.0%	1125
	Right	-	6	10.0%	7

Advancing Volume:	1359
Right Turn Volume:	7

TURN LANE WARRANT FINDINGS

Left Turn Lane Warrant Findings

Applicable Warrant Figure: **N/A**

Warrant Met?: **N/A**

Right Turn Lane Warrant Findings

Applicable Warrant Figure: **Figure 12**

Warrant Met?: **No**

TURN LANE LENGTH CALCULATIONS

Intersection Control:	Signalized
Design Hour Volume of Turning Lane:	7
Cycles Per Hour (Assumed):	Known
Cycles Per Hour (If Known):	45
Average # of Vehicles/Cycle:	N/A

PennDOT Publication 46, Exhibit 11-6

Type of Traffic Control	Speed (MPH)					
	25-35		40-45		50-60	
	Turn Demand Volume					
	High	Low	High	Low	High	Low
Signalized	A	A	B or C	B or C	B or C	B or C
Unsignalized	A	A	C	B	B or C	B

Right Turn Lane Storage Length, Condition A:	N/A	Feet
Condition B:	N/A	Feet
Condition C:	N/A	Feet
Required Right Turn Lane Storage Length:	N/A	Feet

Additional Findings:

N/A

Additional Comments / Justifications:

Even with left turn volumes included in Advancing (which they should not be) and generous HV percentages across all movements, the right turn lane is still not warranted, even at 100% occupancy of site.

Turn Lane Warrant and Length Analysis Workbook

STUDY LOCATION AND ANALYSIS INFORMATION

Municipality:	East Whiteland Township	Analysis Date:	8/15/2015
County:	Chester County	Conducted By:	FT
PennDOT Engineering District:	6	Checked By:	FT
		Agency/Company Name:	FTA, Inc.

Intersection & Approach Description: Route 30 & Malin Road

Analysis Period:	2021 Build	Number of Approach Lanes:	2
Design Hour:	PM Peak Hour	Undivided or Divided Highway:	Undivided
Intersection Control:	Signalized		
Posted Speed Limit (MPH):	45		Type of Analysis
Type of Terrain:	Level	Left or Right-Turn Lane Analysis?:	Right Turn Lane

VOLUME CALCULATIONS

Left Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left	Yes	0	0.0%	N/A
	Through	-	0	0.0%	N/A
	Right	Yes	0	0.0%	N/A
Opposing	Left	Yes	0	0.0%	N/A
	Through	-	0	0.0%	N/A
	Right	Yes	0	0.0%	N/A

Advancing Volume:	N/A
Opposing Volume:	N/A
Left Turn Volume:	N/A
% Left Turns in Advancing Volume:	N/A

Right Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left	Yes	89	10.0%	94
	Through	-	678	10.0%	712
	Right	-	18	10.0%	19

Advancing Volume:	825
Right Turn Volume:	19

TURN LANE WARRANT FINDINGS

Left Turn Lane Warrant Findings

Applicable Warrant Figure: **N/A**

Warrant Met?: **N/A**

Right Turn Lane Warrant Findings

Applicable Warrant Figure: **Figure 12**

Warrant Met?: **No**

TURN LANE LENGTH CALCULATIONS

Intersection Control:	Signalized
Design Hour Volume of Turning Lane:	19
Cycles Per Hour (Assumed):	Known
Cycles Per Hour (If Known):	45

Average # of Vehicles/Cycle: N/A

PennDOT Publication 46, Exhibit 11-6

Type of Traffic Control	Speed (MPH)					
	25-35		40-45		50-60	
	Turn Demand Volume					
	High	Low	High	Low	High	Low
Signalized	A	A	B or C	B or C	B or C	B or C
Unsignalized	A	A	C	B	B or C	B

Right Turn Lane Storage Length, Condition A:	N/A	Feet
Condition B:	N/A	Feet
Condition C:	N/A	Feet
Required Right Turn Lane Storage Length:	N/A	Feet

Additional Findings:

N/A

Additional Comments / Justifications:

Even with left turn volumes included in Advancing (which they should not be) and generous HV percentages across all movements, the right turn lane is still not warranted, even at 100% occupancy of site.