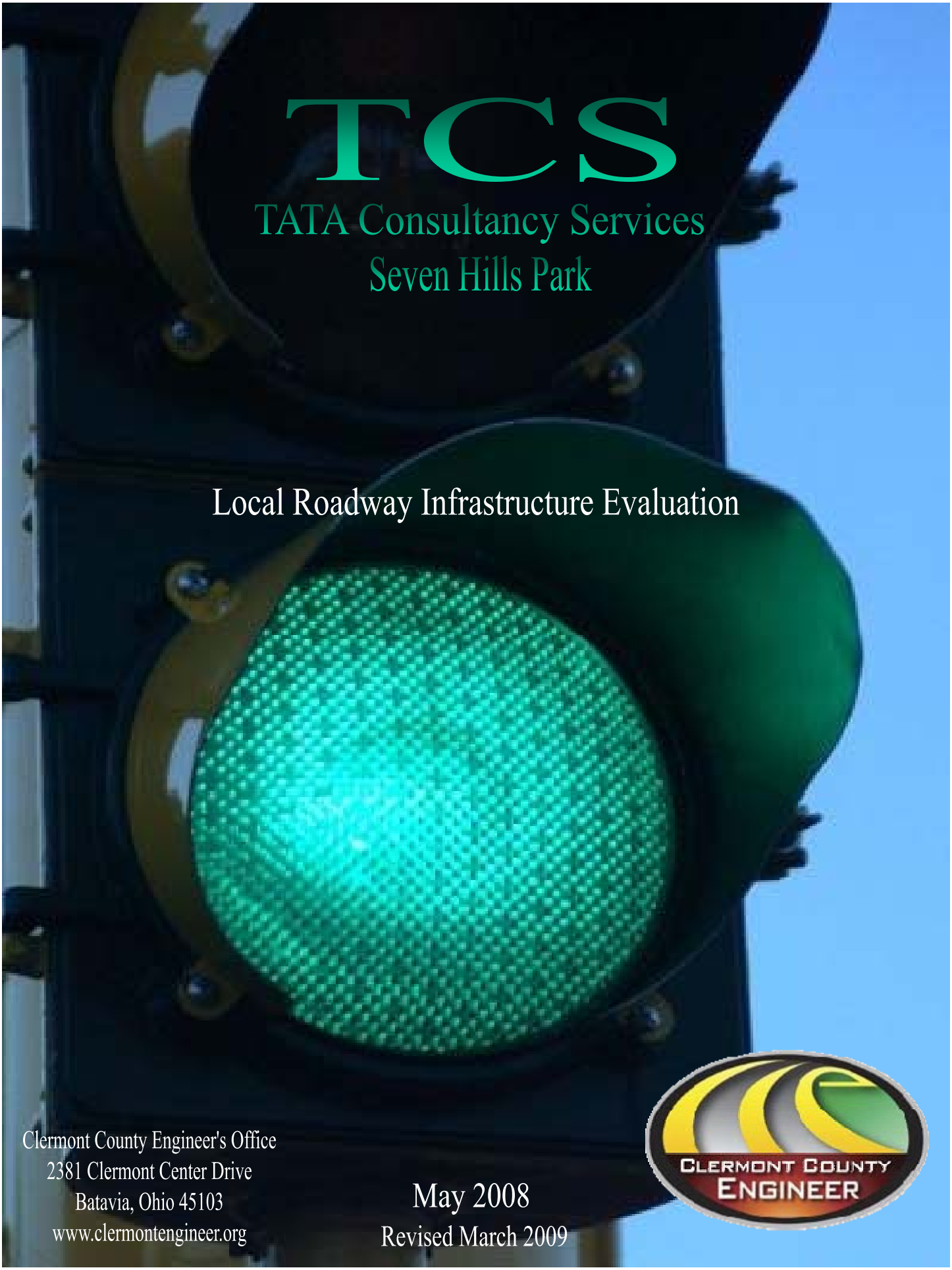


TCS

TATA Consultancy Services
Seven Hills Park

Local Roadway Infrastructure Evaluation

Clermont County Engineer's Office
2381 Clermont Center Drive
Batavia, Ohio 45103
www.clermontengineer.org

May 2008
Revised March 2009

CLERMONT COUNTY ENGINEER

Table of Contents

Introduction……..3
TCS Site Access……4
Street Lighting……6
Traffic Signal Warrants Explained……7
Traffic Signal Warrant Analysis……..10
Intersection Level of Service Explained……11
Year 2010 Intersection Capacity Analysis – Existing Geometry……..12
Roadway Improvements……14
Estimated Cost of Roadway Improvements……19
Year 2010 Intersection Capacity Analysis – Proposed Geometry……26
Year 2030 Intersection Capacity Analysis – Existing Geometry……...27
Year 2030 Intersection Capacity Analysis – Proposed Geometry……28
Accident Analysis……29
Appendix A – Existing Traffic Volumes
Appendix B – Signal Warrant Analysis
Appendix C – Intersection Capacity Analysis – 2010
Appendix D – Intersection Capacity Analysis – 2030
Appendix E – Trip Generation and Turning Movement Diagrams

Introduction

In anticipation of a fully staffed TCS building and the additional traffic volumes that this will generate, the Clermont County Engineer's Office has prepared this evaluation of the area roadway infrastructure.

Traffic signals, roadway capacity, accidents and safety, site access, and street lighting have all been reviewed and are discussed in the following pages.

TCS Site Access

Our analysis shows that current access to the TCS site via Eastman Drive and Techne Center Drive is **adequate** to handle the traffic volumes generated by the addition of 1,000 TCS employees.

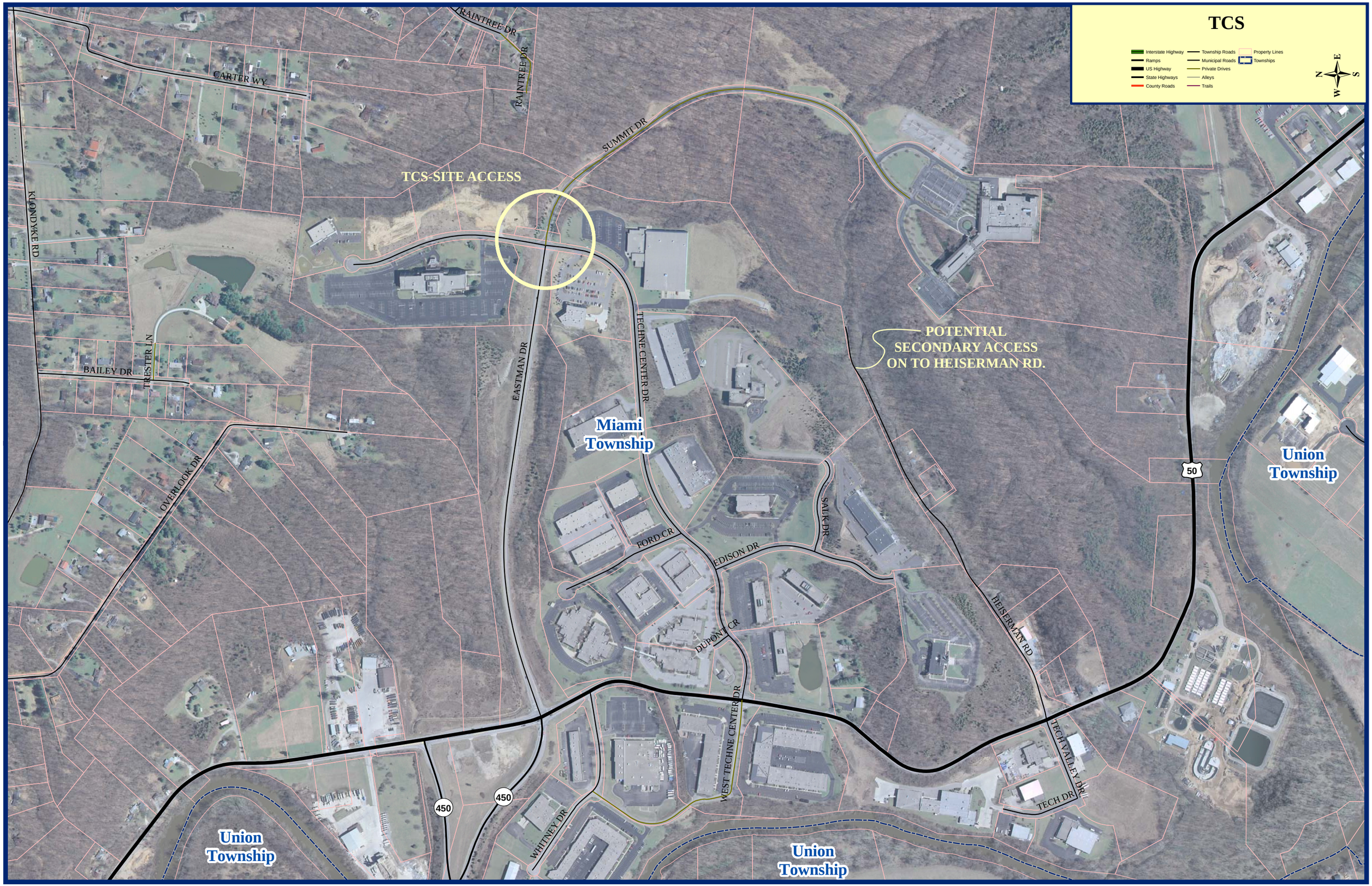
As will be explained later in this report, expected **Levels of Service are good** at the intersection of Eastman Drive and Techne Center Drive. Any delays experienced by motorists in the peak hours are expected to be **minimal** and would only last for a short duration.

As far as traffic flow is concerned, the need for a second access point does not appear to be warranted at this time. However, a potential future access could be established via Heiserman Lane from US 50, south of the Techne Center Drive.

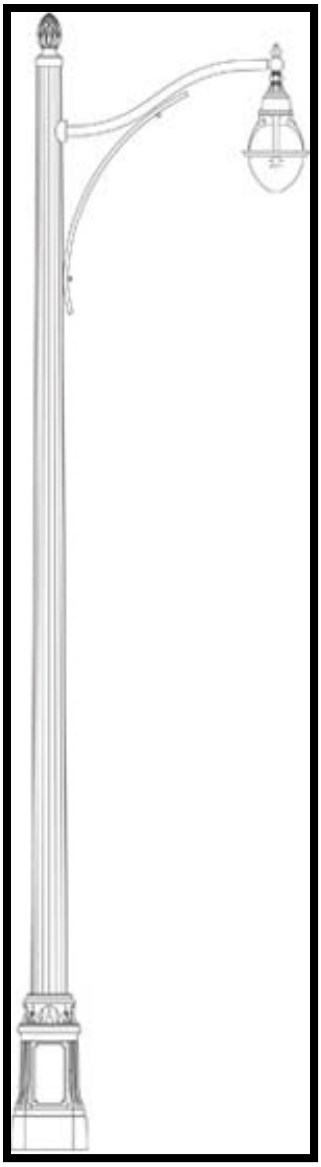
It should be noted that the topography that exists along this alignment is severe and the construction of a proper access road would be difficult and costly.

Traffic volume splits under existing conditions show that the large majority of traffic is being generated from I-275 and US 50 north of this area. Providing secondary access to the TCS site would be expected to re-route those few trips that are generated from US 50 south of the area away from Eastman Drive and may be expected to re-route some of the motorists planning to travel north towards the I-275 interchange.

This redistribution of traffic would necessitate a redistribution of the allotted green times at the traffic signals on US 50, but would not be expected to have a significant effect on the Levels of Service at those intersections.


TCS
Interstate Highway
Ramps
US Highway
State Highways
County Roads
Township Roads
Municipal Roads
Private Drives
Alleys
Trails
Property Lines
Townships
N
E
S
W
TCS-SITE ACCESS
POTENTIAL
SECONDARY ACCESS
ON TO HEISERMAN RD.
Miami
Township
Union
Township
Union
Township
Union
Township
CARTER WY
RAINTREE DR
RAINTREE DR
SUMMIT DR
KLONDYKE RD
BAILEY DR
TRESTER LN
OVERLOOK DR
EASTMAN DR
TECHNE CENTER DR
FORD CR
EDISON DR
SALK DR
DUPONT CR
WEST TECHNE CENTER DR
HEISERMAN RD
TECH VALLEY DR
TECH DR
WHITNEY DR
50
450
450

Street Lighting



There are **no existing street lights** at the intersection of Eastman Drive & Techne Center Drive. All electrical service is underground in this area and Duke Energy representatives have stated that there is currently no single phase electrical circuit near this intersection that could be used for lighting. Additionally, there is no available space in the existing underground conduit system to pull the necessary wiring to the top of the hill.

In order to provide public street lighting at this intersection, new conduit and wiring would have to be installed for approximately 4,000 feet.

This cost is estimated at $50,000. Traditional street light poles would cost approximately $4,000 each in addition to the conduit and wiring costs. There are also countless options in regards to decorative street light poles and the cost of these poles vary greatly as well. Decorative pole prices begin around $7,500 each.

Upgraded street lighting throughout the area could be coordinated with the proposed roadway improvements which are detailed later in this report. The Ohio Department of Transportation will have to approve any changes or additions to the street lighting on US 50 and SR 450.

Street lights are currently installed at the intersections of US 50 & Eastman Drive/Eastbound SR 450 and US 50 & Westbound SR 450. These lights are traditional cobra head style lights mounted on galvanized metal light poles.

The intersection of US 50 & Techne Center Drive is not lit directly, but indirect lighting exists from private lighting at the parking lots on each corner of the intersection. Lighting at this intersection could easily be installed in conjunction with the planned traffic signal improvements.

Traffic Signal Warrants

The installation of traffic signals is regulated by criteria set forth by the **Federal Highway Administration (FHWA**). The FHWA dictates in their Manual of Uniform Traffic Control Devices that, as a minimum, one or more of eight traffic signal warrants must be met before a traffic signal can be installed.

Warrant 1, Eight Hour Vehicular Volume

Minimum threshold volumes are given based upon the number of travel lanes approaching the intersection, travel speed, and whether the intersection is in a rural or urban area. Traffic volumes passing through the intersection must meet or exceed these threshold volumes for each of any 8 hours in an average day. There are two parts to Warrant 1, either of which must be satisfied in order to satisfy Warrant 1.

> **Condition A – Minimum Vehicular Volume**
>
> This warrant is intended for application at locations where a large volume of intersecting traffic is the principal reason to consider installing a traffic control signal. In our case, the total of both major street approaches must be at least 500 vehicles per hour and the total of both minor street approaches must be at least 150 vehicles per hour, for each of any 8 hours of an average day.
>
> **Condition B – Interruption of Continuous Traffic**
>
> This condition is intended for application where the traffic volume on a major street is so heavy that traffic on a minor intersecting street suffers excessive delay or conflict in entering or crossing the major street. In our case, the total of both major street approaches must be at least 750 vehicles per hour and the total of both minor street approaches must be at least 75 vehicles per hour, for each of any 8 hours of an average day.

Warrant 2, Four Hour Vehicular Volume

This warrant is intended to be applied where the volume of intersecting traffic is the principal reason to consider installing a traffic control signal. Points representing the major street and minor street traffic volumes for the 4 highest hours of an average day are plotted on a graph and compared to the applicable curve based upon intersection conditions. This graph can be found in Appendix B of this report.

Warrant 3, Peak Hour

This warrant is intended for use at a location where traffic conditions are such that for a minimum of 1 hour of an average day, the minor street traffic suffers undue delay when entering or crossing the major street. This warrants is to be applied only in unusual cases, such as office complexes, manufacturing plants, industrial complexes, or high occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time. A point representing the major street and minor street traffic volumes for the single highest hour of an average day is plotted on a graph and compared to the applicable curve based upon intersection conditions. This graph can be found in Appendix B of this report.

Warrant 4, Pedestrian Volume

This warrant is intended for application where the traffic volume on a major street is so heavy that pedestrians experience excessive delay in crossing the major street. Pedestrian volumes must be 100 or more for each of any 4 hours or 190 or more during any 1 hour on an average day and there must be fewer than 60 gaps per hour in the traffic stream of adequate length to allow pedestrians to cross.

Warrant 5, School Crossing

This warrant is intended for application where the fact that school children cross the major street is the principal reason to consider installing a traffic control signal. There must be a minimum of 20 students during the highest crossing hour and the frequency of adequate gaps must be such that the students could not cross safely otherwise.

Warrant 6, Coordinated Signal System

Progressive movement in a coordinated signal system sometimes necessitates installing traffic signals at intersections where they would not otherwise be needed in order to maintain proper movement of the vehicles. It must be proven through engineering study that proper progression of vehicles on the main street cannot be achieved due to interruptions from side street traffic at the intersection in question.

Warrant 7, Crash Experience

This warrant is intended for application where the severity and frequency of crashes are the principal reasons to consider installing a traffic control signal. An engineering study must find that a trial of adequate alternatives and enforcement have failed to reduce accident frequency and that the accidents occurring must be of the type susceptible to correction by the installation of a traffic control signal

Warrant 8, Roadway Network

Installing a traffic signal at some intersections might be justified to encourage concentration and organization of traffic flow on a roadway network. An engineering study must show that this intersection is part of a system that serves as the principal roadway network for through traffic flow and that the volume entering the intersection is at least 1,000 vehicles per hour during the peak hour of a typical weekday or at least 1,000 vehicles per hour for each of any 5 hours of a Saturday or Sunday.

Traffic Signal Warrant Analysis

Eastman Drive & Techne Center Drive Warrant Analysis

Of the eight traffic signal warrants, Warrant 3, Peak Hour Volume, is the only warrant that would currently apply in this situation. Our analysis shows **(See Appendix B for Traffic Signal Warrant Analysis)** that the intersection of Eastman Drive and Techne Center Drive falls well short of meeting any of these signal warrants.

Existing intersection volumes are relatively low. A fully staffed TCS building will add a significant amount of traffic to the intersection, but these expected numbers still fall well short of meeting the minimum warrant criteria.

It would take approximately 1,200 more employees, in addition to the fully staffed TCS building, before approaching the minimum warrant requirements. This equates to roughly a 370% increase in traffic volumes over 2008 numbers during the peak hours.

This warrant analysis **can be reevaluated** any time in the future as properties continue to develop and vehicle trips continue to be added to these intersection volumes. Different types of developments generate different amounts of volumes so it is impossible to predict if or when a signal may be warranted without knowing how this area may develop.

Intersection Levels of Service

An intersection's operational performance and capacity utilization, or congestion level, can be evaluated with the results represented in terms of Level of Service (LOS). These levels of service are representative of the perceived quality of service experienced by motorists.

Intersection level of service is calculated in terms of the delay, in seconds, that the average motorist would experience while attempting to pass through the intersection. There are six levels of service, described as follows:

Levels of Service

LOS A – Free flow conditions with little to no delay.

LOS B – Reasonably free flowing conditions.

LOS C – Constrained constant flow at or near the speed limits.

LOS D – Approaching unstable flow. An acceptable condition for arterials and collectors in urban areas.

LOS E – Unstable flow conditions very near capacity.

LOS F – Traffic demand exceeds capacity. Heavily congested flow with poor travel time.

Intersection Capacity Analysis

Year 2010 – Existing Geometry

In order to establish a baseline, we first evaluated the existing roadway conditions with existing traffic volumes plus the additional traffic that will be generated by the fully staffed TCS building. The results are as follows:

Fully Staffed TCS Opening Day LOS – Existing Roadway Conditions

Reference Number	Intersection	AM Peak Existing Geometry	PM Peak Existing Geometry
1	Eastman Drive & Techne Center Drive	C	B
2	US 50 & Eastbound SR 450/Eastman Drive	C	E
3	US 50 & Techne Center Drive	C	D
4	US 50 & Westbound SR 450	B	B

With TCS at 1,000 employees, LOS under existing roadway conditions are within an acceptable range, with the exception of **Intersection 2 – US 50 & Eastbound SR 450/Eastman Drive.** This intersection will approach maximum capacity in the PM Peak unless improvements are made to the intersection to increase the capacity.

Making improvements to the existing roadway network will improve the Levels of Service and provide additional capacity to this intersection to allow for growth in the area as the community continues to develop. Discussion of these proposed roadway improvements follows.

See Appendix C for year 2010 intersection capacity analysis.

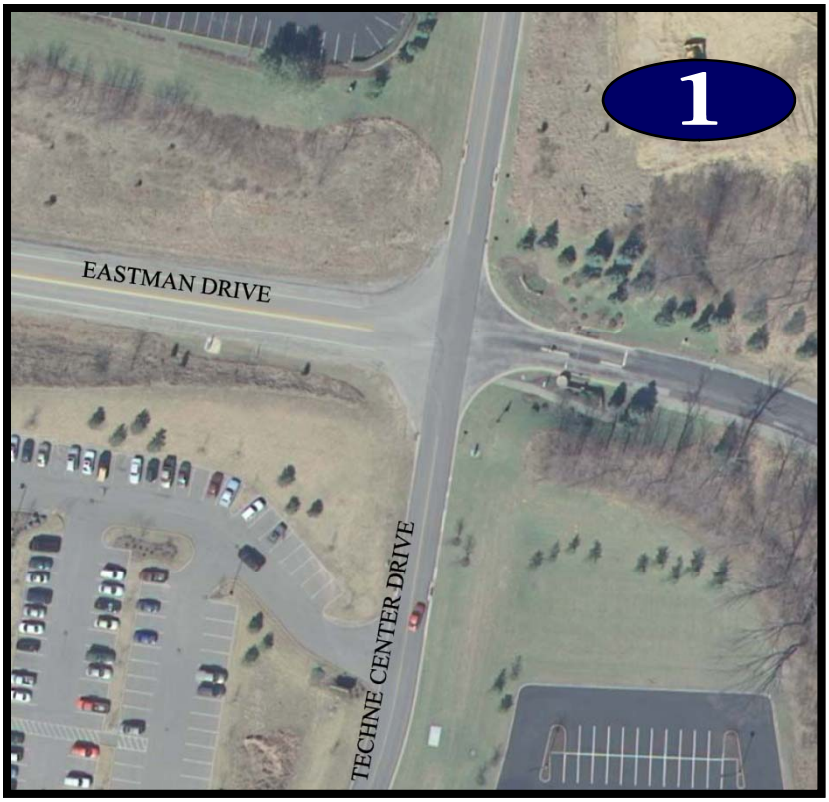
STATE ROUTE 450
STATE ROUTE 50
EASTMAN DRIVE
WHITNEY DRIVE
TECHNE CENTER DRIVE
W. TECHNE CENTER DRIVE
1
2
3
4

Roadway Improvements

Intersection 1 1

The Eastman Drive and Techne Center Drive intersection is shown to **operate well** with the current roadway geometry. No roadway improvements are planned in this area. As mentioned previously in this report, street lighting can be added to this intersection but this task is not as simple as first expected and the associated cost is higher as well due to the overcrowded condition of the existing underground electrical network.

In addition to the street lighting enhancement, upgrades to the signs and pavement markings would provide for **clearer definition of the intersection.**

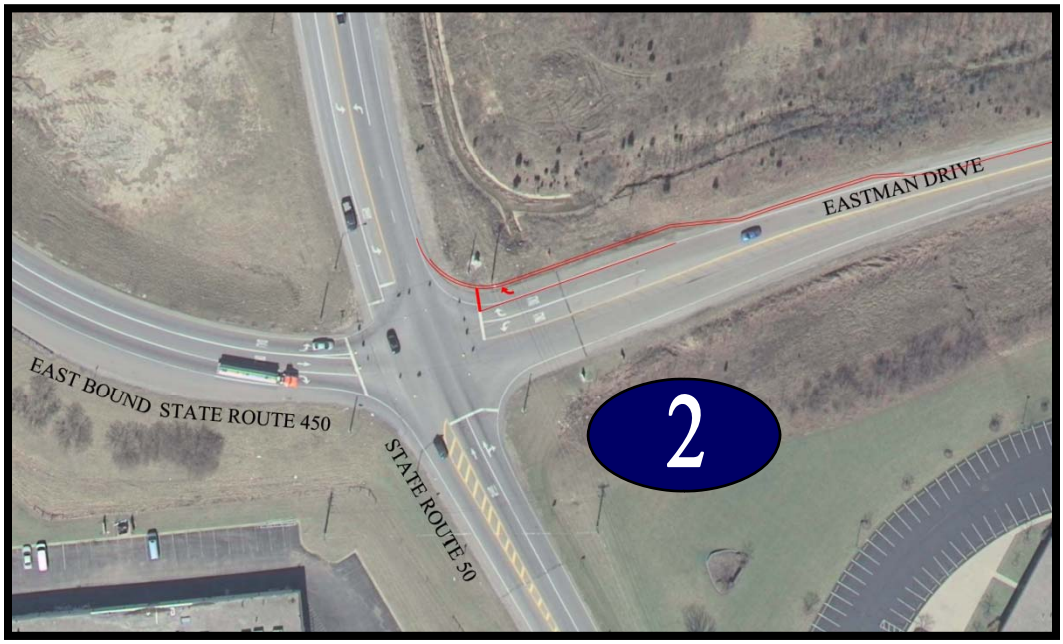


Overhead flashing lights are typically reserved for high speed, **high accident intersection** locations. A better alternative for this intersection would be the **new stop sign technology** which includes bright, flashing, LED lights built into the sign itself. Not only is this alternative more aesthetically pleasing than the overhead flashers, but it is a better application for this intersection and is less costly to install and maintain.

Intersection 2

Implementing the improvements mentioned for Intersection 1 will address immediate needs, but when the 1,000 TCS employee growth milestone is reached Intersection 2 will experience a degradation in Level of Service.

Our analysis shows that the addition of a **second right turn lane** on westbound Eastman Drive will allow traffic to flow more efficiently through the intersection, increasing the intersections Level of Service.



This extra lane will solve the issue of moving traffic efficiently from Eastman Drive and would require that changes be made to the operation of the traffic signal as well.

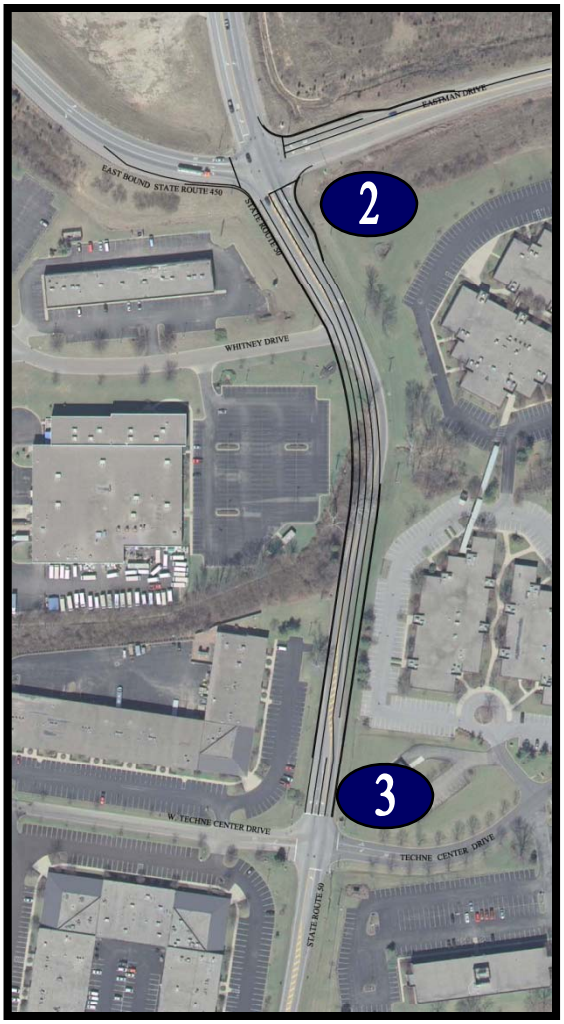
Under current conditions, traffic from both SR 450 and Eastman Drive have a green light at the same time, which, as we understand, **leads to potential conflicts** between vehicles turning left from SR 450 and those attempting to leave Eastman Drive. With the new geometry these movements are required to be separated because the dual right turns from Eastman Drive would leave no room for the opposing left turns. This **change would eliminate** the potential conflict that exists today.

Granting separate green times to Eastman Drive and SR 450 will reduce the amount of available green time for US 50 traffic. This change will lead to a degradation of the traffic flow through the US 50 corridor, which leads to discussion of roadway improvements on US 50 between Intersections 2 & 3.

Segment 2 / 3 2 -- 3

As mentioned previously, making improvements to Intersection 2 will solve some of the issues in this area, but at the same time this will create additional delay for US 50 traffic. The close proximity of signalized intersections dictates that this section of the US 50 corridor be looked at as a whole in order to promote efficient travel through the corridor.

Our analysis shows that creating **two lanes in each direction** in this area will serve to increase capacity and improve the speed and efficiency in which vehicles travel through this section. The curve just south of Whitney Drive would also be straightened which will increase visibility and is expected to further increase the safety of the corridor.



With a second southbound lane in place, a second westbound right turn lane can be added to the SR 450 approach at Intersection 2. This will allow more traffic to move through the intersection in a shorter amount of time which will free some green time for US 50 traffic.

The second northbound lane is required to provide additional northbound capacity to SR 450/I-275 that will offset the decrease in green time at the Eastman Drive/SR 450 intersection (Intersection 2) as described previously.

In addition to physical roadway improvements, the three existing traffic signals on US 50 in this area should be **coordinated either via hardwire or radio interconnect**. This will allow all three intersections to work in harmony, preventing drivers from having to make multiple stops as they attempt to progress through this corridor.

Intersection 3

As part of the US 50 corridor improvements, the intersection of US 50 and Techne Center Drive would only require improvements to the north leg, where the second northbound and southbound lanes would begin and end. This additional capacity allows the intersection to operate at an acceptable level of service during the peak hours.

Upgrading the traffic signal operation and coordinating this signal with the two existing signals to the north will serve to enhance the progression of traffic through the area.

New street lighting would be added to the intersection and included as part of the traffic signal upgrade.

Intersection 4

The intersection of US 50 & Westbound SR 450 is found to operate very efficiently. The majority of traffic passing through this intersection are vehicles turning left from US 50 onto SR 450. The existing double left turn lanes help this traffic to move quickly through the intersection. This left turn traffic stops only for a short time while the smaller traffic volumes from the north on US 50 are permitted to pass through the intersection. Northbound US 50 traffic is allowed to free flow through the intersection as there are no conflicting movements to these vehicles.

No improvements are necessary at this intersection.

Roadway Improvements

Cost Estimates

The improvements mentioned in this report could be separated into three phases, addressing the immediate needs of the area first and then progressing to the next phases as the TCS staff continues to grow making the need for these next phases more essential.

Phase I

Phase I would address the improvements to Intersection 1 – Eastman Drive and Techne Center Drive. This would consist of the installation of new pavement markings, including stop bars, the installation of new LED stop signs on all four approaches, and street lighting for enhanced visibility at the intersection itself as well as aesthetic decorative lighting for the entire length of Eastman Drive. The estimated cost of constructing **Phase I is $235,000**.

Phase II

Our analysis shows that the Level of Service at Intersection 2 – US 50 & Eastbound SR 450/Eastman Drive will begin to deteriorate as the TCS site becomes fully staffed. For this reason, Phase II would address the reconstruction of this intersection, including the additional turn lane and upgrades to the traffic signal. The estimated cost of constructing **Phase II is $394,000**.

Phase III

Phase III will complete the area improvements with the reconstruction of US 50 between Intersections 2 & 3. This includes the realignment of the existing roadway and the widening to two lanes in each direction. Upgrades to the traffic signal at Intersection 3 – US 50 & Techne Center Drive are also included. The estimated cost of constructing **Phase III is $1,170,000**.

The Grand Total for all **three phases is $1,799,000**. These estimates are established in 2008 dollars and were calculated based upon 2-dimentional line work and knowledge of the existing area. These estimates may require some adjustment after a field survey and detailed design work are completed.

A breakdown of these cost estimates can be found on the following pages.

CLERMONT COUNTY ENGINEER

ENGINEERS ESTIMATE

US 50 PHASE I
LIGHTING
SIGNAGE/STRIPING

REF	ITEM	TOTAL QUANTITY	UNIT	DESCRIPTION	COST	PROJECT TOTAL
				ROADWAY		
				PAVEMENT MARKINGS & SIGNAGE		
1	630	1	L.S.	SIGNAGE	$8,000.00	$8,000.00
2	644	1	L.S.	PAVEMENT MARKINGS	$3,000.00	$3,000.00
3	SPECIAL	1	L.F.	LIGHTING CONDUIT/WIRING	$50,000.00	$50,000.00
4	SPECIAL	18	Each	LIGHT POLES	$7,500.00	$135,000.00
				TOTAL		$196,000.00
				20% CONTINGENCY		$39,200.00
				TOTAL CONSTRUCTION COST		**$235,200.00**

REF	ITEM	TOTAL QUANTITY	UNIT	DESCRIPTION	COST	PROJECT TOTAL
24	301	300	CU. YD.	BITUMINOUS AGGREGATE BASE, PG 64-22	$115.00	$34,500.00
25	304	225	CU. YD.	AGGREGATE BASE	$55.00	$12,375.00
26	407	150	GALLON	TACK COAT	$1.25	$187.50
27	448	75	CU. YD.	ASPHALT CONCRETE INTERMEDIATE COURSE, TYPE 2, PG 64-22	$135.00	$10,125.00
28	448	75	CU. YD.	ASPHALT CONCRETE SURFACE COURSE, TYPE IH, PG 64-22	$135.00	$10,125.00
				MAINTENANCE OF TRAFFIC		
29	614	1	L.S.	MAINTAINING TRAFFIC, AS PER PLAN	$25,000.00	$25,000.00
				PAVEMENT MARKINGS & SIGNAGE		
30	630	1	L.S.	SIGNAL MODIFICATION	$75,000.00	$75,000.00
31	630	1	L.S.	SIGNAGE	$5,000.00	$5,000.00
32	644	1	L.S.	PAVEMENT MARKINGS	$5,000.00	$5,000.00
34	SPECIAL	1	L.S.	UTILITY RELOCATION	$25,000.00	$25,000.00
35	623	1	L.S.	CONSTRUCTION LAYOUT STAKES	$10,000.00	$10,000.00
36	624	1	L.S.	MOBILIZATION	$10,000.00	$10,000.00
				TOTAL		$328,457.50
				20% CONTINGENCY		$65,691.50
				TOTAL CONSTRUCTION COST		**$394,149.00**

CLERMONT COUNTY ENGINEER

ENGINEERS ESTIMATE

US 50 PHASE II
INTERSECTION TURN LANES
SIGNAL MODIFICATIONS

REF	ITEM	TOTAL QUANTITY	UNIT	DESCRIPTION	COST	PROJECT TOTAL
				ROADWAY		
1	201	1	L.S.	CLEARING AND GRUBBING	$5,000.00	$5,000.00
2	202	1	L.S.	PIPE REMOVED, 24" AND UNDER & STORM REMOVAL	$2,000.00	$2,000.00
3	203	500	CU. YD.	EMBANKMENT	$15.00	$7,500.00
4	203	1000	CU. YD.	EXCAVATION NOT INCLUDING EMBANKMENT (INCLUDES PVMT)	$20.00	$20,000.00
5	203	100	CU. YD.	UNDERCUT, REPLACE W/COMPACTED 304	$50.00	$5,000.00
6	204	5	HOUR	PROOF ROLLING	$100.00	$500.00
7	204	1300	SQ. YD.	SUBGRADE COMPACTION	$1.25	$1,625.00
8	659	200	CU. YD.	TOPSOIL	$25.00	$5,000.00
9	606	200	L.F.	GUARDRAIL, TYPE 5	$20.00	$4,000.00
10	609	1000	L.F.	CONCRETE CURB, TYPE 6 (INCLUDING UNDERDRAINS)	$25.00	$25,000.00
				EROSION CONTROL		
11	207	1500	SQ. YD.	SEEDING AND MULCHING	$1.50	$2,250.00
12	207	250	LIN. FT.	PERIMETER FILTER FABRIC FENCE	$2.00	$500.00
13	207	50	LIN. FT.	FILTER FABRIC DITCH CHECKS	$5.00	$250.00
14	832	1	L.S.	STORM WATER POLLUTION PREVENTION PLAN	$2,500.00	$2,500.00
15	832	1	L.S.	EROSION CONTROL	$2,500.00	$2,500.00
				DRAINAGE		
16	601	2	CU. YD.	ROCK CHANNEL PROTECTION, TYPE B, WITHOUT FILTER	$85.00	$170.00
17	602	0.5	CU. YD.	CONCRETE MASONRY	$700.00	$350.00
18	603	100	LIN. FT.	15" CONDUIT, TYPE B	$60.00	$6,000.00
19	603	100	LIN. FT.	18" CONDUIT, TYPE B	$65.00	$6,500.00
20	603	50	LIN. FT.	24" CONDUIT, TYPE B	$80.00	$4,000.00
21	604	2	EACH	CATCH BASIN, NO. 2-2-A	$1,250.00	$2,500.00
22	604	1	EACH	MANHOLE, NO. 3	$2,000.00	$2,000.00
23	604	2	EACH	MANHOLE ADJUSTED TO GRADE	$500.00	$1,000.00
				PAVEMENT		

CLERMONT COUNTY ENGINEER

ENGINEERS ESTIMATE

US 50 PHASE III
WIDENING FROM
EASTMAN TO TECHNE CENTER

REF	ITEM	TOTAL QUANTITY	UNIT	DESCRIPTION	COST	PROJECT TOTAL
				ROADWAY		
1	201	1	L.S.	CLEARING AND GRUBBING	$10,000.00	$10,000.00
2	202	1	L.S.	PIPE REMOVED, 24" AND UNDER & STORM REMOVAL	$500.00	$500.00
3	203	2500	CU. YD.	EMBANKMENT	$15.00	$37,500.00
4	203	7000	CU. YD.	EXCAVATION NOT INCLUDING EMBANKMENT (INCLUDES PVMT)	$20.00	$140,000.00
5	203	400	CU. YD.	UNDERCUT, REPLACE W/COMPACTED 304	$50.00	$20,000.00
6	204	10	HOUR	PROOF ROLLING	$100.00	$1,000.00
7	204	5000	SQ. YD.	SUBGRADE COMPACTION	$1.25	$6,250.00
8	659	750	CU. YD.	TOPSOIL	$25.00	$18,750.00
9	606	400	L.F.	GUARDRAIL, TYPE 5	$20.00	$8,000.00
10	609	2000	L.F.	CONCRETE CURB, TYPE 6 (INCLUDING UNDERDRAINS)	$25.00	$50,000.00
				EROSION CONTROL		
11	207	2500	SQ. YD.	SEEDING AND MULCHING	$1.50	$3,750.00
12	207	1250	LIN. FT.	PERIMETER FILTER FABRIC FENCE	$2.00	$2,500.00
13	207	75	LIN. FT.	FILTER FABRIC DITCH CHECKS	$5.00	$375.00
14	832	1	L.S.	STORM WATER POLLUTION PREVENTION PLAN	$2,500.00	$2,500.00
15	832	1	L.S.	EROSION CONTROL	$2,500.00	$2,500.00
				DRAINAGE		
16	601	3	CU. YD.	ROCK CHANNEL PROTECTION, TYPE B, WITHOUT FILTER	$85.00	$255.00
17	602	0.5	CU. YD.	CONCRETE MASONRY	$700.00	$350.00
18	603	100	LIN. FT.	15" CONDUIT, TYPE B	$60.00	$6,000.00
19	603	100	LIN. FT.	18" CONDUIT, TYPE B	$65.00	$6,500.00
20	603	150	LIN. FT.	24" CONDUIT, TYPE B	$80.00	$12,000.00
21	604	2	EACH	CATCH BASIN, NO. 2-2-A	$1,250.00	$2,500.00
22	604	1	EACH	MANHOLE, NO. 3	$2,000.00	$2,000.00
23	604	2	EACH	MANHOLE ADJUSTED TO GRADE	$500.00	$1,000.00
				PAVEMENT		

REF	ITEM	TOTAL QUANTITY	UNIT	DESCRIPTION	COST	PROJECT TOTAL
24	301	1500	CU. YD.	BITUMINOUS AGGREGATE BASE, PG 64-22	$115.00	$172,500.00
25	304	1225	CU. YD.	AGGREGATE BASE	$55.00	$67,375.00
26	407	550	GALLON	TACK COAT	$1.25	$687.50
27	448	225	CU. YD.	ASPHALT CONCRETE INTERMEDIATE COURSE, TYPE 2, PG 64-22	$135.00	$30,375.00
28	448	425	CU. YD.	ASPHALT CONCRETE SURFACE COURSE, TYPE IH, PG 64-22	$135.00	$57,375.00
				MAINTENANCE OF TRAFFIC		
29	614	1	L.S.	MAINTAINING TRAFFIC, AS PER PLAN	$75,000.00	$75,000.00
				PAVEMENT MARKINGS & SIGNAGE		
30	630	1	L.S.	SIGNAL MODIFICATION	$75,000.00	$75,000.00
31	630	1	L.S.	SIGNAGE	$10,000.00	$10,000.00
32	644	1	L.S.	PAVEMENT MARKINGS	$10,000.00	$10,000.00
33	SPECIAL	2500	S.F.	RETAINING WALL	$35.00	$87,500.00
34	SPECIAL	1	L.S.	UTILITY RELOCATION	$25,000.00	$25,000.00
35	623	1	L.S.	CONSTRUCTION LAYOUT STAKES	$10,000.00	$10,000.00
36	624	1	L.S.	MOBILIZATION	$20,000.00	$20,000.00
				TOTAL		$975,042.50
				20% CONTINGENCY		$195,008.50
				TOTAL CONSTRUCTION COST		**$1,170,051.00**

Trip Generation

1,000 Additional TCS Employees

The ITE Trip Generation Manual was used to determine the number of trips generated by the addition of 1,000 employees to the TCS site. ITE 710 – General Office shows that the AM Peak hour would gain 480 additional trips; 423 entering, 57 exiting. Likewise, the PM Peak hour shows an increase of 460 trips; 78 entering, 382 exiting.

The TCS building currently contains a modeerate number of employees and there are several operational office buildings adjacent to the Eastman Drive & Techne Center Drive intersection. Because these current employee trips are generated from the same location as the additional TCS trips, current turning movement percentages at each intersection were used to distribute the additional TCS trips throughout this system.

See Appendix E for Trip Generation and Turn Movement Diagrams

Intersection Capacity Analysis

Year 2010 – Proposed Geometry

Analysis shows that the worst of the existing intersections in this network under existing roadway conditions is **Intersection 2 – US 50 & Eastbound SR 450/Eastman Drive**.

The additional traffic added by the new TCS employees increases the overall volumes of the intersection to very near capacity. Installing additional lanes at the intersection will allow more vehicles to pass through during a given amount of green time, therefore reducing the delay experienced and increasing the Level of Service.

Our analysis indicated that the addition of a second eastbound turn lane and a second westbound turn lane would allow traffic to move more efficiently through this intersection. The Level of Service can be improved from LOS E to LOS C in the PM Peak with the addition of these turn lanes.

The Level of Service rating is improved at Intersection 3 – US 50 & Techne Center Drive in the AM Peak, changing from LOS C to LOS B. The additional lanes north of this intersection allow traffic to move more efficiently to and from the north.

Intersections 1 and 4 receive no roadway geometry improvements and therefore experience no change in their already above average Levels of Service.

Fully Staffed TCS Opening Day LOS – With Roadway Improvements

Reference Number	Intersection	AM Peak Improved Geometry	PM Peak Improved Geometry
1	Eastman Drive & Techne Center Drive	C	B
2	US 50 & Eastbound SR 450/Eastman Drive	C	C
3	US 50 & Techne Center Drive	B	D
4	US 50 & Westbound SR 450	B	B

Intersection Capacity Analysis

Year 2030 – Existing Geometry

It is standard procedure to review the roadway conditions 20 years past the anticipated construction date to ensure that any improvements made will provide benefit beyond the immediate future. Background traffic is anticipated to grow at a rate of 1% per year. Traffic volumes on Eastman Drive and Techne Center Drive are controlled by the number of employees and are therefore expected to remain the same as 2010 in our scenario.

The table below shows the expected Levels of Service in the year 2030 if no improvements are made to the existing roadway.

Fully Staffed TCS Year 2030 LOS – Existing Roadway Conditions

Reference Number	Intersection	AM Peak Existing Geometry	PM Peak Existing Geometry
1	Eastman Drive & Techne Center Drive	C	B
2	US 50 & Eastbound SR 450/Eastman Drive	C	F
3	US 50 & Techne Center Drive	C	E
4	US 50 & Westbound SR 450	B	B

Intersection Capacity Analysis

Year 2030 – Proposed Geometry

Results of our analysis indicate that while the Levels of Service do deteriorate slightly over this 20 year timeframe, all intersections will still operate at an acceptable LOS with the proposed roadway improvements in place.

Intersection 1 is found to operate very efficiently with no change in Level of Service even with a 20 year growth in traffic volumes. No improvements are planned for this intersection and none are necessary in the year 2030.

The Levels of Service at intersections 2 & 3 are shown to be at a LOS D with the 20 year increase in background traffic volumes. This is no change for Intersection 3 and a slight decline for Intersection 2 from LOS C in the year 2010. These Levels of Service are perfectly acceptable for an Urban Collector such as US 50.

The results for Intersection 4 – Eastman Drive & Techne Center Drive would not be expected to change from the year 2010 because these volumes are largely destination driven, meaning that there is little pass-thru traffic at this intersection. Until such a time when additional employees are added to the campus, traffic volumes would not be expected to increase over 2010 numbers.

Fully Staffed TCS Year 2030 LOS – With Roadway Improvements

Reference Number	Intersection	AM Peak Improved Geometry	PM Peak Improved Geometry
1	Eastman Drive & Techne Center Drive	C	B
2	US 50 & Eastbound SR 450/Eastman Drive	C	D
3	US 50 & Techne Center Drive	C	D
4	US 50 & Westbound SR 450	B	B

Accident Analysis

A typical accident analysis reviews data from the three most recent complete years. Our office has maintained a database of all accidents recorded in Clermont County since 1996. Results of a database search for all accidents between 2005 and 2007 are shown below.

Accidents are often compared in terms of an accident rate. For instance, if an intersection averages 10 crashes over 3 years and has an average daily traffic count (ADT) of 20,000 vehicles, this intersection would have a very low accident rate of 0.46 accidents per million entering vehicles (acc/mev). However, 10 crashes in 3 years at an intersection with an ADT of 2,000 vehicles would yield a high accident rate of 4.57 acc/mev. A rate of 1 acc/mev is considered a typical average rate.

Accident analysis in the area of US 50, Eastman Drive, and Techne Center Drive shows that accident rates are quite low compared to other urban intersections in our area. Please see the accident table on the following page.

In cases with high accident rates, it is often possible to observe trends in the data and as a result it can sometimes be determined that specific improvements can be made which will have a direct impact on reducing the number off accidents at a particular location. For example, an area with a high percentage of crashes occurring in the dark may benefit from having street lighting installed if there were no other apparent factors in those crashes.

2005-2007 Accidents

Reference Number	Intersection	Number of Accidents	Accident Rate
1	Eastman Drive & Techne Center Drive	1	0.14 acc/mev
2	US 50 & Eastman Drive/SR 450	18	0.55 acc/mev
3	US 50 & Techne Center Drive	1	0.05 acc/mev
4	US 50 & WB SR 450	1	0.09 acc/mev

Accident rates are very low in this area and there are no noticeable trends in the data. As much as we strive to reduce the accidents and increase the safety for motorists in Clermont County, factors such as driver inattention will always be present making it nearly impossible to ever be accident free.

Enhancing the roadway geometry and improving the traffic signal timing will improve traffic flow through the area and should help to further improve the safety. As mentioned previously in this report, the upgrades to Intersection 2 – US 50 & SR 450/Eastman Drive will separate the existing Eastman Drive traffic from the opposing left turn traffic, eliminating any potential conflict between those movements.

The addition of street lighting, LED stop signs, and painted stop bars at the intersection of Eastman Drive & Techne Center Drive will help to ensure that the accident rate continues to remain low at this location even with the expected increase in traffic volumes.

Appendix A

Existing Traffic Volumes

US 50 @ WB SR 450

Turning Movement
February 5, 2008
7 AM to 9 AM & 4 PM to 6 PM

File Name : US50&SR450_wb
Site Code : 00000000
Start Date : 2/5/2008
Page No : 1

Groups Printed- Unshifted - Bank 1

	US 50 From North					From East					US 50 From South					SR 450 From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	30	18	0	0	48	0	0	0	0	0	0	24	84	0	108	0	0	0	0	0	156
07:15 AM	41	16	0	0	57	0	0	0	0	0	0	81	116	0	197	0	0	0	0	0	254
07:30 AM	38	38	0	0	76	0	0	0	0	0	0	108	104	0	212	0	0	0	0	0	288
07:45 AM	44	70	0	0	114	0	0	0	0	0	0	89	73	0	162	0	0	0	0	0	276
Total	153	142	0	0	295	0	0	0	0	0	0	302	377	0	679	0	0	0	0	0	974
08:00 AM	26	47	0	0	73	0	0	0	0	0	0	91	86	0	177	0	0	0	0	0	250
08:15 AM	16	54	0	0	70	0	0	0	0	0	0	57	97	0	154	0	0	0	0	0	224
08:30 AM	21	35	0	0	56	0	0	0	0	0	0	59	79	0	138	0	0	0	0	0	194
08:45 AM	15	44	0	0	59	0	0	0	0	0	0	56	57	0	113	0	0	0	0	0	172
Total	78	180	0	0	258	0	0	0	0	0	0	263	319	0	582	0	0	0	0	0	840
*** BREAK ***																					
04:00 PM	15	39	0	0	54	0	0	0	0	0	0	42	105	0	147	0	0	0	0	0	201
04:15 PM	28	61	0	0	89	0	0	0	0	0	0	64	128	0	192	0	0	0	0	0	281
04:30 PM	17	48	0	0	65	0	0	0	0	0	0	98	175	0	273	0	0	0	0	0	338
04:45 PM	21	50	0	0	71	0	0	0	0	0	0	98	172	0	270	0	0	0	0	0	341
Total	81	198	0	0	279	0	0	0	0	0	0	302	580	0	882	0	0	0	0	0	1161
05:00 PM	17	40	0	0	57	0	0	0	0	0	0	131	293	0	424	0	0	0	0	0	481
05:15 PM	10	55	0	0	65	0	0	0	0	0	0	132	257	0	389	0	0	0	0	0	454
05:30 PM	12	43	0	0	55	0	0	0	0	0	0	89	167	0	256	0	0	0	0	0	311
05:45 PM	18	35	0	0	53	0	0	0	0	0	0	84	142	0	226	0	0	0	0	0	279
Total	57	173	0	0	230	0	0	0	0	0	0	436	859	0	1295	0	0	0	0	0	1525
Grand Total	369	693	0	0	1062	0	0	0	0	0	0	1303	2135	0	3438	0	0	0	0	0	4500
Apprch %	34.7	65.3	0	0		0	0	0	0		0	37.9	62.1	0		0	0	0	0		
Total %	8.2	15.4	0	0	23.6	0	0	0	0	0	0	29	47.4	0	76.4	0	0	0	0	0	
Unshifted	369	693	0	0	1062	0	0	0	0	0	0	1303	2135	0	3438	0	0	0	0	0	4500
% Unshifted	100	100	0	0	100	0	0	0	0	0	0	100	100	0	100	0	0	0	0	0	100
Bank 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bank 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

US 50 @ EB SR 450/Eastman Drive

Turning Movement

February 5, 2008

7 AM to 9 AM & 4 PM to 6 PM

File Name : US50&EBSR450-Eastman_2-5-08
Site Code : 00000000
Start Date : 2/5/2008
Page No : 1

Groups Printed- Unshifted - Bank 1

	US 50 From North					Eastman Drive From East					US 50 From South					SR 450 From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	0	19	7	0	26	0	0	0	0	0	0	152	0	0	152	87	30	34	0	151	329
07:15 AM	0	14	8	0	22	1	0	0	0	1	0	191	0	0	191	89	32	41	0	162	376
07:30 AM	0	29	10	0	39	1	0	1	0	2	1	173	0	0	174	128	51	34	0	213	428
07:45 AM	0	56	14	0	70	3	0	1	0	4	3	111	0	0	114	157	78	67	0	302	490
Total	0	118	39	0	157	5	0	2	0	7	4	627	0	0	631	461	191	176	0	828	1623
08:00 AM	0	32	20	0	52	4	0	0	0	4	3	133	0	0	136	166	65	34	0	265	457
08:15 AM	0	29	26	0	55	4	0	1	0	5	1	130	0	0	131	143	74	31	0	248	439
08:30 AM	0	29	9	0	38	8	0	1	0	9	1	101	0	0	102	106	68	26	0	200	349
08:45 AM	0	38	18	0	56	5	0	0	0	5	1	90	0	0	91	112	45	28	0	185	337
Total	0	128	73	0	201	21	0	2	0	23	6	454	0	0	460	527	252	119	0	898	1582
*** BREAK ***																					
04:15 PM	0	59	1	0	60	43	0	0	0	43	0	121	0	0	121	149	1	42	0	192	416
04:30 PM	0	54	2	0	56	38	0	1	0	39	2	196	0	0	198	176	6	52	0	234	527
04:45 PM	0	57	0	0	57	58	0	0	0	58	0	176	0	0	176	145	5	63	0	213	504
Total	0	170	3	0	173	139	0	1	0	140	2	493	0	0	495	470	12	157	0	639	1447
05:00 PM	0	37	0	0	37	133	0	2	0	135	0	264	0	0	264	128	5	75	0	208	644
05:15 PM	0	60	5	0	65	113	0	0	0	113	0	219	0	0	219	122	7	74	0	203	600
05:30 PM	0	41	1	0	42	60	0	0	0	60	2	173	0	0	175	118	2	42	0	162	439
05:45 PM	0	42	0	0	42	80	0	0	0	80	0	126	0	0	126	135	0	39	0	174	422
Total	0	180	6	0	186	386	0	2	0	388	2	782	0	0	784	503	14	230	0	747	2105
Grand Total	0	596	121	0	717	551	0	7	0	558	14	2356	0	0	2370	1961	469	682	0	3112	6757
Apprch %	0	83.1	16.9	0		98.7	0	1.3	0		0.6	99.4	0	0		63	15.1	21.9	0		
Total %	0	8.8	1.8	0	10.6	8.2	0	0.1	0	8.3	0.2	34.9	0	0	35.1	29	6.9	10.1	0	46.1	
Unshifted	0	596	121	0	717	551	0	7	0	558	14	2356	0	0	2370	1961	469	682	0	3112	6757
% Unshifted	0	100	100	0	100	100	0	100	0	100	100	100	0	0	100	100	100	100	0	100	100
Bank 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bank 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

US 50 & Whitney Drive

Turning Movement
January 31, 2008
7 AM to 9 AM & 4 PM to 6 PM

File Name : 50&Whitney_1-31-08
Site Code : 00000000
Start Date : 1/31/2008
Page No : 1

Groups Printed- Unshifted - Bank 1

	US 50 From North					From East					US 50 From South					Whitney Drive From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	16	65	0	0	81	0	0	0	0	0	0	144	1	0	145	0	0	2	0	2	228
07:15 AM	28	92	0	0	120	0	0	0	0	0	0	200	1	0	201	0	0	3	0	3	324
07:30 AM	25	148	0	0	173	0	0	0	0	0	0	140	2	0	142	0	0	4	0	4	319
07:45 AM	38	178	0	0	216	0	0	0	0	0	0	146	5	0	151	1	0	7	0	8	375
Total	107	483	0	0	590	0	0	0	0	0	0	630	9	0	639	1	0	16	0	17	1246
08:00 AM	45	148	0	0	193	0	0	0	0	0	0	111	6	0	117	0	0	9	0	9	319
08:15 AM	17	145	0	0	162	0	0	0	0	0	0	100	1	0	101	0	0	5	0	5	268
08:30 AM	28	113	0	0	141	0	0	0	0	0	0	93	0	0	93	1	0	7	0	8	242
08:45 AM	20	118	0	0	138	0	0	0	0	0	0	87	0	0	87	0	0	5	0	5	230
Total	110	524	0	0	634	0	0	0	0	0	0	391	7	0	398	1	0	26	0	27	1059
*** BREAK ***																					
04:00 PM	16	170	0	0	186	0	0	0	0	0	0	118	1	0	119	4	0	19	0	23	328
04:15 PM	11	177	0	0	188	0	0	0	0	0	0	123	1	0	124	3	0	14	0	17	329
04:30 PM	4	155	0	0	159	0	0	0	0	0	0	183	1	0	184	2	0	13	0	15	358
04:45 PM	7	171	0	0	178	0	0	0	0	0	0	154	1	0	155	0	0	22	0	22	355
Total	38	673	0	0	711	0	0	0	0	0	0	578	4	0	582	9	0	68	0	77	1370
05:00 PM	7	127	0	0	134	0	0	0	0	0	0	230	1	0	231	1	0	12	0	13	378
05:15 PM	12	188	0	1	201	0	0	0	0	0	0	181	0	0	181	1	0	12	0	13	395
05:30 PM	18	164	0	0	182	0	0	0	0	0	0	127	0	0	127	1	0	17	0	18	327
05:45 PM	21	148	0	0	169	0	0	0	0	0	0	81	1	0	82	1	0	23	0	24	275
Total	58	627	0	1	686	0	0	0	0	0	0	619	2	0	621	4	0	64	0	68	1375
Grand Total	313	2307	0	1	2621	0	0	0	0	0	0	2218	22	0	2240	15	0	174	0	189	5050
Apprch %	11.9	88	0	0		0	0	0	0		0	99	1	0		7.9	0	92.1	0		
Total %	6.2	45.7	0	0	51.9	0	0	0	0	0	0	43.9	0.4	0	44.4	0.3	0	3.4	0	3.7	
Unshifted	313	2307	0	1	2621	0	0	0	0	0	0	2218	22	0	2240	15	0	174	0	189	5050
% Unshifted	100	100	0	100	100	0	0	0	0	0	0	100	100	0	100	100	0	100	0	100	100
Bank 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bank 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

US 50 & Techne Center Dr

Turning Movement
January 31, 2008
7 AM to 9 AM & 4 PM to 6 PM

File Name : 50&Tech_1-31-08
Site Code : 00000000
Start Date : 1/31/2008
Page No : 1

Groups Printed- Unshifted - Bank 1

	US 50 From North					Techne Center Dr From East					US 50 From South					West Techne Center Dr From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	5	45	44	0	94	1	0	1	0	2	7	90	1	0	98	0	3	6	0	9	203
07:15 AM	11	52	27	0	90	3	0	1	0	4	27	196	10	0	233	1	2	11	0	14	341
07:30 AM	19	75	52	0	146	3	2	2	0	7	19	128	9	0	156	2	1	7	0	10	319
07:45 AM	31	70	68	0	169	5	2	0	0	7	38	153	19	0	210	2	0	10	0	12	398
Total	66	242	191	0	499	12	4	4	0	20	91	567	39	0	697	5	6	34	0	45	1261
08:00 AM	26	50	91	0	167	0	1	1	0	2	33	108	10	0	151	2	0	7	0	9	329
08:15 AM	16	40	75	0	131	6	1	1	0	8	18	82	6	0	106	1	1	8	0	10	255
08:30 AM	12	41	69	0	122	4	0	2	0	6	13	88	4	0	105	2	0	4	0	6	239
08:45 AM	11	50	63	0	124	3	0	0	0	3	26	82	6	0	114	3	0	0	0	3	244
Total	65	181	298	0	544	13	2	4	0	19	90	360	26	0	476	8	1	19	0	28	1067
*** BREAK ***																					
04:00 PM	3	156	7	0	166	39	0	21	0	60	4	65	0	0	69	16	1	14	0	31	326
04:15 PM	10	161	8	0	179	25	2	19	0	46	1	76	3	0	80	7	1	30	0	38	343
04:30 PM	3	164	9	0	176	82	4	20	0	106	4	80	2	0	86	14	0	31	0	45	413
04:45 PM	2	173	9	0	184	59	1	12	0	72	3	91	1	0	95	5	0	20	0	25	376
Total	18	654	33	0	705	205	7	72	0	284	12	312	6	0	330	42	2	95	0	139	1458
05:00 PM	4	175	6	0	185	71	1	16	0	88	1	84	1	0	86	7	2	27	0	36	395
05:15 PM	6	179	5	0	190	78	2	19	0	99	1	86	2	0	89	9	3	38	0	50	428
05:30 PM	2	190	12	0	204	50	0	12	0	62	2	69	1	0	72	8	2	27	0	37	375
05:45 PM	1	183	10	0	194	33	1	8	0	42	1	55	2	0	58	5	0	16	0	21	315
Total	13	727	33	0	773	232	4	55	0	291	5	294	6	0	305	29	7	108	0	144	1513
Grand Total	162	1804	555	0	2521	462	17	135	0	614	198	1533	77	0	1808	84	16	256	0	356	5299
Apprch %	6.4	71.6	22	0		75.2	2.8	22	0		11	84.8	4.3	0		23.6	4.5	71.9	0		
Total %	3.1	34	10.5	0	47.6	8.7	0.3	2.5	0	11.6	3.7	28.9	1.5	0	34.1	1.6	0.3	4.8	0	6.7	
Unshifted	162	1804	555	0	2521	462	17	135	0	614	198	1533	77	0	1808	84	16	256	0	356	5299
% Unshifted	100	100	100	0	100	100	100	100	0	100	100	100	100	0	100	100	100	100	0	100	100
Bank 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bank 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Techne Center Dr. & Eastman Dr.

Turning Movement
February 28, 2008
7 AM to 9 AM & 4 PM to 6PM

File Name : TechneCenter&Eastman_2-28-08
Site Code : 00000000
Start Date : 2/28/2008
Page No : 1

Groups Printed- Unshifted - Bank 1

	Better Way Rd From North					Summit Dr From East					Techne Center Dr From South					Eastman Dr From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	0	0	0	0	0	0	0	0	0	0	2	3	0	0	5	3	2	4	0	9	14
07:15 AM	1	0	0	0	1	0	1	0	0	1	3	4	1	0	8	13	11	27	0	51	61
07:30 AM	0	0	0	0	0	0	1	1	0	2	3	5	0	0	8	11	14	41	0	66	76
07:45 AM	3	0	0	0	3	0	0	0	0	0	1	4	0	0	5	20	21	53	0	94	102
Total	4	0	0	0	4	0	2	1	0	3	9	16	1	0	26	47	48	125	0	220	253
08:00 AM	3	0	0	0	3	1	2	0	0	3	1	9	1	0	11	19	20	68	0	107	124
08:15 AM	2	1	1	0	4	1	2	0	0	3	6	7	2	0	15	4	14	64	0	82	104
08:30 AM	2	0	1	0	3	0	1	0	0	1	3	7	1	0	11	11	13	29	0	53	68
08:45 AM	1	0	0	0	1	0	4	0	0	4	2	3	1	0	6	7	31	36	0	74	85
Total	8	1	2	0	11	2	9	0	0	11	12	26	5	0	43	41	78	197	0	316	381
*** BREAK ***																					
04:00 PM	19	3	0	0	22	0	10	2	0	12	0	1	11	0	12	2	1	0	0	3	49
04:15 PM	12	2	0	0	14	0	11	2	0	13	1	0	6	0	7	0	0	5	0	5	39
04:30 PM	36	6	1	0	43	0	24	1	0	25	1	0	7	0	8	1	1	3	0	5	81
04:45 PM	30	4	0	0	34	0	12	1	0	13	0	1	11	0	12	1	0	2	0	3	62
Total	97	15	1	0	113	0	57	6	0	63	2	2	35	0	39	4	2	10	0	16	231
05:00 PM	69	10	0	0	79	0	26	3	0	29	0	0	34	0	34	2	1	1	0	4	146
05:15 PM	47	4	0	0	51	0	20	1	0	21	0	0	19	0	19	5	1	2	0	8	99
05:30 PM	47	4	0	0	51	0	25	3	0	28	0	1	3	0	4	1	0	2	0	3	86
05:45 PM	40	5	0	0	45	0	10	1	0	11	0	0	5	0	5	1	1	1	0	3	64
Total	203	23	0	0	226	0	81	8	0	89	0	1	61	0	62	9	3	6	0	18	395
Grand Total	312	39	3	0	354	2	149	15	0	166	23	45	102	0	170	101	131	338	0	570	1260
Apprch %	88.1	11	0.8	0		1.2	89.8	9	0		13.5	26.5	60	0		17.7	23	59.3	0		
Total %	24.8	3.1	0.2	0	28.1	0.2	11.8	1.2	0	13.2	1.8	3.6	8.1	0	13.5	8	10.4	26.8	0	45.2	
Unshifted	312	39	3	0	354	2	149	15	0	166	23	45	102	0	170	101	131	338	0	570	1260
% Unshifted	100	100	100	0	100	100	100	100	0	100	100	100	100	0	100	100	100	100	0	100	100
Bank 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bank 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix B

Signal Warrant Analysis

Intersection Signal Warrant Analysis

Clermont County Engineer
2381 Clermont Center Drive
Batavia, Ohio 45103
(513) 732-8857

City/Twp. Miami Twp
Location: Eastman & Techne Center
Comments: Warrants Analysis

Site Code: 1
Count Date: 6/30/1905

Hourly Volumes

Start Time	EB Eastman (minor street) Hour Volume	SB Better Way (minor street) Hour Volume	NB Techne Center (major street) Hour Volume	WB Summit Dr (major street) Hour Volume	Intsct Total
6:00am	0	0	0	0	0
7:00am	26	3	220	4	253
8:00am	43	11	316	11	381
9:00am	0	0	0	0	0
10:00am	0	0	0	0	0
11:00am	0	0	0	0	0
12:00pm	0	0	0	0	0
1:00pm	0	0	0	0	0
2:00pm	0	0	0	0	0
3:00pm	0	0	0	0	0
4:00pm	39	63	16	113	231
5:00pm	62	89	18	226	395
6:00pm	0	0	0	0	0
7:00pm	0	0	0	0	0
8:00pm	0	0	0	0	0
9:00pm	0	0	0	0	0
10:00pm	0	0	0	0	0

Intersection Data

No. of approaching traffic lanes on major st.	1
No. of approaching traffic lanes on minor st.	1
Number of intersection approaches:	4
85th percentile major-street speed (mph):	35
Rural or Urban area? (R or U)	U

MUTCD WARRANT ANALYSIS

Warrant 1, Condition A - Minimum Vehicular Volume

Major street volume requirement:	500
Minor street volume requirement:	150
Warrant hours required:	8
Warrant hours met:	0
Condition A met?	**NO**

Warrant 1, Condition B - Interruption of Continuous Traffic

Major street volume requirement:	750
Minor street volume requirement:	75
Warrant hours required:	8
Warrant hours met:	0
Condition B met?	**NO**

Warrant 1 met? **NO**

Warrant 2, Four-Hour Vehicular Volume

(SEE FOUR HOUR VOLUME WARRANT CURVE, FIGURES 4C-1, 4C-2 - NEXT PAGE)

Warrant hours required:	4
Warrant hours met:	0
Warrant 2 met?	**NO**

Warrant 3 - Peak Hour

(SEE PEAK HOUR VOLUME WARRANT CURVE, FIGURES 4C-3, 4C-4 - NEXT PAGE)

Warrant hours required:	1
Warrant hours met:	0
Warrant 3 met?	**NO**

Warrant 4 - Pedestrian Volume

100 or more crossing for each of any 4 hours? (Y/N)	N
190 or more crossing during any 1 hour? (Y/N)	N
Number of gaps/hour with adequate length for pedestrian crossing?	n/a
Warrant 4 met?	**NO**

Warrant 5 - School Crossing

Is this signal near or part of a school crossing? (Y/N)	N
Warrant 5 met?	**NO**

Warrant 6 - Coordinated Signal System

Is signal to be used to control progressive movement throughout a system? (Y/N)	N
Warrant 6 met?	**NO**

Warrant 7 - Crash Experience

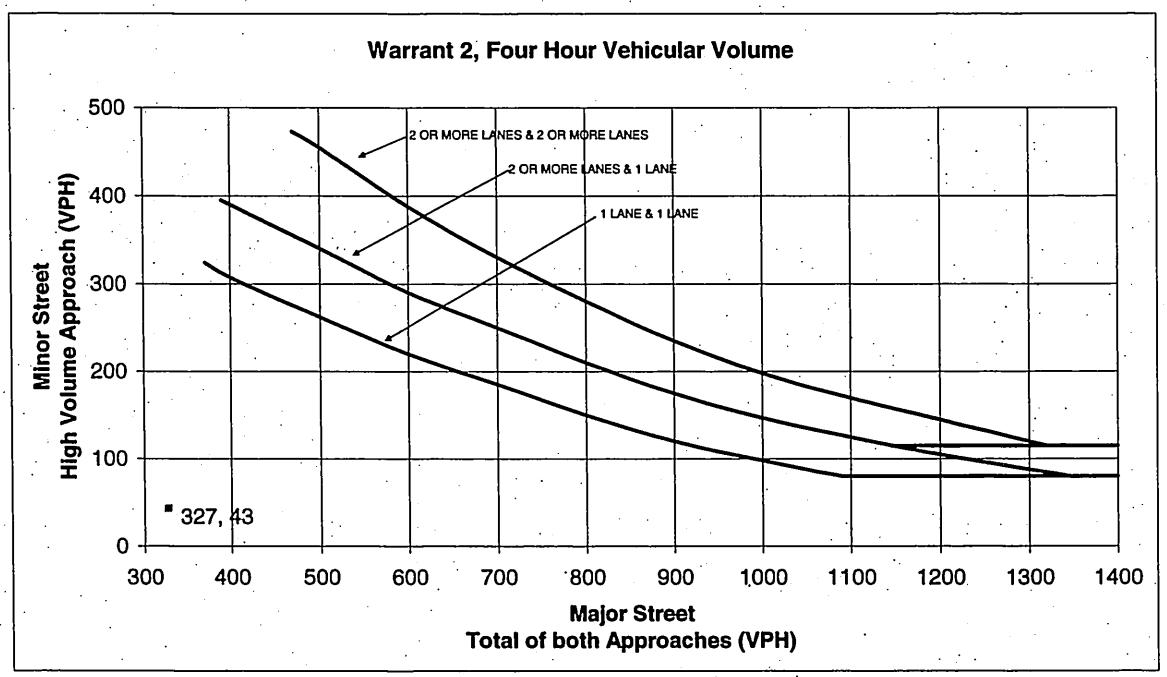
No. of intersection accidents within a one-year period susceptible to correction by a traffic signal (# or N/A):	n/a
Warrant 7 met?	**NO**

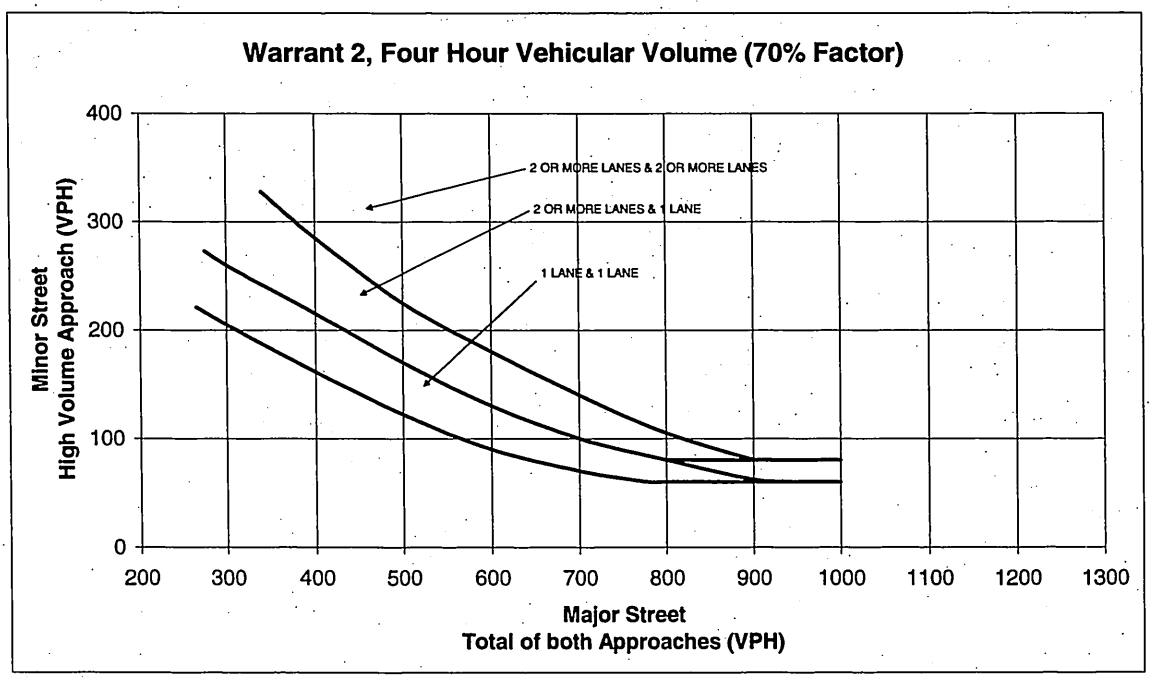
Warrant 8 - Roadway Network

Is signal to be used to control progressive movement throughout a roadway network? (Y/N)	N
Warrant 8 met?	**NO**

Intersection Signal Warrant Analysis

Clermont County Engineer
2381 Clermont Center Drive
Batavia, Ohio 45103
(513) 732-8857





Intersection Signal Warrant Analysis

Clermont County Engineer
2381 Clermont Center Drive
Batavia, Ohio 45103
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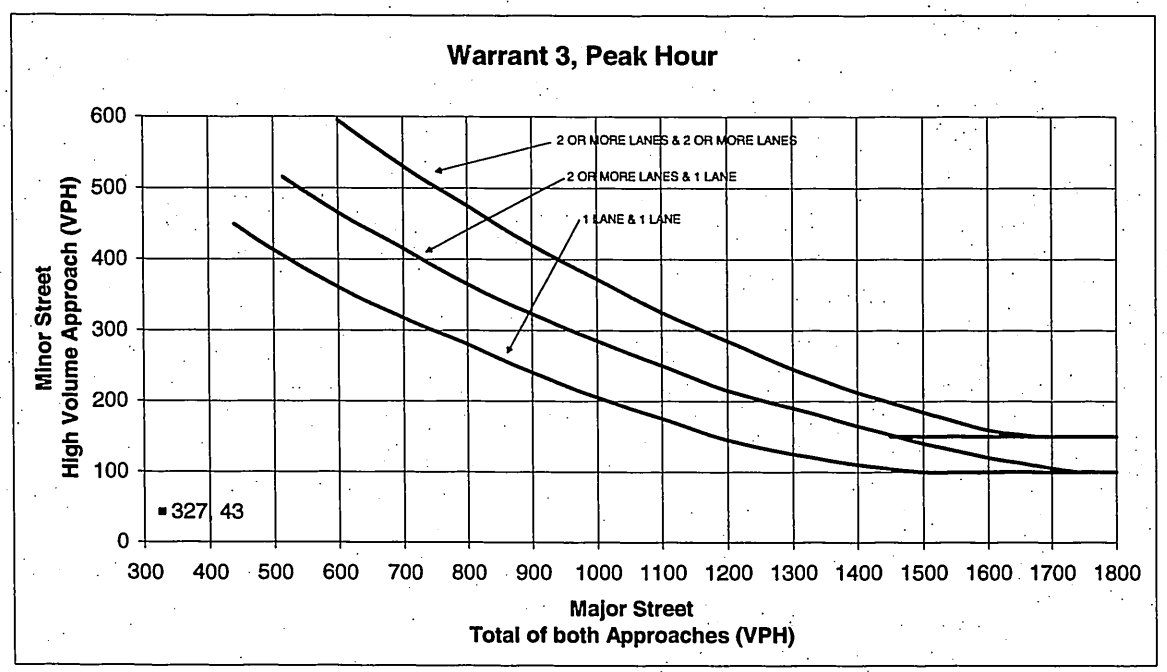
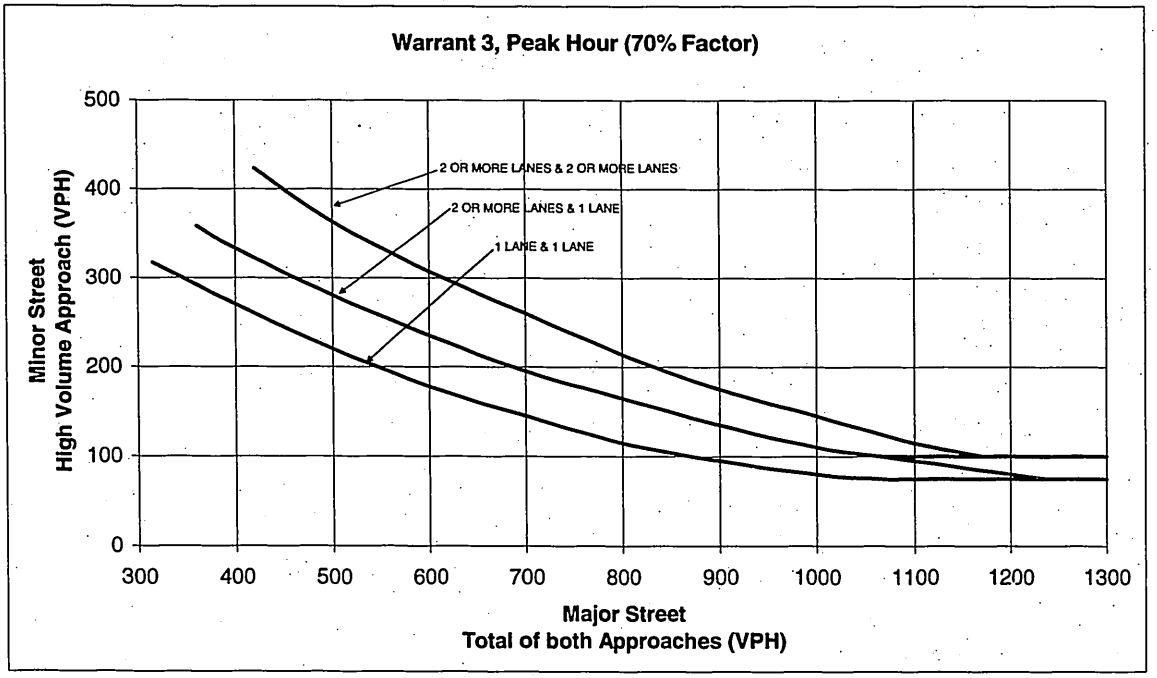




Appendix C

Intersection Capacity Analysis - 2010

HCS+: Signalized Intersections Release 5.2

Analyst: JPE
Agency:
Date: 3/3/2008
Period: AM Peak
Project ID: Existing Conditions
E/W St: US 450 Westbound

Inter.: US 50 & US 450
Area Type: All other areas
Jurisd: ODOT
Year : 2010

N/S St: US 50

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	0	0	0	0	0	2	1	0	0	1	0
LGConfig							L	T			TR	
Volume							400	320			214	153
Lane Width							12.0	12.0			12.0	
RTOR Vol												0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4			5	6	7	8
EB Left					NB	Left		P		
Thru						Thru		P		
Right						Right				
Peds						Peds				
WB Left					SB	Left				
Thru						Thru	P			
Right						Right	P			
Peds						Peds				
NB Right					EB	Right				
SB Right					WB	Right				
Green							21.0	20.0		
Yellow							3.0	3.0		
All Red							2.0	1.0		

Cycle Length: 50.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
Westbound								
Northbound								
L	1402	3505	0.32	0.40	10.9	B		
T	760	1900	0.47	0.40	13.1	B	11.9	B
Southbound								
TR	753	1793	0.54	0.42	13.7	B	13.7	B

Intersection Delay = 12.5 (sec/veh) Intersection LOS = B

HCS+: Signalized Intersections Release 5.2

Analyst: JPE
Agency:
Date: 3/3/2008
Period: PM Peak
Project ID: Existing Conditions
E/W St: US 450 Westbound

Inter.: US 50 & US 450
Area Type: All other areas
Jurisd: ODOT
Year : 2010

N/S St: US 50

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	0	0	0	0	0	2	1	0	0	1	0
LGConfig							L	T			TR	
Volume							1169	508			190	57
Lane Width							12.0	12.0			12.0	
RTOR Vol												0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4			5	6	7	8
EB Left					NB	Left		P		
Thru						Thru		P		
Right						Right				
Peds						Peds				
WB Left					SB	Left				
Thru						Thru	P			
Right						Right	P			
Peds						Peds				
NB Right					EB	Right				
SB Right					WB	Right				
Green							22.0	29.0		
Yellow							3.0	3.0		
All Red							2.0	1.0		

Cycle Length: 60.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
Westbound								
Northbound								
L	1694	3505	0.77	0.48	16.1	B		
T	918	1900	0.61	0.48	14.5	B	15.6	B
Southbound								
TR	675	1841	0.41	0.37	15.9	B	15.9	B

Intersection Delay = 15.7 (sec/veh) Intersection LOS = B

HCS+: Signalized Intersections Release 5.2

Analyst: JPE
Agency:
Date: 3/3/2008
Period: AM Peak
Project ID: Existing Conditions
E/W St: US 450 Eastbound

Inter.: US 50 & US 450
Area Type: All other areas
Jurisd: ODOT
Year : 2010

N/S St: US 50

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	1	1	0	2	0	2	1	1	1	0
LGConfig	L	T	R	L		R		T	R	L	T	
Volume	176	538	461	18		46		627	8	111	118	
Lane Width	12.0	12.0	12.0	12.0		12.0		12.0	12.0	12.0	12.0	
RTOR Vol			0			0			0			

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination		1	2	3	4			5	6	7	8
EB	Left	P	P			NB	Left				
	Thru	P	P				Thru		P		
	Right	P	P				Right		P		
	Peds						Peds				
WB	Left		P			SB	Left	P	P		
	Thru						Thru		P		
	Right		P				Right				
	Peds						Peds				
NB	Right					EB	Right	P			
SB	Right					WB	Right				
Green		17.5	12.7					5.0	19.8		
Yellow		0.0	3.0					3.0	3.0		
All Red		0.0	2.0					2.0	2.0		

Cycle Length: 70.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	779	1805	0.25	0.43	13.5	B		
T	820	1900	0.73	0.43	22.2	C	16.7	B
R	927	1615	0.55	0.57	11.7	B		
Westbound								
L	151	833	0.13	0.18	25.8	C		
							24.7	C
R	519	2859	0.10	0.18	24.3	C		
Northbound								
T	1023	3618	0.68	0.28	26.0	C	25.9	C
R	457	1615	0.02	0.28	18.2	B		
Southbound								
L	255	1805	0.48	0.43	20.2	C		
T	537	1900	0.24	0.28	20.4	C	20.3	C

Intersection Delay = 20.1 (sec/veh) Intersection LOS = C

HCS+: Signalized Intersections Release 5.2

Analyst: JPE
Agency:
Date: 3/3/2008
Period: PM Peak
Project ID: Existing Conditions
E/W St: US 450 Eastbound

Inter.: US 50 & US 450
Area Type: All other areas
Jurisd: ODOT
Year : 2010

N/S St: US 50

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	1	1	0	1	0	2	0	1	1	0
LGConfig	L	T	R	L		R		TR		L	T	
Volume	230	64	503	6		764		782	13	23	180	
Lane Width	12.0	12.0	12.0	12.0		12.0		12.0		12.0	12.0	
RTOR Vol			0			0			0			

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination		1	2	3	4			5	6	7	8
EB	Left	P				NB	Left				
	Thru		P				Thru	P			
	Right		P				Right	P			
	Peds						Peds				
WB	Left	P				SB	Left	P			
	Thru						Thru	P			
	Right		P				Right				
	Peds						Peds				
NB	Right					EB	Right				
SB	Right					WB	Right				
Green		15.0	42.5					20.5			
Yellow		3.0	3.0					3.0			
All Red		1.0	1.0					1.0			

Cycle Length: 90.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	301	1805	0.85	0.17	61.3	E		
T	897	1900	0.08	0.47	13.2	B	34.7	C
R	763	1615	0.73	0.47	25.3	C		
Westbound								
L	301	1805	0.02	0.17	31.5	C		
							91.3	F
R	763	1615	1.11	0.47	91.8	F		
Northbound								
TR	822	3609	1.07	0.23	88.0	F	88.0	F
Southbound								
L	85	371	0.31	0.23	37.9	D		
T	433	1900	0.46	0.23	33.5	C	34.0	C

Intersection Delay = 68.2 (sec/veh) Intersection LOS = E

HCS+: Signalized Intersections Release 5.2

Analyst: JPE
Agency:
Date: 2/24/09
Period: AM Peak
Project ID: Improved Geometry
E/W St: US 450 Eastbound

Inter.: US 50 & US 450
Area Type: All other areas
Jurisd: ODOT
Year : 2010

N/S St: US 50

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	1	1	0	2	0	2	0	1	1	0
LGConfig	L	T	R	L		R		TR		L	T	
Volume	176	538	461	18		46		627	8	111	118	
Lane Width	12.0	12.0	12.0	12.0		12.0		12.0		12.0	12.0	
RTOR Vol			0			0			0			

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4			5	6	7	8
EB Left	P				NB	Left				
Thru	P	P				Thru		P		
Right	P	P				Right		P		
Peds						Peds				
WB Left		P			SB	Left	P	P		
Thru						Thru		P		
Right		P				Right				
Peds						Peds				
NB Right					EB	Right	P			
SB Right					WB	Right				
Green	31.0	12.0					15.0	26.0		
Yellow	3.0	3.0					3.0	3.0		
All Red	1.0	1.0					1.0	1.0		

Cycle Length: 100.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	560	1805	0.35	0.31	28.4	C		
T	893	1900	0.67	0.47	24.5	C	19.4	B
R	1066	1615	0.48	0.66	10.0+	B		
Westbound								
L	100	833	0.20	0.12	44.1	D		
							41.4	D
R	343	2859	0.15	0.12	40.3	D		
Northbound								
TR	939	3611	0.75	0.26	39.6	D	39.6	D
Southbound								
L	350	1805	0.35	0.45	21.2	C		
T	494	1900	0.27	0.26	30.7	C	26.1	C

Intersection Delay = 26.9 (sec/veh) Intersection LOS = C

HCS+: Signalized Intersections Release 5.2

Analyst: JPE
Agency:
Date: 2/24/09
Period: PM Peak
Project ID: Improved Geometry
E/W St: US 450 Eastbound

Inter.: US 50 & US 450
Area Type: All other areas
Jurisd: ODOT
Year : 2010

N/S St: US 50

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	1	1	0	2	0	2	0	1	1	0
LGConfig	L	T	R	L		R		TR		L	T	
Volume	230	64	503	6		764		782	13	23	180	
Lane Width	12.0	12.0	12.0	12.0		12.0		12.0		12.0	12.0	
RTOR Vol			0			0			0			

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination		1	2	3	4			5	6	7	8
EB	Left	P				NB	Left				
	Thru		P				Thru	P			
	Right		P				Right	P			
	Peds						Peds				
WB	Left	P				SB	Left	P			
	Thru						Thru	P			
	Right		P				Right				
	Peds						Peds				
NB	Right					EB	Right				
SB	Right					WB	Right				
Green		11.5	27.7					18.8			
Yellow		3.0	3.0					3.0			
All Red		1.0	1.0					1.0			

Cycle Length: 70.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	297	1805	0.86	0.16	55.0-	D		
T	752	1900	0.09	0.40	13.5	B	39.1	D
R	639	1615	0.87	0.40	35.0-	C		
Westbound								
L	297	1805	0.02	0.16	24.7	C		
							22.8	C
R	1131	2859	0.75	0.40	22.8	C		
Northbound								
TR	969	3609	0.91	0.27	38.9	D	38.9	D
Southbound								
L	109	404	0.24	0.27	25.1	C		
T	510	1900	0.39	0.27	23.2	C	23.4	C

Intersection Delay = 32.9 (sec/veh) Intersection LOS = C

HCS+: Signalized Intersections Release 5.2

Analyst: JPE
Agency:
Date: 3/3/2008
Period: AM Peak
Project ID: Existing Geometry
E/W St: Techne Center

Inter.: US 50 & Techne Center
Area Type: All other areas
Jurisd: ODOT
Year : 2010

N/S St: US 50

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	0	1	1	0	1	1	0	1	1	0
LGConfig	L	TR		L	TR		L	TR		L	TR	
Volume	34	6	5	4	4	12	39	567	91	191	242	66
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	
RTOR Vol			0			0			0			0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination		1	2	3	4			5	6	7	8
EB	Left	A				NB	Left	P	P		
	Thru	A					Thru		P		
	Right	A					Right		P		
	Peds						Peds				
WB	Left	A				SB	Left	P	P		
	Thru	A					Thru		P		
	Right	A					Right		P		
	Peds						Peds				
NB	Right					EB	Right				
SB	Right					WB	Right				
Green		19.0						10.0	39.0		
Yellow		3.0						3.0	3.0		
All Red		1.0						1.0	1.0		

Cycle Length: 80.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	337	1418	0.11	0.24	24.0	C		
TR	420	1768	0.03	0.24	23.5	C	23.9	C
Westbound								
L	338	1423	0.01	0.24	23.3	C		
TR	399	1682	0.04	0.24	23.5	C	23.5	C
Northbound								
L	666	1805	0.06	0.66	5.5	A		
TR	907	1861	0.81	0.49	24.9	C	23.8	C
Southbound								
L	364	1805	0.58	0.66	18.7	B		
TR	897	1839	0.38	0.49	14.1	B	15.9	B

Intersection Delay = 20.7 (sec/veh) Intersection LOS = C

HCS+: Signalized Intersections Release 5.2

Analyst: JPE
Agency:
Date: 3/3/2008
Period: PM Peak
Project ID: Existing Geometery
E/W St: Techne Center

Inter.: US 50 & Techne Center
Area Type: All other areas
Jurisd: ODOT
Year : 2010

N/S St: US 50

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	0	1	1	0	1	1	0	1	1	0
LGConfig	L	TR		L	TR		L	TR		L	TR	
Volume	108	7	29	55	4	232	6	294	5	33	727	13
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	
RTOR Vol			0			0			0			0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination		1	2	3	4			5	6	7	8
EB	Left	A				NB	Left	P			
	Thru		A				Thru		P		
	Right		A				Right		P		
	Peds						Peds				
WB	Left	A				SB	Left	P			
	Thru		A				Thru		P		
	Right		A				Right		P		
	Peds						Peds				
NB	Right					EB	Right				
SB	Right					WB	Right				
Green		12.0	22.0					10.0	50.0		
Yellow		3.0	3.0					3.0	3.0		
All Red		1.0	1.0					1.0	1.0		

Cycle Length: 110.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	197	1805	0.61	0.11	52.2	D		
TR	334	1672	0.12	0.20	36.2	D	48.2	D
Westbound								
L	197	1805	0.31	0.11	46.1	D		
TR	324	1619	0.81	0.20	56.1	E	54.2	D
Northbound								
L	164	1805	0.04	0.09	46.1	D		
TR	861	1895	0.39	0.45	21.2	C	21.7	C
Southbound								
L	164	1805	0.23	0.09	49.6	D		
TR	861	1895	0.95	0.45	50.4	D	50.3	D

Intersection Delay = 45.1 (sec/veh) Intersection LOS = D

HCS+: Signalized Intersections Release 5.2

Analyst: JPE
Agency:
Date: 3/3/2008
Period: AM Peak
Project ID: Improved Geometry
E/W St: Techne Center

Inter.: US 50 & Techne Center
Area Type: All other areas
Jurisd: ODOT
Year : 2010

N/S St: US 50

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	0	1	1	0	1	1	0	1	1	1
LGConfig	L	TR		L	TR		L	TR		L	T	R
Volume	34	6	5	4	4	12	39	567	91	191	242	66
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	12.0
RTOR Vol			0			0			0			0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination		1	2	3	4			5	6	7	8
EB	Left	A				NB	Left	P	P		
	Thru	A					Thru		P		
	Right	A					Right		P		
	Peds						Peds				
WB	Left	A				SB	Left	P	P		
	Thru	A					Thru		P		
	Right	A					Right		P		
	Peds						Peds				
NB	Right					EB	Right				
SB	Right					WB	Right				
Green		18.0						10.0	40.0		
Yellow		3.0						3.0	3.0		
All Red		1.0						1.0	1.0		

Cycle Length: 80.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	319	1418	0.12	0.22	24.9	C		
TR	398	1768	0.03	0.22	24.2	C	24.7	C
Westbound								
L	320	1423	0.01	0.22	24.1	C		
TR	378	1682	0.04	0.22	24.3	C	24.3	C
Northbound								
L	747	1805	0.06	0.68	4.8	A		
TR	931	1861	0.79	0.50	23.1	C	22.1	C
Southbound								
L	379	1805	0.56	0.68	17.2	B		
T	950	1900	0.28	0.50	12.4	B	14.0	B
R	808	1615	0.09	0.50	10.7	B		

Intersection Delay = 19.0 (sec/veh) Intersection LOS = B

HCS+: Signalized Intersections Release 5.2

Analyst: JPE
Agency:
Date: 3/3/2008
Period: PM Peak
Project ID: Improved Geometry
E/W St: Techne Center

Inter.: US 50 & Techne Center
Area Type: All other areas
Jurisd: ODOT
Year : 2010

N/S St: US 50

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	0	1	1	0	1	1	0	1	1	1
LGConfig	L	TR		L	TR		L	TR		L	T	R
Volume	108	7	29	55	4	232	6	294	5	33	727	13
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	12.0
RTOR Vol			0			0			0			0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4			5	6	7	8
EB Left	A				NB	Left	P			
Thru		A				Thru		P		
Right		A				Right		P		
Peds						Peds				
WB Left	A				SB	Left	P			
Thru		A				Thru		P		
Right		A				Right		P		
Peds						Peds				
NB Right					EB	Right				
SB Right					WB	Right				
Green	12.0	23.0					10.0	49.0		
Yellow	3.0	3.0					3.0	3.0		
All Red	1.0	1.0					1.0	1.0		

Cycle Length: 110.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	197	1805	0.61	0.11	52.2	D		
TR	350	1672	0.11	0.21	35.4	D	48.0	D
Westbound								
L	197	1805	0.31	0.11	46.1	D		
TR	339	1619	0.77	0.21	51.6	D	50.6	D
Northbound								
L	164	1805	0.04	0.09	46.1	D		
TR	844	1895	0.39	0.45	21.9	C	22.4	C
Southbound								
L	164	1805	0.23	0.09	49.6	D		
T	846	1900	0.96	0.45	51.2	D	50.6	D
R	719	1615	0.02	0.45	17.1	B		

Intersection Delay = 44.6 (sec/veh) Intersection LOS = D

Phone:
E-Mail:
Fax:

ALL-WAY STOP CONTROL(AWSC) ANALYSIS

Analyst:
Agency/Co.: CCEO
Date Performed: 4/23/2008
Analysis Time Period: AM Peak
Intersection:
Jurisdiction: Miami Twp
Units: U. S. Customary
Analysis Year: 2010
Project ID: Existing Conditions
East/West Street: Eastman
North/South Street: Techne Center

Worksheet 2 - Volume Adjustments and Site Characteristics

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	125	467	47	1	57	0	1	16	9	0	0	4
% Thrus Left Lane												

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	LTR		LTR		LTR		LTR	
PHF	1.00		1.00		1.00		1.00	
Flow Rate	639		58		26		4	
% Heavy Veh	0		0		0		0	
No. Lanes	1		1		1		1	
Opposing-Lanes	1		1		1		1	
Conflicting-lanes	1		1		1		1	
Geometry group	1		1		1		1	

Duration, T 0.25 hrs.

Worksheet 3 - Saturation Headway Adjustment Worksheet

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Flow Rates:								
Total in Lane	639		58		26		4	
Left-Turn	125		1		1		0	
Right-Turn	47		0		9		4	
Prop. Left-Turns	0.2		0.0		0.0		0.0	
Prop. Right-Turns	0.1		0.0		0.3		1.0	
Prop. Heavy Vehicle	0.0		0.0		0.0		0.0	
Geometry Group	1		1		1		1	
Adjustments Exhibit 17-33:								
hLT-adj	0.2		0.2		0.2		0.2	

hRT-adj	-0.6	-0.6	-0.6	-0.6
hHV-adj	1.7	1.7	1.7	1.7
hadj, computed	-0.0	0.0	-0.2	-0.6

Worksheet 4 - Departure Headway and Service Time

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Flow rate	639		58		26		4	
hd, initial value	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20
x, initial	0.57		0.05		0.02		0.00	
hd, final value	4.04		4.59		5.20		4.84	
x, final value	0.72		0.07		0.04		0.01	
Move-up time, m	2.0		2.0		2.0		2.0	
Service Time	2.0		2.6		3.2		2.8	

Worksheet 5 - Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Flow Rate	639		58		26		4	
Service Time	2.0		2.6		3.2		2.8	
Utilization, x	0.72		0.07		0.04		0.01	
Dep. headway, hd	4.04		4.59		5.20		4.84	
Capacity	889		308		276		254	
Delay	16.57		7.96		8.40		7.86	
LOS	C		A		A		A	
Approach:								
Delay	16.57		7.96		8.40		7.86	
LOS	C		A		A		A	

Intersection Delay 15.54 Intersection LOS C

Phone:
E-Mail:
Fax:

ALL-WAY STOP CONTROL(AWSC) ANALYSIS

Analyst:
Agency/Co.: CCEO
Date Performed: 4/23/2008
Analysis Time Period: PM Peak
Intersection:
Jurisdiction: Miami Twp
Units: U. S. Customary
Analysis Year: 2010
Project ID:
East/West Street: Eastman
North/South Street: Techne Center

Worksheet 2 - Volume Adjustments and Site Characteristics

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	6	70	9	8	463	0	61	1	0	0	23	203
% Thrus Left Lane												

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	LTR		LTR		LTR		LTR	
PHF	1.00		1.00		1.00		1.00	
Flow Rate	85		471		62		226	
% Heavy Veh	0		0		0		0	
No. Lanes	1		1		1		1	
Opposing-Lanes	1		1		1		1	
Conflicting-lanes	1		1		1		1	
Geometry group	1		1		1		1	

Duration, T 0.25 hrs.

Worksheet 3 - Saturation Headway Adjustment Worksheet

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Flow Rates:								
Total in Lane	85		471		62		226	
Left-Turn	6		8		61		0	
Right-Turn	9		0		0		203	
Prop. Left-Turns	0.1		0.0		1.0		0.0	
Prop. Right-Turns	0.1		0.0		0.0		0.9	
Prop. Heavy Vehicle	0.0		0.0		0.0		0.0	
Geometry Group	1		1		1		1	
Adjustments Exhibit 17-33:								
hLT-adj	0.2		0.2		0.2		0.2	

hRT-adj	-0.6	-0.6	-0.6	-0.6
hHV-adj	1.7	1.7	1.7	1.7
hadj, computed	-0.0	0.0	0.2	-0.5

Worksheet 4 - Departure Headway and Service Time

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Flow rate	85		471		62		226	
hd, initial value	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20
x, initial	0.08		0.42		0.06		0.20	
hd, final value	5.27		4.80		5.89		4.89	
x, final value	0.12		0.63		0.10		0.31	
Move-up time, m	2.0		2.0		2.0		2.0	
Service Time	3.3		2.8		3.9		2.9	

Worksheet 5 - Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Flow Rate	85		471		62		226	
Service Time	3.3		2.8		3.9		2.9	
Utilization, x	0.12		0.63		0.10		0.31	
Dep. headway, hd	5.27		4.80		5.89		4.89	
Capacity	335		721		312		476	
Delay	9.02		15.56		9.55		10.03	
LOS	A		C		A		B	
Approach:								
Delay	9.02		15.56		9.55		10.03	
LOS	A		C		A		B	

Intersection Delay 12.98 Intersection LOS B

Appendix D

Intersection Capacity Analysis - 2030

HCS+: Signalized Intersections Release 5.2

Analyst: JPE
Agency:
Date: 3/3/2008
Period: AM Peak
Project ID: Existing Conditions
E/W St: US 450 Westbound

Inter.: US 50 & US 450
Area Type: All other areas
Jurisd: ODOT
Year : 2030

N/S St: US 50

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	0	0	0	0	0	2	1	0	0	1	0
LGConfig							L	T			TR	
Volume							483	387			245	187
Lane Width							12.0	12.0			12.0	
RTOR Vol												0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4			5	6	7	8
EB Left					NB	Left		P		
Thru						Thru		P		
Right						Right				
Peds						Peds				
WB Left					SB	Left				
Thru						Thru	P			
Right						Right	P			
Peds						Peds				
NB Right					EB	Right				
SB Right					WB	Right				
Green							26.0	25.0		
Yellow							3.0	3.0		
All Red							2.0	1.0		

Cycle Length: 60.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
Westbound								
Northbound								
L	1460	3505	0.37	0.42	12.8	B		
T	792	1900	0.54	0.42	15.9	B	14.1	B
Southbound								
TR	775	1789	0.62	0.43	16.9	B	16.9	B

Intersection Delay = 15.0 (sec/veh) Intersection LOS = B

HCS+: Signalized Intersections Release 5.2

Analyst: JPE
Agency:
Date: 3/3/2008
Period: PM Peak
Project ID: Existing Conditions
E/W St: US 450 Westbound

Inter.: US 50 & US 450
Area Type: All other areas
Jurisd: ODOT
Year : 2030

N/S St: US 50

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	0	0	0	0	0	2	1	0	0	1	0
LGConfig							L	T			TR	
Volume							1359	405			228	70
Lane Width							12.0	12.0			12.0	
RTOR Vol												0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left					NB Left	P		
Thru					Thru	P		
Right					Right			
Peds					Peds			
WB Left					SB Left			
Thru					Thru	P		
Right					Right	P		
Peds					Peds			
NB Right					EB Right			
SB Right					WB Right			
Green					21.0	30.0		
Yellow					3.0	3.0		
All Red					2.0	1.0		

Cycle Length: 60.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
Westbound								
Northbound								
L	1753	3505	0.86	0.50	19.0	B		
T	950	1900	0.47	0.50	11.5	B	17.3	B
Southbound								
TR	644	1840	0.51	0.35	18.4	B	18.4	B

Intersection Delay = 17.4 (sec/veh) Intersection LOS = B

HCS+: Signalized Intersections Release 5.2

Analyst: JPE
Agency:
Date: 3/3/2008
Period: AM Peak
Project ID: Existing Conditions
E/W St: US 450 Eastbound

Inter.: US 50 & US 450
Area Type: All other areas
Jurisd: ODOT
Year : 2030

N/S St: US 50

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	1	1	0	1	0	2	0	1	1	0
LGConfig	L	T	R	L		R		TR		L	T	
Volume	215	580	563	19		47		766	9	120	144	
Lane Width	12.0	12.0	12.0	12.0		12.0		12.0		12.0	12.0	
RTOR Vol			0			0			0			

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination		1	2	3	4			5	6	7	8
EB	Left	P	P			NB	Left				
	Thru	P	P				Thru		P		
	Right	P	P				Right		P		
	Peds						Peds				
WB	Left		P			SB	Left	P	P		
	Thru						Thru		P		
	Right		P				Right				
	Peds						Peds				
NB	Right					EB	Right	P			
SB	Right					WB	Right				
Green		18.0	13.0					10.0	24.0		
Yellow		0.0	3.0					3.0	3.0		
All Red		0.0	2.0					2.0	2.0		

Cycle Length: 80.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	699	1805	0.34	0.39	18.6	B		
T	736	1900	0.88	0.39	36.5	D	25.0	C
R	929	1615	0.67	0.57	15.7	B		
Westbound								
L	95	585	0.22	0.16	34.4	C		
							31.8	C
R	262	1615	0.20	0.16	30.7	C		
Northbound								
TR	1083	3611	0.80	0.30	31.8	C	31.8	C
Southbound								
L	321	1805	0.41	0.49	17.9	B		
T	570	1900	0.28	0.30	22.6	C	20.5	C

Intersection Delay = 26.8 (sec/veh) Intersection LOS = C

HCS+: Signalized Intersections Release 5.2

Analyst: JPE
Agency:
Date: 3/3/2008
Period: PM Peak
Project ID: Existing Conditions
E/W St: US 450 Eastbound

Inter.: US 50 & US 450
Area Type: All other areas
Jurisd: ODOT
Year : 2030

N/S St: US 50

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	1	1	0	1	0	2	0	1	1	0
LGConfig	L	T	R	L		R		TR		L	T	
Volume	281	67	614	7		849		955	14	24	220	
Lane Width	12.0	12.0	12.0	12.0		12.0		12.0		12.0	12.0	
RTOR Vol			0			0			0			

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4			5	6	7	8
EB Left	P				NB	Left				
Thru		P				Thru	P			
Right		P				Right	P			
Peds						Peds				
WB Left	P				SB	Left	P			
Thru						Thru	P			
Right		P				Right				
Peds						Peds				
NB Right					EB	Right				
SB Right					WB	Right				
Green	15.0	40.5					21.5			
Yellow	3.0	3.0					3.0			
All Red	1.0	1.0					1.0			

Cycle Length: 89.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	304	1805	1.03	0.17	95.5	F		
T	865	1900	0.09	0.46	13.9	B	56.0	E
R	735	1615	0.93	0.46	42.5	D		
Westbound								
L	304	1805	0.03	0.17	31.1	C		
							160.8	F
R	735	1615	1.28	0.46	161.9	F		
Northbound								
TR	872	3610	1.24	0.24	149.5	F	149.5	F
Southbound								
L	85	353	0.32	0.24	37.3	D		
T	459	1900	0.53	0.24	33.7	C	34.1	C

Intersection Delay = 113.7 (sec/veh) Intersection LOS = F

HCS+: Signalized Intersections Release 5.2

Analyst: JPE
Agency:
Date: 2/24/09
Period: AM Peak
Project ID: Improved Geometry
E/W St: US 450 Eastbound

Inter.: US 50 & US 450
Area Type: All other areas
Jurisd: ODOT
Year : 2030

N/S St: US 50

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	1	1	0	2	0	2	0	1	1	0
LGConfig	L	T	R	L		R		TR		L	T	
Volume	563	580	215	19		47		766	9	120	144	
Lane Width	12.0	12.0	12.0	12.0		12.0		12.0		12.0	12.0	
RTOR Vol			0			0			0			

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination		1	2	3	4			5	6	7	8
EB	Left	P				NB	Left				
	Thru	P	P				Thru		P		
	Right	P	P				Right		P		
	Peds						Peds				
WB	Left		P			SB	Left	P	P		
	Thru						Thru		P		
	Right		P				Right				
	Peds						Peds				
NB	Right					EB	Right	P			
SB	Right					WB	Right				
Green		36.0	12.0					10.0	29.0		
Yellow		3.0	3.0					3.0	3.0		
All Red		1.0	1.0					1.0	1.0		

Cycle Length: 103.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	631	1805	0.99	0.35	67.3	E		
T	959	1900	0.67	0.50	22.8	C	39.0	D
R	1035	1615	0.23	0.64	8.3	A		
Westbound								
L	93	798	0.23	0.12	46.8	D		
							43.4	D
R	333	2859	0.16	0.12	41.9	D		
Northbound								
TR	1017	3611	0.85	0.28	43.6	D	43.6	D
Southbound								
L	249	1805	0.53	0.42	30.3	C		
T	535	1900	0.30	0.28	30.5	C	30.4	C

Intersection Delay = 39.6 (sec/veh) Intersection LOS = D

HCS+: Signalized Intersections Release 5.2

Analyst: JPE
Agency:
Date: 2/24/09
Period: PM Peak
Project ID: Improved Geometry
E/W St: US 450 Eastbound

Inter.: US 50 & US 450
Area Type: All other areas
Jurisd: ODOT
Year : 2030

N/S St: US 50

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	2	1	1	1	0	2	0	2	0	1	1	0
LGConfig	L	T	R	L		R		TR		L	T	
Volume	281	67	614	7		849		955	14	24	220	
Lane Width	12.0	12.0	12.0	12.0		12.0		12.0		12.0	12.0	
RTOR Vol			0			0			0			

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left	P				NB Left			
Thru		P			Thru	P		
Right		P			Right	P		
Peds					Peds			
WB Left	P				SB Left	P		
Thru					Thru	P		
Right		P			Right			
Peds					Peds			
NB Right					EB Right			
SB Right					WB Right			
Green	14.0	43.0			31.0			
Yellow	3.0	3.0			3.0			
All Red	1.0	1.0			1.0			

Cycle Length: 100.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	491	3505	0.64	0.14	46.7	D		
T	817	1900	0.09	0.43	17.1	B	52.1	D
R	694	1615	0.98	0.43	58.3	E		
Westbound								
L	253	1805	0.03	0.14	37.4	D		
							28.9	C
R	1229	2859	0.77	0.43	28.9	C		
Northbound								
TR	1119	3610	0.96	0.31	53.2	D	53.2	D
Southbound								
L	76	245	0.36	0.31	39.3	D		
T	589	1900	0.41	0.31	29.5	C	30.4	C

Intersection Delay = 44.2 (sec/veh) Intersection LOS = D

HCS+: Signalized Intersections Release 5.2

Analyst: JPE
Agency:
Date: 3/3/2008
Period: AM Peak
Project ID: Existing Conditions
E/W St: Techne Center

Inter.: US 50 & Techne Center
Area Type: All other areas
Jurisd: ODOT
Year : 2030

N/S St: US 50

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	0	1	1	0	1	1	0	1	1	0
LGConfig	L	TR		L	TR		L	TR		L	TR	
Volume	34	6	5	4	4	12	39	693	91	191	296	66
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	
RTOR Vol			0			0			0			0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination		1	2	3	4			5	6	7	8
EB	Left	A				NB	Left	P	P		
	Thru	A					Thru		P		
	Right	A					Right		P		
	Peds						Peds				
WB	Left	A				SB	Left	P	P		
	Thru	A					Thru		P		
	Right	A					Right		P		
	Peds						Peds				
NB	Right					EB	Right				
SB	Right					WB	Right				
Green		18.0						10.0	45.0		
Yellow		3.0						3.0	3.0		
All Red		1.0						1.0	1.0		

Cycle Length: 85.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	300	1418	0.13	0.21	27.3	C		
TR	374	1768	0.03	0.21	26.6	C	27.2	C
Westbound								
L	301	1423	0.01	0.21	26.5	C		
TR	356	1682	0.05	0.21	26.7	C	26.7	C
Northbound								
L	652	1805	0.07	0.69	5.1	A		
TR	988	1867	0.88	0.53	28.9	C	27.7	C
Southbound								
L	301	1805	0.70	0.69	33.9	C		
TR	978	1848	0.41	0.53	13.3	B	20.4	C

Intersection Delay = 24.9 (sec/veh) Intersection LOS = C

HCS+: Signalized Intersections Release 5.2

Analyst: JPE
Agency:
Date: 3/3/2008
Period: PM Peak
Project ID: Existing Geometery
E/W St: Techne Center

Inter.: US 50 & Techne Center
Area Type: All other areas
Jurisd: ODOT
Year : 2030

N/S St: US 50

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	0	1	1	0	1	1	0	1	1	0
LGConfig	L	TR		L	TR		L	TR		L	TR	
Volume	108	7	29	55	4	232	6	359	5	33	888	13
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	
RTOR Vol			0			0			0			0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination		1	2	3	4			5	6	7	8
EB	Left	A				NB	Left	P			
	Thru		A				Thru		P		
	Right		A				Right		P		
	Peds						Peds				
WB	Left	A				SB	Left	P			
	Thru		A				Thru		P		
	Right		A				Right		P		
	Peds						Peds				
NB	Right					EB	Right				
SB	Right					WB	Right				
Green		12.0	21.0					10.0	61.0		
Yellow		3.0	3.0					3.0	3.0		
All Red		1.0	1.0					1.0	1.0		

Cycle Length: 120.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	181	1805	0.66	0.10	60.8	E		
TR	293	1672	0.14	0.17	42.1	D	56.1	E
Westbound								
L	181	1805	0.34	0.10	51.4	D		
TR	283	1619	0.93	0.17	83.2	F	77.2	E
Northbound								
L	150	1805	0.05	0.08	51.2	D		
TR	964	1896	0.42	0.51	19.8	B	20.3	C
Southbound								
L	150	1805	0.25	0.08	55.4	E		
TR	964	1896	1.04	0.51	68.9	E	68.4	E

Intersection Delay = 58.6 (sec/veh) Intersection LOS = E

HCS+: Signalized Intersections Release 5.2

Analyst: JPE
Agency:
Date: 3/3/2008
Period: AM Peak
Project ID: Improved Geometery
E/W St: Techne Center

Inter.: US 50 & Techne Center
Area Type: All other areas
Jurisd: ODOT
Year : 2030

N/S St: US 50

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	0	1	1	0	1	1	0	1	1	1
LGConfig	L	TR		L	TR		L	TR		L	T	R
Volume	34	6	5	4	4	12	39	693	91	191	296	66
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	12.0
RTOR Vol			0			0			0			0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination		1	2	3	4			5	6	7	8
EB	Left	A				NB	Left	P	P		
	Thru	A					Thru		P		
	Right	A					Right		P		
	Peds						Peds				
WB	Left	A				SB	Left	P	P		
	Thru	A					Thru		P		
	Right	A					Right		P		
	Peds						Peds				
NB	Right					EB	Right				
SB	Right					WB	Right				
Green		18.0						10.0	45.0		
Yellow		3.0						3.0	3.0		
All Red		1.0						1.0	1.0		

Cycle Length: 85.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	300	1418	0.13	0.21	27.3	C		
TR	374	1768	0.03	0.21	26.6	C	27.2	C
Westbound								
L	301	1423	0.01	0.21	26.5	C		
TR	356	1682	0.05	0.21	26.7	C	26.7	C
Northbound								
L	715	1805	0.06	0.69	4.7	A		
TR	988	1867	0.88	0.53	28.9	C	27.7	C
Southbound								
L	301	1805	0.70	0.69	33.9	C		
T	1006	1900	0.33	0.53	12.2	B	19.5	B
R	855	1615	0.09	0.53	10.1	B		

Intersection Delay = 24.5 (sec/veh) Intersection LOS = C

HCS+: Signalized Intersections Release 5.2

Analyst: JPE
Agency:
Date: 3/3/2008
Period: PM Peak
Project ID: Improved Geometry
E/W St: Techne Center

Inter.: US 50 & Techne Center
Area Type: All other areas
Jurisd: ODOT
Year : 2030

N/S St: US 50

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	0	1	1	0	1	1	0	1	1	1
LGConfig	L	TR		L	TR		L	TR		L	T	R
Volume	108	7	29	55	4	232	6	359	5	33	888	13
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	12.0
RTOR Vol			0			0			0			0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4			5	6	7	8
EB Left	A				NB	Left	P			
Thru		A				Thru		P		
Right		A				Right		P		
Peds						Peds				
WB Left	A				SB	Left	P			
Thru		A				Thru		P		
Right		A				Right		P		
Peds						Peds				
NB Right					EB	Right				
SB Right					WB	Right				
Green	12.0	23.0					10.0	49.0		
Yellow	3.0	3.0					3.0	3.0		
All Red	1.0	1.0					1.0	1.0		

Cycle Length: 110.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	197	1805	0.61	0.11	52.2	D		
TR	350	1672	0.11	0.21	35.4	D	48.0	D
Westbound								
L	197	1805	0.31	0.11	46.1	D		
TR	339	1619	0.77	0.21	51.6	D	50.6	D
Northbound								
L	164	1805	0.04	0.09	46.1	D		
TR	845	1896	0.48	0.45	23.4	C	23.8	C
Southbound								
L	164	1805	0.23	0.09	49.6	D		
T	846	1900	1.17	0.45	118.2	F	114.4	F
R	719	1615	0.02	0.45	17.1	B		

Intersection Delay = 78.9 (sec/veh) Intersection LOS = E

Phone:
E-Mail:
Fax:

ALL-WAY STOP CONTROL(AWSC) ANALYSIS

Analyst:
Agency/Co.: CCEO
Date Performed: 4/23/2008
Analysis Time Period: AM Peak
Intersection:
Jurisdiction: Miami Twp
Units: U. S. Customary
Analysis Year: 2030
Project ID:
East/West Street: Eastman
North/South Street: Techne Center

Worksheet 2 - Volume Adjustments and Site Characteristics

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	125	467	47	1	57	0	1	16	9	0	0	4
% Thrus Left Lane												

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	LTR		LTR		LTR		LTR	
PHF	1.00		1.00		1.00		1.00	
Flow Rate	639		58		26		4	
% Heavy Veh	0		0		0		0	
No. Lanes	1		1		1		1	
Opposing-Lanes	1		1		1		1	
Conflicting-lanes	1		1		1		1	
Geometry group	1		1		1		1	

Duration, T 0.25 hrs.

Worksheet 3 - Saturation Headway Adjustment Worksheet

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Flow Rates:								
Total in Lane	639		58		26		4	
Left-Turn	125		1		1		0	
Right-Turn	47		0		9		4	
Prop. Left-Turns	0.2		0.0		0.0		0.0	
Prop. Right-Turns	0.1		0.0		0.3		1.0	
Prop. Heavy Vehicle	0.0		0.0		0.0		0.0	
Geometry Group	1		1		1		1	
Adjustments Exhibit 17-33:								
hLT-adj	0.2		0.2		0.2		0.2	

hRT-adj	-0.6	-0.6	-0.6	-0.6
hHV-adj	1.7	1.7	1.7	1.7
hadj, computed	-0.0	0.0	-0.2	-0.6

Worksheet 4 - Departure Headway and Service Time

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Flow rate	639		58		26		4	
hd, initial value	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20
x, initial	0.57		0.05		0.02		0.00	
hd, final value	4.04		4.59		5.20		4.84	
x, final value	0.72		0.07		0.04		0.01	
Move-up time, m	2.0		2.0		2.0		2.0	
Service Time	2.0		2.6		3.2		2.8	

Worksheet 5 - Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Flow Rate	639		58		26		4	
Service Time	2.0		2.6		3.2		2.8	
Utilization, x	0.72		0.07		0.04		0.01	
Dep. headway, hd	4.04		4.59		5.20		4.84	
Capacity	889		308		276		254	
Delay	16.57		7.96		8.40		7.86	
LOS	C		A		A		A	
Approach:								
Delay	16.57		7.96		8.40		7.86	
LOS	C		A		A		A	

Intersection Delay 15.54 Intersection LOS C

Phone:
E-Mail:
Fax:

ALL-WAY STOP CONTROL(AWSC) ANALYSIS

Analyst:
Agency/Co.: CCEO
Date Performed: 4/23/2008
Analysis Time Period: PM Peak
Intersection:
Jurisdiction: Miami Twp
Units: U. S. Customary
Analysis Year: 2030
Project ID:
East/West Street: Eastman
North/South Street: Techne Center

Worksheet 2 - Volume Adjustments and Site Characteristics

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	6	70	9	8	463	0	61	1	0	0	23	203
% Thrus Left Lane												

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	LTR		LTR		LTR		LTR	
PHF	1.00		1.00		1.00		1.00	
Flow Rate	85		471		62		226	
% Heavy Veh	0		0		0		0	
No. Lanes	1		1		1		1	
Opposing-Lanes	1		1		1		1	
Conflicting-lanes	1		1		1		1	
Geometry group	1		1		1		1	

Duration, T 0.25 hrs.

Worksheet 3 - Saturation Headway Adjustment Worksheet

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Flow Rates:								
Total in Lane	85		471		62		226	
Left-Turn	6		8		61		0	
Right-Turn	9		0		0		203	
Prop. Left-Turns	0.1		0.0		1.0		0.0	
Prop. Right-Turns	0.1		0.0		0.0		0.9	
Prop. Heavy Vehicle	0.0		0.0		0.0		0.0	
Geometry Group	1		1		1		1	
Adjustments Exhibit 17-33:								
hLT-adj	0.2		0.2		0.2		0.2	

hRT-adj	-0.6	-0.6	-0.6	-0.6
hHV-adj	1.7	1.7	1.7	1.7
hadj, computed	-0.0	0.0	0.2	-0.5

Worksheet 4 - Departure Headway and Service Time

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Flow rate	85		471		62		226	
hd, initial value	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20
x, initial	0.08		0.42		0.06		0.20	
hd, final value	5.27		4.80		5.89		4.89	
x, final value	0.12		0.63		0.10		0.31	
Move-up time, m	2.0		2.0		2.0		2.0	
Service Time	3.3		2.8		3.9		2.9	

Worksheet 5 - Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Flow Rate	85		471		62		226	
Service Time	3.3		2.8		3.9		2.9	
Utilization, x	0.12		0.63		0.10		0.31	
Dep. headway, hd	5.27		4.80		5.89		4.89	
Capacity	335		721		312		476	
Delay	9.02		15.56		9.55		10.03	
LOS	A		C		A		B	
Approach:								
Delay	9.02		15.56		9.55		10.03	
LOS	A		C		A		B	

Intersection Delay 12.98 Intersection LOS B

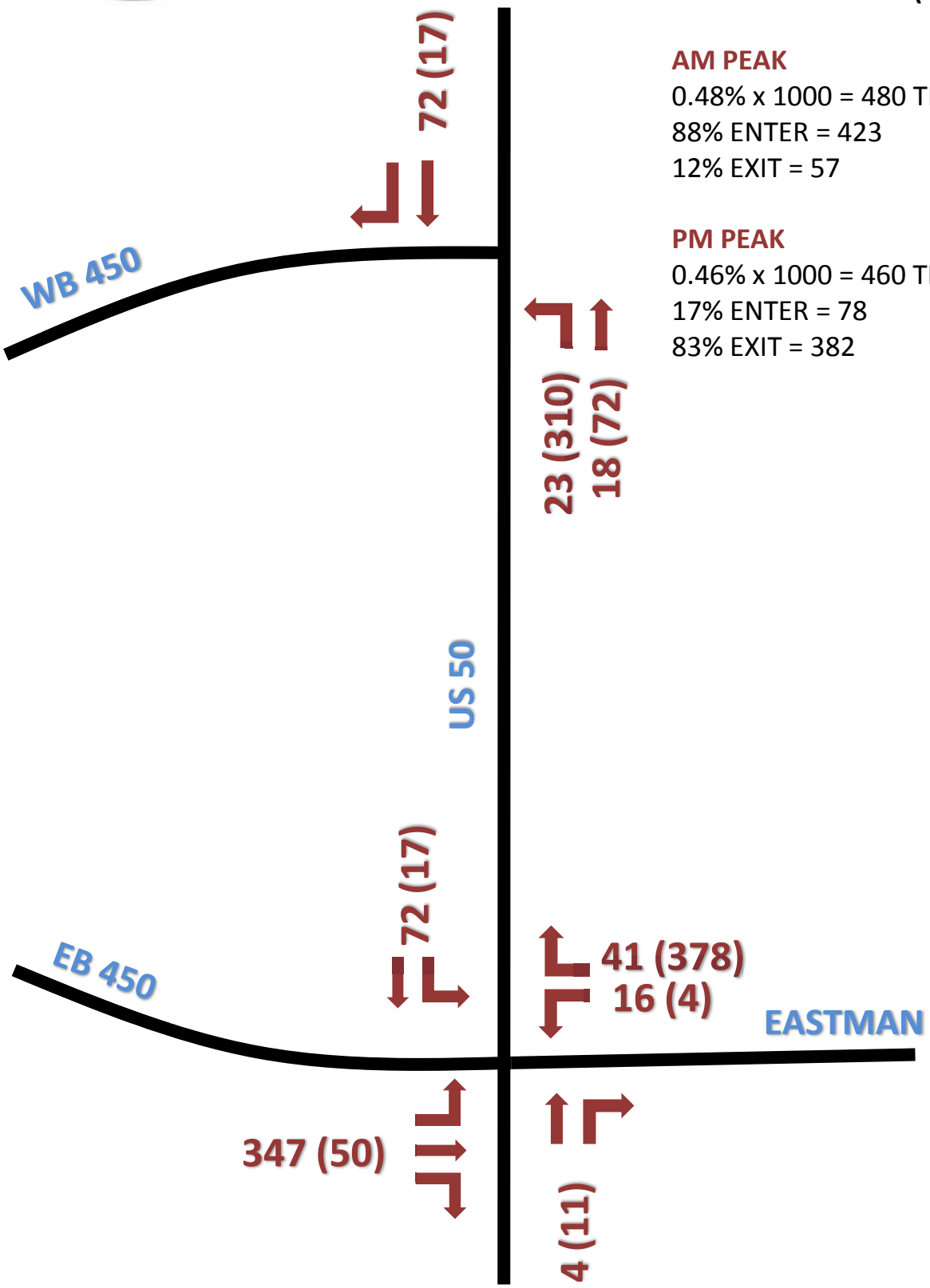
Appendix E

Trip Generation and Turn Movement Diagrams

TCS GENERATED TRIPS
1000 EMPLOYEES
GENERAL OFFICE (ITE 710)

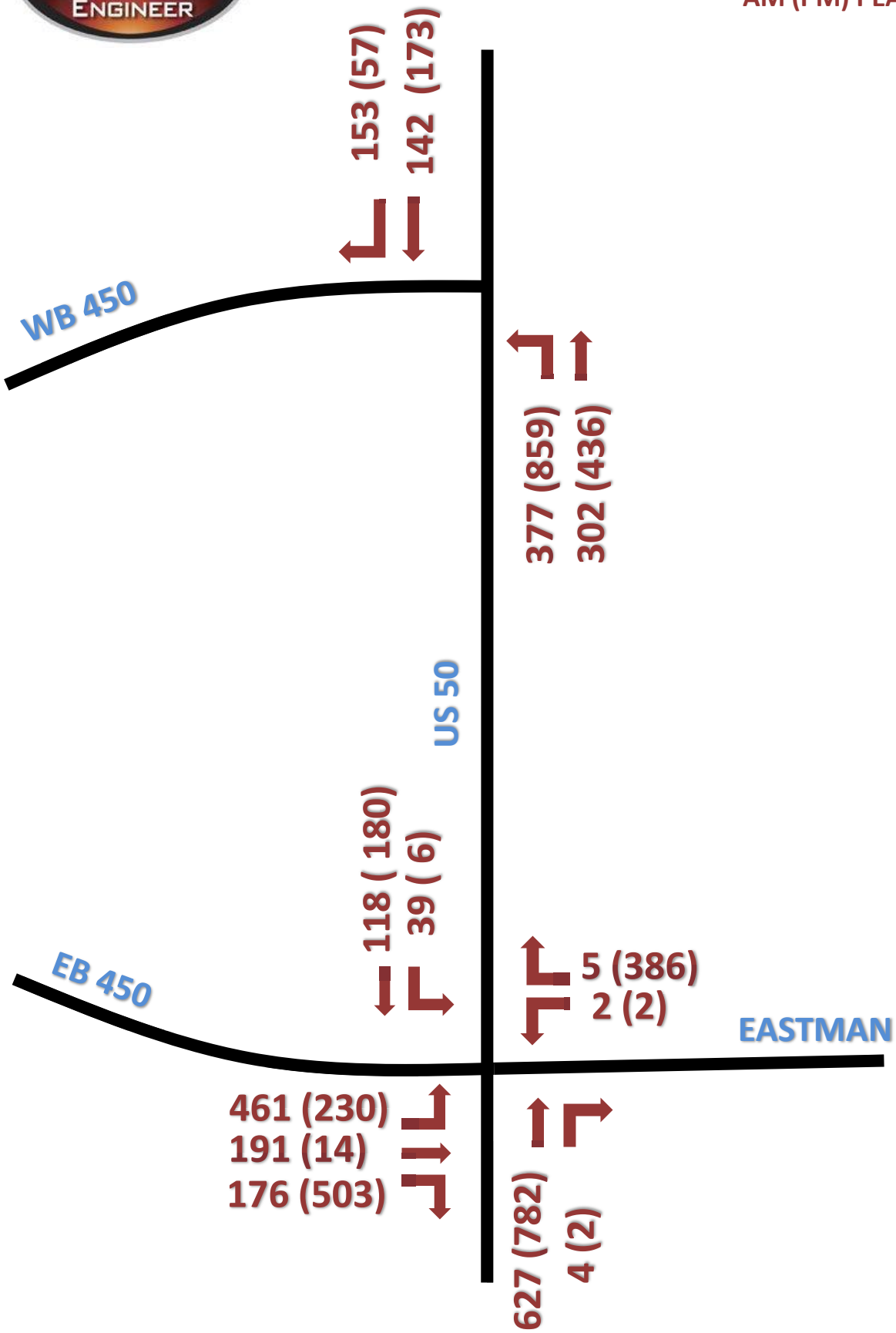
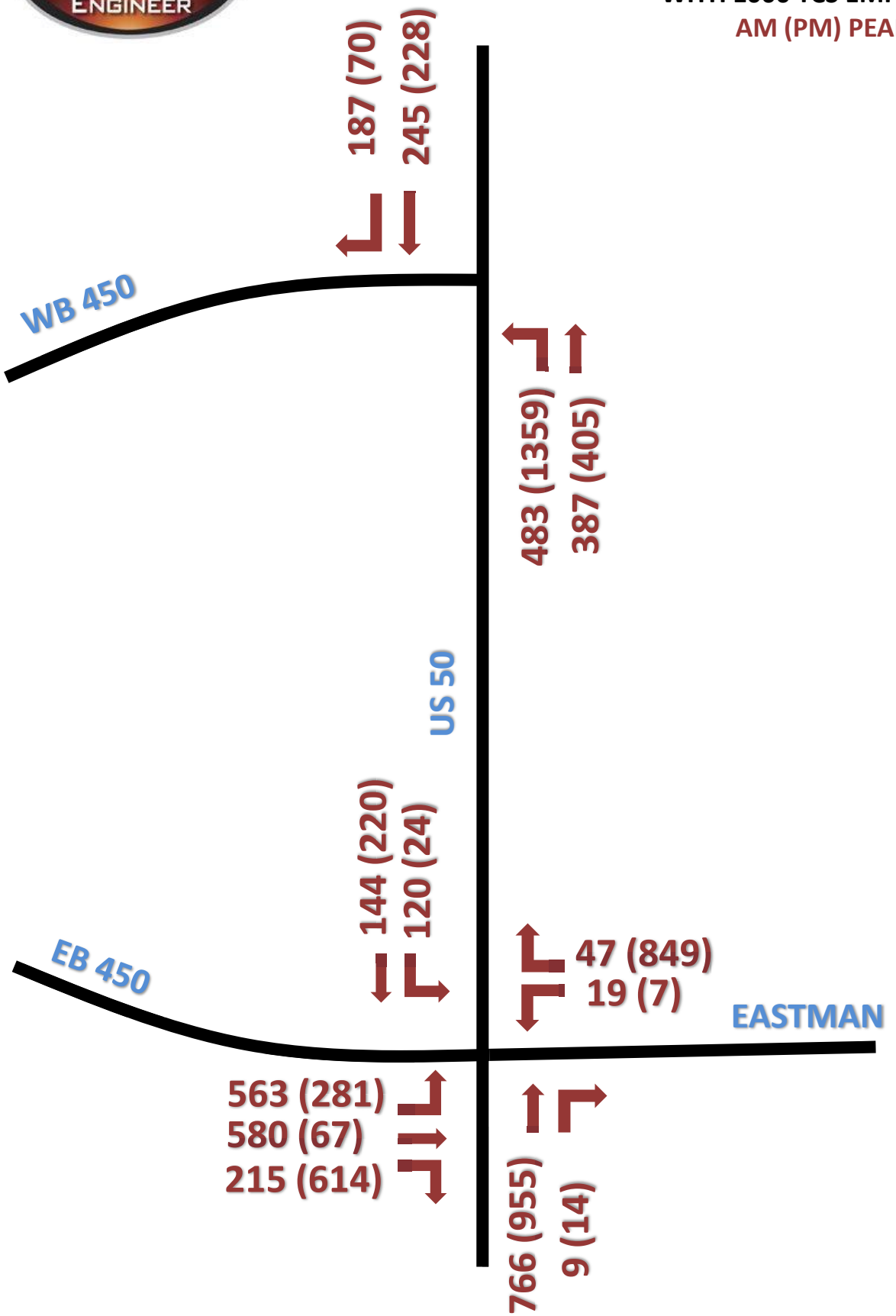
AM PEAK
0.48% x 1000 = 480 TRIPS
88% ENTER = 423
12% EXIT = 57

PM PEAK
0.46% x 1000 = 460 TRIPS
17% ENTER = 78
83% EXIT = 382



2008 VOLUMES

AM (PM) PEAK



2030 VOLUMES
WITH 1000 TCS EMPLOYEES
AM (PM) PEAK