



AMERICAN  
**STRUCTUREPOINT**  
INC.

**DRAFT**

**Traffic Impact Study**  
For  
Proposed Harmony Development  
Westfield, Indiana

Prepared for:

JR Farmer Harmony LLC  
and  
City of Westfield

Prepared by:

American Structurepoint, Inc.  
7260 Shadeland Station  
Indianapolis, Indiana 46256

February 20, 2012



DRAFT  
Traffic Impact Study  
For  
Proposed Harmony Development  
Westfield, Indiana

I certify that this Traffic Impact Study has been prepared by me or under my immediate supervision and that I have experience and training in the field of traffic and transportation engineering.

---

Jeromy Grenard, PE, PTOE  
Indiana Registration #10504827

---

Amanda Johnson, EI

TABLE OF CONTENTS

|  | PAGE      |
|--|-----------|
| <b>Executive Summary</b> .....                           | <b>1</b>  |
| <b>Study Purpose and Scope</b> .....                     | <b>3</b>  |
| Study Purpose .....                                      | 3         |
| Study Scope .....  | 3         |
| <b>Background Information</b> .....                      | <b>5</b>  |
| Existing Roadway Conditions within Study Area .....      | 5         |
| Existing Intersection Conditions within Study Area ..... | 5         |
| Existing Land Use within Study Area .....                | 6         |
| Future Roadway Improvements.....                         | 6         |
| Proposed Development .....                               | 6         |
| <b>Traffic Forecast</b> .....                            | <b>8</b>  |
| Existing Traffic Data .....                              | 8         |
| Background Traffic Growth .....                          | 10        |
| Trip Generation.....                                     | 10        |
| Internal Trips .....                                     | 10        |
| Pass-By Trips.....                                       | 10        |
| Trip Distribution and Traffic Assignment .....           | 12        |
| Resulting 2022 Traffic Volumes .....                     | 13        |
| <b>Capacity Analysis</b> .....                           | <b>16</b> |
| Lane Configurations .....                                | 17        |
| Level of Service and Delay Results.....                  | 17        |
| <b>Findings</b> .....                                    | <b>23</b> |
| <b>Appendices</b>  |           |
| Appendix A – Existing Traffic Counts                     |           |
| Appendix B – Capacity Analysis Output                    |           |
| Appendix C – Trip Distribution Figures                   |           |
| Appendix D – Meeting Notes                               |           |

**LIST OF FIGURES**

|   | PAGE |
|---|------|
| Figure 1 – Study Area.....  | 4    |
| Figure 2 – Site Layout .....  | 7    |
| Figure 3 – Existing Traffic Volumes.....  | 9    |
| Figure 4 – Trip Distribution .....  | 13   |
| Figure 5 – Scenario 2: Year 2022 Traffic Volumes .....                          | 14   |
| Figure 6 – Scenario 3: Year 2022 Traffic Volumes with Proposed Development..... | 15   |

**LIST OF TABLES**

|   | PAGE |
|---|------|
| Table 1 – Trip Generation for Proposed Land Uses.....                                       | 11   |
| Table 2 – Level of Service Criteria for Signalized and Unsignalized Intersections .....     | 16   |
| Table 3 – Study Scenarios .....   | 16   |
| Table 4 – Summary of Capacity Analysis for 156 <sup>th</sup> Street & Towne Road .....      | 17   |
| Table 5 – Summary of Capacity Analysis for 151 <sup>st</sup> Street & Ditch Road.....       | 18   |
| Table 6 – Summary of Capacity Analysis for 151 <sup>st</sup> Street & Towne Road.....       | 18   |
| Table 7 – Summary of Capacity Analysis for 151 <sup>st</sup> Street & Ditch Road.....       | 19   |
| Table 8 – Summary of Capacity Analysis for 146 <sup>th</sup> Street & Towne Road .....      | 19   |
| Table 9 – Summary of Capacity Analysis for 146 <sup>th</sup> Street & Ditch Road .....      | 20   |
| Table 10 – Summary of Capacity Analysis for 146 <sup>th</sup> Street & Drive A.....         | 20   |
| Table 11 – Summary of Capacity Analysis for 146 <sup>th</sup> Street & Drive B .....        | 20   |
| Table 12 – Summary of Capacity Analysis for Ditch Road & Drive C/I & Somerville Drive ..... | 21   |
| Table 13 – Summary of Capacity Analysis for 151 <sup>st</sup> Street & Drive D .....        | 21   |
| Table 14 – Summary of Capacity Analysis for 151 <sup>st</sup> Street & Drive E .....        | 21   |
| Table 15 – Summary of Capacity Analysis for 151 <sup>st</sup> Street & Drive F.....         | 22   |
| Table 16 – Summary of Capacity Analysis for 151 <sup>st</sup> Street & Drive G .....        | 22   |
| Table 17 – Summary of Capacity Analysis for 151 <sup>st</sup> Street & Drive H .....        | 22   |

## **Executive Summary**

### Study Purpose and Scope

The purpose of this traffic impact study (TIS) is to evaluate the operational impacts of the proposed development on the surrounding road network in Westfield, Indiana. The proposed development is bounded by 156<sup>th</sup> Street to the north, 146<sup>th</sup> Street to the south, Ditch Road to the east and Towne Road to the west. The study provides a summary of the traffic forecast and identifies the operational impacts.

The scenarios examined in this study are as follows:

- Scenario 1 – Year 2012 AM and PM peak hour traffic, with existing lane configurations.
- Scenario 2 – Year 2022 AM and PM peak hour traffic, with future lane configurations. This scenario includes scheduled improvements to the study area roadways and intersections.
- Scenario 3 – Year 2022 AM and PM peak hour traffic, with the addition of the proposed development traffic and proposed roadway lane configurations.

The year 2022 was assumed to be the year at which the development will be fully developed.

The study intersections are as follows:

- 156<sup>th</sup> Street & Towne Road
- 156<sup>th</sup> Street & Ditch Road
- 151<sup>st</sup> Street & Towne Road
- 151<sup>st</sup> Street & Ditch Road
- 146<sup>th</sup> Street & Towne Road
- 146<sup>th</sup> Street & Ditch Road
- All development drives

### Background and Proposed Development Information

The *Westfield Thoroughfare Plan* was used to determine the classifications of the study area roadways. The existing roadway conditions and land uses within the study area were also reviewed and considered.

The proposed development is comprised of 274 acres in southwest Westfield, Indiana. It will consist of a single family residential portion to the north and a multi-use portion to the south. The multi-use portion will include multi-family residential, grocery store, pharmacy, restaurant, gas station, and medical office land uses. The multi-use nature of this site plan necessitates internal and pass-by trip reductions to be applied. In addition, internal trips between the north portion and the south portion were considered during the assignment and distribution process.

Traffic Forecast

Traffic volumes have been forecasted by determining the base year (2012) traffic volumes using existing traffic data provided by the City of Westfield supplemented by traffic counts performed by American Structurepoint, Inc. A background traffic growth rate was then applied to obtain the 2022 traffic volumes, followed by adding in any new trips generated by the development to the 2022 background traffic.

Capacity Analysis

A capacity analysis has been performed at each of the study intersections for the above-mentioned scenarios. To facilitate the analysis, Synchro (Version 8) was used to perform the capacity analysis at signalized and stop-controlled intersections. ARCADY 8.0 was used to perform the capacity analysis at roundabout intersections. An acceptable level of service (LOS) for this study was considered to be LOS “D” or better at each of the study intersections.

Findings

This study has shown that all study intersections can operate at acceptable levels of service. The following table summarizes what improvements, if any, are necessary.

| <b>Intersection</b>            | <b>Improvements Needed?</b> | <b>Description</b>   |
|--------------------------------|-----------------------------|--|
| 156 <sup>th</sup> & Towne      | No                          |  |
| 156 <sup>th</sup> & Ditch      | No                          |  |
| 151 <sup>st</sup> & Towne      | No                          |  |
| 151 <sup>st</sup> & Ditch      | Yes                         | Westbound exclusive right-turn lane or single lane roundabout.   |
| 146 <sup>th</sup> & Towne      | Yes                         | Double lane roundabout.  |
| 146 <sup>th</sup> & Ditch      | Yes                         | Double lane roundabout as shown in design plans.   |
| 146 <sup>th</sup> & Drive A    | N/A                         | Right-in/Right-out Drive. Single lane approaches.  |
| 146 <sup>th</sup> & Drive B    | N/A                         | Right-in/Right-out Drive. Single lane approaches.  |
| Ditch & Drive C/I & Somerville | N/A                         | Double lane roundabout. Single lane entries except northbound. Northbound Ditch Road will have two lane entry. |
| 151 <sup>st</sup> & Drive D    | N/A                         | Stop-controlled drive. Single lane approaches.   |
| 151 <sup>st</sup> & Drive E    | N/A                         | Stop-controlled drive. Single lane approaches.   |
| 151 <sup>st</sup> & Drive F    | N/A                         | Stop-controlled drive. Single lane approaches.   |
| 151 <sup>st</sup> & Drive G    | N/A                         | Single lane roundabout with two entry lanes along Drive I.   |
| 156 <sup>th</sup> & Drive H    | N/A                         | Stop-controlled drive. Single lane approaches.   |

## Study Purpose and Scope

### Study Purpose

The purpose of this traffic impact study (TIS) is to evaluate the operational impacts of a proposed multi-use development to be located on a 274 acre site within the area bounded by 156<sup>th</sup> Street, Ditch Road, 146<sup>th</sup> Street, and Towne Road in the City of Westfield, Indiana. This study will determine the effects of the proposed development on the adjacent roadway system and will provide necessary recommendations.

### Study Scope

To solidify the scope of this study, a traffic impact study scoping meeting was held between American Structurepoint and the City of Westfield on February 7, 2012.

The study estimates the number of new trips that will be generated by the proposed Harmony development and shows how these new trips are distributed to the surrounding public roadway system. New trips are determined based on procedures set forth in the *ITE Trip Generation Report*<sup>1</sup>. The proposed development is to consist of multi-family residential, single family residential, grocery, general retail, bank, restaurant, medical office, and pharmacy land uses.

The year 2022 was assumed to be the horizon year at which the development will be fully developed. Year 2022 background traffic volumes were obtained by applying a growth rate of 2% per year to the existing traffic volumes.

The study area is bounded by 146<sup>th</sup> Street to the south, 156<sup>th</sup> Street to the north, Towne Road to the west and Ditch Road to the east. **Figure 1** shows the overall study area. The study intersections include the following:

- 156<sup>th</sup> Street & Towne Road
- 156<sup>th</sup> Street & Ditch Road
- 151<sup>st</sup> Street & Towne Road
- 151<sup>st</sup> Street & Ditch Road
- 146<sup>th</sup> Street & Towne Road
- 146<sup>th</sup> Street & Ditch Road
- One full access drive along 156<sup>th</sup> Street
- Four full access drives along 151<sup>st</sup> Street
- One full access drive on Ditch Road at Somerville Drive
- Two full-access drives along 146<sup>th</sup> Street

Turning movement traffic counts at existing intersections and ADT counts along 151<sup>st</sup> Street were either provided by the City of Westfield or obtained by American Structurepoint, Inc.

---

<sup>1</sup> ITE, *Trip Generation Report*, 8<sup>th</sup> Edition. 2008.

A traffic capacity analysis was performed using Synchro, Version 8 software and ARCADY 8.0 software for each of the study scenarios. The scenarios examined in this study are as follows.

- Scenario 1 – Year 2012 AM and PM peak hour traffic, with existing lane configurations.
- Scenario 2 – Year 2022 AM and PM peak hour traffic, with future lane configurations.
- Scenario 3 – Year 2022 AM and PM peak hour traffic, with the addition of the proposed Harmony development traffic and proposed intersection conditions.

The study procedures follow the *Applicant's Guide to Traffic Impact Study* (from INDOT).

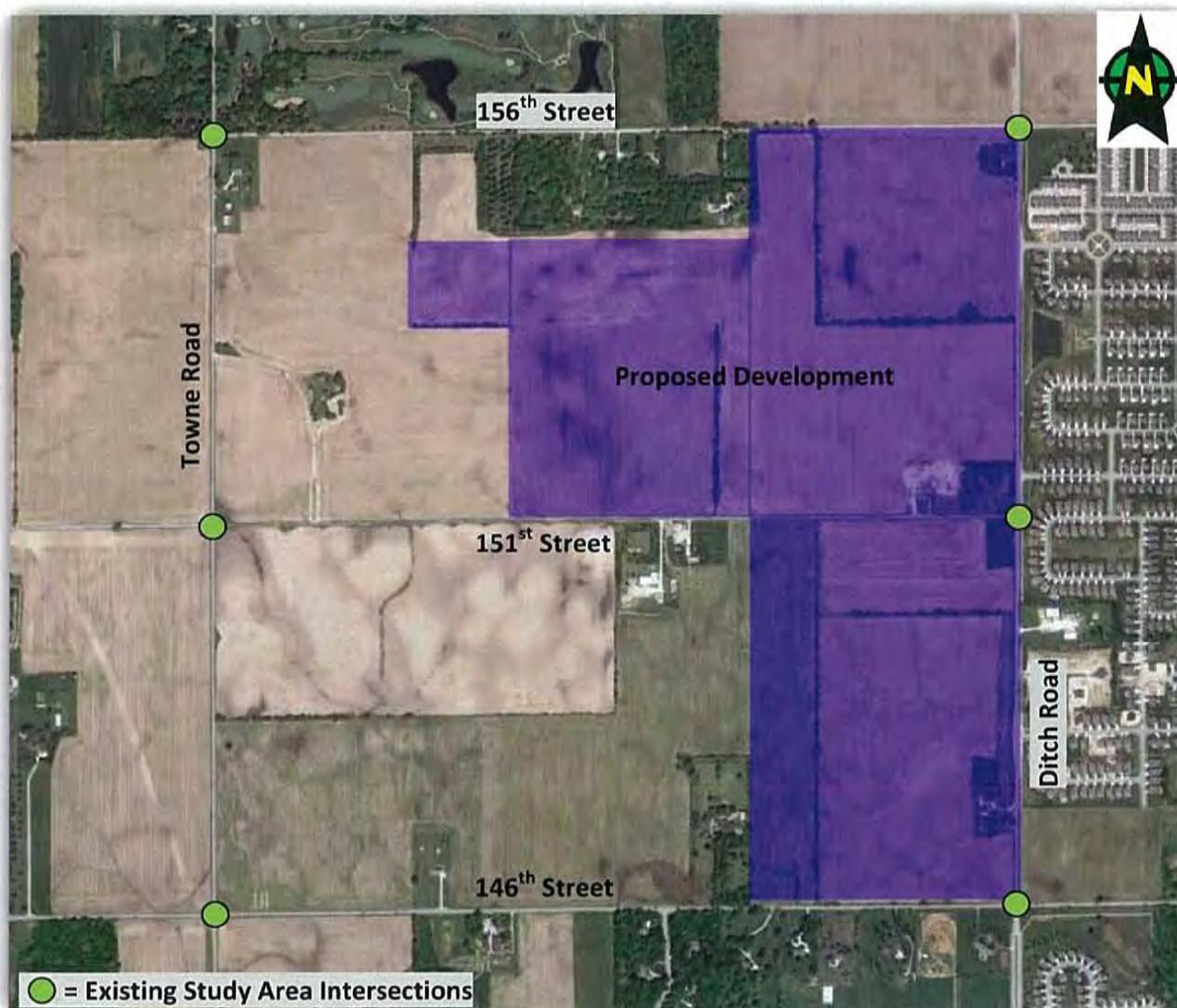


Figure 1 – Study Area

## **Background Information**

### Existing Roadway Conditions within Study Area

- 146<sup>th</sup> Street: 146<sup>th</sup> Street is a 2-lane east-west facility. The speed limit within the vicinity of the study area is posted at 50 mph. It is classified in the Westfield Thoroughfare Plan as a primary arterial 2. 146<sup>th</sup> Street is planned to be a 4-lane roadway before the year 2022. Therefore, scenarios 2 and 3 will include 146<sup>th</sup> Street as a 4-lane roadway.
- 151<sup>st</sup> Street: 151<sup>st</sup> Street is a 2-lane east-west facility. The speed limit within the vicinity of the study area is not posted. It is classified in the Westfield Thoroughfare Plan as a collector street.
- 156<sup>th</sup> Street: 156<sup>th</sup> Street is a 2-lane east-west facility. The speed limit within the vicinity of the study area is posted at 50 mph. It is classified in the Westfield Thoroughfare Plan as a collector street.
- Towne Road: Towne Road is a 2-lane north-south facility. The speed limit within the vicinity of the study area is posted at 45 mph. It is classified in the Westfield Thoroughfare Plan as a primary arterial 2.
- Ditch Road: Ditch Road is a 2-lane north-south facility. The speed limit within the vicinity of the study area is posted at 40 mph south of 151<sup>st</sup> Street and 50 mph north of 151<sup>st</sup> Street. It is classified in the Westfield Thoroughfare Plan as a primary arterial 2.

### Existing Intersection Conditions within Study Area

- 146<sup>th</sup> Street & Towne Road: This intersection is currently an all-way stop controlled intersection with one lane in each direction on all approaches. When 146<sup>th</sup> Street is widened to four-lanes, this intersection will become a roundabout. Therefore, scenario 2 and 3 will analyze this intersection as a roundabout.
- 146<sup>th</sup> Street & Ditch Road: This intersection is currently an all-way stop controlled intersection with one lane in each direction along all approaches. When 146<sup>th</sup> Street is widened to four-lanes, this intersection will become a roundabout. Therefore, scenario 2 and 3 will analyze this intersection as a roundabout.
- 151<sup>st</sup> Street & Towne Road: This intersection is currently a two-way stop controlled intersection with 151<sup>st</sup> Street stopping for Towne Road. Each approach has one lane in each direction.
- 151<sup>st</sup> Street & Ditch Road: This intersection is currently a one-way stop controlled intersection with 151<sup>st</sup> Street stopping for Ditch Road. Each approach has one lane in each direction.
- 156<sup>th</sup> Street & Towne Road: This intersection is currently a one-way stop controlled intersection with 156<sup>th</sup> Street stopping for Ditch Road. Each approach has one lane in each direction.

- o 156<sup>th</sup> Street & Ditch Road: This intersection is currently an all-way stop controlled intersection with one lane in each direction on all approaches.

#### Existing Land Use within Study Area

The areas near the proposed Harmony development consist primarily of single family homes or agricultural land.

#### Future Roadway Improvements

Hamilton County is planning to upgrade 146<sup>th</sup> Street to a limited access 4-lane divided roadway within the vicinity of the site. This improvement will include roundabout intersections at 146<sup>th</sup> Street & Towne Road and 146<sup>th</sup> Street & Ditch Road. In addition, two frontage roads will be constructed on either side of proposed 146<sup>th</sup> Street. Since 146<sup>th</sup> Street is to be a limited access roadway, these frontage roads will provide access to drives along 146<sup>th</sup> Street.

This improvement is expected to be completed before the year 2022. Therefore, this improvement was considered in Scenario 2 and Scenario 3 of this analysis. New traffic volumes from the proposed development were distributed based on the new 146<sup>th</sup> Street configuration and intersection capacity analysis was based on the proposed intersection conditions. Specific geometry for 146<sup>th</sup> Street & Ditch Road was provided by RW Armstrong.

In addition, US 31 is currently being upgraded to freeway standards through Hamilton County. With this project, some roads that currently have direct access to US 31 will no longer have access. For instance, 156<sup>th</sup> Street currently has direct access to US 31 but will not have an interchange when US 31 is upgraded to freeway standards. Therefore, future interchange locations were taken into consideration when determining trip distribution.

#### Proposed Development

The proposed development is to be located on a 274-acre site which is bounded by 146<sup>th</sup> Street, 156<sup>th</sup> Street, Towne Road, and Ditch Road. The proposed development will consist of a multi-use section and a single family residential section, as shown in **Figure 2**. In this figure, the yellow and light pink is the single family residential area, and the red is the multi-use section. The single family residential section will consist of 708 lots and the multi-use section will consist of a grocery store, inline retail, two banks, three sit down restaurants, a pharmacy, a medical office building, and 250 multi-use family dwelling units. A further breakdown of land uses is shown in the Trip Generation section of this report.

Multiple access points have been identified for the proposed Harmony development. All proposed access drives will be full access drives with the exception of the drives along 146<sup>th</sup> Street which will be right-in/right-out only drives. The access drives are shown and labeled on **Figure 2**.



Figure 2 – Site Layout

### **Traffic Forecast**

Traffic has been forecasted by determining the base year (2012) traffic volumes using existing traffic data provided by the City of Westfield or collected by American Structurepoint, Inc., then applying a background traffic growth rate to obtain the 2022 traffic volumes, and finally adding in any new trips generated by the development to the 2022 background traffic. The following sections of the report provide greater detail of these steps.

#### Existing Traffic Data

Manual turning movement counts were provided by the City of Westfield for the intersections of 146<sup>th</sup> Street & Towne Road and 146<sup>th</sup> Street & Ditch Road. The remaining turning movement counts were obtained by American Structurepoint, Inc. in January 2012. In addition, the City of Westfield provided 24-hour average daily traffic (ADT) counts for 151<sup>st</sup> Street between Towne Road and Ditch Road. The ADT counts were obtained in September 2011. Counts obtained in 2011 were assumed to be existing traffic volumes.

**Figure 3** shows the 2012 existing traffic volumes. The raw data for the traffic counts are provided in **Appendix A** of this report.

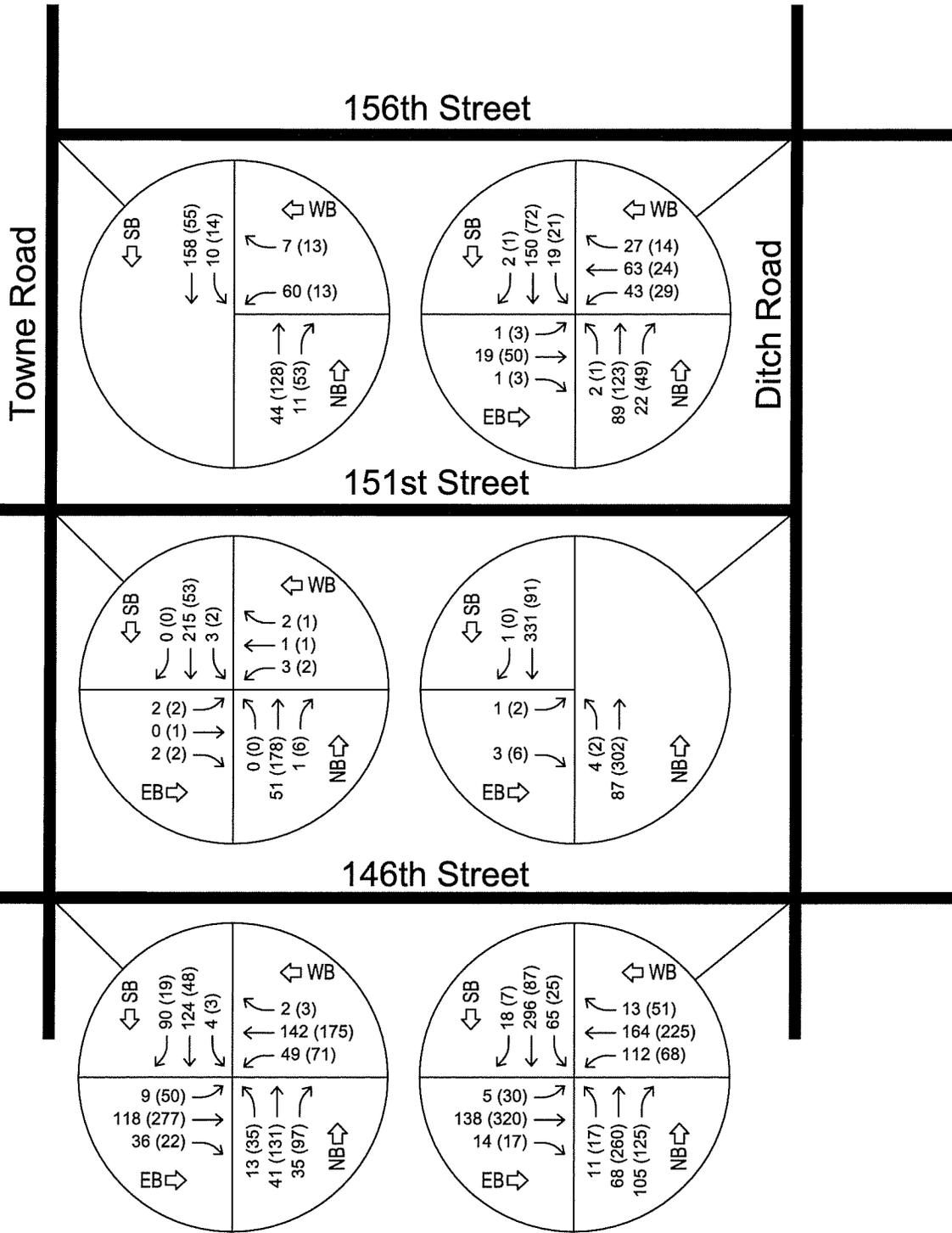
**LEGEND:**

Intersection Peak Hour Turning Movement: AM (PM)

↗ 111 (222)

↖ 111 (222)

↘ 111 (222)



**Figure 3 - Year 2012 Existing Traffic Volumes**

### Background Traffic Growth

It has been assumed the site will be fully developed by the year 2022; therefore, the year 2022 was chosen as the horizon year. In order to estimate the existing traffic volumes that will be present on the study area roadways for the year 2022, the background traffic growth must be determined.

Background traffic growth refers to the growth of traffic volumes that occur over time due to influences outside of the study area. These influences can range from transportation improvements to the status of the economy. Typically, the background traffic growth rate is determined by comparing historic traffic counts with current traffic counts.

In order to determine the background traffic growth rate, various sources of data were consulted. INDOT historic traffic data, Hamilton County historic traffic data, the projected volumes from a current impact fee study (provided by HNTB), and a previous INDOT study performed in the area were all used to help determine the background growth rate. A background growth rate of 2% per year was chosen. This growth rate is consistent with the projections from HNTB, which accounts for growth within the study area. This growth rate is also consistent with the previous INDOT report<sup>2</sup>. This study analyzed SR 32 through the City of Westfield which is directly to the north of the proposed site. The INDOT study used growth rates ranging from 1.4% per year to 2.7% per year.

It should also be noted that this growth rate was applied in a linear manner, as opposed to compounded. Linear growth is growth that occurs at a constant amount per year, as opposed to an exponentially growing amount added each year (compound growth).

### Trip Generation

The Institute of Transportation Engineers (ITE) *Trip Generation Report, 8<sup>th</sup> Edition* was used to calculate the generated trips for the proposed development. **Table 1** contains the number of AM peak and PM peak trips that would be generated by each specific land use within the proposed Harmony development.

### Internal Trips

Internal trips are trips which have origins and destinations within a development, but never actually travel on the public roadway system. For instance, a trip may begin at a pharmacy and end at a bank, both of which are located within the same development, and would not travel on external roads. For this proposed development, internal trips will occur between the land uses within the multi-use portion of the proposed development since they are all connected via internal roads. Procedures outlined in the ITE *Trip Generation Handbook* were used to estimate the number of internal trips that will occur within the proposed multi-use development. The internal trips are shown in **Table 2**.

### Pass-By Trips

Pass-by trips consist of those that are an intermediate stop en route from a trip origin to a trip destination. For example, on the way home (destination) from work (origin), many people stop along

---

<sup>2</sup> *Project Summary for SR 32 from US 31 to SR 38 in Hamilton County*, INDOT. April 2008

their route to get fuel (intermediate stop). This is not a new trip for the overall area but does change the travel pattern of the individual vehicles that were already present.

The ITE *Trip Generation Handbook* provides estimated pass-by trip percentages for each retail land use and was used to determine the appropriate pass-by percentages for the proposed development. These percentages were applied to the generated traffic volumes and the non pass-by trips represent the new trips added to the roadway system by the proposed development. The pass-by trip reductions are shown in **Table 1**.

**Table 1 – Trip Generation for Proposed Land Uses**

| Land Use     | ITE Code | Size          | AM Enter | AM Exit | PM Enter | PM Exit |
|--------------|----------|---------------|----------|---------|----------|---------|
| Multi-Family | 220      | 250 DU        | 25       | 101     | 101      | 54      |
|              |          | Internal      | 16       | 13      | 54       | 40      |
|              |          | External      | 9        | 88      | 47       | 14      |
| Grocery      | 850      | 68,000 SF     | 149      | 95      | 364      | 350     |
|              |          | Internal      | 37       | 37      | 56       | 63      |
|              |          | External      | 112      | 58      | 308      | 287     |
|              |          | Pass-By (36%) | 40       | 21      | 111      | 103     |
|              |          | Non Pass-By   | 72       | 37      | 197      | 184     |
| Retail       | 820      | 22,000 SF     | 38       | 25      | 113      | 118     |
|              |          | Internal      | 10       | 10      | 18       | 21      |
|              |          | External      | 28       | 15      | 95       | 97      |
|              |          | Pass-By (61%) | 17       | 9       | 58       | 59      |
|              |          | Non Pass-By   | 11       | 6       | 37       | 38      |
| Bank         | 912      | 8,400 SF      | 9        | 7       | 21       | 18      |
|              |          | Internal      | 4        | 3       | 7        | 6       |
|              |          | External      | 5        | 4       | 14       | 12      |
|              |          | Pass-By (47%) | 2        | 2       | 7        | 6       |
|              |          | Non Pass-By   | 3        | 2       | 7        | 6       |
| Restaurant   | 932      | 16,600 SF     | 99       | 92      | 109      | 76      |
|              |          | Internal      | 35       | 36      | 34       | 27      |
|              |          | External      | 64       | 56      | 75       | 49      |
|              |          | Pass-By (43%) | 28       | 24      | 32       | 21      |
|              |          | Non Pass-By   | 36       | 32      | 43       | 28      |
| Pharmacy     | 881      | 15,500 SF     | 23       | 18      | 80       | 80      |
|              |          | Internal      | 8        | 7       | 25       | 28      |
|              |          | External      | 15       | 11      | 55       | 52      |
|              |          | Pass-By (49%) | 7        | 5       | 27       | 25      |
|              |          | Non Pass-By   | 8        | 6       | 28       | 27      |

*Continued on Next Page*

*Continued from Previous Page*

| Land Use                        | ITE Code | Size                       | AM Enter   | AM Exit    | PM Enter   | PM Exit    |
|---------------------------------|----------|----------------------------|------------|------------|------------|------------|
| Medical Office                  | 720      | 40,000 SF                  | 73         | 19         | 37         | 101        |
|                                 |          | Internal                   | 8          | 8          | 16         | 16         |
|                                 |          | External                   | 65         | 11         | 21         | 85         |
| Single Family                   | 210      | 708 DU                     | 126        | 379        | 386        | 226        |
| Fast Food Restaurant            | 934      | 4,500 SF                   | 113        | 109        | 79         | 73         |
|                                 |          | Internal                   | 16         | 15         | 19         | 20         |
|                                 |          | External                   | 97         | 94         | 60         | 53         |
|                                 |          | Pass-By (AM: 49%, PM: 50%) | 48         | 46         | 30         | 27         |
|                                 |          | Non Pass-By                | 49         | 48         | 30         | 26         |
| Gas Station w/Convenience Store | 853      | 3,000 SF                   | 66         | 66         | 90         | 89         |
|                                 |          | Internal                   | 15         | 16         | 20         | 19         |
|                                 |          | External                   | 51         | 50         | 70         | 70         |
|                                 |          | Pass-By (AM: 63%, PM: 66%) | 32         | 32         | 46         | 46         |
|                                 |          | Non Pass-By                | 19         | 18         | 24         | 24         |
| <b>Total New Trips</b>          |          |                            | <b>398</b> | <b>627</b> | <b>820</b> | <b>658</b> |
| <b>Total Pass-By Trips</b>      |          |                            | <b>174</b> | <b>139</b> | <b>311</b> | <b>287</b> |

Trip Distribution and Traffic Assignment

The existing land uses and transportation system were taken into account when determining where to distribute the newly generated trips. In addition to the land uses and transportation system, the existing traffic volumes were used to determine the percentage of traffic that would use each route. The computer software program TRAFFIX was used to help facilitate the assignment and distribution. **Figure 4** shows the overall trip distribution amounts. It should be noted that Figure 4 represents a combination of assignment and distribution percentages. Different distribution percentages were assumed for each type of land use. For example, distribution percentages for retail land uses differed from distribution percentages for residential land uses. Additional figures in **Appendix C** show the distribution percentages for each land use type.

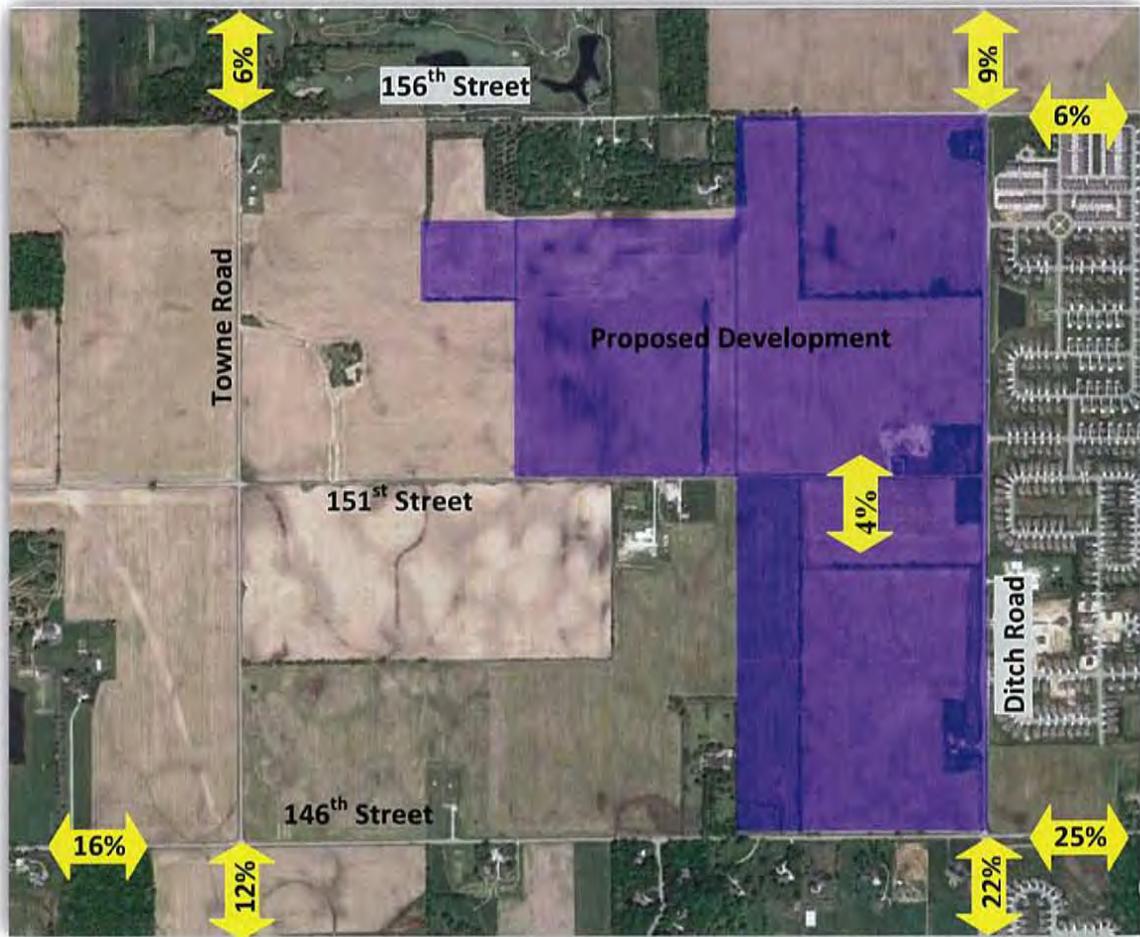


Figure 4 – Trip Distribution

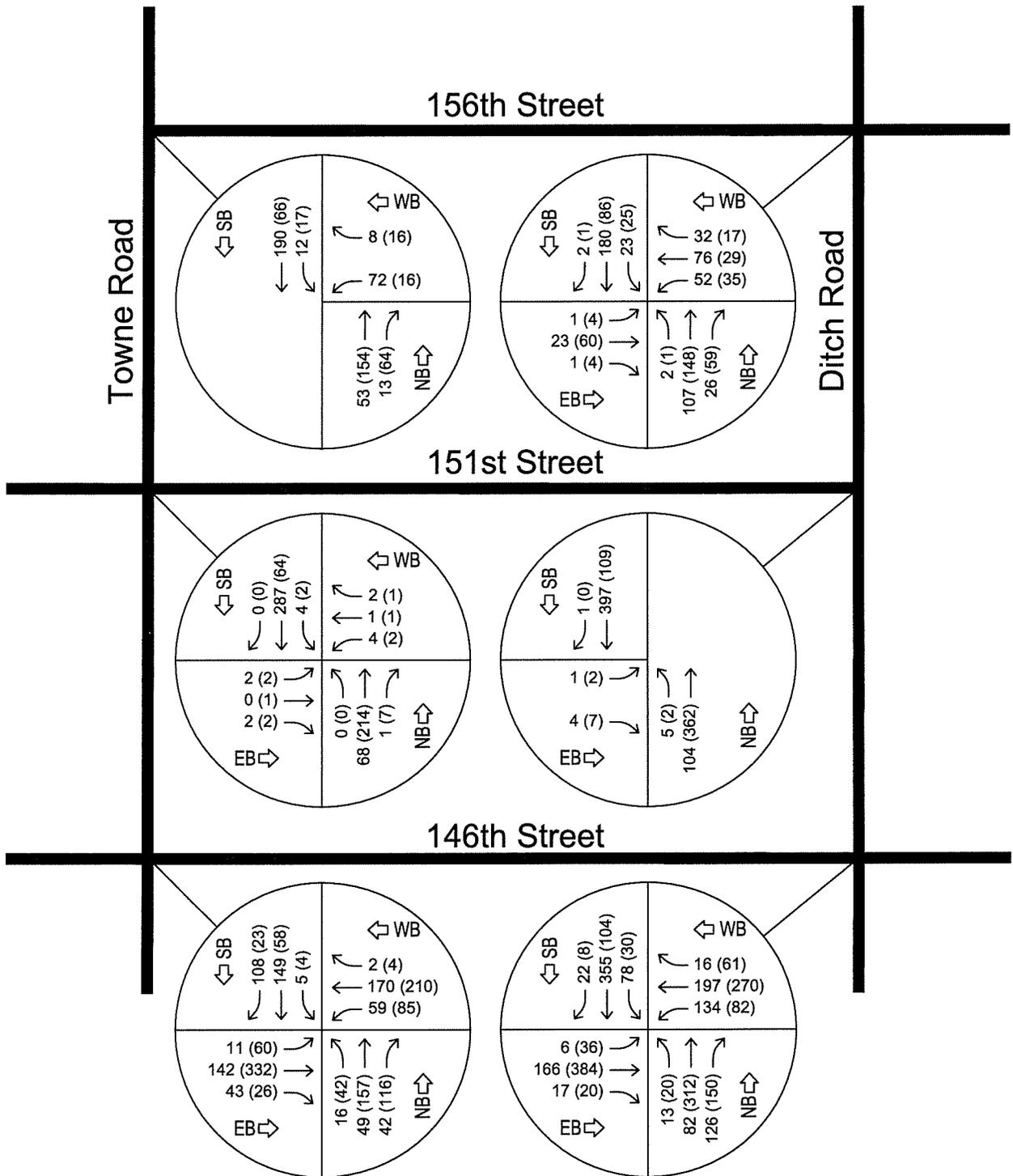
Resulting 2022 Traffic Volumes

After applying the background growth rate of 2.0 percent per year to the 2012 traffic volumes and adding in trips generated by the proposed development, the total 2022 traffic volumes were obtained for each of the study intersections. **Figure 5** shows the background 2022 traffic volumes at the study intersections for study scenario 2. **Figure 6** illustrates the generated traffic volumes added to the 2022 background traffic volumes at the study intersections and access drives for study scenario 3.

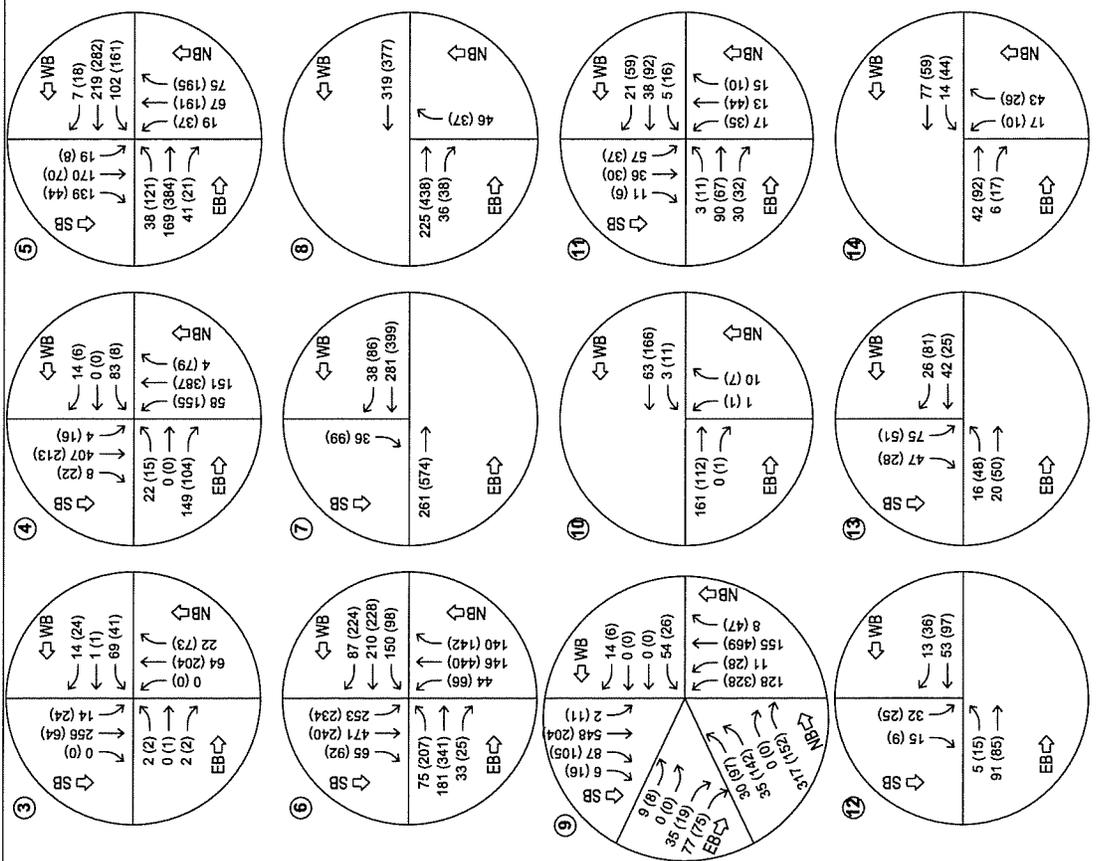
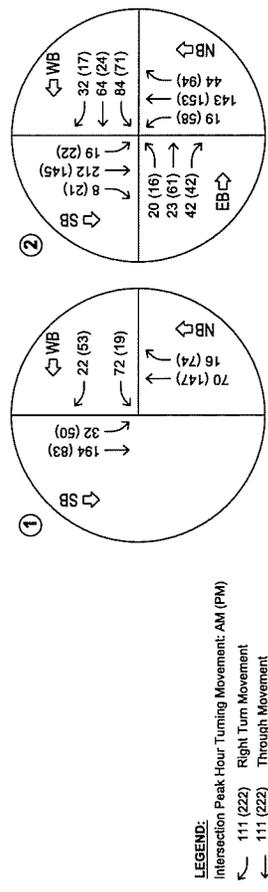
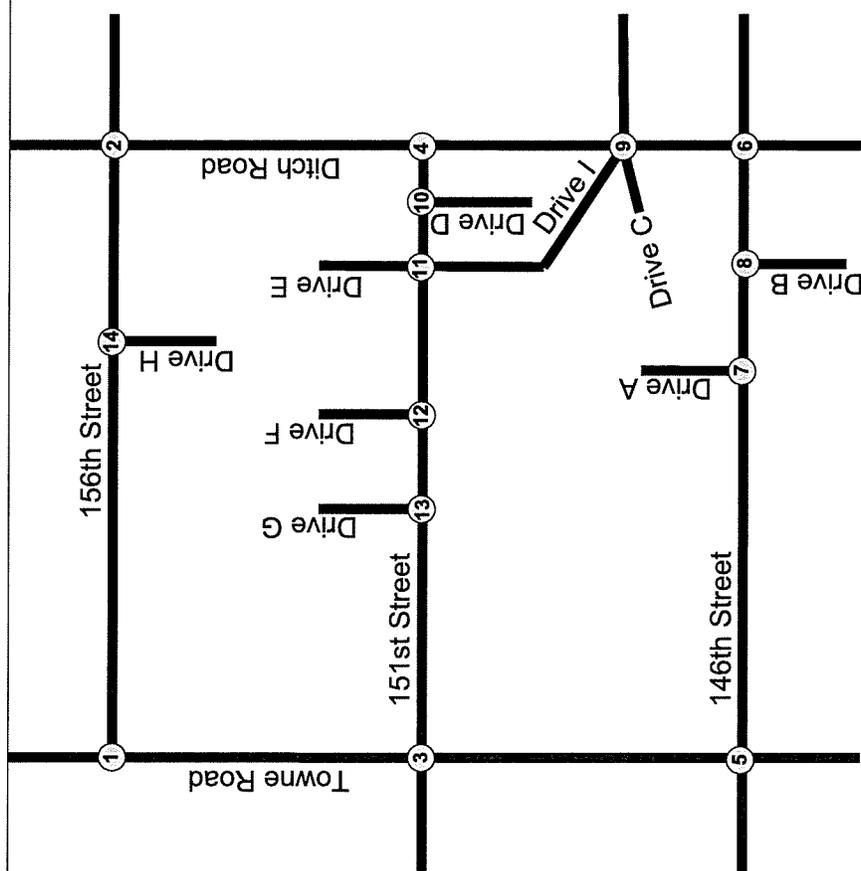
**LEGEND:**

Intersection Peak Hour Turning Movement: AM (PM)

- ↶ 111 (222) Right Turn Movement
- ← 111 (222) Through Movement
- ↷ 111 (222) Left Turn Movement



**Figure 5 - Year 2022 Background Traffic Volumes**



**LEGEND:**  
 Intersection Peak Hour Turning Movement: AM (PM)  
 111 (222) Right Turn Movement  
 111 (222) Through Movement  
 111 (222) Left Turn Movement

Figure 6 - Year 2022 Total Traffic Volumes

### Capacity Analysis

A capacity analysis has been performed for each study intersection and each study scenario based on the methodology outlined in the *Highway Capacity Manual* (TRB 2010). The standard parameter used to evaluate traffic operating conditions is referred to as the level-of-service (LOS). There are six LOS (A through F), which relate to driving conditions from best to worst, respectively. LOS for both signalized and unsignalized intersections are defined in terms of control delay per vehicle, which is a direct correlation to driver discomfort, frustration, fuel consumption, and lost travel time. **Table 2** provides the LOS criteria as defined in the *Highway Capacity Manual*. To facilitate the analysis, Synchro and SimTraffic (Version 8) were used to perform the capacity analysis at signalized and stop-controlled intersections and driveways. ARCADY 8.0 was used to perform the capacity analysis at roundabout intersections. The output from Synchro and ARCADY includes the average vehicle control delay, LOS, average queue length, and 95<sup>th</sup> percentile (or maximum) queue length.

**Table 2 – Level of Service Criteria for Signalized and Unsignalized Intersections**

| LOS | Control Delay Per Vehicle (second) |  |
|-----|------------------------------------|--|
|     | Signalized Intersection            | Unsignalized and Roundabout Intersection |
| A   | ≤ 10                               | ≤ 10                                     |
| B   | > 10 and ≤ 20                      | > 10 and ≤ 15                            |
| C   | > 20 and ≤ 35                      | > 15 and ≤ 25                            |
| D   | > 35 and ≤ 55                      | > 25 and ≤ 35                            |
| E   | > 55 and ≤ 80                      | > 35 and ≤ 50                            |
| F   | > 80                               | > 50                                     |

The capacity analysis has been performed at the study intersections for each of the study scenarios summarized in **Table 3**. **Appendix B** provides the software output from the capacity analysis.

**Table 3 – Study Scenarios**

| Scenario | Year | Analysis Hours | Harmony Volumes |
|----------|------|----------------|-----------------|
| 1        | 2012 | AM & PM Peak   | Not Included    |
| 2        | 2022 | AM & PM Peak   | Not Included    |
| 3        | 2022 | AM & PM Peak   | Included        |

Lane Configurations

During the capacity analysis, the proposed year 2022 intersection lane configurations were developed based upon the Harmony development and the intersection improvements required to achieve an acceptable LOS (LOS “D” or better) for each of the study intersections.

The existing traffic data, the traffic forecast for the year 2022, and the existing intersection lane configurations were used as the input for the capacity analysis. During the capacity analysis, the proposed year 2022 intersection lane configurations were developed based upon current plans for 146<sup>th</sup> Street and the intersection improvements required to achieve an acceptable LOS (LOS “D” or better) for each of the study intersections.

Level of Service and Delay Results

**Table 4** shows the intersection of 156<sup>th</sup> Street & Towne Road will continue to operate at an acceptable LOS in the year 2022 with the existing intersection lane configurations and control. The City of Westfield also requested a roundabout analysis at this location. **Table 4** shows that a one-lane roundabout would also operate above an acceptable level of service in the year 2022.

**Table 4 – Summary of Capacity Analysis for 156<sup>th</sup> Street & Towne Road**

| Scenarios | Analysis Year | AM Peak |                        | PM Peak |                        |
|-----------|---------------|---------|------------------------|---------|------------------------|
|           |               | LOS**   | Avg. Delay (sec/veh)** | LOS**   | Avg. Delay (sec/veh)** |
| 1         | 2012          | B       | 10.3                   | A       | 9.7                    |
| 2         | 2022          | B       | 10.8                   | B       | 10.1                   |
| 3A*       | 2022          | B       | 11.3                   | B       | 10.4                   |
| 3B*       | 2022          | A       | 4.1                    | A       | 4.1                    |

\*3A refers to the existing intersection conditions and 3B refers to roundabout intersection conditions.  
 \*\*Represents the worst approach at the intersection.

**Table 5** shows the intersection of 156<sup>th</sup> Street & Ditch Road will continue to operate at an acceptable LOS in the year 2022 with the existing intersection lane configurations and control. The City of Westfield also requested a roundabout analysis at this location. **Table 5** shows that a one-lane roundabout would also operate above an acceptable level of service in the year 2022.

**Table 5 – Summary of Capacity Analysis for 151<sup>st</sup> Street & Ditch Road**

| Scenarios | Analysis Year | AM Peak |                      | PM Peak |                      |
|-----------|---------------|---------|----------------------|---------|----------------------|
|           |               | LOS     | Avg. Delay (sec/veh) | LOS     | Avg. Delay (sec/veh) |
| 1         | 2012          | A       | 8.6                  | A       | 8.3                  |
| 2         | 2022          | A       | 9.2                  | A       | 8.7                  |
| 3A*       | 2022          | B       | 10.5                 | B       | 10.7                 |
| 3B*       | 2022          | A       | 4.5                  | A       | 4.6                  |

*\*3A refers to the existing intersection conditions and 3B refers to roundabout intersection conditions.*

**Table 6** shows the intersection of 151<sup>st</sup> Street & Towne Road will continue to operate at an acceptable LOS in the year 2022 with the existing intersection lane configurations and control.

**Table 6 – Summary of Capacity Analysis for 151<sup>st</sup> Street & Towne Road**

| Scenarios | Analysis Year | AM Peak |                       | PM Peak |                       |
|-----------|---------------|---------|-----------------------|---------|-----------------------|
|           |               | LOS*    | Avg. Delay (sec/veh)* | LOS*    | Avg. Delay (sec/veh)* |
| 1         | 2012          | B       | 10.0                  | B       | 10.1                  |
| 2         | 2022          | B       | 10.5                  | B       | 10.5                  |
| 3         | 2022          | B       | 11.8                  | B       | 11.8                  |

*\*Represents the worst approach at the intersection.*

**Table 7** shows the intersection of 151<sup>st</sup> Street & Ditch Road will continue to operate at an acceptable LOS for scenario 2 with the existing intersection lane configurations and control. Scenarios 1 and 2 represent existing intersection conditions. For scenario 3, 151<sup>st</sup> Street will be realigned just north of the existing intersection to align with the existing drive on the east side of Ditch Road. In scenario 3, the eastbound approach will operate below acceptable levels of service with the proposed intersection conditions. The proposed intersection conditions include existing lane configurations along Ditch Road and the westbound approach. The eastbound approach of 151<sup>st</sup> Street should consist of two exit lanes and one entry lane. Scenario 3B shows that if a roundabout is installed at this intersection, a level of service “A” can be achieved during both the AM and PM peak hours.

**Table 7 – Summary of Capacity Analysis for 151<sup>st</sup> Street & Ditch Road**

| Scenarios | Analysis Year | AM Peak |                       | PM Peak |                       |
|-----------|---------------|---------|-----------------------|---------|-----------------------|
|           |               | LOS*    | Avg. Delay (sec/veh)* | LOS*    | Avg. Delay (sec/veh)* |
| 1         | 2012          | B       | 10.6                  | A       | 9.4                   |
| 2         | 2022          | B       | 11.2                  | A       | 9.6                   |
| 3A**      | 2022          | E       | 43.5                  | C       | 25.0                  |
| 3B**      | 2022          | A       | 5.5                   | A       | 7.4                   |

\*Represents the worst approach at the intersection.

\*\*3A refers to the existing intersection conditions and 3B refers to roundabout intersection conditions.

**Table 8** shows the intersection of 146<sup>th</sup> Street & Towne Road will continue to operate at an acceptable LOS in the year 2022 with the proposed intersection lane configurations and control. Scenario 1 represents existing intersection conditions. Scenarios 2 and 3 represent the proposed intersection conditions. These intersection conditions include a two-lane roundabout with two-lane entries on each approach. The northbound and southbound approaches will flare from a single lane to a double lane entry.

**Table 8 – Summary of Capacity Analysis for 146<sup>th</sup> Street & Towne Road**

| Scenarios | Analysis Year | AM Peak |                      | PM Peak |                      |
|-----------|---------------|---------|----------------------|---------|----------------------|
|           |               | LOS     | Avg. Delay (sec/veh) | LOS     | Avg. Delay (sec/veh) |
| 1         | 2012          | B       | 11.1                 | C       | 15.3                 |
| 2         | 2022          | A       | 2.1                  | A       | 2.3                  |
| 3         | 2022          | A       | 2.3                  | A       | 2.6                  |

**Table 9** shows the intersection of 146<sup>th</sup> Street & Ditch Road will continue to operate at an acceptable LOS in the year 2022 with the proposed intersection conditions. Scenario 1 represents existing intersection conditions. Scenarios 2 and 3 represent the proposed intersection conditions as provided by RW Armstrong. These intersection conditions include a two-lane roundabout with two-lane entries on each approach. The northbound and southbound approaches will flare from a single lane to a double lane entry.

**Table 9 – Summary of Capacity Analysis for 146<sup>th</sup> Street & Ditch Road**

| Scenarios | Analysis Year | AM Peak |                      | PM Peak |                      |
|-----------|---------------|---------|----------------------|---------|----------------------|
|           |               | LOS     | Avg. Delay (sec/veh) | LOS     | Avg. Delay (sec/veh) |
| 1         | 2012          | C       | 17.2                 | D       | 34.4                 |
| 2         | 2022          | A       | 2.5                  | A       | 2.6                  |
| 3         | 2022          | A       | 3.6                  | A       | 3.9                  |

**Table 10** shows the intersection of 146<sup>th</sup> Street & Drive A will operate at an acceptable LOS in the year 2022 with the proposed intersection conditions. The proposed intersection conditions consist of a right-in/right-out stop-sign controlled intersection with the southbound approach stopping for the westbound approach. The drive will consist of one entry lane and one right-turn only exit lane. 146<sup>th</sup> Street will consist of two through lanes in the eastbound direction, and one through lane and one through/right shared lane in the westbound direction.

**Table 10 – Summary of Capacity Analysis for 146<sup>th</sup> Street & Drive A**

| Scenarios | Analysis Year | AM Peak |                       | PM Peak |                       |
|-----------|---------------|---------|-----------------------|---------|-----------------------|
|           |               | LOS*    | Avg. Delay (sec/veh)* | LOS*    | Avg. Delay (sec/veh)* |
| 3         | 2022          | A       | 9.5                   | B       | 10.8                  |

*\*Represents the worst approach at the intersection.*

**Table 11** shows the intersection of 146<sup>th</sup> Street & Drive B will operate at an acceptable LOS in the year 2022 with the proposed intersection conditions. The proposed intersection conditions consist of a right-in/right-out stop-sign controlled intersection with the northbound approach stopping for the eastbound approach. The drive will consist of one entry lane and one right-turn only exit lane. 146<sup>th</sup> Street will consist of one through lane and one through/right shared lane in the eastbound direction, and two through lanes in the westbound direction.

**Table 11 – Summary of Capacity Analysis for 146<sup>th</sup> Street & Drive B**

| Scenarios | Analysis Year | AM Peak |                       | PM Peak |                       |
|-----------|---------------|---------|-----------------------|---------|-----------------------|
|           |               | LOS*    | Avg. Delay (sec/veh)* | LOS*    | Avg. Delay (sec/veh)* |
| 3         | 2022          | A       | 9.3                   | B       | 10.2                  |

*\*Represents the worst approach at the intersection.*

**Table 12** shows the intersection of 146<sup>th</sup> Street & Drive C/I & Somerville Drive will operate at an acceptable LOS in the year 2022 with the proposed intersection conditions. The proposed intersection conditions consist of a 5-legged roundabout intersection. The southbound, westbound, north-eastbound, and south-eastbound approaches will consist of a single entry lane and a single exit lane. Due to the high number of northbound left-turning vehicles during the PM peak hour, the northbound approach should consist of a two-lane entry and a single lane exit. This entry should consist of an exclusive left-turn lane and a shared through/right-turn lane.

**Table 12 – Summary of Capacity Analysis for Ditch Road & Drive C/I & Somerville Drive**

| Scenarios | Analysis Year | AM Peak |                      | PM Peak |                      |
|-----------|---------------|---------|----------------------|---------|----------------------|
|           |               | LOS     | Avg. Delay (sec/veh) | LOS     | Avg. Delay (sec/veh) |
| 3         | 2022          | A       | 9.37                 | A       | 5.43                 |

**Table 13** shows the intersection of 151<sup>st</sup> Street & Drive D will operate at an acceptable LOS in the year 2022 with the proposed intersection conditions. The proposed intersection conditions include a stop controlled intersection with the northbound approach (Drive D) stopping for the eastbound and westbound approaches (151<sup>st</sup> Street). Each approach will consist of one lane in each direction.

**Table 13 – Summary of Capacity Analysis for 151<sup>st</sup> Street & Drive D**

| Scenarios | Analysis Year | AM Peak |                       | PM Peak |                       |
|-----------|---------------|---------|-----------------------|---------|-----------------------|
|           |               | LOS*    | Avg. Delay (sec/veh)* | LOS*    | Avg. Delay (sec/veh)* |
| 3         | 2022          | A       | 9.3                   | A       | 9.1                   |

*\*Represents the worst approach at the intersection.*

**Table 14** shows the intersection of 151<sup>st</sup> Street & Drive E will operate at an acceptable LOS in the year 2022 with the proposed intersection conditions. The proposed intersection conditions include a stop controlled intersection with the northbound and southbound approaches (Drive E) stopping for the eastbound and westbound approaches (151<sup>st</sup> Street). Each approach will consist of one lane in each direction.

**Table 14 – Summary of Capacity Analysis for 151<sup>st</sup> Street & Drive E**

| Scenarios | Analysis Year | AM Peak |                       | PM Peak |                       |
|-----------|---------------|---------|-----------------------|---------|-----------------------|
|           |               | LOS*    | Avg. Delay (sec/veh)* | LOS*    | Avg. Delay (sec/veh)* |
| 3         | 2022          | B       | 10.8                  | B       | 11.9                  |

*\*Represents the worst approach at the intersection.*

**Table 15** shows the intersection of 151<sup>st</sup> Street & Drive F will operate at an acceptable LOS in the year 2022 with the proposed intersection conditions. The proposed intersection conditions include a stop controlled intersection with the southbound approach (Drive F) stopping for the eastbound and westbound approaches (151<sup>st</sup> Street). Each approach will consist of one lane in each direction.

**Table 15 – Summary of Capacity Analysis for 151<sup>st</sup> Street & Drive F**

| Scenarios | Analysis Year | AM Peak |                       | PM Peak |                       |
|-----------|---------------|---------|-----------------------|---------|-----------------------|
|           |               | LOS*    | Avg. Delay (sec/veh)* | LOS*    | Avg. Delay (sec/veh)* |
| 3         | 2022          | A       | 9.4                   | A       | 9.9                   |

*\*Represents the worst approach at the intersection.*

**Table 16** shows the intersection of 151<sup>st</sup> Street & Drive G will operate at an acceptable LOS in the year 2022 with the proposed intersection conditions. The proposed intersection conditions include a stop controlled intersection with the southbound approach (Drive G) stopping for the eastbound and westbound approaches (151<sup>st</sup> Street). Each approach will consist of one lane in each direction.

**Table 16 – Summary of Capacity Analysis for 151<sup>st</sup> Street & Drive G**

| Scenarios | Analysis Year | AM Peak |                       | PM Peak |                       |
|-----------|---------------|---------|-----------------------|---------|-----------------------|
|           |               | LOS*    | Avg. Delay (sec/veh)* | LOS*    | Avg. Delay (sec/veh)* |
| 3         | 2022          | A       | 9.6                   | B       | 10.0                  |

*\*Represents the worst approach at the intersection.*

**Table 17** shows the intersection of 151<sup>st</sup> Street & Drive H will operate at an acceptable LOS in the year 2022 with the proposed intersection conditions. The proposed intersection conditions include a stop controlled intersection with the northbound approach (Drive H) stopping for the eastbound and westbound approaches (156<sup>th</sup> Street). Each approach will consist of one lane in each direction.

**Table 17 – Summary of Capacity Analysis for 151<sup>st</sup> Street & Drive H**

| Scenarios | Analysis Year | AM Peak |                       | PM Peak |                       |
|-----------|---------------|---------|-----------------------|---------|-----------------------|
|           |               | LOS*    | Avg. Delay (sec/veh)* | LOS*    | Avg. Delay (sec/veh)* |
| 3         | 2022          | A       | 9.0                   | A       | 9.4                   |

*\*Represents the worst approach at the intersection.*

## Findings

The capacity analysis has shown that all study intersections can achieve acceptable levels of service for all three study scenarios with the proposed intersection conditions. The proposed intersection conditions are described below.

*156<sup>th</sup> Street & Towne Road* – This intersection will operate above acceptable levels of service during the AM and PM peak hours for all scenarios with either existing intersection conditions or with a single lane roundabout.

*156<sup>th</sup> Street & Ditch Road* – This intersection will operate above acceptable levels of service during the AM and PM peak hours for all scenarios with either existing intersection conditions or with a single lane roundabout.

*151<sup>st</sup> Street & Towne Road* – This intersection will operate above acceptable levels of service during the AM and PM peak hours for all scenarios with existing intersection conditions.

*151<sup>st</sup> Street & Ditch Road* – This intersection will operate above acceptable levels of service during the PM peak hour for all scenarios with proposed intersection conditions; however, the eastbound approach will operate below acceptable levels of service for Scenario 3 during the AM peak hour. The proposed intersection conditions should include one of the following two options:

- Two-way stop controlled with 151<sup>st</sup> stopping for Ditch: 151<sup>st</sup> Street should be realigned with the drive to the east and eastbound 151<sup>st</sup> Street approach should consist of two eastbound lanes and one westbound lane. For this intersection condition, the eastbound approach will experience delays amounting to a LOS E during the AM peak hour.
- Roundabout: This intersection should be a single-lane roundabout and all approaches should consist of a single entry and exit lane.

*146<sup>th</sup> Street & Towne Road* – This intersection will operate above acceptable levels of service during the AM and PM peak hours for all scenarios with proposed intersection conditions:

- Double lane roundabout.
- Two-lane entries on all approaches.

*146<sup>th</sup> Street & Ditch Road* – This intersection will operate above acceptable levels of service during the AM and PM peak hours for all scenarios with proposed intersection conditions:

- Double lane roundabout.
- Two-lane entries on all approaches.

*146<sup>th</sup> Street & Drive A* – This intersection will operate above acceptable levels of service during the AM and PM peak hours for Scenario 3 with proposed intersection conditions:

- Right-in/Right-out intersection.
- Drive A to consist of one entry lane and one exit lane.
- 146<sup>th</sup> Street to be constructed as planned.

*146<sup>th</sup> Street & Drive B* – This intersection will operate above acceptable levels of service during the AM and PM peak hours for Scenario 3 with proposed intersection conditions:

- Right-in/Right-out intersection.
- Drive B to consist of one entry lane and one exit lane.
- 146<sup>th</sup> Street to be constructed as planned.

*Ditch Road & Drive C/I & Somerville Road* – This intersection will operate above acceptable levels of service during the AM and PM peak hours for Scenario 3 with proposed intersection conditions:

- Double lane roundabout.
- Northbound Ditch Road to consist of one two entry lanes and one exit lane.
- All remaining approaches to consist of one entry lane and one exit lane.

*151<sup>st</sup> Street & Drive D* – This intersection will operate above acceptable levels of service during the AM and PM peak hours for Scenario 3 with proposed intersection conditions:

- Stop controlled T-intersection with Drive D stopping for 151<sup>st</sup> Street.
- All approaches consisting of one lane in each direction.

*151<sup>st</sup> Street & Drive E* – This intersection will operate above acceptable levels of service during the AM and PM peak hours for Scenario 3 with proposed intersection conditions:

- Stop controlled intersection with Drive E stopping for 151<sup>st</sup> Street.
- All approaches consisting of one lane in each direction.

*151<sup>st</sup> Street & Drive F* – This intersection will operate above acceptable levels of service during the AM and PM peak hours for Scenario 3 with proposed intersection conditions:

- Stop controlled T-intersection with Drive F stopping for 151<sup>st</sup> Street.
- All approaches consisting of one lane in each direction.

*151<sup>st</sup> Street & Drive G* – This intersection will operate above acceptable levels of service during the AM and PM peak hours for Scenario 3 with proposed intersection conditions:

- Stop controlled T-intersection with Drive G stopping for 151<sup>st</sup> Street.
- All approaches consisting of one lane in each direction.

*156<sup>th</sup> Street & Drive H* – This intersection will operate above acceptable levels of service during the AM and PM peak hours for Scenario 3 with proposed intersection conditions:

- Stop controlled T-intersection with Drive H stopping for 156<sup>th</sup> Street.
- All approaches consisting of one lane in each direction.

**Appendices**

Appendix A – Existing Traffic Counts

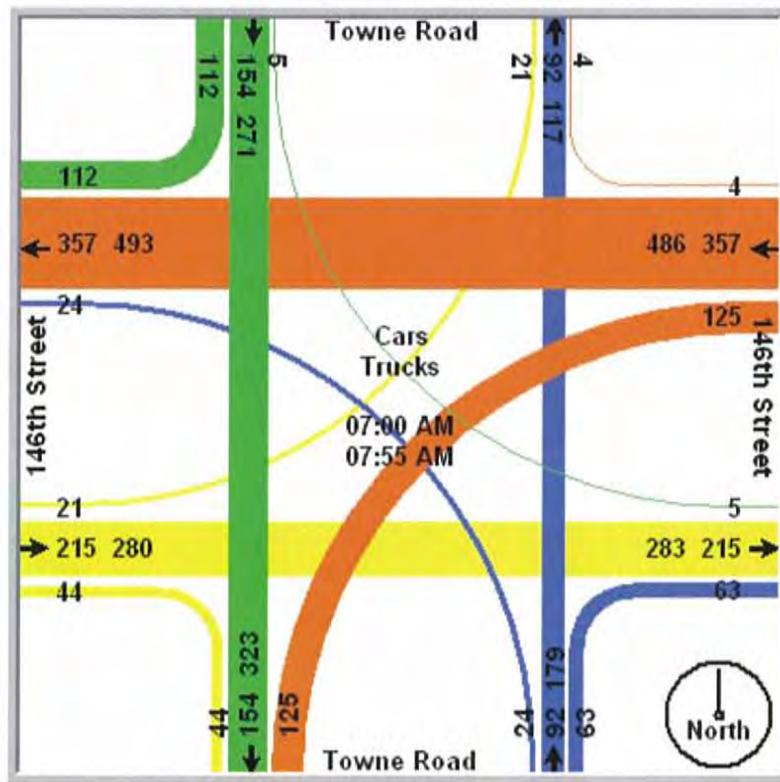
Appendix B – Capacity Analysis Output

Appendix C – Trip Distribution Figures

Appendix D – Meeting Notes

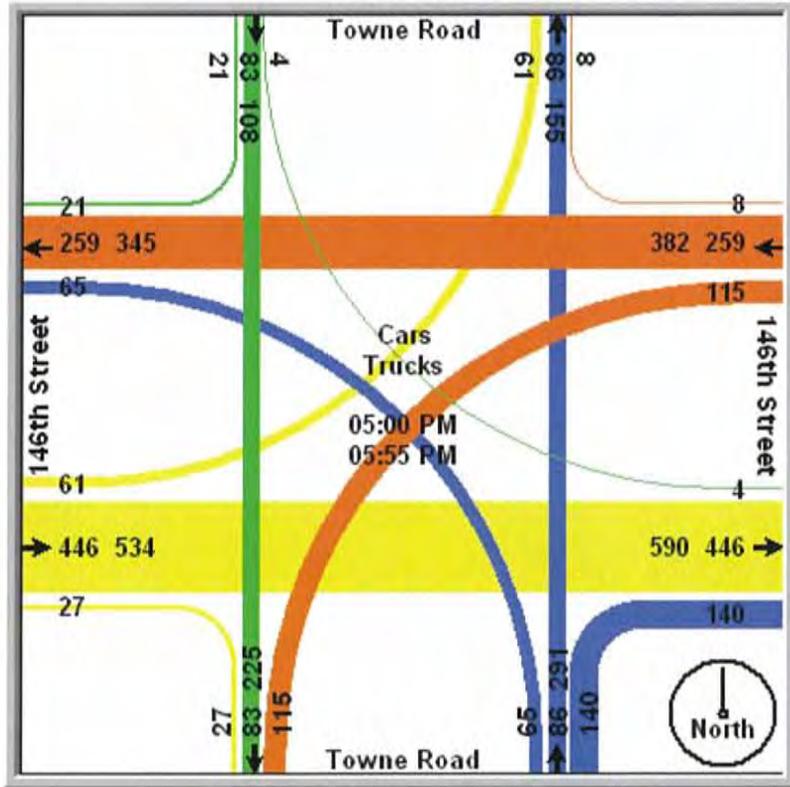
Appendix A  
Existing Traffic Counts

Location #10: **146<sup>th</sup> Street at Towne Road**  
**AM Peak Hour** - Cars and Trucks



| Start Time   | Towne Road From North |      |      |            | 146th Street From East |      |       |            | Towne Road From South |      |      |            | 146th Street From West |      |       |            | Int. Total |
|--|-----------------------|------|------|------------|------------------------|------|-------|------------|-----------------------|------|------|------------|------------------------|------|-------|------------|------------|
|  | Right                 | Thru | Left | App. Total | Right                  | Thru | Left  | App. Total | Right                 | Thru | Left | App. Total | Right                  | Thru | Left  | App. Total |            |
| Peak Hour Analysis From 7:00:00 AM to 8:45:00 AM - Peak 1 of 1 |                       |      |      |            |                        |      |       |            |                       |      |      |            |                        |      |       |            |            |
| Peak Hour for Entire Intersection Begins at 7:00:00 AM         |                       |      |      |            |                        |      |       |            |                       |      |      |            |                        |      |       |            |            |
| 7:00:00 AM   | 20                    | 38   | 2    | 60         | 0                      | 75   | 27    | 102        | 14                    | 27   | 10   | 51         | 4                      | 44   | 6     | 54         | 267        |
| 7:15:00 AM   | 34                    | 43   | 1    | 78         | 1                      | 86   | 36    | 123        | 16                    | 22   | 5    | 43         | 15                     | 56   | 6     | 77         | 321        |
| 7:30:00 AM   | 40                    | 36   | 1    | 77         | 2                      | 105  | 28    | 135        | 18                    | 27   | 5    | 50         | 6                      | 71   | 3     | 80         | 342        |
| 7:45:00 AM   | 18                    | 37   | 1    | 56         | 1                      | 91   | 34    | 126        | 15                    | 16   | 4    | 35         | 19                     | 44   | 6     | 69         | 286        |
| Total Volume   | 112                   | 154  | 5    | 271        | 4                      | 357  | 125   | 486        | 63                    | 92   | 24   | 179        | 44                     | 215  | 21    | 280        | 1216       |
| % App. Total   | 41.3                  | 56.8 | 1.8  |            | 0.8                    | 73.5 | 25.7  |            | 35.2                  | 51.4 | 13.4 |            | 15.7                   | 76.8 | 7.5   |            |            |
| PHF  | 0.7                   | 0.9  | 0.6  | 0.87       | 0.5                    | 0.85 | 0.868 | 0.9        | 0.88                  | 0.85 | 0.6  | 0.88       | 0.579                  | 0.76 | 0.875 | 0.88       | 0.889      |
| Cars   | 110                   | 147  | 4    | 261        | 3                      | 351  | 122   | 476        | 61                    | 90   | 24   | 175        | 38                     | 197  | 21    | 256        | 1168       |
| % Cars   | 98.2                  | 95.5 | 80   | 96.3       | 75                     | 98.3 | 97.6  | 97.9       | 96.8                  | 97.8 | 100  | 97.8       | 86.4                   | 91.6 | 100   | 91.4       | 96.1       |
| Trucks   | 2                     | 7    | 1    | 10         | 1                      | 6    | 3     | 10         | 2                     | 2    | 0    | 4          | 6                      | 18   | 0     | 24         | 48         |
| % Trucks   | 1.8                   | 4.5  | 20   | 3.7        | 25                     | 1.7  | 2.4   | 2.1        | 3.2                   | 2.2  | 0    | 2.2        | 13.6                   | 8.4  | 0     | 8.6        | 3.9        |

Location #10: 146<sup>th</sup> Street at Towne Road  
 PM Peak Hour - Cars and Trucks



| Start Time   | Towne Road From North |      |      |            | 146th Street From East |      |       |            | Towne Road From South |      |       |            | 146th Street From West |      |      |            | Int. Total |
|--|-----------------------|------|------|------------|------------------------|------|-------|------------|-----------------------|------|-------|------------|------------------------|------|------|------------|------------|
|  | Right                 | Thru | Left | App. Total | Right                  | Thru | Left  | App. Total | Right                 | Thru | Left  | App. Total | Right                  | Thru | Left | App. Total |            |
| Peak Hour Analysis From 4:00:00 PM to 5:45:00 PM - Peak 1 of 1 |                       |      |      |            |                        |      |       |            |                       |      |       |            |                        |      |      |            |            |
| Peak Hour for Entire Intersection Begins at 5:00:00 PM         |                       |      |      |            |                        |      |       |            |                       |      |       |            |                        |      |      |            |            |
| 5:00:00 PM   | 4                     | 19   | 2    | 25         | 2                      | 62   | 26    | 90         | 34                    | 31   | 18    | 83         | 4                      | 106  | 14   | 124        | 322        |
| 5:15:00 PM   | 6                     | 24   | 1    | 31         | 2                      | 62   | 35    | 99         | 32                    | 17   | 16    | 65         | 8                      | 106  | 13   | 127        | 322        |
| 5:30:00 PM   | 5                     | 20   | 0    | 25         | 1                      | 65   | 33    | 99         | 45                    | 15   | 15    | 75         | 6                      | 126  | 9    | 141        | 340        |
| 5:45:00 PM   | 6                     | 20   | 1    | 27         | 3                      | 70   | 21    | 94         | 29                    | 23   | 16    | 68         | 9                      | 108  | 25   | 142        | 331        |
| Total Volume   | 21                    | 83   | 4    | 108        | 8                      | 259  | 115   | 382        | 140                   | 86   | 65    | 291        | 27                     | 446  | 61   | 534        | 1315       |
| % App. Total   | 19.4                  | 76.9 | 3.7  |            | 2.1                    | 67.8 | 30.1  |            | 48.1                  | 29.6 | 22.3  |            | 5.1                    | 83.5 | 11.4 |            |            |
| PHF  | 0.88                  | 0.87 | 0.5  | 0.87       | 0.67                   | 0.93 | 0.821 | 0.965      | 0.78                  | 0.69 | 0.903 | 0.88       | 0.75                   | 0.89 | 0.61 | 0.94       | 0.967      |
| Cars   | 21                    | 83   | 4    | 108        | 7                      | 247  | 113   | 367        | 134                   | 81   | 61    | 276        | 25                     | 435  | 60   | 520        | 1271       |
| % Cars   | 100                   | 100  | 100  | 100        | 87.5                   | 95.4 | 98.3  | 96.1       | 95.7                  | 94.2 | 93.8  | 94.8       | 92.6                   | 97.5 | 98.4 | 97.4       | 96.7       |
| Trucks   | 0                     | 0    | 0    | 0          | 1                      | 12   | 2     | 15         | 6                     | 5    | 4     | 15         | 2                      | 11   | 1    | 14         | 44         |
| % Trucks   | 0                     | 0    | 0    | 0          | 12.5                   | 4.6  | 1.7   | 3.9        | 4.3                   | 5.8  | 6.2   | 5.2        | 7.4                    | 2.5  | 1.6  | 2.6        | 3.3        |

Groups Printed- Unshifted - Bank 1

| Start Time  | Ditch From North |      |      |      |       |      | Ditch From South |      |      |      |       |      | 146th From East |      |      |      |       |      | 146th From West |      |      |      |       |      |
|-------------|------------------|------|------|------|-------|------|------------------|------|------|------|-------|------|-----------------|------|------|------|-------|------|-----------------|------|------|------|-------|------|
|             | Right            | Thru | Left | Peds | Right | Thru | Right            | Thru | Left | Peds | Right | Thru | Right           | Thru | Left | Peds | Right | Thru | Right           | Thru | Left | Peds | Right | Thru |
|             |                  |      |      |      |       |      |                  |      |      |      |       |      |                 |      |      |      |       |      |                 |      |      |      |       |      |
| 07:00 AM    | 5                | 68   | 18   | 0    | 3     | 28   | 25               | 22   | 4    | 0    | 25    | 22   | 25              | 22   | 4    | 0    | 25    | 22   | 1               | 20   | 2    | 0    | 1     | 20   |
| 07:15 AM    | 2                | 77   | 22   | 0    | 3     | 42   | 29               | 20   | 3    | 0    | 33    | 20   | 29              | 20   | 3    | 0    | 33    | 20   | 5               | 44   | 0    | 0    | 5     | 44   |
| 07:30 AM    | 9                | 96   | 15   | 0    | 5     | 47   | 35               | 15   | 2    | 0    | 24    | 15   | 35              | 15   | 2    | 0    | 24    | 15   | 5               | 37   | 0    | 0    | 5     | 37   |
| 07:45 AM    | 2                | 55   | 10   | 0    | 2     | 47   | 23               | 11   | 2    | 0    | 23    | 11   | 23              | 11   | 2    | 0    | 23    | 11   | 3               | 37   | 3    | 0    | 3     | 37   |
| Total       | 18               | 296  | 65   | 0    | 13    | 164  | 112              | 68   | 11   | 0    | 105   | 68   | 112             | 68   | 11   | 0    | 105   | 68   | 14              | 138  | 5    | 0    | 14    | 138  |
| 08:00 AM    | 2                | 60   | 9    | 0    | 6     | 41   | 21               | 13   | 2    | 0    | 27    | 13   | 21              | 13   | 2    | 0    | 27    | 13   | 1               | 20   | 1    | 0    | 1     | 20   |
| 08:15 AM    | 3                | 36   | 13   | 0    | 4     | 41   | 15               | 12   | 1    | 0    | 9     | 12   | 15              | 12   | 1    | 0    | 9     | 12   | 0               | 25   | 1    | 0    | 0     | 25   |
| 08:30 AM    | 5                | 38   | 7    | 0    | 1     | 40   | 18               | 9    | 4    | 0    | 16    | 9    | 18              | 9    | 4    | 0    | 16    | 9    | 2               | 25   | 1    | 0    | 2     | 25   |
| 08:45 AM    | 5                | 16   | 4    | 0    | 3     | 26   | 9                | 12   | 0    | 0    | 9     | 12   | 9               | 12   | 0    | 0    | 9     | 12   | 2               | 18   | 1    | 0    | 2     | 18   |
| Total       | 15               | 150  | 33   | 0    | 14    | 148  | 63               | 46   | 7    | 0    | 61    | 46   | 63              | 46   | 7    | 0    | 61    | 46   | 5               | 88   | 4    | 0    | 5     | 88   |
| Grand Total | 33               | 446  | 98   | 0    | 27    | 312  | 175              | 114  | 18   | 0    | 166   | 114  | 175             | 114  | 18   | 0    | 166   | 114  | 19              | 226  | 9    | 0    | 19    | 226  |
| Approch %   | 5.7              | 77.3 | 17   | 0    | 5.2   | 60.6 | 34               | 38.3 | 6    | 0    | 55.7  | 38.3 | 34              | 38.3 | 6    | 0    | 55.7  | 38.3 | 7.5             | 89   | 3.5  | 0    | 7.5   | 89   |
| Total %     | 2                | 27.1 | 6    | 0    | 1.6   | 19   | 10.6             | 6.9  | 1.1  | 0    | 10.1  | 6.9  | 10.6            | 6.9  | 1.1  | 0    | 10.1  | 6.9  | 1.2             | 13.7 | 0.5  | 0    | 1.2   | 13.7 |
| Unshifted   | 33               | 446  | 97   | 0    | 26    | 303  | 173              | 111  | 16   | 0    | 165   | 111  | 173             | 111  | 16   | 0    | 165   | 111  | 18              | 220  | 9    | 0    | 18    | 220  |
| % Unshifted | 100              | 100  | 99   | 0    | 96.3  | 97.1 | 98.9             | 97.4 | 88.9 | 0    | 99.4  | 97.4 | 98.9            | 97.4 | 88.9 | 0    | 99.4  | 97.4 | 94.7            | 97.3 | 100  | 0    | 94.7  | 97.3 |
| Bank 1      | 0                | 0    | 1    | 0    | 1     | 9    | 2                | 3    | 2    | 0    | 1     | 3    | 2               | 2.6  | 11.1 | 0    | 0.6   | 2.6  | 1               | 6    | 0    | 0    | 1     | 6    |
| % Bank 1    | 0                | 0    | 1    | 0    | 3.7   | 2.9  | 1.1              | 2.6  | 11.1 | 0    | 0.6   | 2.6  | 1.1             | 2.6  | 11.1 | 0    | 0.6   | 2.6  | 5.3             | 2.7  | 0    | 0    | 5.3   | 2.7  |

| Start Time   | Ditch From North |      |      |      |       |      | 146th From East |      |      |      |       |      | Ditch From South |      |      |      |       |      | 146th From West |      |      |      |       |      |
|--------------|------------------|------|------|------|-------|------|-----------------|------|------|------|-------|------|------------------|------|------|------|-------|------|-----------------|------|------|------|-------|------|
|              | Right            | Thru | Left | Peds | Right | Thru | Right           | Thru | Left | Peds | Right | Thru | Right            | Thru | Left | Peds | Right | Thru | Right           | Thru | Left | Peds | Right | Thru |
|              |                  |      |      |      |       |      |                 |      |      |      |       |      |                  |      |      |      |       |      |                 |      |      |      |       |      |
| 7:00:00 AM   | 5                | 68   | 18   | 0    | 3     | 28   | 25              | 22   | 4    | 0    | 25    | 22   | 25               | 22   | 4    | 0    | 25    | 22   | 1               | 20   | 2    | 0    | 1     | 20   |
| 7:15:00 AM   | 2                | 77   | 22   | 0    | 3     | 42   | 29              | 20   | 3    | 0    | 33    | 20   | 29               | 20   | 3    | 0    | 33    | 20   | 5               | 44   | 0    | 0    | 5     | 44   |
| 7:30:00 AM   | 9                | 96   | 15   | 0    | 5     | 47   | 35              | 15   | 2    | 0    | 24    | 15   | 35               | 15   | 2    | 0    | 24    | 15   | 5               | 37   | 0    | 0    | 5     | 37   |
| 7:45:00 AM   | 2                | 55   | 10   | 0    | 2     | 47   | 23              | 11   | 2    | 0    | 23    | 11   | 23               | 11   | 2    | 0    | 23    | 11   | 3               | 37   | 3    | 0    | 3     | 37   |
| Total Volume | 18               | 296  | 65   | 0    | 13    | 164  | 112             | 68   | 11   | 0    | 105   | 68   | 112              | 68   | 11   | 0    | 105   | 68   | 14              | 138  | 5    | 0    | 14    | 138  |
| % App. Total | 4.7              | 78.1 | 17.2 | 0    | 4.5   | 56.6 | 38.6            | 37.3 | 6    | 0    | 57.1  | 37.3 | 38.6             | 37.3 | 6    | 0    | 57.1  | 37.3 | 8.9             | 87.9 | 3.2  | 0    | 8.9   | 87.9 |
| PHF          | 500              | 771  | 739  | 000  | 650   | 872  | 800             | 790  | 000  | 833  | 795   | 773  | 688              | 000  | 821  | 700  | 784   | 417  | 000             | 801  | 801  | 871  |       |      |
| Unshifted    | 18               | 296  | 64   | 0    | 13    | 162  | 111             | 68   | 9    | 0    | 104   | 68   | 9                | 0    | 181  | 13   | 135   | 5    | 0               | 153  | 153  | 999  |       |      |
| % Unshifted  | 100              | 100  | 98.5 | 0    | 99.7  | 98.8 | 99.1            | 100  | 99.0 | 0    | 99.0  | 100  | 81.8             | 0    | 98.4 | 92.9 | 97.8  | 100  | 0               | 97.5 | 97.5 | 98.9 |       |      |
| Bank 1       | 0                | 0    | 1    | 0    | 0     | 2    | 1               | 0    | 2    | 0    | 1     | 0    | 2                | 0    | 3    | 1    | 3     | 0    | 0               | 4    | 4    | 11   |       |      |
| % Bank 1     | 0                | 0    | 1.5  | 0    | 0     | 1.2  | 0.9             | 0    | 1.0  | 0    | 1.0   | 0    | 18.2             | 0    | 1.6  | 7.1  | 2.2   | 0    | 0               | 2.5  | 2.5  | 1.1  |       |      |

Peak Hour Analysis From 7:00:00 AM to 8:45:00 AM - Peak 1 of 1  
 Peak Hour for Entire Intersection Begins at 7:00:00 AM

Groups Printed- Unshifted - Bank 1

| Start Time  | Ditch From North |      |      |      |            |            | 146th From East |      |      |      |            |            | Ditch From South |      |      |      |            |            | 146th From West |      |      |      |            |            |
|-------------|------------------|------|------|------|------------|------------|-----------------|------|------|------|------------|------------|------------------|------|------|------|------------|------------|-----------------|------|------|------|------------|------------|
|             | Right            | Thru | Left | Peds | App. Total | Int. Total | Right           | Thru | Left | Peds | App. Total | Int. Total | Right            | Thru | Left | Peds | App. Total | Int. Total | Right           | Thru | Left | Peds | App. Total | Int. Total |
|             | 04:00 PM         | 4    | 11   | 6    | 0          | 17         | 0               | 8    | 36   | 7    | 0          | 44         | 0                | 14   | 26   | 5    | 0          | 45         | 0               | 2    | 26   | 4    | 0          | 32         |
| 04:15 PM    | 4                | 13   | 5    | 0    | 22         | 0          | 4               | 28   | 15   | 0    | 39         | 0          | 12               | 39   | 3    | 0    | 54         | 0          | 1               | 39   | 3    | 0    | 51         | 0          |
| 04:30 PM    | 3                | 7    | 7    | 0    | 17         | 0          | 5               | 40   | 14   | 0    | 54         | 0          | 18               | 54   | 4    | 0    | 76         | 0          | 1               | 33   | 4    | 0    | 41         | 0          |
| 04:45 PM    | 1                | 19   | 7    | 0    | 27         | 0          | 9               | 40   | 8    | 0    | 54         | 0          | 24               | 54   | 2    | 0    | 80         | 0          | 1               | 42   | 8    | 0    | 52         | 0          |
| Total       | 12               | 50   | 25   | 0    | 87         | 0          | 26              | 144  | 44   | 0    | 173        | 0          | 68               | 173  | 14   | 0    | 255        | 0          | 5               | 140  | 19   | 0    | 164        | 0          |
| 05:00 PM    | 0                | 23   | 7    | 0    | 30         | 0          | 13              | 39   | 14   | 0    | 63         | 0          | 32               | 63   | 4    | 0    | 101        | 0          | 0               | 48   | 4    | 0    | 56         | 0          |
| 05:15 PM    | 1                | 23   | 4    | 0    | 28         | 0          | 15              | 47   | 19   | 0    | 77         | 0          | 36               | 77   | 4    | 0    | 117        | 0          | 3               | 55   | 10   | 0    | 73         | 0          |
| 05:30 PM    | 2                | 26   | 6    | 0    | 34         | 0          | 12              | 31   | 14   | 0    | 68         | 0          | 31               | 68   | 0    | 0    | 99         | 0          | 2               | 54   | 6    | 0    | 62         | 0          |
| 05:45 PM    | 2                | 21   | 8    | 0    | 31         | 0          | 11              | 32   | 21   | 0    | 64         | 0          | 26               | 64   | 2    | 0    | 92         | 0          | 1               | 48   | 5    | 0    | 54         | 0          |
| Total       | 5                | 93   | 25   | 0    | 118        | 0          | 51              | 149  | 68   | 0    | 260        | 0          | 125              | 260  | 10   | 0    | 356        | 0          | 6               | 205  | 25   | 0    | 236        | 0          |
| Grand Total | 17               | 143  | 50   | 0    | 210        | 0          | 77              | 293  | 112  | 0    | 433        | 0          | 193              | 433  | 24   | 0    | 550        | 0          | 11              | 345  | 44   | 0    | 400        | 0          |
| Approch %   | 8.1              | 68.1 | 23.8 | 0    | 100        | 0          | 16              | 60.8 | 23.2 | 0    | 66.6       | 0          | 29.7             | 66.6 | 3.7  | 0    | 70.0       | 0          | 2.8             | 86.2 | 11   | 0    | 90.0       | 0          |
| Total %     | 1                | 8.2  | 2.9  | 0    | 11.9       | 0          | 4.4             | 16.8 | 6.4  | 0    | 24.9       | 0          | 11.1             | 24.9 | 1.4  | 0    | 27.4       | 0          | 0.6             | 19.8 | 2.5  | 0    | 22.9       | 0          |
| Unshifted   | 17               | 142  | 48   | 0    | 207        | 0          | 77              | 290  | 112  | 0    | 432        | 0          | 192              | 432  | 24   | 0    | 558        | 0          | 11              | 341  | 44   | 0    | 396        | 0          |
| % Unshifted | 100              | 99.3 | 96   | 0    | 100        | 0          | 100             | 99   | 100  | 0    | 99.8       | 0          | 99.5             | 99.8 | 100  | 0    | 100        | 0          | 100             | 98.8 | 100  | 0    | 99.3       | 0          |
| Bank 1      | 0                | 1    | 2    | 0    | 3          | 0          | 0               | 3    | 0    | 0    | 1          | 0          | 1                | 1    | 0    | 0    | 2          | 0          | 0               | 4    | 0    | 0    | 4          | 0          |
| % Bank 1    | 0                | 0.7  | 4    | 0    | 2.6        | 0          | 0               | 1    | 0    | 0    | 0.2        | 0          | 0.5              | 0.2  | 0    | 0    | 0.7        | 0          | 0               | 1.2  | 0    | 0    | 1.2        | 0          |

| Start Time   | Ditch From North |      |      |      |            |            | 146th From East |      |      |      |            |            | Ditch From South |      |      |      |            |            | 146th From West |      |      |      |            |            |
|--------------|------------------|------|------|------|------------|------------|-----------------|------|------|------|------------|------------|------------------|------|------|------|------------|------------|-----------------|------|------|------|------------|------------|
|              | Right            | Thru | Left | Peds | App. Total | Int. Total | Right           | Thru | Left | Peds | App. Total | Int. Total | Right            | Thru | Left | Peds | App. Total | Int. Total | Right           | Thru | Left | Peds | App. Total | Int. Total |
|              | 5:00:00 PM       | 0    | 23   | 7    | 0          | 30         | 0               | 13   | 39   | 14   | 0          | 66         | 0                | 32   | 63   | 4    | 0          | 99         | 0               | 0    | 48   | 4    | 0          | 52         |
| 5:15:00 PM   | 1                | 23   | 4    | 0    | 28         | 0          | 15              | 47   | 19   | 0    | 81         | 0          | 36               | 77   | 4    | 0    | 117        | 0          | 3               | 55   | 10   | 0    | 68         | 0          |
| 5:30:00 PM   | 2                | 26   | 6    | 0    | 34         | 0          | 12              | 31   | 14   | 0    | 57         | 0          | 31               | 68   | 0    | 0    | 99         | 0          | 2               | 54   | 6    | 0    | 62         | 0          |
| 5:45:00 PM   | 2                | 21   | 8    | 0    | 31         | 0          | 11              | 32   | 21   | 0    | 64         | 0          | 26               | 64   | 2    | 0    | 92         | 0          | 1               | 48   | 5    | 0    | 54         | 0          |
| Total Volume | 5                | 93   | 25   | 0    | 123        | 0          | 51              | 149  | 68   | 0    | 268        | 0          | 125              | 260  | 10   | 0    | 395        | 0          | 6               | 205  | 25   | 0    | 236        | 0          |
| % App. Total | 4.1              | 75.6 | 20.3 | 0    | 100        | 0          | 19              | 55.6 | 25.4 | 0    | 82.7       | 0          | 31.6             | 65.8 | 2.5  | 0    | 99.5       | 0          | 2.5             | 86.9 | 10.6 | 0    | 90.0       | 0          |
| PHF          | .625             | .894 | .781 | .000 | .904       | 0          | .850            | .793 | .810 | .000 | .827       | 0          | .868             | .844 | .625 | .000 | .844       | 0          | .500            | .932 | .625 | .000 | .868       | 0          |
| Unshifted    | 5                | 93   | 24   | 0    | 122        | 0          | 51              | 147  | 68   | 0    | 266        | 0          | 124              | 259  | 10   | 0    | 393        | 0          | 6               | 203  | 25   | 0    | 234        | 0          |
| % Unshifted  | 100              | 100  | 96.0 | 0    | 99.2       | 0          | 100             | 98.7 | 100  | 0    | 99.3       | 0          | 99.2             | 99.6 | 100  | 0    | 99.5       | 0          | 100             | 99.0 | 100  | 0    | 99.2       | 0          |
| Bank 1       | 0                | 0    | 1    | 0    | 1          | 0          | 0               | 2    | 0    | 0    | 2          | 0          | 1                | 1    | 0    | 0    | 2          | 0          | 0               | 2    | 0    | 0    | 2          | 0          |
| % Bank 1     | 0                | 0    | 4.0  | 0    | 0.8        | 0          | 0               | 1.3  | 0    | 0    | 0.7        | 0          | 0.8              | 0.4  | 0    | 0    | 0.5        | 0          | 0               | 1.0  | 0    | 0    | 0.8        | 0          |

Peak Hour Analysis From 4:00:00 PM to 5:45:00 PM - Peak 1 of 1

Peak Hour for Entire Intersection Begins at 5:00:00 PM

## TRAFFIC VOLUMES

INTERSECTION: **Ditch Road & 156th Street**

BASE YEAR 0  
 FORECAST YEAR 0  
 GROWTH RATE (%) 0

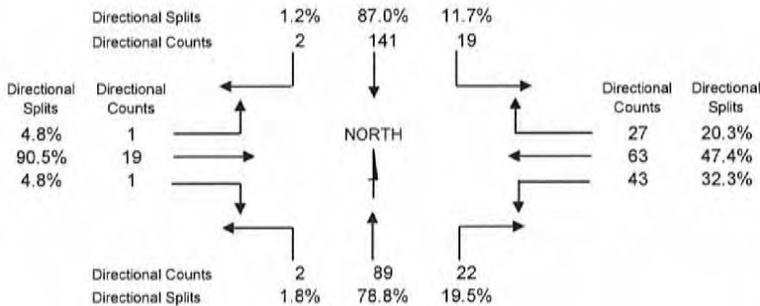
DATE **1/25/2012** 7am-9am

VEHICLES - TOTAL SEE TO RIGHT FOR TRUCKS AND PASSENGER VEHICLES SUBTOTAL

| TIME BEGIN | NB         |      |       | SB         |      |       | EB           |      |       | WB           |      |       | INTERVAL TOTAL | HOUR TOTAL |
|------------|------------|------|-------|------------|------|-------|--------------|------|-------|--------------|------|-------|----------------|------------|
|            | Ditch Road |      |       | Ditch Road |      |       | 156th Street |      |       | 156th Street |      |       |                |            |
|            | LEFT       | THRU | RIGHT | LEFT       | THRU | RIGHT | LEFT         | THRU | RIGHT | LEFT         | THRU | RIGHT |                |            |
|            | ↶          | ↑    | ↷     | ↵          | ↓    | ↶     | ↷            | →    | ↶     | ←            | ↷    |       |                |            |
| 06:00AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0            | 0    | 0     | 0            | 0    | 0     | 0              | 0          |
| 06:15AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0            | 0    | 0     | 0            | 0    | 0     | 0              | 79         |
| 06:30AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0            | 0    | 0     | 0            | 0    | 0     | 0              | 174        |
| 06:45AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0            | 0    | 0     | 0            | 0    | 0     | 0              | 299        |
| 07:00AM    | 0          | 21   | 2     | 2          | 23   | 0     | 0            | 2    | 0     | 7            | 19   | 3     | 79             | 421        |
| 07:15AM    | 0          | 28   | 5     | 3          | 29   | 1     | 1            | 3    | 0     | 8            | 8    | 9     | 95             | 429        |
| 07:30AM    | 0          | 23   | 9     | 2          | 46   | 0     | 0            | 3    | 1     | 16           | 21   | 4     | 125            | 404        |
| 07:45AM    | 2          | 17   | 5     | 6          | 42   | 1     | 0            | 6    | 0     | 9            | 24   | 10    | 122            | 347        |
| 08:00AM    | 0          | 21   | 3     | 8          | 24   | 0     | 0            | 7    | 0     | 10           | 10   | 4     | 87             | 267        |
| 08:15AM    | 0          | 12   | 5     | 4          | 16   | 0     | 0            | 7    | 0     | 8            | 8    | 10    | 70             | --         |
| 08:30AM    | 0          | 15   | 3     | 11         | 11   | 1     | 0            | 3    | 0     | 5            | 10   | 9     | 68             | --         |
| 08:45AM    | 0          | 3    | 4     | 7          | 13   | 2     | 0            | 3    | 0     | 2            | 6    | 2     | 42             | --         |
| 09:00AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0            | 0    | 0     | 0            | 0    | 0     | 0              | 0          |
| 09:15AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0            | 0    | 0     | 0            | 0    | 0     | 0              | 0          |
| 09:30AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0            | 0    | 0     | 0            | 0    | 0     | 0              | 0          |
| 09:45AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0            | 0    | 0     | 0            | 0    | 0     | 0              | 0          |
| 10:00AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0            | 0    | 0     | 0            | 0    | 0     | 0              | 0          |
| 10:15AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0            | 0    | 0     | 0            | 0    | 0     | 0              | 0          |
| 10:30AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0            | 0    | 0     | 0            | 0    | 0     | 0              | 0          |
| 10:45AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0            | 0    | 0     | 0            | 0    | 0     | 0              | 0          |
| 11:00AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0            | 0    | 0     | 0            | 0    | 0     | 0              | 0          |
| 11:15AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0            | 0    | 0     | 0            | 0    | 0     | 0              | --         |
| 11:30AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0            | 0    | 0     | 0            | 0    | 0     | 0              | --         |
| 11:45AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0            | 0    | 0     | 0            | 0    | 0     | 0              | --         |

| Ditch Road                       |      |       | Ditch Road |      |       | 156th Street |      |       | 156th Street |      |       | TOTAL |
|----------------------------------|------|-------|------------|------|-------|--------------|------|-------|--------------|------|-------|-------|
| LEFT                             | THRU | RIGHT | LEFT       | THRU | RIGHT | LEFT         | THRU | RIGHT | LEFT         | THRU | RIGHT |       |
| BASE YEAR PEAK HOUR VOLUMES -- 0 |      |       |            |      |       |              |      |       |              |      |       |       |
| 2                                | 89   | 22    | 19         | 141  | 2     | 1            | 19   | 1     | 43           | 63   | 27    | 429   |
| FUTURE PEAK HOUR VOLUMES -- 0    |      |       |            |      |       |              |      |       |              |      |       |       |
| 2                                | 89   | 22    | 19         | 141  | 2     | 1            | 19   | 1     | 43           | 63   | 27    | 429   |
| NEW GENERATED TRAFFIC            |      |       |            |      |       |              |      |       |              |      |       |       |
| 0                                | 0    | 0     | 0          | 0    | 0     | 0            | 0    | 0     | 0            | 0    | 0     |       |
| TOTAL TRAFFIC                    |      |       |            |      |       |              |      |       |              |      |       |       |
| 2                                | 89   | 22    | 19         | 141  | 2     | 1            | 19   | 1     | 43           | 63   | 27    | 429   |

**YEAR 0 TOTAL TRAFFIC**  
 Ditch Road & 156th Street  
 0



OVERALL PHF = 0.86

**Approach-Based Totals For Peak Hour**

| Leg   | Direction | Count |
|-------|-----------|-------|
| North | NB        | 117   |
|       | SB        | 162   |
| East  | EB        | 60    |
|       | WB        | 133   |
| South | SB        | 185   |
|       | NB        | 113   |
| West  | WB        | 67    |
|       | EB        | 21    |

# TRAFFIC VOLUMES

INTERSECTION: Ditch Road & 156th Street

BASE YEAR 0  
 FORECAST YEAR 0  
 GROWTH RATE (%) 0

DATE 1/25/2012 3pm-6pm

VEHICLES - TOTAL SEE TO RIGHT FOR TRUCKS AND PASSENGER VEHICLES SUBTOTAL

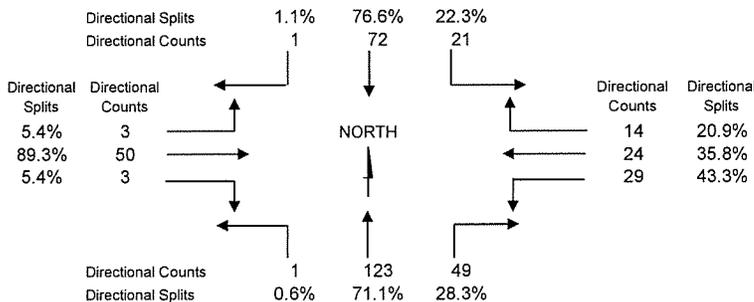
| TIME BEGIN | NB         |      |       | SB         |      |       | EB           |      |       | WB           |      |       | INTERVAL TOTAL | HOUR TOTAL |
|------------|------------|------|-------|------------|------|-------|--------------|------|-------|--------------|------|-------|----------------|------------|
|            | Ditch Road |      |       | Ditch Road |      |       | 156th Street |      |       | 156th Street |      |       |                |            |
|            | LEFT       | THRU | RIGHT | LEFT       | THRU | RIGHT | LEFT         | THRU | RIGHT | LEFT         | THRU | RIGHT |                |            |
| 12:00PM    | 0          | 0    | 0     | 0          | 0    | 0     | 0            | 0    | 0     | 0            | 0    | 0     | 0              | 0          |
| 12:15PM    | 0          | 0    | 0     | 0          | 0    | 0     | 0            | 0    | 0     | 0            | 0    | 0     | 0              | 0          |
| 12:30PM    | 0          | 0    | 0     | 0          | 0    | 0     | 0            | 0    | 0     | 0            | 0    | 0     | 0              | 0          |
| 12:45PM    | 0          | 0    | 0     | 0          | 0    | 0     | 0            | 0    | 0     | 0            | 0    | 0     | 0              | 0          |
| 01:00PM    | 0          | 0    | 0     | 0          | 0    | 0     | 0            | 0    | 0     | 0            | 0    | 0     | 0              | 0          |
| 01:15PM    | 0          | 0    | 0     | 0          | 0    | 0     | 0            | 0    | 0     | 0            | 0    | 0     | 0              | 0          |
| 01:30PM    | 0          | 0    | 0     | 0          | 0    | 0     | 0            | 0    | 0     | 0            | 0    | 0     | 0              | 0          |
| 01:45PM    | 0          | 0    | 0     | 0          | 0    | 0     | 0            | 0    | 0     | 0            | 0    | 0     | 0              | 0          |
| 02:00PM    | 0          | 0    | 0     | 0          | 0    | 0     | 0            | 0    | 0     | 0            | 0    | 0     | 0              | 0          |
| 02:15PM    | 0          | 0    | 0     | 0          | 0    | 0     | 0            | 0    | 0     | 0            | 0    | 0     | 0              | 38         |
| 02:30PM    | 0          | 0    | 0     | 0          | 0    | 0     | 0            | 0    | 0     | 0            | 0    | 0     | 0              | 117        |
| 02:45PM    | 0          | 0    | 0     | 0          | 0    | 0     | 0            | 0    | 0     | 0            | 0    | 0     | 0              | 176        |
| 03:00PM    | 0          | 8    | 7     | 4          | 5    | 0     | 0            | 2    | 0     | 5            | 4    | 3     | 38             | 245        |
| 03:15PM    | 0          | 15   | 1     | 9          | 29   | 4     | 0            | 11   | 0     | 3            | 3    | 4     | 79             | 274        |
| 03:30PM    | 0          | 8    | 5     | 4          | 14   | 0     | 0            | 10   | 0     | 5            | 4    | 9     | 59             | 262        |
| 03:45PM    | 3          | 17   | 6     | 4          | 15   | 0     | 0            | 5    | 0     | 6            | 5    | 8     | 69             | 283        |
| 04:00PM    | 3          | 25   | 6     | 5          | 8    | 0     | 2            | 4    | 1     | 4            | 4    | 5     | 67             | 293        |
| 04:15PM    | 0          | 20   | 9     | 2          | 14   | 1     | 0            | 9    | 2     | 4            | 2    | 4     | 67             | 329        |
| 04:30PM    | 0          | 19   | 11    | 4          | 15   | 0     | 1            | 14   | 1     | 6            | 6    | 3     | 80             | 382        |
| 04:45PM    | 0          | 28   | 8     | 0          | 16   | 1     | 1            | 12   | 0     | 5            | 7    | 1     | 79             | 390        |
| 05:00PM    | 0          | 34   | 15    | 3          | 18   | 1     | 0            | 12   | 2     | 5            | 9    | 4     | 103            | 390        |
| 05:15PM    | 0          | 38   | 12    | 6          | 27   | 0     | 1            | 17   | 1     | 9            | 5    | 4     | 120            | --         |
| 05:30PM    | 1          | 31   | 13    | 4          | 14   | 0     | 2            | 10   | 0     | 8            | 2    | 3     | 88             | --         |
| 05:45PM    | 0          | 20   | 9     | 8          | 13   | 0     | 0            | 11   | 0     | 7            | 8    | 3     | 79             | --         |

| Ditch Road |      |       | Ditch Road |      |       | 156th Street |      |       | 156th Street |      |       | TOTAL |
|------------|------|-------|------------|------|-------|--------------|------|-------|--------------|------|-------|-------|
| LEFT       | THRU | RIGHT | LEFT       | THRU | RIGHT | LEFT         | THRU | RIGHT | LEFT         | THRU | RIGHT |       |

BASE YEAR PEAK HOUR VOLUMES -- 0

|                               |     |    |    |    |   |   |    |   |    |    |    |               |        |
|-------------------------------|-----|----|----|----|---|---|----|---|----|----|----|---------------|--------|
| 1                             | 123 | 49 | 21 | 72 | 1 | 3 | 50 | 3 | 29 | 24 | 14 | 390           |        |
| FUTURE PEAK HOUR VOLUMES -- 0 |     |    |    |    |   |   |    |   |    |    |    | GROWTH FACTOR | 1.0000 |
| 1                             | 123 | 49 | 21 | 72 | 1 | 3 | 50 | 3 | 29 | 24 | 14 | 390           |        |
| NEW GENERATED TRAFFIC         |     |    |    |    |   |   |    |   |    |    |    |               |        |
| 0                             | 0   | 0  | 0  | 0  | 0 | 0 | 0  | 0 | 0  | 0  | 0  |               |        |
| TOTAL TRAFFIC                 |     |    |    |    |   |   |    |   |    |    |    |               |        |
| 1                             | 123 | 49 | 21 | 72 | 1 | 3 | 50 | 3 | 29 | 24 | 14 | 390           |        |

YEAR 0 TOTAL TRAFFIC  
 Ditch Road & 156th Street  
 3pm-6pm



OVERALL PHF = 0.81

Approach-Based Totals For  
 Peak Hour

| Leg   | Direction | Count |
|-------|-----------|-------|
| North | NB        | 140   |
|       | SB        | 94    |
| East  | EB        | 120   |
|       | WB        | 67    |
| South | SB        | 104   |
|       | NB        | 173   |
| West  | WB        | 26    |
|       | EB        | 56    |

## TRAFFIC VOLUMES

INTERSECTION: **Ditch Road & Somerville Drive**

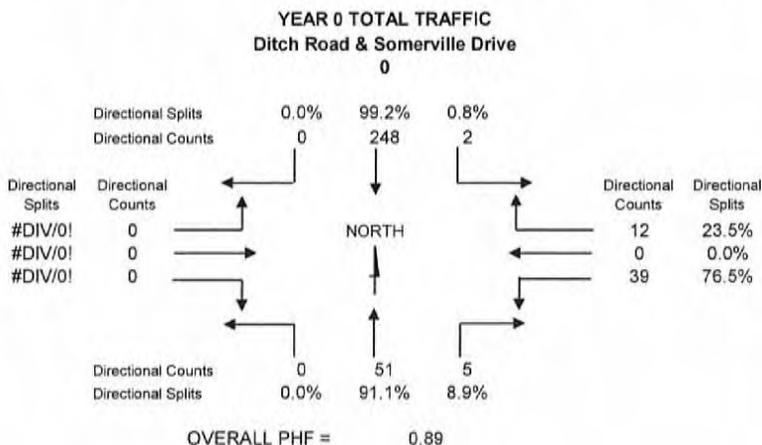
BASE YEAR 0  
 FORECAST YEAR 0  
 GROWTH RATE (%) 0

DATE **1/26/2012** 7am-9am

VEHICLES - TOTAL SEE TO RIGHT FOR TRUCKS AND PASSENGER VEHICLES SUBTOTAL

| TIME BEGIN | NB         |      |       | SB         |      |       | EB               |      |       | WB               |      |       | INTERVAL TOTAL | HOUR TOTAL |
|------------|------------|------|-------|------------|------|-------|------------------|------|-------|------------------|------|-------|----------------|------------|
|            | Ditch Road |      |       | Ditch Road |      |       | Somerville Drive |      |       | Somerville Drive |      |       |                |            |
|            | LEFT       | THRU | RIGHT | LEFT       | THRU | RIGHT | LEFT             | THRU | RIGHT | LEFT             | THRU | RIGHT |                |            |
|            | ↶          | ↑    | ↷     | ↶          | ↓    | ↷     | ↶                | →    | ↷     | ↶                | ←    | ↷     |                |            |
| 06:00AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0                | 0    | 0     | 0                | 0    | 0     | 0              | 0          |
| 06:15AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0                | 0    | 0     | 0                | 0    | 0     | 0              | 66         |
| 06:30AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0                | 0    | 0     | 0                | 0    | 0     | 0              | 166        |
| 06:45AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0                | 0    | 0     | 0                | 0    | 0     | 0              | 263        |
| 07:00AM    | 0          | 8    | 0     | 1          | 36   | 0     | 0                | 0    | 0     | 15               | 0    | 6     | 66             | 345        |
| 07:15AM    | 0          | 17   | 1     | 0          | 69   | 0     | 0                | 0    | 0     | 11               | 0    | 2     | 100            | 357        |
| 07:30AM    | 0          | 13   | 1     | 1          | 66   | 0     | 0                | 0    | 0     | 10               | 0    | 6     | 97             | 321        |
| 07:45AM    | 0          | 12   | 0     | 0          | 60   | 0     | 0                | 0    | 0     | 8                | 0    | 2     | 82             | 279        |
| 08:00AM    | 0          | 9    | 3     | 1          | 53   | 0     | 0                | 0    | 0     | 10               | 0    | 2     | 78             | 246        |
| 08:15AM    | 0          | 18   | 3     | 0          | 32   | 0     | 0                | 0    | 0     | 7                | 0    | 4     | 64             | --         |
| 08:30AM    | 0          | 9    | 2     | 0          | 29   | 0     | 0                | 0    | 0     | 12               | 0    | 3     | 55             | --         |
| 08:45AM    | 0          | 6    | 2     | 1          | 29   | 0     | 0                | 0    | 0     | 7                | 0    | 4     | 49             | --         |
| 09:00AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0                | 0    | 0     | 0                | 0    | 0     | 0              | 0          |
| 09:15AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0                | 0    | 0     | 0                | 0    | 0     | 0              | 0          |
| 09:30AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0                | 0    | 0     | 0                | 0    | 0     | 0              | 0          |
| 09:45AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0                | 0    | 0     | 0                | 0    | 0     | 0              | 0          |
| 10:00AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0                | 0    | 0     | 0                | 0    | 0     | 0              | 0          |
| 10:15AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0                | 0    | 0     | 0                | 0    | 0     | 0              | 0          |
| 10:30AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0                | 0    | 0     | 0                | 0    | 0     | 0              | 0          |
| 10:45AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0                | 0    | 0     | 0                | 0    | 0     | 0              | 0          |
| 11:00AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0                | 0    | 0     | 0                | 0    | 0     | 0              | 0          |
| 11:15AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0                | 0    | 0     | 0                | 0    | 0     | 0              | --         |
| 11:30AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0                | 0    | 0     | 0                | 0    | 0     | 0              | --         |
| 11:45AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0                | 0    | 0     | 0                | 0    | 0     | 0              | --         |

| Ditch Road                       |      |       | Ditch Road |      |       | Somerville Drive |      |       | Somerville Drive |      |       | TOTAL |
|----------------------------------|------|-------|------------|------|-------|------------------|------|-------|------------------|------|-------|-------|
| LEFT                             | THRU | RIGHT | LEFT       | THRU | RIGHT | LEFT             | THRU | RIGHT | LEFT             | THRU | RIGHT |       |
| BASE YEAR PEAK HOUR VOLUMES -- 0 |      |       |            |      |       |                  |      |       |                  |      |       |       |
| 0                                | 51   | 5     | 2          | 248  | 0     | 0                | 0    | 0     | 39               | 0    | 12    | 357   |
| FUTURE PEAK HOUR VOLUMES -- 0    |      |       |            |      |       |                  |      |       |                  |      |       |       |
| 0                                | 51   | 5     | 2          | 248  | 0     | 0                | 0    | 0     | 39               | 0    | 12    | 357   |
| NEW GENERATED TRAFFIC            |      |       |            |      |       |                  |      |       |                  |      |       |       |
| 0                                | 0    | 0     | 0          | 0    | 0     | 0                | 0    | 0     | 0                | 0    | 0     | 0     |
| TOTAL TRAFFIC                    |      |       |            |      |       |                  |      |       |                  |      |       |       |
| 0                                | 51   | 5     | 2          | 248  | 0     | 0                | 0    | 0     | 39               | 0    | 12    | 357   |



**Approach-Based Totals For Peak Hour**

| Leg   | Direction | Count |
|-------|-----------|-------|
| North | NB        | 63    |
|       | SB        | 250   |
| East  | EB        | 7     |
|       | WB        | 51    |
| South | SB        | 287   |
|       | NB        | 56    |
| West  | WB        | 0     |
|       | EB        | 0     |

# TRAFFIC VOLUMES

INTERSECTION: Ditch Road & Somerville Drive

BASE YEAR 0  
 FORECAST YEAR 0  
 GROWTH RATE (%) 0

DATE 1/26/2012 3pm-6pm

VEHICLES - TOTAL SEE TO RIGHT FOR TRUCKS AND PASSENGER VEHICLES SUBTOTAL

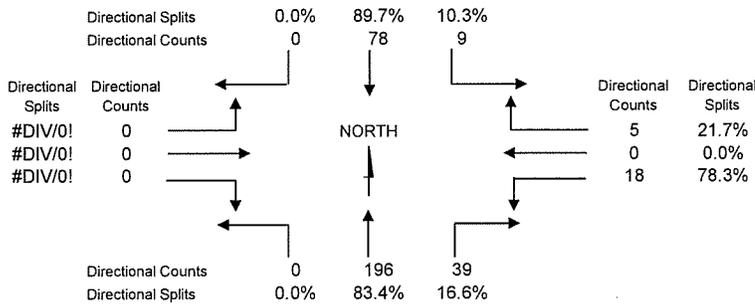
| TIME BEGIN | NB         |      |       | SB         |      |       | EB               |      |       | WB               |      |       | INTERVAL TOTAL | HOUR TOTAL |
|------------|------------|------|-------|------------|------|-------|------------------|------|-------|------------------|------|-------|----------------|------------|
|            | Ditch Road |      |       | Ditch Road |      |       | Somerville Drive |      |       | Somerville Drive |      |       |                |            |
|            | LEFT       | THRU | RIGHT | LEFT       | THRU | RIGHT | LEFT             | THRU | RIGHT | LEFT             | THRU | RIGHT |                |            |
| 12:00PM    | 0          | 0    | 0     | 0          | 0    | 0     | 0                | 0    | 0     | 0                | 0    | 0     | 0              | 0          |
| 12:15PM    | 0          | 0    | 0     | 0          | 0    | 0     | 0                | 0    | 0     | 0                | 0    | 0     | 0              | 0          |
| 12:30PM    | 0          | 0    | 0     | 0          | 0    | 0     | 0                | 0    | 0     | 0                | 0    | 0     | 0              | 0          |
| 12:45PM    | 0          | 0    | 0     | 0          | 0    | 0     | 0                | 0    | 0     | 0                | 0    | 0     | 0              | 0          |
| 01:00PM    | 0          | 0    | 0     | 0          | 0    | 0     | 0                | 0    | 0     | 0                | 0    | 0     | 0              | 0          |
| 01:15PM    | 0          | 0    | 0     | 0          | 0    | 0     | 0                | 0    | 0     | 0                | 0    | 0     | 0              | 0          |
| 01:30PM    | 0          | 0    | 0     | 0          | 0    | 0     | 0                | 0    | 0     | 0                | 0    | 0     | 0              | 0          |
| 01:45PM    | 0          | 0    | 0     | 0          | 0    | 0     | 0                | 0    | 0     | 0                | 0    | 0     | 0              | 0          |
| 02:00PM    | 0          | 0    | 0     | 0          | 0    | 0     | 0                | 0    | 0     | 0                | 0    | 0     | 0              | 0          |
| 02:15PM    | 0          | 0    | 0     | 0          | 0    | 0     | 0                | 0    | 0     | 0                | 0    | 0     | 0              | 40         |
| 02:30PM    | 0          | 0    | 0     | 0          | 0    | 0     | 0                | 0    | 0     | 0                | 0    | 0     | 0              | 79         |
| 02:45PM    | 0          | 0    | 0     | 0          | 0    | 0     | 0                | 0    | 0     | 0                | 0    | 0     | 0              | 130        |
| 03:00PM    | 0          | 12   | 6     | 4          | 10   | 0     | 0                | 0    | 0     | 5                | 0    | 3     | 40             | 175        |
| 03:15PM    | 0          | 16   | 5     | 1          | 12   | 0     | 0                | 0    | 0     | 3                | 0    | 2     | 39             | 177        |
| 03:30PM    | 0          | 19   | 8     | 2          | 18   | 0     | 0                | 0    | 0     | 2                | 0    | 2     | 51             | 201        |
| 03:45PM    | 0          | 23   | 2     | 3          | 15   | 0     | 0                | 0    | 0     | 1                | 0    | 1     | 45             | 221        |
| 04:00PM    | 0          | 23   | 8     | 1          | 8    | 0     | 0                | 0    | 0     | 2                | 0    | 0     | 42             | 245        |
| 04:15PM    | 0          | 24   | 14    | 4          | 16   | 0     | 0                | 0    | 0     | 4                | 0    | 1     | 63             | 265        |
| 04:30PM    | 0          | 36   | 1     | 4          | 22   | 0     | 0                | 0    | 0     | 5                | 0    | 3     | 71             | 288        |
| 04:45PM    | 0          | 37   | 6     | 0          | 16   | 0     | 0                | 0    | 0     | 8                | 0    | 2     | 69             | 308        |
| 05:00PM    | 0          | 40   | 10    | 0          | 7    | 0     | 0                | 0    | 0     | 5                | 0    | 0     | 62             | 345        |
| 05:15PM    | 0          | 54   | 7     | 5          | 17   | 0     | 0                | 0    | 0     | 3                | 0    | 0     | 86             | --         |
| 05:30PM    | 0          | 47   | 10    | 1          | 27   | 0     | 0                | 0    | 0     | 3                | 0    | 3     | 91             | --         |
| 05:45PM    | 0          | 55   | 12    | 3          | 27   | 0     | 0                | 0    | 0     | 7                | 0    | 2     | 106            | --         |

| Ditch Road |      |       | Ditch Road |      |       | Somerville Drive |      |       | Somerville Drive |      |       | TOTAL |
|------------|------|-------|------------|------|-------|------------------|------|-------|------------------|------|-------|-------|
| LEFT       | THRU | RIGHT | LEFT       | THRU | RIGHT | LEFT             | THRU | RIGHT | LEFT             | THRU | RIGHT |       |

BASE YEAR PEAK HOUR VOLUMES -- 0

|                               |     |    |  |   |    |   |   |   |  |   |    |   |   |               |        |
|-------------------------------|-----|----|--|---|----|---|---|---|--|---|----|---|---|---------------|--------|
| 0                             | 196 | 39 |  | 9 | 78 | 0 | 0 | 0 |  | 0 | 18 | 0 | 5 | 345           |        |
| FUTURE PEAK HOUR VOLUMES -- 0 |     |    |  |   |    |   |   |   |  |   |    |   | → | GROWTH FACTOR | 1.0000 |
| 0                             | 196 | 39 |  | 9 | 78 | 0 | 0 | 0 |  | 0 | 18 | 0 | 5 | 345           |        |
| NEW GENERATED TRAFFIC         |     |    |  |   |    |   |   |   |  |   |    |   |   |               |        |
| 0                             | 0   | 0  |  | 0 | 0  | 0 | 0 | 0 |  | 0 | 0  | 0 | 0 |               |        |
| TOTAL TRAFFIC                 |     |    |  |   |    |   |   |   |  |   |    |   |   |               |        |
| 0                             | 196 | 39 |  | 9 | 78 | 0 | 0 | 0 |  | 0 | 18 | 0 | 5 | 345           |        |

YEAR 0 TOTAL TRAFFIC  
 Ditch Road & Somerville Drive  
 3pm-6pm



OVERALL PHF = 0.81

Approach-Based Totals For  
 Peak Hour

| Leg   | Direction | Count |
|-------|-----------|-------|
| North | NB        | 201   |
|       | SB        | 87    |
| East  | EB        | 48    |
|       | WB        | 23    |
| South | SB        | 96    |
|       | NB        | 235   |
| West  | WB        | 0     |
|       | EB        | 0     |

## TRAFFIC VOLUMES

INTERSECTION: **Towne Road & 156th Street**

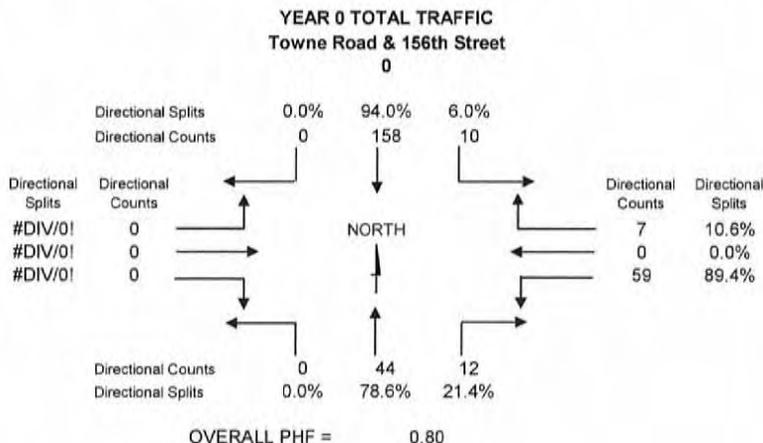
BASE YEAR 0  
 FORECAST YEAR 0  
 GROWTH RATE (%) 0

DATE **1/25/2012** 7am-9am

VEHICLES - TOTAL SEE TO RIGHT FOR TRUCKS AND PASSENGER VEHICLES SUBTOTAL

| TIME BEGIN | NB         |      |       | SB         |      |       | EB           |      |       | WB           |      |       | INTERVAL TOTAL | HOUR TOTAL |
|------------|------------|------|-------|------------|------|-------|--------------|------|-------|--------------|------|-------|----------------|------------|
|            | Towne Road |      |       | Towne Road |      |       | 156th Street |      |       | 156th Street |      |       |                |            |
|            | LEFT       | THRU | RIGHT | LEFT       | THRU | RIGHT | LEFT         | THRU | RIGHT | LEFT         | THRU | RIGHT |                |            |
|            |            |      |       |            |      |       |              |      |       |              |      |       |                |            |
| 06:00AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0            | 0    | 0     | 0            | 0    | 0     | 0              | 0          |
| 06:15AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0            | 0    | 0     | 0            | 0    | 0     | 0              | 60         |
| 06:30AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0            | 0    | 0     | 0            | 0    | 0     | 0              | 128        |
| 06:45AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0            | 0    | 0     | 0            | 0    | 0     | 0              | 193        |
| 07:00AM    | 0          | 10   | 1     | 0          | 29   | 0     | 0            | 0    | 0     | 20           | 0    | 0     | 60             | 284        |
| 07:15AM    | 0          | 8    | 4     | 0          | 42   | 0     | 0            | 0    | 0     | 13           | 0    | 1     | 68             | 290        |
| 07:30AM    | 0          | 15   | 1     | 0          | 33   | 0     | 0            | 0    | 0     | 16           | 0    | 0     | 65             | 264        |
| 07:45AM    | 0          | 11   | 4     | 5          | 48   | 0     | 0            | 0    | 0     | 19           | 0    | 4     | 91             | 239        |
| 08:00AM    | 0          | 10   | 3     | 5          | 35   | 0     | 0            | 0    | 0     | 11           | 0    | 2     | 66             | 180        |
| 08:15AM    | 0          | 9    | 6     | 1          | 17   | 0     | 0            | 0    | 0     | 6            | 0    | 3     | 42             | --         |
| 08:30AM    | 0          | 4    | 1     | 2          | 25   | 0     | 0            | 0    | 0     | 6            | 0    | 2     | 40             | --         |
| 08:45AM    | 0          | 3    | 1     | 2          | 16   | 0     | 0            | 0    | 0     | 7            | 0    | 3     | 32             | --         |
| 09:00AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0            | 0    | 0     | 0            | 0    | 0     | 0              | 0          |
| 09:15AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0            | 0    | 0     | 0            | 0    | 0     | 0              | 0          |
| 09:30AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0            | 0    | 0     | 0            | 0    | 0     | 0              | 0          |
| 09:45AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0            | 0    | 0     | 0            | 0    | 0     | 0              | 0          |
| 10:00AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0            | 0    | 0     | 0            | 0    | 0     | 0              | 0          |
| 10:15AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0            | 0    | 0     | 0            | 0    | 0     | 0              | 0          |
| 10:30AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0            | 0    | 0     | 0            | 0    | 0     | 0              | 0          |
| 10:45AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0            | 0    | 0     | 0            | 0    | 0     | 0              | 0          |
| 11:00AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0            | 0    | 0     | 0            | 0    | 0     | 0              | 0          |
| 11:15AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0            | 0    | 0     | 0            | 0    | 0     | 0              | --         |
| 11:30AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0            | 0    | 0     | 0            | 0    | 0     | 0              | --         |
| 11:45AM    | 0          | 0    | 0     | 0          | 0    | 0     | 0            | 0    | 0     | 0            | 0    | 0     | 0              | --         |

| Towne Road                       |      |       | Towne Road |      |       | 156th Street |      |       | 156th Street |      |       | TOTAL |
|----------------------------------|------|-------|------------|------|-------|--------------|------|-------|--------------|------|-------|-------|
| LEFT                             | THRU | RIGHT | LEFT       | THRU | RIGHT | LEFT         | THRU | RIGHT | LEFT         | THRU | RIGHT |       |
| BASE YEAR PEAK HOUR VOLUMES -- 0 |      |       |            |      |       |              |      |       |              |      |       |       |
| 0                                | 44   | 12    | 10         | 158  | 0     | 0            | 0    | 0     | 59           | 0    | 7     | 290   |
| FUTURE PEAK HOUR VOLUMES -- 0    |      |       |            |      |       |              |      |       |              |      |       |       |
| 0                                | 44   | 12    | 10         | 158  | 0     | 0            | 0    | 0     | 59           | 0    | 7     | 290   |
| NEW GENERATED TRAFFIC            |      |       |            |      |       |              |      |       |              |      |       |       |
| 0                                | 0    | 0     | 0          | 0    | 0     | 0            | 0    | 0     | 0            | 0    | 0     |       |
| TOTAL TRAFFIC                    |      |       |            |      |       |              |      |       |              |      |       |       |
| 0                                | 44   | 12    | 10         | 158  | 0     | 0            | 0    | 0     | 59           | 0    | 7     | 290   |



**Approach-Based Totals For Peak Hour**

| Leg   | Direction | Count |
|-------|-----------|-------|
| North | NB        | 51    |
|       | SB        | 188   |
| East  | EB        | 22    |
|       | WB        | 66    |
| South | SB        | 217   |
|       | NB        | 56    |
| West  | WB        | 0     |
|       | EB        | 0     |

# TRAFFIC VOLUMES

INTERSECTION: Towne Road & 156th Street

BASE YEAR 0  
 FORECAST YEAR 0  
 GROWTH RATE (%) 0

DATE 1/25/2012 3pm-6pm

VEHICLES - TOTAL SEE TO RIGHT FOR TRUCKS AND PASSENGER VEHICLES SUBTOTAL

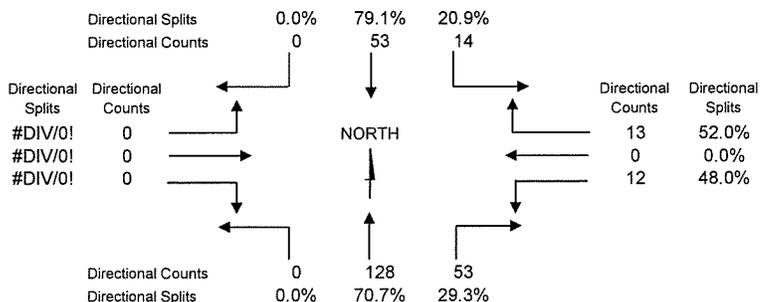
| TIME BEGIN | NB<br>Towne Road |      |       | SB<br>Towne Road |      |       | EB<br>156th Street |      |       | WB<br>156th Street |      |       | INTERVAL TOTAL | HOUR TOTAL |
|------------|------------------|------|-------|------------------|------|-------|--------------------|------|-------|--------------------|------|-------|----------------|------------|
|            | LEFT             | THRU | RIGHT | LEFT             | THRU | RIGHT | LEFT               | THRU | RIGHT | LEFT               | THRU | RIGHT |                |            |
|            | ↶                | ↷    | ↸     | ↵                | ↶    | ↷     | ↶                  | →    | ↷     | ↶                  | ←    | ↷     |                |            |
| 12:00PM    | 0                | 0    | 0     | 0                | 0    | 0     | 0                  | 0    | 0     | 0                  | 0    | 0     | 0              | 0          |
| 12:15PM    | 0                | 0    | 0     | 0                | 0    | 0     | 0                  | 0    | 0     | 0                  | 0    | 0     | 0              | 0          |
| 12:30PM    | 0                | 0    | 0     | 0                | 0    | 0     | 0                  | 0    | 0     | 0                  | 0    | 0     | 0              | 0          |
| 12:45PM    | 0                | 0    | 0     | 0                | 0    | 0     | 0                  | 0    | 0     | 0                  | 0    | 0     | 0              | 0          |
| 01:00PM    | 0                | 0    | 0     | 0                | 0    | 0     | 0                  | 0    | 0     | 0                  | 0    | 0     | 0              | 0          |
| 01:15PM    | 0                | 0    | 0     | 0                | 0    | 0     | 0                  | 0    | 0     | 0                  | 0    | 0     | 0              | 0          |
| 01:30PM    | 0                | 0    | 0     | 0                | 0    | 0     | 0                  | 0    | 0     | 0                  | 0    | 0     | 0              | 0          |
| 01:45PM    | 0                | 0    | 0     | 0                | 0    | 0     | 0                  | 0    | 0     | 0                  | 0    | 0     | 0              | 0          |
| 02:00PM    | 0                | 0    | 0     | 0                | 0    | 0     | 0                  | 0    | 0     | 0                  | 0    | 0     | 0              | 0          |
| 02:15PM    | 0                | 0    | 0     | 0                | 0    | 0     | 0                  | 0    | 0     | 0                  | 0    | 0     | 0              | 23         |
| 02:30PM    | 0                | 0    | 0     | 0                | 0    | 0     | 0                  | 0    | 0     | 0                  | 0    | 0     | 0              | 60         |
| 02:45PM    | 0                | 0    | 0     | 0                | 0    | 0     | 0                  | 0    | 0     | 0                  | 0    | 0     | 0              | 104        |
| 03:00PM    | 0                | 6    | 2     | 1                | 8    | 0     | 0                  | 0    | 0     | 3                  | 0    | 3     | 23             | 137        |
| 03:15PM    | 0                | 15   | 8     | 3                | 7    | 0     | 0                  | 0    | 0     | 3                  | 0    | 1     | 37             | 154        |
| 03:30PM    | 0                | 19   | 6     | 0                | 12   | 0     | 0                  | 0    | 0     | 4                  | 0    | 3     | 44             | 163        |
| 03:45PM    | 0                | 9    | 6     | 1                | 13   | 0     | 0                  | 0    | 0     | 2                  | 0    | 2     | 33             | 188        |
| 04:00PM    | 0                | 25   | 3     | 4                | 4    | 0     | 0                  | 0    | 0     | 2                  | 0    | 2     | 40             | 223        |
| 04:15PM    | 0                | 21   | 7     | 1                | 13   | 0     | 0                  | 0    | 0     | 2                  | 0    | 2     | 46             | 252        |
| 04:30PM    | 0                | 29   | 13    | 4                | 17   | 0     | 0                  | 0    | 0     | 3                  | 0    | 3     | 69             | 273        |
| 04:45PM    | 0                | 41   | 12    | 2                | 7    | 0     | 0                  | 0    | 0     | 2                  | 0    | 4     | 68             | 269        |
| 05:00PM    | 0                | 33   | 15    | 2                | 13   | 0     | 0                  | 0    | 0     | 3                  | 0    | 3     | 69             | 247        |
| 05:15PM    | 0                | 25   | 13    | 6                | 16   | 0     | 0                  | 0    | 0     | 4                  | 0    | 3     | 67             | --         |
| 05:30PM    | 0                | 43   | 13    | 2                | 6    | 0     | 0                  | 0    | 0     | 0                  | 0    | 1     | 65             | --         |
| 05:45PM    | 0                | 22   | 6     | 2                | 15   | 0     | 0                  | 0    | 0     | 1                  | 0    | 0     | 46             | --         |

| Towne Road |      |       | Towne Road |      |       | 156th Street |      |       | 156th Street |      |       | TOTAL |
|------------|------|-------|------------|------|-------|--------------|------|-------|--------------|------|-------|-------|
| LEFT       | THRU | RIGHT | LEFT       | THRU | RIGHT | LEFT         | THRU | RIGHT | LEFT         | THRU | RIGHT |       |

BASE YEAR PEAK HOUR VOLUMES -- 0

|                               |     |    |    |    |   |   |   |   |   |    |               |        |     |
|-------------------------------|-----|----|----|----|---|---|---|---|---|----|---------------|--------|-----|
| 0                             | 128 | 53 | 14 | 53 | 0 | 0 | 0 | 0 | 0 | 12 | 0             | 13     | 273 |
| FUTURE PEAK HOUR VOLUMES -- 0 |     |    |    |    |   |   |   |   |   | →  | GROWTH FACTOR | 1.0000 |     |
| 0                             | 128 | 53 | 14 | 53 | 0 | 0 | 0 | 0 | 0 | 12 | 0             | 13     | 273 |
| NEW GENERATED TRAFFIC         |     |    |    |    |   |   |   |   |   |    |               |        |     |
| 0                             | 0   | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 | 0  | 0             | 0      |     |
| TOTAL TRAFFIC                 |     |    |    |    |   |   |   |   |   |    |               |        |     |
| 0                             | 128 | 53 | 14 | 53 | 0 | 0 | 0 | 0 | 0 | 12 | 0             | 13     | 273 |

**YEAR 0 TOTAL TRAFFIC**  
 Towne Road & 156th Street  
 3pm-6pm



OVERALL PHF = 0.99

**Approach-Based Totals For Peak Hour**

| Leg   | Direction | Count |
|-------|-----------|-------|
| North | NB        | 141   |
|       | SB        | 67    |
| East  | EB        | 67    |
|       | WB        | 25    |
| South | SB        | 65    |
|       | NB        | 181   |
| West  | WB        | 0     |
|       | EB        | 0     |

151st - Towne to Ditch

| Start Time   | 19-Sep-11 |    | Tue |    | Wed |    | Thu |    | Fri |    | Weekday Avg. |    | Sat |    | Sun |    |    |                   |
|--------------|-----------|----|-----|----|-----|----|-----|----|-----|----|--------------|----|-----|----|-----|----|----|-------------------|
|              | EB        | WB | EB  | WB | EB  | WB | EB  | WB | EB  | WB | EB           | WB | EB  | WB | EB  | WB |    |                   |
| 12:00 AM     | *         | *  | *   | *  | *   | *  | *   | *  | *   | *  | *            | *  | *   | *  | *   | 0  | 0  |                   |
| 01:00        | *         | *  | *   | *  | *   | *  | *   | *  | *   | *  | *            | *  | *   | *  | *   | 1  | 1  |                   |
| 02:00        | *         | *  | *   | *  | *   | *  | *   | *  | *   | *  | *            | *  | *   | *  | *   | 0  | 0  |                   |
| 03:00        | *         | *  | *   | *  | *   | *  | *   | *  | *   | *  | *            | *  | *   | *  | *   | 0  | 0  |                   |
| 04:00        | *         | *  | *   | *  | *   | *  | *   | *  | *   | *  | *            | *  | *   | *  | *   | 1  | 0  |                   |
| 05:00        | *         | *  | *   | *  | *   | *  | *   | *  | *   | *  | *            | *  | *   | *  | *   | 0  | 1  |                   |
| 06:00        | *         | *  | *   | *  | *   | *  | *   | *  | *   | *  | *            | *  | *   | *  | *   | 0  | 0  |                   |
| 07:00        | *         | *  | *   | *  | *   | *  | *   | *  | *   | *  | *            | *  | *   | *  | *   | 1  | 0  |                   |
| 08:00        | *         | *  | *   | *  | *   | *  | *   | *  | *   | *  | *            | *  | *   | *  | *   | 1  | 0  |                   |
| 09:00        | *         | *  | *   | *  | *   | *  | *   | *  | *   | *  | *            | *  | *   | *  | *   | 0  | 1  |                   |
| 10:00        | *         | *  | *   | *  | *   | *  | *   | *  | *   | *  | *            | *  | *   | *  | *   | 1  | 0  |                   |
| 11:00        | *         | *  | *   | *  | *   | *  | *   | *  | *   | *  | *            | *  | *   | *  | *   | 1  | 0  |                   |
| 12:00 PM     | *         | *  | *   | *  | *   | *  | *   | *  | *   | *  | *            | *  | *   | *  | *   | 1  | 0  |                   |
| 01:00        | *         | *  | *   | *  | *   | *  | *   | *  | *   | *  | *            | *  | *   | *  | *   | 3  | 3  |                   |
| 02:00        | *         | *  | *   | *  | *   | *  | *   | *  | *   | *  | *            | *  | *   | *  | *   | 1  | 0  |                   |
| 03:00        | *         | *  | *   | *  | *   | *  | *   | *  | *   | *  | *            | *  | *   | *  | *   | 2  | 2  |                   |
| 04:00        | *         | *  | *   | *  | *   | *  | *   | *  | *   | *  | *            | *  | *   | *  | *   | 4  | 1  |                   |
| 05:00        | *         | *  | *   | *  | *   | *  | *   | *  | *   | *  | *            | *  | *   | *  | *   | 3  | 0  |                   |
| 06:00        | *         | *  | *   | *  | *   | *  | *   | *  | *   | *  | *            | *  | *   | *  | *   | 0  | 0  |                   |
| 07:00        | *         | *  | *   | *  | *   | *  | *   | *  | *   | *  | *            | *  | *   | *  | *   | 2  | 1  |                   |
| 08:00        | *         | *  | *   | *  | *   | *  | *   | *  | *   | *  | *            | *  | *   | *  | *   | 1  | 2  |                   |
| 09:00        | *         | *  | *   | *  | *   | *  | *   | *  | *   | *  | *            | *  | *   | *  | *   | 1  | 0  |                   |
| 10:00        | *         | *  | *   | *  | *   | *  | *   | *  | *   | *  | *            | *  | *   | *  | *   | 0  | 0  |                   |
| 11:00        | *         | *  | *   | *  | *   | *  | *   | *  | *   | *  | *            | *  | *   | *  | *   | 0  | 0  |                   |
| Total        | 0         | 0  | 0   | 0  | 0   | 0  | 0   | 0  | 0   | 0  | 0            | 0  | 0   | 21 | 13  | 18 | 15 |                   |
| Day          | 0         | 0  | 0   | 0  | 0   | 0  | 0   | 0  | 0   | 0  | 0            | 0  | 34  | 33 | 33  | 33 | 33 |                   |
| AM Peak Vol. |           |    |     |    |     |    |     |    |     |    |              |    |     |    |     |    |    | 01:00 01:00       |
| PM Peak Vol. |           |    |     |    |     |    |     |    |     |    |              |    |     |    |     |    |    | 15:00 16:00 18:00 |

151st - Towne to Ditch

| Start Time | 26-Sep-11 |       | Tue   |       | Wed   |       | Thu |    | Fri |    | Weekday Avg. |       | Sat |    | Sun |    |
|------------|-----------|-------|-------|-------|-------|-------|-----|----|-----|----|--------------|-------|-----|----|-----|----|
|            | EB        | WB    | EB    | WB    | EB    | WB    | EB  | WB | EB  | WB | EB           | WB    | EB  | WB | EB  | WB |
| 12:00 AM   | 1         | 0     | 0     | 0     | 0     | 0     | *   | *  | *   | *  | 1            | 0     | *   | *  | *   | *  |
| 01:00      | 0         | 0     | 0     | 0     | 0     | 0     | *   | *  | *   | *  | 0            | 0     | *   | *  | *   | *  |
| 02:00      | 0         | 0     | 0     | 0     | 0     | 0     | *   | *  | *   | *  | 0            | 0     | *   | *  | *   | *  |
| 03:00      | 0         | 0     | 0     | 0     | 0     | 0     | *   | *  | *   | *  | 0            | 0     | *   | *  | *   | *  |
| 04:00      | 1         | 0     | 0     | 0     | 1     | 0     | *   | *  | *   | *  | 1            | 0     | *   | *  | *   | *  |
| 05:00      | 0         | 0     | 0     | 0     | 0     | 0     | *   | *  | *   | *  | 0            | 1     | *   | *  | *   | *  |
| 06:00      | 2         | 0     | 3     | 0     | 3     | 1     | *   | *  | *   | *  | 3            | 0     | *   | *  | *   | *  |
| 07:00      | 3         | 5     | 6     | 5     | 4     | 6     | *   | *  | *   | *  | 4            | 5     | *   | *  | *   | *  |
| 08:00      | 1         | 3     | 0     | 2     | 2     | 3     | *   | *  | *   | *  | 1            | 3     | *   | *  | *   | *  |
| 09:00      | 5         | 2     | 0     | 1     | 0     | 1     | *   | *  | *   | *  | 2            | 1     | *   | *  | *   | *  |
| 10:00      | 1         | 0     | 2     | 2     | *     | *     | *   | *  | *   | *  | 2            | 1     | *   | *  | *   | *  |
| 11:00      | 2         | 1     | 5     | 3     | *     | *     | *   | *  | *   | *  | 4            | 2     | *   | *  | *   | *  |
| 12:00 PM   | 1         | 3     | 1     | 2     | *     | *     | *   | *  | *   | *  | 1            | 2     | *   | *  | *   | *  |
| 01:00      | 3         | 2     | 4     | 2     | *     | *     | *   | *  | *   | *  | 4            | 2     | *   | *  | *   | *  |
| 02:00      | 3         | 1     | 3     | 2     | *     | *     | *   | *  | *   | *  | 3            | 2     | *   | *  | *   | *  |
| 03:00      | 2         | 0     | 5     | 1     | *     | *     | *   | *  | *   | *  | 4            | 0     | *   | *  | *   | *  |
| 04:00      | 6         | 4     | 8     | 2     | *     | *     | *   | *  | *   | *  | 7            | 3     | *   | *  | *   | *  |
| 05:00      | 9         | 2     | 6     | 1     | *     | *     | *   | *  | *   | *  | 8            | 2     | *   | *  | *   | *  |
| 06:00      | 5         | 1     | 2     | 4     | *     | *     | *   | *  | *   | *  | 4            | 2     | *   | *  | *   | *  |
| 07:00      | 1         | 3     | 4     | 0     | *     | *     | *   | *  | *   | *  | 2            | 2     | *   | *  | *   | *  |
| 08:00      | 3         | 1     | 0     | 3     | *     | *     | *   | *  | *   | *  | 2            | 2     | *   | *  | *   | *  |
| 09:00      | 3         | 0     | 0     | 1     | *     | *     | *   | *  | *   | *  | 2            | 0     | *   | *  | *   | *  |
| 10:00      | 0         | 1     | 0     | 0     | *     | *     | *   | *  | *   | *  | 0            | 0     | *   | *  | *   | *  |
| 11:00      | 0         | 0     | 0     | 0     | *     | *     | *   | *  | *   | *  | 0            | 0     | *   | *  | *   | *  |
| Total Day  | 52        | 30    | 52    | 32    | 10    | 12    | 0   | 0  | 0   | 0  | 55           | 30    | 0   | 0  | 0   | 0  |
| AM Peak    | 82        | 84    | 22    | 85    | 0     | 0     | 0   | 0  | 0   | 0  | 85           | 0     | 0   | 0  | 0   | 0  |
| Vol.       | 09:00     | 07:00 | 07:00 | 07:00 | 07:00 | 07:00 |     |    |     |    | 07:00        | 07:00 |     |    |     |    |
| PM Peak    | 17:00     | 16:00 | 16:00 | 18:00 | 17:00 | 16:00 |     |    |     |    | 17:00        | 16:00 |     |    |     |    |
| Vol.       | 9         | 4     | 4     | 8     | 4     | 6     |     |    |     |    | 8            | 3     |     |    |     |    |

Comb. Total ADT 82 84 22 85 0 0 85 34 33

ADT ADT 66 AADT 66

Appendix B  
Capacity Analysis Output

HCM Unsignalized Intersection Capacity Analysis  
 3: Towne Road & 146th Street

2/13/2012

|                                   |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement                          | EBL   | EBT   | EBR   | WBL   | WBT   | WBR   | NBL   | NBT   | NBR   | SBL   | SBT   | SBR   |
| Lane Configurations               |   |  |   |   |  |   |   |  |   |   |  |   |
| Sign Control                      |   | Stop  |   |   | Stop  |   |   | Stop  |   |   | Stop  |   |
| Volume (vph)                      | 9   | 118   | 36  | 49  | 142   | 2   | 133   | 41  | 35  | 4   | 124   | 90  |
| Peak Hour Factor                  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  |
| Hourly flow rate (vph)            | 10  | 131   | 40  | 54  | 158   | 2   | 148   | 46  | 39  | 4   | 138   | 100   |
| Direction, Lane #                 | EB 1  | WB 1  | NB 1  | SB 1  |   |   |   |   |   |   |   |   |
| Volume Total (vph)                | 181   | 214   | 232   | 242   |   |   |   |   |   |   |   |   |
| Volume Left (vph)                 | 10  | 54  | 148   | 4   |   |   |   |   |   |   |   |   |
| Volume Right (vph)                | 40  | 2   | 39  | 100   |   |   |   |   |   |   |   |   |
| Hadj (s)                          | -0.10   | 0.07  | 0.03  | -0.24   |   |   |   |   |   |   |   |   |
| Departure Headway (s)             | 5.5   | 5.6   | 5.4   | 5.2   |   |   |   |   |   |   |   |   |
| Degree Utilization, x             | 0.28  | 0.33  | 0.35  | 0.35  |   |   |   |   |   |   |   |   |
| Capacity (veh/h)                  | 592   | 590   | 604   | 639   |   |   |   |   |   |   |   |   |
| Control Delay (s)                 | 10.6  | 11.3  | 11.4  | 10.9  |   |   |   |   |   |   |   |   |
| Approach Delay (s)                | 10.6  | 11.3  | 11.4  | 10.9  |   |   |   |   |   |   |   |   |
| Approach LOS                      | B   | B   | B   | B   |   |   |   |   |   |   |   |   |
| Intersection Summary              |   |   |   |   |   |   |   |   |   |   |   |   |
| Delay                             |   |   | 11.1  |   |   |   |   |   |   |   |   |   |
| HCM Level of Service              |   |   | B   |   |   |   |   |   |   |   |   |   |
| Intersection Capacity Utilization |   |   | 56.4%   | ICU Level of Service  |   |   | B   |   |   |   |   |   |
| Analysis Period (min)             |   |   | 15  |   |   |   |   |   |   |   |   |   |

HCM Unsignalized Intersection Capacity Analysis  
 6: Ditch Road & 146th Street

2/13/2012

|                                   |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|--|---|---|---|---|---|
| Movement                          | EBL   | EBT   | EBR   | WBL   | WBT   | WBR   | NBL  | NBT   | NBR   | SBL   | SBT   | SBR   |
| Lane Configurations               |   |  |   |   |  |   |  |  |   |   |  |   |
| Sign Control                      |   | Stop  |   |   | Stop  |   |  | Stop  |   |   | Stop  |   |
| Volume (vph)                      | 5   | 138   | 14  | 112   | 164   | 13  | 11   | 68  | 105   | 65  | 296   | 18  |
| Peak Hour Factor                  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90   | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  |
| Hourly flow rate (vph)            | 6   | 153   | 16  | 124   | 182   | 14  | 12   | 76  | 117   | 72  | 329   | 20  |
| Direction, Lane #                 | EB 1  | WB 1  | NB 1  | SB 1  |   |   |  |   |   |   |   |   |
| Volume Total (vph)                | 174   | 321   | 204   | 421   |   |   |  |   |   |   |   |   |
| Volume Left (vph)                 | 6   | 124   | 12  | 72  |   |   |  |   |   |   |   |   |
| Volume Right (vph)                | 16  | 14  | 117   | 20  |   |   |  |   |   |   |   |   |
| Hadj (s)                          | -0.02   | 0.07  | -0.33   | 0.01  |   |   |  |   |   |   |   |   |
| Departure Headway (s)             | 6.6   | 6.3   | 6.1   | 6.0   |   |   |  |   |   |   |   |   |
| Degree Utilization, x             | 0.32  | 0.56  | 0.35  | 0.70  |   |   |  |   |   |   |   |   |
| Capacity (veh/h)                  | 468   | 530   | 515   | 576   |   |   |  |   |   |   |   |   |
| Control Delay (s)                 | 12.6  | 17.1  | 12.3  | 21.5  |   |   |  |   |   |   |   |   |
| Approach Delay (s)                | 12.6  | 17.1  | 12.3  | 21.5  |   |   |  |   |   |   |   |   |
| Approach LOS                      | B   | C   | B   | C   |   |   |  |   |   |   |   |   |
| Intersection Summary              |   |   |   |   |   |   |  |   |   |   |   |   |
| Delay                             |   |   | 17.2  |   |   |   |  |   |   |   |   |   |
| HCM Level of Service              |   |   | C   |   |   |   |  |   |   |   |   |   |
| Intersection Capacity Utilization |   |   | 68.2%   | ICU Level of Service  | C   |   |  |   |   |   |   |   |
| Analysis Period (min)             |   |   | 15  |   |   |   |  |   |   |   |   |   |

# HCM Unsignalized Intersection Capacity Analysis

## 10: Towne Road & 156th Street

2/13/2012

|                                   | ↙    | ↖    | ↑     | ↗                    | ↘    | ↓    |
|-----------------------------------|------|------|-------|----------------------|------|------|
| Movement                          | WBL  | WBR  | NBT   | NBR                  | SBL  | SBT  |
| Lane Configurations               | ↙    |      | ↖     |                      |      | ↓    |
| Volume (veh/h)                    | 60   | 7    | 44    | 11                   | 10   | 158  |
| Sign Control                      | Stop |      | Free  |                      |      | Free |
| Grade                             | 0%   |      | 0%    |                      |      | 0%   |
| Peak Hour Factor                  | 0.90 | 0.90 | 0.90  | 0.90                 | 0.90 | 0.90 |
| Hourly flow rate (vph)            | 67   | 8    | 49    | 12                   | 11   | 176  |
| Pedestrians                       |      |      |       |                      |      |      |
| Lane Width (ft)                   |      |      |       |                      |      |      |
| Walking Speed (ft/s)              |      |      |       |                      |      |      |
| Percent Blockage                  |      |      |       |                      |      |      |
| Right turn flare (veh)            |      |      |       |                      |      |      |
| Median type                       | None |      |       | None                 |      |      |
| Median storage veh                |      |      |       |                      |      |      |
| Upstream signal (ft)              |      |      |       |                      |      |      |
| pX, platoon unblocked             |      |      |       |                      |      |      |
| vC, conflicting volume            | 253  | 55   |       |                      | 61   |      |
| vC1, stage 1 conf vol             |      |      |       |                      |      |      |
| vC2, stage 2 conf vol             |      |      |       |                      |      |      |
| vCu, unblocked vol                | 253  | 55   |       |                      | 61   |      |
| tC, single (s)                    | 6.4  | 6.2  |       |                      | 4.1  |      |
| tC, 2 stage (s)                   |      |      |       |                      |      |      |
| tF (s)                            | 3.5  | 3.3  |       |                      | 2.2  |      |
| p0 queue free %                   | 91   | 99   |       |                      | 99   |      |
| cM capacity (veh/h)               | 735  | 1018 |       |                      | 1555 |      |
| Direction, Lane #                 | WB 1 | NB 1 | SB 1  |                      |      |      |
| Volume Total                      | 74   | 61   | 187   |                      |      |      |
| Volume Left                       | 67   | 0    | 11    |                      |      |      |
| Volume Right                      | 8    | 12   | 0     |                      |      |      |
| cSH                               | 757  | 1700 | 1555  |                      |      |      |
| Volume to Capacity                | 0.10 | 0.04 | 0.01  |                      |      |      |
| Queue Length 95th (ft)            | 8    | 0    | 1     |                      |      |      |
| Control Delay (s)                 | 10.3 | 0.0  | 0.5   |                      |      |      |
| Lane LOS                          | B    |      | A     |                      |      |      |
| Approach Delay (s)                | 10.3 | 0.0  | 0.5   |                      |      |      |
| Approach LOS                      | B    |      |       |                      |      |      |
| Intersection Summary              |      |      |       |                      |      |      |
| Average Delay                     |      |      | 2.7   |                      |      |      |
| Intersection Capacity Utilization |      |      | 26.0% | ICU Level of Service | A    |      |
| Analysis Period (min)             |      |      | 15    |                      |      |      |

HCM Unsignalized Intersection Capacity Analysis  
 9: Ditch Road & 156th Street

2/13/2012

|                                   |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|--|---|---|---|---|---|
| Movement                          | EBL   | EBT   | EBR   | WBL   | WBT   | WBR   | NBL  | NBT   | NBR   | SBL   | SBT   | SBR   |
| Lane Configurations               |   |  |   |   |  |   |  |  |   |   |  |   |
| Sign Control                      |   | Stop  |   |   | Stop  |   |  | Stop  |   |   | Stop  |   |
| Volume (vph)                      | 1   | 19  | 1   | 43  | 63  | 27  | 2  | 89  | 22  | 19  | 150   | 2   |
| Peak Hour Factor                  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90   | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  |
| Hourly flow rate (vph)            | 1   | 21  | 1   | 48  | 70  | 30  | 2  | 99  | 24  | 21  | 167   | 2   |
| Direction, Lane #                 | EB 1  | WB 1  | NB 1  | SB 1  |   |   |  |   |   |   |   |   |
| Volume Total (vph)                | 23  | 148   | 126   | 190   |   |   |  |   |   |   |   |   |
| Volume Left (vph)                 | 1   | 48  | 2   | 21  |   |   |  |   |   |   |   |   |
| Volume Right (vph)                | 1   | 30  | 24  | 2   |   |   |  |   |   |   |   |   |
| Hadj (s)                          | -0.02   | -0.05   | -0.10   | 0.05  |   |   |  |   |   |   |   |   |
| Departure Headway (s)             | 4.8   | 4.6   | 4.4   | 4.5   |   |   |  |   |   |   |   |   |
| Degree Utilization, x             | 0.03  | 0.19  | 0.15  | 0.24  |   |   |  |   |   |   |   |   |
| Capacity (veh/h)                  | 682   | 726   | 769   | 759   |   |   |  |   |   |   |   |   |
| Control Delay (s)                 | 8.0   | 8.7   | 8.3   | 8.9   |   |   |  |   |   |   |   |   |
| Approach Delay (s)                | 8.0   | 8.7   | 8.3   | 8.9   |   |   |  |   |   |   |   |   |
| Approach LOS                      | A   | A   | A   | A   |   |   |  |   |   |   |   |   |
| Intersection Summary              |   |   |   |   |   |   |  |   |   |   |   |   |
| Delay                             |   |   | 8.6   |   |   |   |  |   |   |   |   |   |
| HCM Level of Service              |   |   | A   |   |   |   |  |   |   |   |   |   |
| Intersection Capacity Utilization |   |   | 36.4%   | ICU Level of Service  | A   |   |  |   |   |   |   |   |
| Analysis Period (min)             |   |   | 15  |   |   |   |  |   |   |   |   |   |

# HCM Unsignalized Intersection Capacity Analysis

## 12: Towne Road & 151st Street

2/13/2012

|                                   |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|--|---|---|---|---|---|
| Movement                          | EBL   | EBT   | EBR   | WBL   | WBT   | WBR   | NBL  | NBT   | NBR   | SBL   | SBT   | SBR   |
| Lane Configurations               |   |  |   |   |  |   |  |  |   |   |  |   |
| Volume (veh/h)                    | 2   | 0   | 2   | 3   | 1   | 2   | 0  | 51  | 1   | 3   | 215   | 0   |
| Sign Control                      |   | Stop  |   |   | Stop  |   |  | Free  |   |   | Free  |   |
| Grade                             |   | 0%  |   |   | 0%  |   |  | 0%  |   |   | 0%  |   |
| Peak Hour Factor                  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90   | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  |
| Hourly flow rate (vph)            | 2   | 0   | 2   | 3   | 1   | 2   | 0  | 57  | 1   | 3   | 239   | 0   |
| Pedestrians                       |   |   |   |   |   |   |  |   |   |   |   |   |
| Lane Width (ft)                   |   |   |   |   |   |   |  |   |   |   |   |   |
| Walking Speed (ft/s)              |   |   |   |   |   |   |  |   |   |   |   |   |
| Percent Blockage                  |   |   |   |   |   |   |  |   |   |   |   |   |
| Right turn flare (veh)            |   |   |   |   |   |   |  |   |   |   |   |   |
| Median type                       |   |   |   |   |   |   |  | None  |   |   | None  |   |
| Median storage (veh)              |   |   |   |   |   |   |  |   |   |   |   |   |
| Upstream signal (ft)              |   |   |   |   |   |   |  |   |   |   |   |   |
| pX, platoon unblocked             |   |   |   |   |   |   |  |   |   |   |   |   |
| vC, conflicting volume            | 306   | 303   | 239   | 305   | 303   | 57  | 239  |   |   | 58  |   |   |
| vC1, stage 1 conf vol             |   |   |   |   |   |   |  |   |   |   |   |   |
| vC2, stage 2 conf vol             |   |   |   |   |   |   |  |   |   |   |   |   |
| vCu, unblocked vol                | 306   | 303   | 239   | 305   | 303   | 57  | 239  |   |   | 58  |   |   |
| tC, single (s)                    | 7.1   | 6.5   | 6.2   | 7.1   | 6.5   | 6.2   | 4.1  |   |   | 4.1   |   |   |
| tC, 2 stage (s)                   |   |   |   |   |   |   |  |   |   |   |   |   |
| tF (s)                            | 3.5   | 4.0   | 3.3   | 3.5   | 4.0   | 3.3   | 2.2  |   |   | 2.2   |   |   |
| p0 queue free %                   | 100   | 100   | 100   | 99  | 100   | 100   | 100  |   |   | 100   |   |   |
| cM capacity (veh/h)               | 647   | 612   | 805   | 648   | 612   | 1015  | 1340   |   |   | 1559  |   |   |
| <b>Direction, Lane #</b>          | <b>EB 1</b>   | <b>WB 1</b>   | <b>NB 1</b>   | <b>SB 1</b>   |   |   |  |   |   |   |   |   |
| Volume Total                      | 4   | 7   | 58  | 242   |   |   |  |   |   |   |   |   |
| Volume Left                       | 2   | 3   | 0   | 3   |   |   |  |   |   |   |   |   |
| Volume Right                      | 2   | 2   | 1   | 0   |   |   |  |   |   |   |   |   |
| cSH                               | 718   | 729   | 1340  | 1559  |   |   |  |   |   |   |   |   |
| Volume to Capacity                | 0.01  | 0.01  | 0.00  | 0.00  |   |   |  |   |   |   |   |   |
| Queue Length 95th (ft)            | 0   | 1   | 0   | 0   |   |   |  |   |   |   |   |   |
| Control Delay (s)                 | 10.0  | 10.0  | 0.0   | 0.1   |   |   |  |   |   |   |   |   |
| Lane LOS                          | B   | A   |   | A   |   |   |  |   |   |   |   |   |
| Approach Delay (s)                | 10.0  | 10.0  | 0.0   | 0.1   |   |   |  |   |   |   |   |   |
| Approach LOS                      | B   | A   |   |   |   |   |  |   |   |   |   |   |
| <b>Intersection Summary</b>       |   |   |   |   |   |   |  |   |   |   |   |   |
| Average Delay                     |   |   | 0.4   |   |   |   |  |   |   |   |   |   |
| Intersection Capacity Utilization |   |   | 23.7%   |   | ICU Level of Service  |   |  |   | A   |   |   |   |
| Analysis Period (min)             |   |   | 15  |   |   |   |  |   |   |   |   |   |

HCM Unsignalized Intersection Capacity Analysis  
 13: Ditch Road & 151st Street

2/13/2012



| Movement                          | EBL         | EBR         | NBL         | NBT  | SBT                  | SBR  |
|-----------------------------------|-------------|-------------|-------------|------|----------------------|------|
| Lane Configurations               |             |             |             |      |                      |      |
| Volume (veh/h)                    | 1           | 3           | 4           | 87   | 331                  | 1    |
| Sign Control                      | Stop        |             |             | Free | Free                 |      |
| Grade                             | 0%          |             |             | 0%   | 0%                   |      |
| Peak Hour Factor                  | 0.90        | 0.90        | 0.90        | 0.90 | 0.90                 | 0.90 |
| Hourly flow rate (vph)            | 1           | 3           | 4           | 97   | 368                  | 1    |
| Pedestrians                       |             |             |             |      |                      |      |
| Lane Width (ft)                   |             |             |             |      |                      |      |
| Walking Speed (ft/s)              |             |             |             |      |                      |      |
| Percent Blockage                  |             |             |             |      |                      |      |
| Right turn flare (veh)            |             |             |             |      |                      |      |
| Median type                       |             |             |             | None | None                 |      |
| Median storage veh                |             |             |             |      |                      |      |
| Upstream signal (ft)              |             |             |             |      |                      |      |
| pX, platoon unblocked             |             |             |             |      |                      |      |
| vC, conflicting volume            | 474         | 368         | 369         |      |                      |      |
| vC1, stage 1 conf vol             |             |             |             |      |                      |      |
| vC2, stage 2 conf vol             |             |             |             |      |                      |      |
| vCu, unblocked vol                | 474         | 368         | 369         |      |                      |      |
| tC, single (s)                    | 6.4         | 6.2         | 4.1         |      |                      |      |
| tC, 2 stage (s)                   |             |             |             |      |                      |      |
| tF (s)                            | 3.5         | 3.3         | 2.2         |      |                      |      |
| p0 queue free %                   | 100         | 100         | 100         |      |                      |      |
| cM capacity (veh/h)               | 551         | 682         | 1201        |      |                      |      |
| <b>Direction, Lane #</b>          | <b>EB 1</b> | <b>NB 1</b> | <b>SB 1</b> |      |                      |      |
| Volume Total                      | 4           | 101         | 369         |      |                      |      |
| Volume Left                       | 1           | 4           | 0           |      |                      |      |
| Volume Right                      | 3           | 0           | 1           |      |                      |      |
| cSH                               | 643         | 1201        | 1700        |      |                      |      |
| Volume to Capacity                | 0.01        | 0.00        | 0.22        |      |                      |      |
| Queue Length 95th (ft)            | 1           | 0           | 0           |      |                      |      |
| Control Delay (s)                 | 10.6        | 0.4         | 0.0         |      |                      |      |
| Lane LOS                          | B           | A           |             |      |                      |      |
| Approach Delay (s)                | 10.6        | 0.4         | 0.0         |      |                      |      |
| Approach LOS                      | B           |             |             |      |                      |      |
| <b>Intersection Summary</b>       |             |             |             |      |                      |      |
| Average Delay                     |             |             | 0.2         |      |                      |      |
| Intersection Capacity Utilization |             |             | 27.5%       |      | ICU Level of Service | A    |
| Analysis Period (min)             |             |             | 15          |      |                      |      |

# HCM Unsignalized Intersection Capacity Analysis

## 3: Towne Road & 146th Street

2/13/2012

|                                   |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement                          | EBL   | EBT   | EBR   | WBL   | WBT   | WBR   | NBL   | NBT   | NBR   | SBL   | SBT   | SBR   |
| Lane Configurations               |   |  |   |   |  |   |   |  |   |   |  |   |
| Sign Control                      |   | Stop  |   |   | Stop  |   |   | Stop  |   |   | Stop  |   |
| Volume (vph)                      | 50  | 277   | 22  | 71  | 175   | 3   | 65  | 131   | 97  | 3   | 48  | 19  |
| Peak Hour Factor                  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  |
| Hourly flow rate (vph)            | 56  | 308   | 24  | 79  | 194   | 3   | 72  | 146   | 108   | 3   | 53  | 21  |
| Direction, Lane #                 | EB 1  | WB 1  | NB 1  | SB 1  |   |   |   |   |   |   |   |   |
| Volume Total (vph)                | 388   | 277   | 326   | 78  |   |   |   |   |   |   |   |   |
| Volume Left (vph)                 | 56  | 79  | 72  | 3   |   |   |   |   |   |   |   |   |
| Volume Right (vph)                | 24  | 3   | 108   | 21  |   |   |   |   |   |   |   |   |
| Hadj (s)                          | 0.02  | 0.07  | -0.15   | -0.15   |   |   |   |   |   |   |   |   |
| Departure Headway (s)             | 5.7   | 5.9   | 5.8   | 6.5   |   |   |   |   |   |   |   |   |
| Degree Utilization, x             | 0.61  | 0.46  | 0.53  | 0.14  |   |   |   |   |   |   |   |   |
| Capacity (veh/h)                  | 600   | 554   | 570   | 452   |   |   |   |   |   |   |   |   |
| Control Delay (s)                 | 17.4  | 13.9  | 15.2  | 10.5  |   |   |   |   |   |   |   |   |
| Approach Delay (s)                | 17.4  | 13.9  | 15.2  | 10.5  |   |   |   |   |   |   |   |   |
| Approach LOS                      | C   | B   | C   | B   |   |   |   |   |   |   |   |   |
| Intersection Summary              |   |   |   |   |   |   |   |   |   |   |   |   |
| Delay                             |   |   | 15.3  |   |   |   |   |   |   |   |   |   |
| HCM Level of Service              |   |   | C   |   |   |   |   |   |   |   |   |   |
| Intersection Capacity Utilization |   |   | 53.6%   | ICU Level of Service  | A   |   |   |   |   |   |   |   |
| Analysis Period (min)             |   |   | 15  |   |   |   |   |   |   |   |   |   |

HCM Unsignalized Intersection Capacity Analysis  
 6: Ditch Road & 146th Street

2/13/2012

|                                   |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|--|---|---|---|---|---|
| Movement                          | EBL   | EBT   | EBR   | WBL   | WBT   | WBR   | NBL  | NBT   | NBR   | SBL   | SBT   | SBR   |
| Lane Configurations               |   |  |   |   |  |   |  |  |   |   |  |   |
| Sign Control                      |   | Stop  |   |   | Stop  |   |  | Stop  |   |   | Stop  |   |
| Volume (vph)                      | 30  | 320   | 17  | 68  | 225   | 51  | 17   | 260   | 125   | 25  | 87  | 7   |
| Peak Hour Factor                  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90   | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  |
| Hourly flow rate (vph)            | 33  | 356   | 19  | 76  | 250   | 57  | 19   | 289   | 139   | 28  | 97  | 8   |
| Direction, Lane #                 | EB 1  | WB 1  | NB 1  | SB 1  |   |   |  |   |   |   |   |   |
| Volume Total (vph)                | 408   | 382   | 447   | 132   |   |   |  |   |   |   |   |   |
| Volume Left (vph)                 | 33  | 76  | 19  | 28  |   |   |  |   |   |   |   |   |
| Volume Right (vph)                | 19  | 57  | 139   | 8   |   |   |  |   |   |   |   |   |
| Hadj (s)                          | 0.02  | -0.03   | -0.18   | 0.01  |   |   |  |   |   |   |   |   |
| Departure Headway (s)             | 7.3   | 7.3   | 7.0   | 8.4   |   |   |  |   |   |   |   |   |
| Degree Utilization, x             | 0.82  | 0.78  | 0.87  | 0.31  |   |   |  |   |   |   |   |   |
| Capacity (veh/h)                  | 472   | 469   | 495   | 368   |   |   |  |   |   |   |   |   |
| Control Delay (s)                 | 35.9  | 31.2  | 41.5  | 15.2  |   |   |  |   |   |   |   |   |
| Approach Delay (s)                | 35.9  | 31.2  | 41.5  | 15.2  |   |   |  |   |   |   |   |   |
| Approach LOS                      | E   | D   | E   | C   |   |   |  |   |   |   |   |   |
| Intersection Summary              |   |   |   |   |   |   |  |   |   |   |   |   |
| Delay                             |   |   | 34.4  |   |   |   |  |   |   |   |   |   |
| HCM Level of Service              |   |   | D   |   |   |   |  |   |   |   |   |   |
| Intersection Capacity Utilization |   |   | 64.7%   | ICU Level of Service  | C   |   |  |   |   |   |   |   |
| Analysis Period (min)             |   |   | 15  |   |   |   |  |   |   |   |   |   |

# HCM Unsignalized Intersection Capacity Analysis

## 10: Towne Road & 156th Street

2/13/2012

|                                   |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|
| Movement                          | WBL   | WBR   | NBT   | NBR   | SBL   | SBT   |
| Lane Configurations               |  |   |  |   |   |  |
| Volume (veh/h)                    | 13  | 13  | 128   | 53  | 14  | 55  |
| Sign Control                      | Stop  |   | Free  |   |   | Free  |
| Grade                             | 0%  |   | 0%  |   |   | 0%  |
| Peak Hour Factor                  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  |
| Hourly flow rate (vph)            | 14  | 14  | 142   | 59  | 16  | 61  |
| Pedestrians                       |   |   |   |   |   |   |
| Lane Width (ft)                   |   |   |   |   |   |   |
| Walking Speed (ft/s)              |   |   |   |   |   |   |
| Percent Blockage                  |   |   |   |   |   |   |
| Right turn flare (veh)            |   |   |   |   |   |   |
| Median type                       |   |   | None  |   |   | None  |
| Median storage veh                |   |   |   |   |   |   |
| Upstream signal (ft)              |   |   |   |   |   |   |
| pX, platoon unblocked             |   |   |   |   |   |   |
| vC, conflicting volume            | 264   | 172   |   |   | 201   |   |
| vC1, stage 1 conf vol             |   |   |   |   |   |   |
| vC2, stage 2 conf vol             |   |   |   |   |   |   |
| vCu, unblocked vol                | 264   | 172   |   |   | 201   |   |
| tC, single (s)                    | 6.4   | 6.2   |   |   | 4.1   |   |
| tC, 2 stage (s)                   |   |   |   |   |   |   |
| tF (s)                            | 3.5   | 3.3   |   |   | 2.2   |   |
| p0 queue free %                   | 98  | 98  |   |   | 99  |   |
| cM capacity (veh/h)               | 721   | 877   |   |   | 1383  |   |
| Direction, Lane #                 | WB 1  | NB 1  | SB 1  |   |   |   |
| Volume Total                      | 29  | 201   | 77  |   |   |   |
| Volume Left                       | 14  | 0   | 16  |   |   |   |
| Volume Right                      | 14  | 59  | 0   |   |   |   |
| cSH                               | 792   | 1700  | 1383  |   |   |   |
| Volume to Capacity                | 0.04  | 0.12  | 0.01  |   |   |   |
| Queue Length 95th (ft)            | 3   | 0   | 1   |   |   |   |
| Control Delay (s)                 | 9.7   | 0.0   | 1.6   |   |   |   |
| Lane LOS                          | A   |   | A   |   |   |   |
| Approach Delay (s)                | 9.7   | 0.0   | 1.6   |   |   |   |
| Approach LOS                      | A   |   |   |   |   |   |
| <b>Intersection Summary</b>       |   |   |   |   |   |   |
| Average Delay                     |   |   | 1.3   |   |   |   |
| Intersection Capacity Utilization |   |   | 25.0%   | ICU Level of Service  |   | A   |
| Analysis Period (min)             |   |   | 15  |   |   |   |

HCM Unsignalized Intersection Capacity Analysis  
 9: Ditch Road & 156th Street

2/13/2012

|                                   |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|--|---|---|---|---|---|
| Movement                          | EBL   | EBT   | EBR   | WBL   | WBT   | WBR   | NBL  | NBT   | NBR   | SBL   | SBT   | SBR   |
| Lane Configurations               |   |  |   |   |  |   |  |  |   |   |  |   |
| Sign Control                      |   | Stop  |   |   | Stop  |   |  | Stop  |   |   | Stop  |   |
| Volume (vph)                      | 3   | 50  | 3   | 29  | 24  | 14  | 1  | 123   | 49  | 21  | 72  | 1   |
| Peak Hour Factor                  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90   | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  |
| Hourly flow rate (vph)            | 3   | 56  | 3   | 32  | 27  | 16  | 1  | 137   | 54  | 23  | 80  | 1   |
| Direction, Lane #                 | EB 1  | WB 1  | NB 1  | SB 1  |   |   |  |   |   |   |   |   |
| Volume Total (vph)                | 62  | 74  | 192   | 104   |   |   |  |   |   |   |   |   |
| Volume Left (vph)                 | 3   | 32  | 1   | 23  |   |   |  |   |   |   |   |   |
| Volume Right (vph)                | 3   | 16  | 54  | 1   |   |   |  |   |   |   |   |   |
| Hadj (s)                          | -0.02   | -0.04   | -0.12   | 0.04  |   |   |  |   |   |   |   |   |
| Departure Headway (s)             | 4.6   | 4.6   | 4.2   | 4.5   |   |   |  |   |   |   |   |   |
| Degree Utilization, x             | 0.08  | 0.10  | 0.23  | 0.13  |   |   |  |   |   |   |   |   |
| Capacity (veh/h)                  | 715   | 722   | 818   | 763   |   |   |  |   |   |   |   |   |
| Control Delay (s)                 | 8.0   | 8.1   | 8.5   | 8.1   |   |   |  |   |   |   |   |   |
| Approach Delay (s)                | 8.0   | 8.1   | 8.5   | 8.1   |   |   |  |   |   |   |   |   |
| Approach LOS                      | A   | A   | A   | A   |   |   |  |   |   |   |   |   |
| Intersection Summary              |   |   |   |   |   |   |  |   |   |   |   |   |
| Delay                             |   |   | 8.3   |   |   |   |  |   |   |   |   |   |
| HCM Level of Service              |   |   | A   |   |   |   |  |   |   |   |   |   |
| Intersection Capacity Utilization |   |   | 34.9%   | ICU Level of Service  | A   |   |  |   |   |   |   |   |
| Analysis Period (min)             |   |   | 15  |   |   |   |  |   |   |   |   |   |

# HCM Unsignalized Intersection Capacity Analysis

## 12: Towne Road & 151st Street

2/13/2012

|                                   |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|--|---|---|---|---|---|
| Movement                          | EBL   | EBT   | EBR   | WBL   | WBT   | WBR   | NBL  | NBT   | NBR   | SBL   | SBT   | SBR   |
| Lane Configurations               |   |  |   |   |  |   |  |  |   |   |  |   |
| Volume (veh/h)                    | 2   | 1   | 2   | 2   | 1   | 1   | 0  | 178   | 6   | 2   | 53  | 0   |
| Sign Control                      |   | Stop  |   |   | Stop  |   |  | Free  |   |   | Free  |   |
| Grade                             |   | 0%  |   |   | 0%  |   |  | 0%  |   |   | 0%  |   |
| Peak Hour Factor                  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90   | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  |
| Hourly flow rate (vph)            | 2   | 1   | 2   | 2   | 1   | 1   | 0  | 198   | 7   | 2   | 59  | 0   |
| Pedestrians                       |   |   |   |   |   |   |  |   |   |   |   |   |
| Lane Width (ft)                   |   |   |   |   |   |   |  |   |   |   |   |   |
| Walking Speed (ft/s)              |   |   |   |   |   |   |  |   |   |   |   |   |
| Percent Blockage                  |   |   |   |   |   |   |  |   |   |   |   |   |
| Right turn flare (veh)            |   |   |   |   |   |   |  |   |   |   |   |   |
| Median type                       |   |   |   |   |   |   |  | None  |   |   | None  |   |
| Median storage veh                |   |   |   |   |   |   |  |   |   |   |   |   |
| Upstream signal (ft)              |   |   |   |   |   |   |  |   |   |   |   |   |
| pX, platoon unblocked             |   |   |   |   |   |   |  |   |   |   |   |   |
| vC, conflicting volume            | 266   | 268   | 59  | 267   | 264   | 201   | 59   |   |   | 204   |   |   |
| vC1, stage 1 conf vol             |   |   |   |   |   |   |  |   |   |   |   |   |
| vC2, stage 2 conf vol             |   |   |   |   |   |   |  |   |   |   |   |   |
| vCu, unblocked vol                | 266   | 268   | 59  | 267   | 264   | 201   | 59   |   |   | 204   |   |   |
| tC, single (s)                    | 7.1   | 6.5   | 6.2   | 7.1   | 6.5   | 6.2   | 4.1  |   |   | 4.1   |   |   |
| tC, 2 stage (s)                   |   |   |   |   |   |   |  |   |   |   |   |   |
| tF (s)                            | 3.5   | 4.0   | 3.3   | 3.5   | 4.0   | 3.3   | 2.2  |   |   | 2.2   |   |   |
| p0 queue free %                   | 100   | 100   | 100   | 100   | 100   | 100   | 100  |   |   | 100   |   |   |
| cM capacity (veh/h)               | 688   | 641   | 1013  | 686   | 643   | 845   | 1558   |   |   | 1379  |   |   |
| <b>Direction, Lane #</b>          | <b>EB 1</b>   | <b>WB 1</b>   | <b>NB 1</b>   | <b>SB 1</b>   |   |   |  |   |   |   |   |   |
| Volume Total                      | 6   | 4   | 204   | 61  |   |   |  |   |   |   |   |   |
| Volume Left                       | 2   | 2   | 0   | 2   |   |   |  |   |   |   |   |   |
| Volume Right                      | 2   | 1   | 7   | 0   |   |   |  |   |   |   |   |   |
| cSH                               | 776   | 708   | 1558  | 1379  |   |   |  |   |   |   |   |   |
| Volume to Capacity                | 0.01  | 0.01  | 0.00  | 0.00  |   |   |  |   |   |   |   |   |
| Queue Length 95th (ft)            | 1   | 0   | 0   | 0   |   |   |  |   |   |   |   |   |
| Control Delay (s)                 | 9.7   | 10.1  | 0.0   | 0.3   |   |   |  |   |   |   |   |   |
| Lane LOS                          | A   | B   |   | A   |   |   |  |   |   |   |   |   |
| Approach Delay (s)                | 9.7   | 10.1  | 0.0   | 0.3   |   |   |  |   |   |   |   |   |
| Approach LOS                      | A   | B   |   |   |   |   |  |   |   |   |   |   |
| <b>Intersection Summary</b>       |   |   |   |   |   |   |  |   |   |   |   |   |
| Average Delay                     |   |   | 0.4   |   |   |   |  |   |   |   |   |   |
| Intersection Capacity Utilization |   |   | 19.7%   | ICU Level of Service  | A   |   |  |   |   |   |   |   |
| Analysis Period (min)             |   |   | 15  |   |   |   |  |   |   |   |   |   |

# HCM Unsignalized Intersection Capacity Analysis

## 13: Ditch Road & 151st Street

2/13/2012



| Movement                          | EBL         | EBR         | NBL         | NBT                  | SBT  | SBR  |
|-----------------------------------|-------------|-------------|-------------|----------------------|------|------|
| Lane Configurations               |             |             |             |                      |      |      |
| Volume (veh/h)                    | 2           | 6           | 2           | 302                  | 91   | 0    |
| Sign Control                      | Stop        |             |             | Free                 | Free |      |
| Grade                             | 0%          |             |             | 0%                   | 0%   |      |
| Peak Hour Factor                  | 0.90        | 0.90        | 0.90        | 0.90                 | 0.90 | 0.90 |
| Hourly flow rate (vph)            | 2           | 7           | 2           | 336                  | 101  | 0    |
| Pedestrians                       |             |             |             |                      |      |      |
| Lane Width (ft)                   |             |             |             |                      |      |      |
| Walking Speed (ft/s)              |             |             |             |                      |      |      |
| Percent Blockage                  |             |             |             |                      |      |      |
| Right turn flare (veh)            |             |             |             |                      |      |      |
| Median type                       |             |             |             | None                 | None |      |
| Median storage (veh)              |             |             |             |                      |      |      |
| Upstream signal (ft)              |             |             |             |                      |      |      |
| pX, platoon unblocked             |             |             |             |                      |      |      |
| vC, conflicting volume            | 441         | 101         | 101         |                      |      |      |
| vC1, stage 1 conf vol             |             |             |             |                      |      |      |
| vC2, stage 2 conf vol             |             |             |             |                      |      |      |
| vCu, unblocked vol                | 441         | 101         | 101         |                      |      |      |
| tC, single (s)                    | 6.4         | 6.2         | 4.1         |                      |      |      |
| tC, 2 stage (s)                   |             |             |             |                      |      |      |
| tF (s)                            | 3.5         | 3.3         | 2.2         |                      |      |      |
| p0 queue free %                   | 100         | 99          | 100         |                      |      |      |
| cM capacity (veh/h)               | 577         | 960         | 1504        |                      |      |      |
| <b>Direction, Lane #</b>          | <b>EB 1</b> | <b>NB 1</b> | <b>SB 1</b> |                      |      |      |
| Volume Total                      | 9           | 338         | 101         |                      |      |      |
| Volume Left                       | 2           | 2           | 0           |                      |      |      |
| Volume Right                      | 7           | 0           | 0           |                      |      |      |
| cSH                               | 823         | 1504        | 1700        |                      |      |      |
| Volume to Capacity                | 0.01        | 0.00        | 0.06        |                      |      |      |
| Queue Length 95th (ft)            | 1           | 0           | 0           |                      |      |      |
| Control Delay (s)                 | 9.4         | 0.1         | 0.0         |                      |      |      |
| Lane LOS                          | A           | A           |             |                      |      |      |
| Approach Delay (s)                | 9.4         | 0.1         | 0.0         |                      |      |      |
| Approach LOS                      | A           |             |             |                      |      |      |
| <b>Intersection Summary</b>       |             |             |             |                      |      |      |
| Average Delay                     |             |             | 0.2         |                      |      |      |
| Intersection Capacity Utilization |             | 27.5%       |             | ICU Level of Service |      | A    |
| Analysis Period (min)             |             |             | 15          |                      |      |      |

# HCM Unsignalized Intersection Capacity Analysis

## 3: Towne Road & 146th Street

2/13/2012

|                                   |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement                          | EBL   | EBT   | EBR   | WBL   | WBT   | WBR   | NBL   | NBT   | NBR   | SBL   | SBT   | SBR   |
| Lane Configurations               |   |  |   |   |  |   |   |  |   |   |  |   |
| Sign Control                      |   | Stop  |   |   | Stop  |   |   | Stop  |   |   | Stop  |   |
| Volume (vph)                      | 11  | 142   | 43  | 59  | 170   | 2   | 16  | 49  | 42  | 5   | 149   | 108   |
| Peak Hour Factor                  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  |
| Hourly flow rate (vph)            | 12  | 158   | 48  | 66  | 189   | 2   | 18  | 54  | 47  | 6   | 166   | 120   |
| Direction, Lane #                 | EB 1  | WB 1  | NB 1  | SB 1  |   |   |   |   |   |   |   |   |
| Volume Total (vph)                | 218   | 257   | 119   | 291   |   |   |   |   |   |   |   |   |
| Volume Left (vph)                 | 12  | 66  | 18  | 6   |   |   |   |   |   |   |   |   |
| Volume Right (vph)                | 48  | 2   | 47  | 120   |   |   |   |   |   |   |   |   |
| Hadj (s)                          | -0.10   | 0.07  | -0.21   | -0.24   |   |   |   |   |   |   |   |   |
| Departure Headway (s)             | 5.4   | 5.5   | 5.5   | 5.2   |   |   |   |   |   |   |   |   |
| Degree Utilization, x             | 0.32  | 0.39  | 0.18  | 0.42  |   |   |   |   |   |   |   |   |
| Capacity (veh/h)                  | 616   | 613   | 568   | 644   |   |   |   |   |   |   |   |   |
| Control Delay (s)                 | 10.9  | 11.9  | 9.7   | 11.8  |   |   |   |   |   |   |   |   |
| Approach Delay (s)                | 10.9  | 11.9  | 9.7   | 11.8  |   |   |   |   |   |   |   |   |
| Approach LOS                      | B   | B   | A   | B   |   |   |   |   |   |   |   |   |
| Intersection Summary              |   |   |   |   |   |   |   |   |   |   |   |   |
| Delay                             |   |   | 11.3  |   |   |   |   |   |   |   |   |   |
| HCM Level of Service              |   |   | B   |   |   |   |   |   |   |   |   |   |
| Intersection Capacity Utilization |   |   | 48.2%   | ICU Level of Service  | A   |   |   |   |   |   |   |   |
| Analysis Period (min)             |   |   | 15  |   |   |   |   |   |   |   |   |   |

|  |
|--|
| <b>ARCADY 8</b>  |
| Version: 8.0.0.249 [24 Oct 2011]<br>© Copyright Transport Research Laboratory 2012   |
| For sales and distribution information, program advice and maintenance, contact TRL:<br>Tel: +44 (0)1344 770758 E-mail: software@trl.co.uk Web: http://www.trlsoftware.co.uk |
| The users of this computer program for the solution of an engineering problem are in no way relieved of their responsibility for the correctness of the solution             |

File: P:\2011\01596\C. Calcs\_Data\Traffic Study\Analysis\ARCADY\146th & Towne.arc8  
Report generation date: 2/17/2012 3:24:46 PM

- « (Default Analysis Set) - Scenario 2, AM
- » Intersection Network
- » Legs
- » Traffic Flows
- » Entry Flows
- » Turning Proportions
- » Vehicle Mix

### Summary of intersection performance

|                            | AM          |                 |           |           |     |                        | PM               |             |                 |           |           |     |                        |
|----------------------------|-------------|-----------------|-----------|-----------|-----|------------------------|------------------|-------------|-----------------|-----------|-----------|-----|------------------------|
|                            | Queue (Veh) | 95% Queue (Veh) | Delay (s) | V/C Ratio | LOS | Intersection Delay (s) | Intersection LOS | Queue (Veh) | 95% Queue (Veh) | Delay (s) | V/C Ratio | LOS | Intersection Delay (s) |
| <b>A1 - Scenario 2</b>     |             |                 |           |           |     |                        |                  |             |                 |           |           |     |                        |
| <b>146th Street WB</b>     | 0.12        | ?               | 1.73      | 0.11      | A   | 2.10                   | A                | 0.18        | ?               | 1.93      | 0.15      | A   | 2.28                   |
| <b>Ditch Towne Road SB</b> | 0.21        | ?               | 2.58      | 0.17      | A   |                        |                  | 0.06        | ?               | 2.35      | 0.06      | A   |                        |
| <b>146th Street EB</b>     | 0.11        | ?               | 1.85      | 0.10      | A   |                        |                  | 0.27        | ?               | 2.05      | 0.21      | A   |                        |
| <b>Towne Road NB</b>       | 0.07        | ?               | 2.22      | 0.07      | A   |                        |                  | 0.28        | ?               | 2.91      | 0.22      | A   |                        |
| <b>A1 - Scenario 3</b>     |             |                 |           |           |     |                        |                  |             |                 |           |           |     |                        |
| <b>146th Street WB</b>     | 0.19        | ?               | 1.86      | 0.16      | A   | 2.26                   | A                | 0.32        | ?               | 2.23      | 0.24      | A   | 2.62                   |
| <b>Ditch Towne Road SB</b> | 0.29        | ?               | 2.86      | 0.22      | A   |                        |                  | 0.10        | ?               | 2.58      | 0.09      | A   |                        |
| <b>146th Street EB</b>     | 0.15        | ?               | 1.96      | 0.13      | A   |                        |                  | 0.38        | ?               | 2.30      | 0.27      | A   |                        |
| <b>Towne Road NB</b>       | 0.12        | ?               | 2.37      | 0.10      | A   |                        |                  | 0.45        | 1.00            | 3.46      | 0.31      | A   |                        |

Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.

"D1 - Scenario 2, AM" model duration: 8:00 AM - 9:30 AM  
 "D2 - Scenario 2, PM" model duration: 8:00 AM - 9:30 AM  
 "D3 - Scenario 3, AM" model duration: 8:00 AM - 9:30 AM  
 "D4 - Scenario 3, PM" model duration: 8:00 AM - 9:30 AM

Run using ARCADY 8.0.0.249 at 2/17/2012 3:24:46 PM

## File summary

### File Description

|             |              |
|-------------|--------------|
| Title       | (untitled)   |
| Location    |              |
| Site Number |              |
| Date        | 2/17/2012    |
| Version     |              |
| Status      | (new file)   |
| Identifier  |              |
| Client      |              |
| Jobnumber   |              |
| Analyst     | ACEvajohnson |
| Description |              |

## Analysis Options

| Vehicle Length (ft) | V/C Ratio Threshold | Average Delay Threshold (s) | Queue Threshold (PCE) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type |
|---------------------|---------------------|-----------------------------|-----------------------|---------------------|-----------------------------|---------------------------------|
| 18.86               | 0.85                | 36.00                       | 20.00                 | ✓                   |                             | N/A                             |

## Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|----------------|-------------|---------------------|-----------------------|------------|---------------------|-------------------|---------------------|
| ft             | mph         | Veh                 | Veh                   | perHour    | s                   | -Min              | perMin              |

## (Default Analysis Set) - Scenario 2, AM

### Data Errors and Warnings

| Severity | Area       | Item                                      | Description  |
|----------|------------|---|--|
| Warning  | Geometry   | 146th Street WB - Roundabout Geometry     | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | Geometry   | Ditch Towne Road SB - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | Geometry   | 146th Street EB - Roundabout Geometry     | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | Geometry   | Towne Road NB - Roundabout Geometry       | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | DemandSets | D1 - Scenario 2, AM                       | Time results are shown for central hour only. (Model is run for a 90 minute period.)                             |

### Analysis Set Details

| Name                   | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|------------------------|---------------------------|-------------|-------------------|----------------------------|-------------------------|--------|---------------------------------|-------------------------------------|----------------------------|
| (Default Analysis Set) | ARCADY                    |             | ✓                 |                            |                         |        | 100.000                         | 85.000                              |                            |

### Demand Set Details

|  |  |  |  |  |  |  |  |  |  |
|--|--|--|--|--|--|--|--|--|--|
|  |  |  |  |  |  |  |  |  |  |
|--|--|--|--|--|--|--|--|--|--|

| Name           | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|----------------|---------------|------------------|-------------|----------------------|--------------------------|---------------------------|--------------------------------|---------------------------|-------------------------------|--------------------------|--------|-------------------|------------------|--------------|
| Scenario 2, AM | Scenario 2    | AM               |             | ONE HOUR             | 08:00                    | 09:30                     | 90                             | 15                        | ✓                             |                          |        | ✓                 |                  |              |

## Intersection Network

### Intersections

| Name       | Intersection Type | Leg Order | Grade Separated | Large Roundabout | Do Geometric Delay | Intersection Delay (s) | Intersection LOS |
|------------|-------------------|-----------|-----------------|------------------|--------------------|------------------------|------------------|
| (untitled) | Roundabout        | 1,2,3,4   |                 |                  |                    | 2.10                   | A                |

### Intersection Network Options

| Driving Side | Lighting       | Road Surface            | Network Residual Capacity (%) | First Leg Reaching Threshold |
|--------------|----------------|-------------------------|-------------------------------|------------------------------|
| Right        | Normal/unknown | (Mini-roundabouts only) | N/A                           | N/A                          |

## Legs

### Legs

| Name                | Name                | Description |
|---------------------|---------------------|-------------|
| 146th Street WB     | 146th Street WB     |             |
| Ditch Towne Road SB | Ditch Towne Road SB |             |
| 146th Street EB     | 146th Street EB     |             |
| Towne Road NB       | Towne Road NB       |             |

### Capacity Options

| Name                | Minimum Capacity (PCE/hr) | Maximum Capacity (PCE/hr) | Assume Flat Start Profile | Initial Queue (PCE) |
|---------------------|---------------------------|---------------------------|---------------------------|---------------------|
| 146th Street WB     | 0.00                      | 99999.00                  |                           | 0.00                |
| Ditch Towne Road SB | 0.00                      | 99999.00                  |                           | 0.00                |
| 146th Street EB     | 0.00                      | 99999.00                  |                           | 0.00                |
| Towne Road NB       | 0.00                      | 99999.00                  |                           | 0.00                |

### Roundabout Geometry

| Name                | V - Approach road half-width (ft) | E - Entry width (ft) | I' - Effective flare length (ft) | R - Entry radius (ft) | D - Inscribed circle diameter (ft) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---------------------|-----------------------------------|----------------------|----------------------------------|-----------------------|------------------------------------|------------------------------------|-----------|
| 146th Street WB     | 26.00                             | 30.00                | 130.00                           | 92.00                 | 165.00                             | 25.00                              |           |
| Ditch Towne Road SB | 12.00                             | 28.00                | 130.00                           | 50.00                 | 161.00                             | 25.00                              |           |
| 146th Street EB     | 26.00                             | 30.00                | 130.00                           | 50.00                 | 165.00                             | 25.00                              |           |
| Towne Road NB       | 12.00                             | 28.00                | 130.00                           | 50.00                 | 161.00                             | 25.00                              |           |

### Pedestrian Crossings

| Name                | Crossing Type |
|---------------------|---------------|
| 146th Street WB     | None          |
| Ditch Towne Road SB | None          |
| 146th Street EB     | None          |
| Towne Road NB       | None          |

### Leg Slope/ Intercept and Capacity

### Slope and Intercept used in model

| Name                | Enter Directly | Slope        | Intercept (PCE/hr) | Final Slope | Final Intercept (PCE/hr) |
|---------------------|----------------|--------------|--------------------|-------------|--------------------------|
| 146th Street WB     |                | (calculated) | (calculated)       | 0.828       | 2823.404                 |
| Ditch Towne Road SB |                | (calculated) | (calculated)       | 0.703       | 2172.895                 |
| 146th Street EB     |                | (calculated) | (calculated)       | 0.805       | 2743.204                 |
| Towne Road NB       |                | (calculated) | (calculated)       | 0.703       | 2172.895                 |

The slope and intercept shown above include any corrections and adjustments.

## Traffic Flows

### Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCE Factor for a Truck (PCE) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---------------------|------------------------------|------------------------------|-------------------------------|--------------------|------------------------------|-----------------------------|---------------------------------|------------------------------------|------------------------------------|-------------------------------------|
|                     |                              | ✓                            | ✓                             | Truck Percentages  | 2.00                         |                             |                                 |                                    | ✓                                  | ✓                                   |

## Entry Flows

### General Flows Data

| Name                | Profile Type | Use Turning Counts | Average Demand Flow (Veh/hr) | Flow Scaling Factor (%) |
|---------------------|--------------|--------------------|------------------------------|-------------------------|
| 146th Street WB     | ONE HOUR     | ✓                  | 231.00                       | 100.000                 |
| Ditch Towne Road SB | ONE HOUR     | ✓                  | 262.00                       | 100.000                 |
| 146th Street EB     | ONE HOUR     | ✓                  | 196.00                       | 100.000                 |
| Towne Road NB       | ONE HOUR     | ✓                  | 107.00                       | 100.000                 |

## Turning Proportions

### Turning Counts or Proportions (Veh/hr) - (untitled) (for whole period)

|      |   | To      |        |         |         |
|------|---|---------|--------|---------|---------|
|      |   | 1       | 2      | 3       | 4       |
| From | 1 | 0.000   | 2.000  | 170.000 | 59.000  |
|      | 2 | 5.000   | 0.000  | 108.000 | 149.000 |
|      | 3 | 142.000 | 11.000 | 0.000   | 43.000  |
|      | 4 | 42.000  | 49.000 | 16.000  | 0.000   |

### Turning Proportions (Veh) - (untitled) (for whole period)

|      |   | To   |      |      |      |
|------|---|------|------|------|------|
|      |   | 1    | 2    | 3    | 4    |
| From | 1 | 0.00 | 0.01 | 0.74 | 0.26 |
|      | 2 | 0.02 | 0.00 | 0.41 | 0.57 |
|      | 3 | 0.72 | 0.06 | 0.00 | 0.22 |
|      | 4 | 0.39 | 0.46 | 0.15 | 0.00 |

## Vehicle Mix

### Average PCE Per Vehicle - (untitled) (for whole period)

|  |
|--|
|  |
|--|



|      |   | To    |       |       |       |
|------|---|-------|-------|-------|-------|
|      |   | 1     | 2     | 3     | 4     |
| From | 1 | 1.000 | 1.000 | 1.020 | 1.000 |
|      | 2 | 1.000 | 1.000 | 1.000 | 1.000 |
|      | 3 | 1.020 | 1.000 | 1.000 | 1.000 |
|      | 4 | 1.000 | 1.000 | 1.000 | 1.000 |

Truck Percentages - (untitled) (for whole period)

|      |   | To    |       |       |       |
|------|---|-------|-------|-------|-------|
|      |   | 1     | 2     | 3     | 4     |
| From | 1 | 0.000 | 0.000 | 2.000 | 0.000 |
|      | 2 | 0.000 | 0.000 | 0.000 | 0.000 |
|      | 3 | 2.000 | 0.000 | 0.000 | 0.000 |
|      | 4 | 0.000 | 0.000 | 0.000 | 0.000 |

# HCM Unsignalized Intersection Capacity Analysis

## 6: Ditch Road & 146th Street

2/13/2012

|                                   |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|--|---|---|---|---|---|
| Movement                          | EBL   | EBT   | EBR   | WBL   | WBT   | WBR   | NBL  | NBT   | NBR   | SBL   | SBT   | SBR   |
| Lane Configurations               |   |  |   |   |  |   |  |  |   |   |  |   |
| Sign Control                      |   | Stop  |   |   | Stop  |   |  | Stop  |   |   | Stop  |   |
| Volume (vph)                      | 6   | 166   | 17  | 134   | 197   | 16  | 13   | 82  | 126   | 78  | 355   | 22  |
| Peak Hour Factor                  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90   | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  |
| Hourly flow rate (vph)            | 7   | 184   | 19  | 149   | 219   | 18  | 14   | 91  | 140   | 87  | 394   | 24  |
| Direction, Lane #                 | EB 1  | WB 1  | NB 1  | SB 1  |   |   |  |   |   |   |   |   |
| Volume Total (vph)                | 210   | 386   | 246   | 506   |   |   |  |   |   |   |   |   |
| Volume Left (vph)                 | 7   | 149   | 14  | 87  |   |   |  |   |   |   |   |   |
| Volume Right (vph)                | 19  | 18  | 140   | 24  |   |   |  |   |   |   |   |   |
| Hadj (s)                          | -0.02   | 0.07  | -0.33   | 0.01  |   |   |  |   |   |   |   |   |
| Departure Headway (s)             | 8.0   | 7.4   | 7.4   | 7.0   |   |   |  |   |   |   |   |   |
| Degree Utilization, x             | 0.47  | 0.79  | 0.51  | 0.98  |   |   |  |   |   |   |   |   |
| Capacity (veh/h)                  | 424   | 480   | 456   | 511   |   |   |  |   |   |   |   |   |
| Control Delay (s)                 | 17.7  | 33.4  | 17.9  | 60.8  |   |   |  |   |   |   |   |   |
| Approach Delay (s)                | 17.7  | 33.4  | 17.9  | 60.8  |   |   |  |   |   |   |   |   |
| Approach LOS                      | C   | D   | C   | F   |   |   |  |   |   |   |   |   |
| Intersection Summary              |   |   |   |   |   |   |  |   |   |   |   |   |
| Delay                             |   |   | 38.4  |   |   |   |  |   |   |   |   |   |
| HCM Level of Service              |   |   | E   |   |   |   |  |   |   |   |   |   |
| Intersection Capacity Utilization |   |   | 79.3%   | ICU Level of Service  | D   |   |  |   |   |   |   |   |
| Analysis Period (min)             |   |   | 15  |   |   |   |  |   |   |   |   |   |

|  |
|--|
| <b>ARCADY 8</b>  |
| Version: 8.0.0.249 [24 Oct 2011]<br>© Copyright Transport Research Laboratory 2012   |
| For sales and distribution information, program advice and maintenance, contact TRL:<br>Tel: +44 (0)1344 770758 E-mail: software@trl.co.uk Web: http://www.trlsoftware.co.uk |
| The users of this computer program for the solution of an engineering problem are in no way relieved of their responsibility for the correctness of the solution             |

File: P:\2011\01596\C. Calcs\_Data\Traffic Study\Analysis\ARCADY\146th & Ditch.arc8  
Report generation date: 2/17/2012 3:20:05 PM

- « (Default Analysis Set) - Scenario AM
- » Intersection Network
- » Legs
- » Traffic Flows
- » Entry Flows
- » Turning Proportions
- » Vehicle Mix

### Summary of intersection performance

|                        | AM          |                 |           |           |     |                        | PM               |             |                 |           |           |     |                        |
|------------------------|-------------|-----------------|-----------|-----------|-----|------------------------|------------------|-------------|-----------------|-----------|-----------|-----|------------------------|
|                        | Queue (Veh) | 95% Queue (Veh) | Delay (s) | V/C Ratio | LOS | Intersection Delay (s) | Intersection LOS | Queue (Veh) | 95% Queue (Veh) | Delay (s) | V/C Ratio | LOS | Intersection Delay (s) |
| <b>A1 - Scenario 2</b> |             |                 |           |           |     |                        |                  |             |                 |           |           |     |                        |
| 146th Street WB        | 0.20        | ?               | 1.86      | 0.17      | A   | 2.53                   | A                | 0.28        | ?               | 2.18      | 0.22      | A   | 2.64                   |
| Ditch Road SB          | 0.45        | 1.00            | 3.22      | 0.31      | A   |                        |                  | 0.11        | ?               | 2.50      | 0.10      | A   |                        |
| 146th Street EB        | 0.12        | ?               | 2.13      | 0.11      | A   |                        |                  | 0.29        | ?               | 2.15      | 0.23      | A   |                        |
| Ditch Road NB          | 0.17        | ?               | 2.50      | 0.14      | A   |                        |                  | 0.52        | 1.00            | 3.55      | 0.34      | A   |                        |
| <b>A1 - Scenario 3</b> |             |                 |           |           |     |                        |                  |             |                 |           |           |     |                        |
| 146th Street WB        | 0.29        | ?               | 2.12      | 0.23      | A   | 3.64                   | A                | 0.49        | 1.00            | 2.91      | 0.33      | A   | 3.91                   |
| Ditch Road SB          | 1.22        | 1.00            | 5.07      | 0.55      | A   |                        |                  | 0.65        | 1.00            | 3.74      | 0.39      | A   |                        |
| 146th Street EB        | 0.24        | ?               | 2.66      | 0.19      | A   |                        |                  | 0.50        | 1.00            | 2.85      | 0.34      | A   |                        |
| Ditch Road NB          | 0.32        | ?               | 3.14      | 0.24      | A   |                        |                  | 1.15        | ?               | 5.86      | 0.54      | A   |                        |

Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle.  
Intersection delay and intersection delay are demand weighted averages.

Scenario model duration  
Scenario model duration  
Scenario model duration  
Scenario model duration

Run using at

## File summary

### File Description

|             |              |
|-------------|--------------|
| Title       | (untitled)   |
| Location    |              |
| Site Number |              |
| Date        | 2/17/2012    |
| Version     |              |
| Status      | (new file)   |
| Identifier  |              |
| Client      |              |
| Jobnumber   |              |
| Analyst     | ACEvajohnson |
| Description |              |

## Analysis Options

| Vehicle Length (ft) | V/C Ratio Threshold | Average Delay Threshold (s) | Queue Threshold (PCE) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type |
|---------------------|---------------------|-----------------------------|-----------------------|---------------------|-----------------------------|---------------------------------|
| 18.86               | 0.85                | 36.00                       | 20.00                 | ✓                   |                             | N/A                             |

## Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|----------------|-------------|---------------------|-----------------------|------------|---------------------|-------------------|---------------------|
| ft             | mph         | Veh                 | Veh                   | perHour    | s                   | -Min              | perMin              |

# (Default Analysis Set) - Scenario 2, AM

## Data Errors and Warnings

| Severity | Area       | Item                                  | Description  |
|----------|------------|---------------------------------------|--|
| Warning  | Geometry   | 146th Street WB - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | Geometry   | Ditch Road SB - Roundabout Geometry   | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | Geometry   | 146th Street EB - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | Geometry   | Ditch Road NB - Roundabout Geometry   | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | DemandSets | D1 - Scenario 2, AM                   | Time results are shown for central hour only. (Model is run for a 90 minute period.)                             |

## Analysis Set Details

| Name                   | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|------------------------|---------------------------|-------------|-------------------|----------------------------|-------------------------|--------|---------------------------------|-------------------------------------|----------------------------|
| (Default Analysis Set) | ARCADY                    |             | ✓                 |                            |                         |        | 100.000                         | 85.000                              |                            |

## Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|------|---------------|------------------|-------------|----------------------|--------------------------|---------------------------|--------------------------------|---------------------------|-------------------------------|--------------------------|--------|-------------------|------------------|--------------|
|------|---------------|------------------|-------------|----------------------|--------------------------|---------------------------|--------------------------------|---------------------------|-------------------------------|--------------------------|--------|-------------------|------------------|--------------|

|                |            |    |  |          |       |       |    |    |   |  |  |   |  |  |
|----------------|------------|----|--|----------|-------|-------|----|----|---|--|--|---|--|--|
| Scenario 2, AM | Scenario 2 | AM |  | ONE HOUR | 08:00 | 09:30 | 90 | 15 | ✓ |  |  | ✓ |  |  |
|----------------|------------|----|--|----------|-------|-------|----|----|---|--|--|---|--|--|

# Intersection Network

## Intersections

| Name       | Intersection Type | Leg Order | Grade Separated | Large Roundabout | Do Geometric Delay | Intersection Delay (s) | Intersection LOS |
|------------|-------------------|-----------|-----------------|------------------|--------------------|------------------------|------------------|
| (untitled) | Roundabout        | 1,2,3,4   |                 |                  |                    | 2.53                   | A                |

## Intersection Network Options

| Driving Side | Lighting       | Road Surface            | Network Residual Capacity (%) | First Leg Reaching Threshold |
|--------------|----------------|-------------------------|-------------------------------|------------------------------|
| Right        | Normal/Unknown | (Mini-roundabouts only) | N/A                           | N/A                          |

# Legs

## Legs

| Name            | Name            | Description |
|-----------------|-----------------|-------------|
| 146th Street WB | 146th Street WB |             |
| Ditch Road SB   | Ditch Road SB   |             |
| 146th Street EB | 146th Street EB |             |
| Ditch Road NB   | Ditch Road NB   |             |

## Capacity Options

| Name            | Minimum Capacity (PCE/hr) | Maximum Capacity (PCE/hr) | Assume Flat Start Profile | Initial Queue (PCE) |
|-----------------|---------------------------|---------------------------|---------------------------|---------------------|
| 146th Street WB | 0.00                      | 99999.00                  |                           | 0.00                |
| Ditch Road SB   | 0.00                      | 99999.00                  |                           | 0.00                |
| 146th Street EB | 0.00                      | 99999.00                  |                           | 0.00                |
| Ditch Road NB   | 0.00                      | 99999.00                  |                           | 0.00                |

## Roundabout Geometry

| Name            | V - Approach road half-width (ft) | E - Entry width (ft) | I' - Effective flare length (ft) | R - Entry radius (ft) | D - Inscribed circle diameter (ft) | PHI - Conflict (entry) angle (deg) | Exit Only |
|-----------------|-----------------------------------|----------------------|----------------------------------|-----------------------|------------------------------------|------------------------------------|-----------|
| 146th Street WB | 26.00                             | 30.00                | 130.00                           | 92.00                 | 165.00                             | 25.00                              |           |
| Ditch Road SB   | 12.00                             | 28.00                | 130.00                           | 50.00                 | 161.00                             | 25.00                              |           |
| 146th Street EB | 26.00                             | 30.00                | 130.00                           | 50.00                 | 165.00                             | 25.00                              |           |
| Ditch Road NB   | 12.00                             | 28.00                | 130.00                           | 50.00                 | 161.00                             | 25.00                              |           |

## Pedestrian Crossings

| Name            | Crossing Type |
|-----------------|---------------|
| 146th Street WB | None          |
| Ditch Road SB   | None          |
| 146th Street EB | None          |
| Ditch Road NB   | None          |

## Leg Slope/ Intercept and Capacity

Slope and Intercept used in model

|  |  |  |  |  |  |  |  |
|--|--|--|--|--|--|--|--|
|  |  |  |  |  |  |  |  |
|--|--|--|--|--|--|--|--|

| Name            | Enter Directly | Slope        | Intercept (PCE/hr) | Final Slope | Final Intercept (PCE/hr) |
|-----------------|----------------|--------------|--------------------|-------------|--------------------------|
| 146th Street WB |                | (calculated) | (calculated)       | 0.828       | 2823.404                 |
| Ditch Road SB   |                | (calculated) | (calculated)       | 0.703       | 2172.895                 |
| 146th Street EB |                | (calculated) | (calculated)       | 0.805       | 2743.204                 |
| Ditch Road NB   |                | (calculated) | (calculated)       | 0.703       | 2172.895                 |

The slope and intercept shown above include any corrections and adjustments.

## Traffic Flows

### Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCE Factor for a Truck (PCE) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---------------------|------------------------------|------------------------------|-------------------------------|--------------------|------------------------------|-----------------------------|---------------------------------|------------------------------------|------------------------------------|-------------------------------------|
|                     |                              | ✓                            | ✓                             | Truck Percentages  | 2.00                         |                             |                                 |                                    | ✓                                  | ✓                                   |

## Entry Flows

### General Flows Data

| Name            | Profile Type | Use Turning Counts | Average Demand Flow (Veh/hr) | Flow Scaling Factor (%) |
|-----------------|--------------|--------------------|------------------------------|-------------------------|
| 146th Street WB | ONE HOUR     | ✓                  | 347.00                       | 100.000                 |
| Ditch Road SB   | ONE HOUR     | ✓                  | 455.00                       | 100.000                 |
| 146th Street EB | ONE HOUR     | ✓                  | 189.00                       | 100.000                 |
| Ditch Road NB   | ONE HOUR     | ✓                  | 221.00                       | 100.000                 |

## Turning Proportions

### Turning Counts or Proportions (Veh/hr) - (untitled) (for whole period)

|      |   | To      |        |         |         |
|------|---|---------|--------|---------|---------|
|      |   | 1       | 2      | 3       | 4       |
| From | 1 | 0.000   | 16.000 | 197.000 | 134.000 |
|      | 2 | 78.000  | 0.000  | 22.000  | 355.000 |
|      | 3 | 166.000 | 6.000  | 0.000   | 17.000  |
|      | 4 | 126.000 | 82.000 | 13.000  | 0.000   |

### Turning Proportions (Veh) - (untitled) (for whole period)

|      |   | To   |      |      |      |
|------|---|------|------|------|------|
|      |   | 1    | 2    | 3    | 4    |
| From | 1 | 0.00 | 0.05 | 0.57 | 0.39 |
|      | 2 | 0.17 | 0.00 | 0.05 | 0.78 |
|      | 3 | 0.88 | 0.03 | 0.00 | 0.09 |
|      | 4 | 0.57 | 0.37 | 0.06 | 0.00 |

## Vehicle Mix

### Average PCE Per Vehicle - (untitled) (for whole period)

|  |  | To |
|--|--|----|
|  |  |    |



|      |   | 1     | 2     | 3     | 4     |
|------|---|-------|-------|-------|-------|
| From | 1 | 1.000 | 1.000 | 1.020 | 1.000 |
|      | 2 | 1.000 | 1.000 | 1.000 | 1.000 |
|      | 3 | 1.020 | 1.000 | 1.000 | 1.000 |
|      | 4 | 1.000 | 1.000 | 1.000 | 1.000 |

Truck Percentages - (untitled) (for whole period)

|      |   | To    |       |       |       |
|------|---|-------|-------|-------|-------|
|      |   | 1     | 2     | 3     | 4     |
| From | 1 | 0.000 | 0.000 | 2.000 | 0.000 |
|      | 2 | 0.000 | 0.000 | 0.000 | 0.000 |
|      | 3 | 2.000 | 0.000 | 0.000 | 0.000 |
|      | 4 | 0.000 | 0.000 | 0.000 | 0.000 |

# HCM Unsignalized Intersection Capacity Analysis

## 10: Towne Road & 156th Street

2/13/2012



| Movement               | WBL  | WBR  | NBT  | NBR  | SBL  | SBT  |
|------------------------|------|------|------|------|------|------|
| Lane Configurations    | ↔    |      | ↔    |      |      | ↔    |
| Volume (veh/h)         | 72   | 8    | 53   | 13   | 12   | 190  |
| Sign Control           | Stop |      | Free |      |      | Free |
| Grade                  | 0%   |      | 0%   |      |      | 0%   |
| Peak Hour Factor       | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Hourly flow rate (vph) | 80   | 9    | 59   | 14   | 13   | 211  |
| Pedestrians            |      |      |      |      |      |      |
| Lane Width (ft)        |      |      |      |      |      |      |
| Walking Speed (ft/s)   |      |      |      |      |      |      |
| Percent Blockage       |      |      |      |      |      |      |
| Right turn flare (veh) |      |      |      |      |      |      |
| Median type            |      |      | None |      |      | None |
| Median storage veh     |      |      |      |      |      |      |
| Upstream signal (ft)   |      |      |      |      |      |      |
| pX, platoon unblocked  |      |      |      |      |      |      |
| vC, conflicting volume | 304  | 66   |      |      | 73   |      |
| vC1, stage 1 conf vol  |      |      |      |      |      |      |
| vC2, stage 2 conf vol  |      |      |      |      |      |      |
| vCu, unblocked vol     | 304  | 66   |      |      | 73   |      |
| tC, single (s)         | 6.4  | 6.2  |      |      | 4.1  |      |
| tC, 2 stage (s)        |      |      |      |      |      |      |
| tF (s)                 | 3.5  | 3.3  |      |      | 2.2  |      |
| p0 queue free %        | 88   | 99   |      |      | 99   |      |
| cM capacity (veh/h)    | 686  | 1003 |      |      | 1539 |      |

| Direction, Lane #      | WB 1 | NB 1 | SB 1 |
|------------------------|------|------|------|
| Volume Total           | 89   | 73   | 224  |
| Volume Left            | 80   | 0    | 13   |
| Volume Right           | 9    | 14   | 0    |
| cSH                    | 709  | 1700 | 1539 |
| Volume to Capacity     | 0.13 | 0.04 | 0.01 |
| Queue Length 95th (ft) | 11   | 0    | 1    |
| Control Delay (s)      | 10.8 | 0.0  | 0.5  |
| Lane LOS               | B    |      | A    |
| Approach Delay (s)     | 10.8 | 0.0  | 0.5  |
| Approach LOS           | B    |      |      |

| Intersection Summary              |  |       |                        |
|-----------------------------------|--|-------|------------------------|
| Average Delay                     |  | 2.8   |                        |
| Intersection Capacity Utilization |  | 28.5% | ICU Level of Service A |
| Analysis Period (min)             |  | 15    |                        |

HCM Unsignalized Intersection Capacity Analysis  
 9: Ditch Road & 156th Street

2/13/2012

|                                   |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|--|---|---|---|---|---|
| Movement                          | EBL   | EBT   | EBR   | WBL   | WBT   | WBR   | NBL  | NBT   | NBR   | SBL   | SBT   | SBR   |
| Lane Configurations               |   |  |   |   |  |   |  |  |   |   |  |   |
| Sign Control                      |   | Stop  |   |   | Stop  |   |  | Stop  |   |   | Stop  |   |
| Volume (vph)                      | 1   | 23  | 1   | 52  | 76  | 32  | 2  | 107   | 26  | 23  | 180   | 2   |
| Peak Hour Factor                  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90   | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  |
| Hourly flow rate (vph)            | 1   | 26  | 1   | 58  | 84  | 36  | 2  | 119   | 29  | 26  | 200   | 2   |
| <b>Direction, Lane #</b>          | <b>EB 1</b>   | <b>WB 1</b>   | <b>NB 1</b>   | <b>SB 1</b>   |   |   |  |   |   |   |   |   |
| Volume Total (vph)                | 28  | 178   | 150   | 228   |   |   |  |   |   |   |   |   |
| Volume Left (vph)                 | 1   | 58  | 2   | 26  |   |   |  |   |   |   |   |   |
| Volume Right (vph)                | 1   | 36  | 29  | 2   |   |   |  |   |   |   |   |   |
| Hadj (s)                          | -0.02   | -0.04   | -0.10   | 0.05  |   |   |  |   |   |   |   |   |
| Departure Headway (s)             | 5.0   | 4.8   | 4.6   | 4.7   |   |   |  |   |   |   |   |   |
| Degree Utilization, x             | 0.04  | 0.24  | 0.19  | 0.29  |   |   |  |   |   |   |   |   |
| Capacity (veh/h)                  | 640   | 696   | 738   | 734   |   |   |  |   |   |   |   |   |
| Control Delay (s)                 | 8.2   | 9.3   | 8.7   | 9.6   |   |   |  |   |   |   |   |   |
| Approach Delay (s)                | 8.2   | 9.3   | 8.7   | 9.6   |   |   |  |   |   |   |   |   |
| Approach LOS                      | A   | A   | A   | A   |   |   |  |   |   |   |   |   |
| <b>Intersection Summary</b>       |   |   |   |   |   |   |  |   |   |   |   |   |
| Delay                             |   |   | 9.2   |   |   |   |  |   |   |   |   |   |
| HCM Level of Service              |   |   | A   |   |   |   |  |   |   |   |   |   |
| Intersection Capacity Utilization |   |   | 43.7%   | ICU Level of Service  | A   |   |  |   |   |   |   |   |
| Analysis Period (min)             |   |   | 15  |   |   |   |  |   |   |   |   |   |

# HCM Unsignalized Intersection Capacity Analysis

## 12: Towne Road & 151st Street

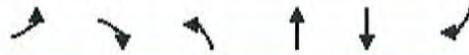
2/13/2012

|                                   |  |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|--|---|---|---|---|---|--|
| Movement                          | EBL   | EBT   | EBR   | WBL   | WBT   | WBR   | NBL  | NBT   | NBR   | SBL   | SBT   | SBR   |  |
| Lane Configurations               |   |  |   |   |  |   |  |  |   |   |  |   |  |
| Volume (veh/h)                    | 2   | 0   | 2   | 4   | 1   | 2   | 0  | 61  | 1   | 4   | 258   | 0   |  |
| Sign Control                      |   | Stop  |   |   | Stop  |   |  | Free  |   |   | Free  |   |  |
| Grade                             |   | 0%  |   |   | 0%  |   |  | 0%  |   |   | 0%  |   |  |
| Peak Hour Factor                  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90   | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  |  |
| Hourly flow rate (vph)            | 2   | 0   | 2   | 4   | 1   | 2   | 0  | 68  | 1   | 4   | 287   | 0   |  |
| Pedestrians                       |   |   |   |   |   |   |  |   |   |   |   |   |  |
| Lane Width (ft)                   |   |   |   |   |   |   |  |   |   |   |   |   |  |
| Walking Speed (ft/s)              |   |   |   |   |   |   |  |   |   |   |   |   |  |
| Percent Blockage                  |   |   |   |   |   |   |  |   |   |   |   |   |  |
| Right turn flare (veh)            |   |   |   |   |   |   |  |   |   |   |   |   |  |
| Median type                       |   |   |   |   |   |   | None   |   |   |   |   |   |  |
| Median storage veh                |   |   |   |   |   |   |  |   |   |   |   |   |  |
| Upstream signal (ft)              |   |   |   |   |   |   |  |   |   |   |   |   |  |
| pX, platoon unblocked             |   |   |   |   |   |   |  |   |   |   |   |   |  |
| vC, conflicting volume            | 367   | 364   | 287   | 366   | 364   | 68  | 287  |   |   |   |   | 69  |  |
| vC1, stage 1 conf vol             |   |   |   |   |   |   |  |   |   |   |   |   |  |
| vC2, stage 2 conf vol             |   |   |   |   |   |   |  |   |   |   |   |   |  |
| vCu, unblocked vol                | 367   | 364   | 287   | 366   | 364   | 68  | 287  |   |   |   |   | 69  |  |
| tC, single (s)                    | 7.1   | 6.5   | 6.2   | 7.1   | 6.5   | 6.2   | 4.1  |   |   |   |   | 4.1   |  |
| tC, 2 stage (s)                   |   |   |   |   |   |   |  |   |   |   |   |   |  |
| tF (s)                            | 3.5   | 4.0   | 3.3   | 3.5   | 4.0   | 3.3   | 2.2  |   |   |   |   | 2.2   |  |
| p0 queue free %                   | 100   | 100   | 100   | 99  | 100   | 100   | 100  |   |   |   |   | 100   |  |
| cM capacity (veh/h)               | 590   | 565   | 757   | 591   | 566   | 1000  | 1287   |   |   |   |   | 1545  |  |
| <b>Direction, Lane #</b>          | <b>EB 1</b>   | <b>WB 1</b>   | <b>NB 1</b>   | <b>SB 1</b>   |   |   |  |   |   |   |   |   |  |
| Volume Total                      | 4   | 8   | 69  | 291   |   |   |  |   |   |   |   |   |  |
| Volume Left                       | 2   | 4   | 0   | 4   |   |   |  |   |   |   |   |   |  |
| Volume Right                      | 2   | 2   | 1   | 0   |   |   |  |   |   |   |   |   |  |
| cSH                               | 663   | 664   | 1287  | 1545  |   |   |  |   |   |   |   |   |  |
| Volume to Capacity                | 0.01  | 0.01  | 0.00  | 0.00  |   |   |  |   |   |   |   |   |  |
| Queue Length 95th (ft)            | 1   | 1   | 0   | 0   |   |   |  |   |   |   |   |   |  |
| Control Delay (s)                 | 10.5  | 10.5  | 0.0   | 0.1   |   |   |  |   |   |   |   |   |  |
| Lane LOS                          | B   | B   |   | A   |   |   |  |   |   |   |   |   |  |
| Approach Delay (s)                | 10.5  | 10.5  | 0.0   | 0.1   |   |   |  |   |   |   |   |   |  |
| Approach LOS                      | B   | B   |   |   |   |   |  |   |   |   |   |   |  |
| <b>Intersection Summary</b>       |   |   |   |   |   |   |  |   |   |   |   |   |  |
| Average Delay                     |   |   | 0.5   |   |   |   |  |   |   |   |   |   |  |
| Intersection Capacity Utilization |   |   | 26.8%   | ICU Level of Service  | A   |   |  |   |   |   |   |   |  |
| Analysis Period (min)             |   |   | 15  |   |   |   |  |   |   |   |   |   |  |

# HCM Unsignalized Intersection Capacity Analysis

## 13: Ditch Road & 151st Street

2/13/2012



| Movement                          | EBL         | EBR         | NBL         | NBT  | SBT                  | SBR  |
|-----------------------------------|-------------|-------------|-------------|------|----------------------|------|
| Lane Configurations               |             |             |             |      |                      |      |
| Volume (veh/h)                    | 1           | 4           | 5           | 104  | 397                  | 1    |
| Sign Control                      | Stop        |             |             | Free | Free                 |      |
| Grade                             | 0%          |             |             | 0%   | 0%                   |      |
| Peak Hour Factor                  | 0.90        | 0.90        | 0.90        | 0.90 | 0.90                 | 0.90 |
| Hourly flow rate (vph)            | 1           | 4           | 6           | 116  | 441                  | 1    |
| Pedestrians                       |             |             |             |      |                      |      |
| Lane Width (ft)                   |             |             |             |      |                      |      |
| Walking Speed (ft/s)              |             |             |             |      |                      |      |
| Percent Blockage                  |             |             |             |      |                      |      |
| Right turn flare (veh)            |             |             |             |      |                      |      |
| Median type                       |             |             |             | None | None                 |      |
| Median storage (veh)              |             |             |             |      |                      |      |
| Upstream signal (ft)              |             |             |             |      |                      |      |
| pX, platoon unblocked             |             |             |             |      |                      |      |
| vC, conflicting volume            | 568         | 442         | 442         |      |                      |      |
| vC1, stage 1 conf vol             |             |             |             |      |                      |      |
| vC2, stage 2 conf vol             |             |             |             |      |                      |      |
| vCu, unblocked vol                | 568         | 442         | 442         |      |                      |      |
| tC, single (s)                    | 6.4         | 6.2         | 4.1         |      |                      |      |
| tC, 2 stage (s)                   |             |             |             |      |                      |      |
| tF (s)                            | 3.5         | 3.3         | 2.2         |      |                      |      |
| p0 queue free %                   | 100         | 99          | 100         |      |                      |      |
| cM capacity (veh/h)               | 485         | 620         | 1129        |      |                      |      |
| <b>Direction, Lane #</b>          | <b>EB 1</b> | <b>NB 1</b> | <b>SB 1</b> |      |                      |      |
| Volume Total                      | 6           | 121         | 442         |      |                      |      |
| Volume Left                       | 1           | 6           | 0           |      |                      |      |
| Volume Right                      | 4           | 0           | 1           |      |                      |      |
| cSH                               | 587         | 1129        | 1700        |      |                      |      |
| Volume to Capacity                | 0.01        | 0.00        | 0.26        |      |                      |      |
| Queue Length 95th (ft)            | 1           | 0           | 0           |      |                      |      |
| Control Delay (s)                 | 11.2        | 0.4         | 0.0         |      |                      |      |
| Lane LOS                          | B           | A           |             |      |                      |      |
| Approach Delay (s)                | 11.2        | 0.4         | 0.0         |      |                      |      |
| Approach LOS                      | B           |             |             |      |                      |      |
| <b>Intersection Summary</b>       |             |             |             |      |                      |      |
| Average Delay                     |             |             | 0.2         |      |                      |      |
| Intersection Capacity Utilization |             |             | 31.0%       |      | ICU Level of Service | A    |
| Analysis Period (min)             |             |             | 15          |      |                      |      |

# HCM Unsignalized Intersection Capacity Analysis

## 3: Towne Road & 146th Street

2/13/2012

|                                   |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement                          | EBL   | EBT   | EBR   | WBL   | WBT   | WBR   | NBL   | NBT   | NBR   | SBL   | SBT   | SBR   |
| Lane Configurations               |   |  |   |   |  |   |   |  |   |   |  |   |
| Sign Control                      |   | Stop  |   |   | Stop  |   |   | Stop  |   |   | Stop  |   |
| Volume (vph)                      | 60  | 332   | 26  | 85  | 210   | 4   | 42  | 157   | 116   | 4   | 58  | 23  |
| Peak Hour Factor                  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  |
| Hourly flow rate (vph)            | 67  | 369   | 29  | 94  | 233   | 4   | 47  | 174   | 129   | 4   | 64  | 26  |
| Direction, Lane #                 | EB 1  | WB 1  | NB 1  | SB 1  |   |   |   |   |   |   |   |   |
| Volume Total (vph)                | 464   | 332   | 350   | 94  |   |   |   |   |   |   |   |   |
| Volume Left (vph)                 | 67  | 94  | 47  | 4   |   |   |   |   |   |   |   |   |
| Volume Right (vph)                | 29  | 4   | 129   | 26  |   |   |   |   |   |   |   |   |
| Hadj (s)                          | 0.02  | 0.07  | -0.19   | -0.15   |   |   |   |   |   |   |   |   |
| Departure Headway (s)             | 6.2   | 6.5   | 6.4   | 7.3   |   |   |   |   |   |   |   |   |
| Degree Utilization, x             | 0.80  | 0.60  | 0.63  | 0.19  |   |   |   |   |   |   |   |   |
| Capacity (veh/h)                  | 562   | 514   | 518   | 403   |   |   |   |   |   |   |   |   |
| Control Delay (s)                 | 29.2  | 18.7  | 19.6  | 12.0  |   |   |   |   |   |   |   |   |
| Approach Delay (s)                | 29.2  | 18.7  | 19.6  | 12.0  |   |   |   |   |   |   |   |   |
| Approach LOS                      | D   | C   | C   | B   |   |   |   |   |   |   |   |   |
| Intersection Summary              |   |   |   |   |   |   |   |   |   |   |   |   |
| Delay                             |   |   | 22.4  |   |   |   |   |   |   |   |   |   |
| HCM Level of Service              |   |   | C   |   |   |   |   |   |   |   |   |   |
| Intersection Capacity Utilization |   |   | 59.6%   | ICU Level of Service  |   |   |   |   |   |   |   | B   |
| Analysis Period (min)             |   |   | 15  |   |   |   |   |   |   |   |   |   |

|  |
|--|
| <b>ARCADY 8</b>  |
| Version: 8.0.0.249 [24 Oct 2011]<br>© Copyright Transport Research Laboratory 2012   |
| For sales and distribution information, program advice and maintenance, contact TRL:<br>Tel: +44 (0)1344 770758 E-mail: software@trl.co.uk Web: http://www.trlsoftware.co.uk |
| The users of this computer program for the solution of an engineering problem are in no way relieved of their responsibility for the correctness of the solution             |

File: P:\2011\01596\C. Calcs\_Data\Traffic Study\Analysis\ARCADY\146th & Towne.arc8  
Report generation date: 2/17/2012 3:25:39 PM

- « (Default Analysis Set) - Scenario 2, PM
- » Intersection Network
- » Legs
- » Traffic Flows
- » Entry Flows
- » Turning Proportions
- » Vehicle Mix

### Summary of intersection performance

|                            | AM          |                 |           |           |     |                        | PM               |             |                 |           |           |     |                        |
|----------------------------|-------------|-----------------|-----------|-----------|-----|------------------------|------------------|-------------|-----------------|-----------|-----------|-----|------------------------|
|                            | Queue (Veh) | 95% Queue (Veh) | Delay (s) | V/C Ratio | LOS | Intersection Delay (s) | Intersection LOS | Queue (Veh) | 95% Queue (Veh) | Delay (s) | V/C Ratio | LOS | Intersection Delay (s) |
| <b>A1 - Scenario 2</b>     |             |                 |           |           |     |                        |                  |             |                 |           |           |     |                        |
| <b>146th Street WB</b>     | 0.12        | ?               | 1.73      | 0.11      | A   | 2.10                   | A                | 0.18        | ?               | 1.93      | 0.15      | A   | 2.28                   |
| <b>Ditch Towne Road SB</b> | 0.21        | ?               | 2.58      | 0.17      | A   |                        |                  | 0.06        | ?               | 2.35      | 0.06      | A   |                        |
| <b>146th Street EB</b>     | 0.11        | ?               | 1.85      | 0.10      | A   |                        |                  | 0.27        | ?               | 2.05      | 0.21      | A   |                        |
| <b>Towne Road NB</b>       | 0.07        | ?               | 2.22      | 0.07      | A   |                        |                  | 0.28        | ?               | 2.91      | 0.22      | A   |                        |
| <b>A1 - Scenario 3</b>     |             |                 |           |           |     |                        |                  |             |                 |           |           |     |                        |
| <b>146th Street WB</b>     | 0.19        | ?               | 1.86      | 0.16      | A   | 2.26                   | A                | 0.32        | ?               | 2.23      | 0.24      | A   | 2.62                   |
| <b>Ditch Towne Road SB</b> | 0.29        | ?               | 2.86      | 0.22      | A   |                        |                  | 0.10        | ?               | 2.58      | 0.09      | A   |                        |
| <b>146th Street EB</b>     | 0.15        | ?               | 1.96      | 0.13      | A   |                        |                  | 0.38        | ?               | 2.30      | 0.27      | A   |                        |
| <b>Towne Road NB</b>       | 0.12        | ?               | 2.37      | 0.10      | A   |                        |                  | 0.45        | 1.00            | 3.46      | 0.31      | A   |                        |

Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.

"D1 - Scenario 2, AM" model duration: 8:00 AM - 9:30 AM  
 "D2 - Scenario 2, PM " model duration: 8:00 AM - 9:30 AM  
 "D3 - Scenario 3, AM" model duration: 8:00 AM - 9:30 AM  
 "D4 - Scenario 3, PM" model duration: 8:00 AM - 9:30 AM

Run using ARCADY 8.0.0.249 at 2/17/2012 3:25:38 PM

## File summary

### File Description

|             |              |
|-------------|--------------|
| Title       | (untitled)   |
| Location    |              |
| Site Number |              |
| Date        | 2/17/2012    |
| Version     |              |
| Status      | (new file)   |
| Identifier  |              |
| Client      |              |
| Jobnumber   |              |
| Analyst     | ACE\ajohnson |
| Description |              |

## Analysis Options

| Vehicle Length (ft) | V/C Ratio Threshold | Average Delay Threshold (s) | Queue Threshold (PCE) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type |
|---------------------|---------------------|-----------------------------|-----------------------|---------------------|-----------------------------|---------------------------------|
| 18.86               | 0.85                | 36.00                       | 20.00                 | ✓                   |                             | N/A                             |

## Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|----------------|-------------|---------------------|-----------------------|------------|---------------------|-------------------|---------------------|
| ft             | mph         | Veh                 | Veh                   | perHour    | s                   | -Min              | perMin              |

## (Default Analysis Set) - Scenario AM PM

### Data Errors and Warnings

| Severity | Area       | Item                                      | Description  |
|----------|------------|---|--|
| Warning  | Geometry   | 146th Street WB - Roundabout Geometry     | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | Geometry   | Ditch Towne Road SB - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | Geometry   | 146th Street EB - Roundabout Geometry     | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | Geometry   | Towne Road NB - Roundabout Geometry       | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | DemandSets | D2 - Scenario 2, PM                       | Time results are shown for central hour only. (Model is run for a 90 minute period.)                             |

### Analysis Set Details

| Name                   | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|------------------------|---------------------------|-------------|-------------------|----------------------------|-------------------------|--------|---------------------------------|-------------------------------------|----------------------------|
| (Default Analysis Set) | ARCADY                    |             | ✓                 |                            |                         |        | 100.000                         | 85,000                              |                            |

### Demand Set Details

| Name | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|------|-------------|-------------------|----------------------------|-------------------------|--------|---------------------------------|-------------------------------------|----------------------------|
|      |             |                   |                            |                         |        |                                 |                                     |                            |

| Name           | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|----------------|---------------|------------------|-------------|----------------------|--------------------------|---------------------------|--------------------------------|---------------------------|-------------------------------|--------------------------|--------|-------------------|------------------|--------------|
| Scenario 2, PM | Scenario 2    | PM               |             | ONE HOUR             | 08:00                    | 09:30                     | 90                             | 15                        | ✓                             |                          |        | ✓                 |                  |              |

## Intersection Network

### Intersections

| Name       | Intersection Type | Leg Order | Grade Separated | Large Roundabout | Do Geometric Delay | Intersection Delay (s) | Intersection LOS |
|------------|-------------------|-----------|-----------------|------------------|--------------------|------------------------|------------------|
| (untitled) | Roundabout        | 1,2,3,4   |                 |                  |                    | 2.28                   | A                |

### Intersection Network Options

| Driving Side | Lighting       | Road Surface            | Network Residual Capacity (%) | First Leg Reaching Threshold |
|--------------|----------------|-------------------------|-------------------------------|------------------------------|
| Right        | Normal/unknown | (Mini-roundabouts only) | N/A                           | N/A                          |

## Legs

### Legs

| Name                | Name                | Description |
|---------------------|---------------------|-------------|
| 146th Street WB     | 146th Street WB     |             |
| Ditch Towne Road SB | Ditch Towne Road SB |             |
| 146th Street EB     | 146th Street EB     |             |
| Towne Road NB       | Towne Road NB       |             |

### Capacity Options

| Name                | Minimum Capacity (PCE/hr) | Maximum Capacity (PCE/hr) | Assume Flat Start Profile | Initial Queue (PCE) |
|---------------------|---------------------------|---------------------------|---------------------------|---------------------|
| 146th Street WB     | 0.00                      | 99999.00                  |                           | 0.00                |
| Ditch Towne Road SB | 0.00                      | 99999.00                  |                           | 0.00                |
| 146th Street EB     | 0.00                      | 99999.00                  |                           | 0.00                |
| Towne Road NB       | 0.00                      | 99999.00                  |                           | 0.00                |

### Roundabout Geometry

| Name                | V - Approach road half-width (ft) | E - Entry width (ft) | I' - Effective flare length (ft) | R - Entry radius (ft) | D - Inscribed circle diameter (ft) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---------------------|-----------------------------------|----------------------|----------------------------------|-----------------------|------------------------------------|------------------------------------|-----------|
| 146th Street WB     | 26.00                             | 30.00                | 130.00                           | 92.00                 | 165.00                             | 25.00                              |           |
| Ditch Towne Road SB | 12.00                             | 28.00                | 130.00                           | 50.00                 | 161.00                             | 25.00                              |           |
| 146th Street EB     | 26.00                             | 30.00                | 130.00                           | 50.00                 | 165.00                             | 25.00                              |           |
| Towne Road NB       | 12.00                             | 28.00                | 130.00                           | 50.00                 | 161.00                             | 25.00                              |           |

### Pedestrian Crossings

| Name                | Crossing Type |
|---------------------|---------------|
| 146th Street WB     | None          |
| Ditch Towne Road SB | None          |
| 146th Street EB     | None          |
| Towne Road NB       | None          |

### Leg Slope/ Intercept and Capacity

### Slope and Intercept used in model

| Name                | Enter Directly | Slope        | Intercept (PCE/hr) | Final Slope | Final Intercept (PCE/hr) |
|---------------------|----------------|--------------|--------------------|-------------|--------------------------|
| 146th Street WB     |                | (calculated) | (calculated)       | 0.828       | 2823.404                 |
| Ditch Towne Road SB |                | (calculated) | (calculated)       | 0.703       | 2172.895                 |
| 146th Street EB     |                | (calculated) | (calculated)       | 0.805       | 2743.204                 |
| Towne Road NB       |                | (calculated) | (calculated)       | 0.703       | 2172.895                 |

The slope and intercept shown above include any corrections and adjustments.

## Traffic Flows

### Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCE Factor for a Truck (PCE) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---------------------|------------------------------|------------------------------|-------------------------------|--------------------|------------------------------|-----------------------------|---------------------------------|------------------------------------|------------------------------------|-------------------------------------|
|                     |                              | ✓                            | ✓                             | Truck Percentages  | 2.00                         |                             |                                 |                                    | ✓                                  | ✓                                   |

## Entry Flows

### General Flows Data

| Name                | Profile Type | Use Turning Counts | Average Demand Flow (Veh/hr) | Flow Scaling Factor (%) |
|---------------------|--------------|--------------------|------------------------------|-------------------------|
| 146th Street WB     | ONE HOUR     | ✓                  | 299.00                       | 100.000                 |
| Ditch Towne Road SB | ONE HOUR     | ✓                  | 85.00                        | 100.000                 |
| 146th Street EB     | ONE HOUR     | ✓                  | 418.00                       | 100.000                 |
| Towne Road NB       | ONE HOUR     | ✓                  | 315.00                       | 100.000                 |

## Turning Proportions

### Turning Counts or Proportions (Veh/hr) - (untitled) (for whole period)

|      |   | To      |         |         |        |
|------|---|---------|---------|---------|--------|
|      |   | 1       | 2       | 3       | 4      |
| From | 1 | 0.000   | 4.000   | 210.000 | 85.000 |
|      | 2 | 4.000   | 0.000   | 23.000  | 58.000 |
|      | 3 | 332.000 | 60.000  | 0.000   | 26.000 |
|      | 4 | 116.000 | 157.000 | 42.000  | 0.000  |

### Turning Proportions (Veh) - (untitled) (for whole period)

|      |   | To   |      |      |      |
|------|---|------|------|------|------|
|      |   | 1    | 2    | 3    | 4    |
| From | 1 | 0.00 | 0.01 | 0.70 | 0.28 |
|      | 2 | 0.05 | 0.00 | 0.27 | 0.68 |
|      | 3 | 0.79 | 0.14 | 0.00 | 0.06 |
|      | 4 | 0.37 | 0.50 | 0.13 | 0.00 |

## Vehicle Mix

### Average PCE Per Vehicle - (untitled) (for whole period)

|  |
|--|
|  |
|--|

|      |   | To    |       |       |       |
|------|---|-------|-------|-------|-------|
|      |   | 1     | 2     | 3     | 4     |
| From | 1 | 1.000 | 1.000 | 1.020 | 1.000 |
|      | 2 | 1.000 | 1.000 | 1.000 | 1.000 |
|      | 3 | 1.020 | 1.000 | 1.000 | 1.000 |
|      | 4 | 1.000 | 1.000 | 1.000 | 1.000 |

Truck Percentages - (untitled) (for whole period)

|      |   | To    |       |       |       |
|------|---|-------|-------|-------|-------|
|      |   | 1     | 2     | 3     | 4     |
| From | 1 | 0.000 | 0.000 | 2.000 | 0.000 |
|      | 2 | 0.000 | 0.000 | 0.000 | 0.000 |
|      | 3 | 2.000 | 0.000 | 0.000 | 0.000 |
|      | 4 | 0.000 | 0.000 | 0.000 | 0.000 |

# HCM Unsignalized Intersection Capacity Analysis

## 6: Ditch Road & 146th Street

2/13/2012

|                                   |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement                          | EBL   | EBT   | EBR   | WBL   | WBT   | WBR   | NBL   | NBT   | NBR   | SBL   | SBT   | SBR   |
| Lane Configurations               |   |  |   |   |  |   |   |  |   |   |  |   |
| Sign Control                      |   | Stop  |   |   | Stop  |   |   | Stop  |   |   | Stop  |   |
| Volume (vph)                      | 36  | 384   | 20  | 82  | 270   | 61  | 20  | 312   | 150   | 30  | 104   | 8   |
| Peak Hour Factor                  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  |
| Hourly flow rate (vph)            | 40  | 427   | 22  | 91  | 300   | 68  | 22  | 347   | 167   | 33  | 116   | 9   |
| Direction, Lane #                 | EB 1  | WB 1  | NB 1  | SB 1  |   |   |   |   |   |   |   |   |
| Volume Total (vph)                | 489   | 459   | 536   | 158   |   |   |   |   |   |   |   |   |
| Volume Left (vph)                 | 40  | 91  | 22  | 33  |   |   |   |   |   |   |   |   |
| Volume Right (vph)                | 22  | 68  | 167   | 9   |   |   |   |   |   |   |   |   |
| Hadj (s)                          | 0.02  | -0.03   | -0.18   | 0.01  |   |   |   |   |   |   |   |   |
| Departure Headway (s)             | 8.1   | 8.0   | 7.9   | 9.6   |   |   |   |   |   |   |   |   |
| Degree Utilization, x             | 1.10  | 1.02  | 1.17  | 0.42  |   |   |   |   |   |   |   |   |
| Capacity (veh/h)                  | 436   | 459   | 461   | 373   |   |   |   |   |   |   |   |   |
| Control Delay (s)                 | 100.0   | 77.7  | 125.3   | 19.3  |   |   |   |   |   |   |   |   |
| Approach Delay (s)                | 100.0   | 77.7  | 125.3   | 19.3  |   |   |   |   |   |   |   |   |
| Approach LOS                      | F   | F   | F   | C   |   |   |   |   |   |   |   |   |
| Intersection Summary              |   |   |   |   |   |   |   |   |   |   |   |   |
| Delay                             |   |   | 94.3  |   |   |   |   |   |   |   |   |   |
| HCM Level of Service              |   |   | F   |   |   |   |   |   |   |   |   |   |
| Intersection Capacity Utilization |   |   | 76.3%   | ICU Level of Service  | D   |   |   |   |   |   |   |   |
| Analysis Period (min)             |   |   | 15  |   |   |   |   |   |   |   |   |   |

|  |
|--|
| <b>ARCADY</b>  |
| Version: 8.0.0.249 [24 Oct 2011]<br>© Copyright Transport Research Laboratory 2012   |
| For sales and distribution information, program advice and maintenance, contact TRL:<br>Tel: +44 (0)1344 770758 E-mail: software@trl.co.uk Web: http://www.trlsoftware.co.uk |
| The users of this computer program for the solution of an engineering problem are in no way relieved of their responsibility for the correctness of the solution             |

File: P:\2011\01596\C. Calcs\_Data\Traffic Study\Analysis\ARCADY\146th & Ditch.arc8  
Report generation date: 2/17/2012 3:20:53 PM

- « (Default Analysis Set) - Scenario PM
- » Intersection Network
- » Legs
- » Traffic Flows
- » Entry Flows
- » Turning Proportions
- » Vehicle Mix

### Summary of intersection performance

| A               |      |       |       |      |                    | B    |      |       |       |      |                    |   |
|-----------------|------|-------|-------|------|--------------------|------|------|-------|-------|------|--------------------|---|
| Leg             | Flow | Delay | Ratio | LOS  | Intersection Delay | Leg  | Flow | Delay | Ratio | LOS  | Intersection Delay |   |
| A1 - Scenario 1 |      |       |       |      |                    |      |      |       |       |      |                    |   |
| 146th Street WB | 0.20 | ?     | 1.86  | 0.17 | A                  | 2.53 | A    | 0.28  | ?     | 2.18 | 0.22               | A |
| Ditch Road SB   | 0.45 | 1.00  | 3.22  | 0.31 | A                  |      |      | 0.11  | ?     | 2.50 | 0.10               | A |
| 146th Street EB | 0.12 | ?     | 2.13  | 0.11 | A                  |      |      | 0.29  | ?     | 2.15 | 0.23               | A |
| Ditch Road NB   | 0.17 | ?     | 2.50  | 0.14 | A                  |      |      | 0.52  | 1.00  | 3.55 | 0.34               | A |
| A1 - Scenario 3 |      |       |       |      |                    |      |      |       |       |      |                    |   |
| 146th Street WB | 0.29 | ?     | 2.12  | 0.23 | A                  | 3.64 | A    | 0.49  | 1.00  | 2.91 | 0.33               | A |
| Ditch Road SB   | 1.22 | 1.00  | 5.07  | 0.55 | A                  |      |      | 0.65  | 1.00  | 3.74 | 0.39               | A |
| 146th Street EB | 0.24 | ?     | 2.66  | 0.19 | A                  |      |      | 0.50  | 1.00  | 2.85 | 0.34               | A |
| Ditch Road NB   | 0.32 | ?     | 3.14  | 0.24 | A                  |      |      | 1.15  | ?     | 5.86 | 0.54               | A |

Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.

"D1 - Scenario 2, AM" model duration: 8:00 AM - 9:30 AM  
 "D2 - Scenario 2, PM " model duration: 8:00 AM - 9:30 AM  
 "D3 - Scenario 3, AM" model duration: 8:00 AM - 9:30 AM  
 "D4 - Scenario 3, PM" model duration: 8:00 AM - 9:30 AM

Run using ARCADY 8.0.0.249 at 2/17/2012 3:20:4 PM



**F**

**F**

|         |              |
|---------|--------------|
| Text    | (untitled)   |
| Diagram |              |
| Diagram |              |
| Diagram | 2/17/2012    |
| Diagram |              |
| Diagram | (new file)   |
| Diagram |              |
| Diagram |              |
| Diagram | ACEvajohnson |
| Diagram |              |

**F**

|         |         |         |         |         |         |         |
|---------|---------|---------|---------|---------|---------|---------|
| Diagram |
| 18.86   | 0.85    | 36.00   | 20.00   | ✓       |         | N/A     |

**F**

|         |         |         |         |         |         |         |         |
|---------|---------|---------|---------|---------|---------|---------|---------|
| Diagram |
| ft      | mph     | Veh     | Veh     | perHour | s       | -Min    | perMin  |

**F**

**F**

|         |            |                                       |  |
|---------|------------|---------------------------------------|--|
| Diagram | Diagram    | Diagram                               | Diagram  |
| Warning | Geometry   | 146th Street WB - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry   | Ditch Road SB - Roundabout Geometry   | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry   | 146th Street EB - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry   | Ditch Road NB - Roundabout Geometry   | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | DemandSets | D2 - Scenario 2, PM                   | Time results are shown for central hour only. (Model is run for a 90 minute period.)                             |

**F**

|                        |         |         |         |         |         |         |         |         |         |
|------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| Diagram                | Diagram | Diagram | Diagram | Diagram | Diagram | Diagram | Diagram | Diagram | Diagram |
| (Default Analysis Set) | ARCADY  |         | ✓       |         |         |         | 100.000 | 85.000  |         |

**F**

|         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| Diagram |
|         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |



|                   |               |    |             |       |       |    |    |   |  |  |   |  |  |
|-------------------|---------------|----|-------------|-------|-------|----|----|---|--|--|---|--|--|
| Scenario<br>2, PM | Scenario<br>2 | FM | ONE<br>HOUR | 08:00 | 09:30 | 90 | 15 | ✓ |  |  | ✓ |  |  |
|-------------------|---------------|----|-------------|-------|-------|----|----|---|--|--|---|--|--|

Roundabout or

Roundabout

|            |            |         |  |  |  |      |   |
|------------|------------|---------|--|--|--|------|---|
| (untitled) | Roundabout | 1,2,3,4 |  |  |  | 2.64 | A |
|------------|------------|---------|--|--|--|------|---|

Roundabout or

|       |                |                         |     |     |
|-------|----------------|-------------------------|-----|-----|
| Right | Normal/unknown | (Mini-roundabouts only) | N/A | N/A |
|-------|----------------|-------------------------|-----|-----|

|  |                 |  |
|--|-----------------|--|
|  |                 |  |
|  | 146th Street WB |  |
|  | Ditch Road SB   |  |
|  | 146th Street EB |  |
|  | Ditch Road NB   |  |

|  |      |          |  |      |
|--|------|----------|--|------|
|  | 0.00 | 99999.00 |  | 0.00 |
|  | 0.00 | 99999.00 |  | 0.00 |
|  | 0.00 | 99999.00 |  | 0.00 |
|  | 0.00 | 99999.00 |  | 0.00 |

Com

|  |       |       |        |       |        |       |  |
|--|-------|-------|--------|-------|--------|-------|--|
|  | 26.00 | 30.00 | 130.00 | 92.00 | 165.00 | 25.00 |  |
|  | 12.00 | 28.00 | 130.00 | 50.00 | 161.00 | 25.00 |  |
|  | 26.00 | 30.00 | 130.00 | 50.00 | 165.00 | 25.00 |  |
|  | 12.00 | 28.00 | 130.00 | 50.00 | 161.00 | 25.00 |  |

Roundabout

|  |      |
|--|------|
|  | None |
|  | None |
|  | None |
|  | None |

| Item | Description | Unit         | Rate         | Quantity | Amount   |
|------|-------------|--------------|--------------|----------|----------|
| ...  | ...         | (calculated) | (calculated) | 0.828    | 2823.404 |
| ...  | ...         | (calculated) | (calculated) | 0.703    | 2172.895 |
| ...  | ...         | (calculated) | (calculated) | 0.805    | 2743.204 |
| ...  | ...         | (calculated) | (calculated) | 0.703    | 2172.895 |

The slope and intercept shown above include any corrections and adjustments.

## Truck Force

Truck Force

| Item | Description | Unit              | Rate | Quantity | Amount | Truck | Truck | Truck |
|------|-------------|-------------------|------|----------|--------|-------|-------|-------|
| ...  | ...         | Truck Percentages | 2.00 |          |        |       | ✓     | ✓     |

## Truck Force

Truck Force

| Item | Description | Unit | Rate   | Quantity | Amount  |
|------|-------------|------|--------|----------|---------|
| ...  | ONE HOUR    | ✓    | 413.00 |          | 100.000 |
| ...  | ONE HOUR    | ✓    | 142.00 |          | 100.000 |
| ...  | ONE HOUR    | ✓    | 440.00 |          | 100.000 |
| ...  | ONE HOUR    | ✓    | 482.00 |          | 100.000 |

## Truck Force

Truck Force

|      |   | To      |         |         |         |
|------|---|---------|---------|---------|---------|
|      |   | 1       | 2       | 3       | 4       |
| From | 1 | 0.000   | 61.000  | 270.000 | 82.000  |
|      | 2 | 30.000  | 0.000   | 8.000   | 104.000 |
|      | 3 | 384.000 | 36.000  | 0.000   | 20.000  |
|      | 4 | 150.000 | 312.000 | 20.000  | 0.000   |

Truck Force

|      |   | To   |      |      |      |
|------|---|------|------|------|------|
|      |   | 1    | 2    | 3    | 4    |
| From | 1 | 0.00 | 0.15 | 0.65 | 0.20 |
|      | 2 | 0.21 | 0.00 | 0.06 | 0.73 |
|      | 3 | 0.87 | 0.08 | 0.00 | 0.05 |
|      | 4 | 0.31 | 0.65 | 0.04 | 0.00 |

Truck Force

Truck Force

|  |  | To |  |  |  |
|--|--|----|--|--|--|
|  |  |    |  |  |  |



|      |   | 1     | 2     | 3     | 4     |
|------|---|-------|-------|-------|-------|
| From | 1 | 1.000 | 1.000 | 1.020 | 1.000 |
|      | 2 | 1.000 | 1.000 | 1.000 | 1.000 |
|      | 3 | 1.020 | 1.000 | 1.000 | 1.000 |
|      | 4 | 1.000 | 1.000 | 1.000 | 1.000 |

Transfer from other projects to other projects

|      |   | To    |       |       |       |
|------|---|-------|-------|-------|-------|
|      |   | 1     | 2     | 3     | 4     |
| From | 1 | 0.000 | 0.000 | 2.000 | 0.000 |
|      | 2 | 0.000 | 0.000 | 0.000 | 0.000 |
|      | 3 | 2.000 | 0.000 | 0.000 | 0.000 |
|      | 4 | 0.000 | 0.000 | 0.000 | 0.000 |

# HCM Unsignalized Intersection Capacity Analysis

## 10: Towne Road & 156th Street

2/13/2012

|                                   |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|
| Movement                          | WBL   | WBR   | NBT   | NBR   | SBL   | SBT   |
| Lane Configurations               |  |   |  |   |   |  |
| Volume (veh/h)                    | 16  | 16  | 154   | 64  | 17  | 66  |
| Sign Control                      | Stop  |   | Free  |   |   | Free  |
| Grade                             | 0%  |   | 0%  |   |   | 0%  |
| Peak Hour Factor                  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  |
| Hourly flow rate (vph)            | 18  | 18  | 171   | 71  | 19  | 73  |
| Pedestrians                       |   |   |   |   |   |   |
| Lane Width (ft)                   |   |   |   |   |   |   |
| Walking Speed (ft/s)              |   |   |   |   |   |   |
| Percent Blockage                  |   |   |   |   |   |   |
| Right turn flare (veh)            |   |   |   |   |   |   |
| Median type                       |   |   | None  |   |   | None  |
| Median storage veh                |   |   |   |   |   |   |
| Upstream signal (ft)              |   |   |   |   |   |   |
| pX, platoon unblocked             |   |   |   |   |   |   |
| vC, conflicting volume            | 318   | 207   |   |   | 242   |   |
| vC1, stage 1 conf vol             |   |   |   |   |   |   |
| vC2, stage 2 conf vol             |   |   |   |   |   |   |
| vCu, unblocked vol                | 318   | 207   |   |   | 242   |   |
| tC, single (s)                    | 6.4   | 6.2   |   |   | 4.1   |   |
| tC, 2 stage (s)                   |   |   |   |   |   |   |
| tF (s)                            | 3.5   | 3.3   |   |   | 2.2   |   |
| p0 queue free %                   | 97  | 98  |   |   | 99  |   |
| cM capacity (veh/h)               | 670   | 839   |   |   | 1336  |   |
| <b>Direction, Lane #</b>          | <b>WB 1</b>   | <b>NB 1</b>   | <b>SB 1</b>   |   |   |   |
| Volume Total                      | 36  | 242   | 92  |   |   |   |
| Volume Left                       | 18  | 0   | 19  |   |   |   |
| Volume Right                      | 18  | 71  | 0   |   |   |   |
| cSH                               | 745   | 1700  | 1336  |   |   |   |
| Volume to Capacity                | 0.05  | 0.14  | 0.01  |   |   |   |
| Queue Length 95th (ft)            | 4   | 0   | 1   |   |   |   |
| Control Delay (s)                 | 10.1  | 0.0   | 1.7   |   |   |   |
| Lane LOS                          | B   |   | A   |   |   |   |
| Approach Delay (s)                | 10.1  | 0.0   | 1.7   |   |   |   |
| Approach LOS                      | B   |   |   |   |   |   |
| <b>Intersection Summary</b>       |   |   |   |   |   |   |
| Average Delay                     |   |   | 1.4   |   |   |   |
| Intersection Capacity Utilization |   |   | 28.2%   | ICU Level of Service  |   | A   |
| Analysis Period (min)             |   |   | 15  |   |   |   |

HCM Unsignalized Intersection Capacity Analysis  
 9: Ditch Road & 156th Street

2/13/2012

|                                   |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|--|---|---|---|---|---|
| Movement                          | EBL   | EBT   | EBR   | WBL   | WBT   | WBR   | NBL  | NBT   | NBR   | SBL   | SBT   | SBR   |
| Lane Configurations               |   |  |   |   |  |   |  |  |   |   |  |   |
| Sign Control                      |   | Stop  |   |   | Stop  |   |  | Stop  |   |   | Stop  |   |
| Volume (vph)                      | 4   | 60  | 4   | 35  | 29  | 17  | 1  | 148   | 59  | 25  | 86  | 1   |
| Peak Hour Factor                  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90   | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  |
| Hourly flow rate (vph)            | 4   | 67  | 4   | 39  | 32  | 19  | 1  | 164   | 66  | 28  | 96  | 1   |
| Direction, Lane #                 | EB 1  | WB 1  | NB 1  | SB 1  |   |   |  |   |   |   |   |   |
| Volume Total (vph)                | 76  | 90  | 231   | 124   |   |   |  |   |   |   |   |   |
| Volume Left (vph)                 | 4   | 39  | 1   | 28  |   |   |  |   |   |   |   |   |
| Volume Right (vph)                | 4   | 19  | 66  | 1   |   |   |  |   |   |   |   |   |
| Hadj (s)                          | -0.02   | -0.04   | -0.12   | 0.04  |   |   |  |   |   |   |   |   |
| Departure Headway (s)             | 4.8   | 4.8   | 4.3   | 4.6   |   |   |  |   |   |   |   |   |
| Degree Utilization, x             | 0.10  | 0.12  | 0.28  | 0.16  |   |   |  |   |   |   |   |   |
| Capacity (veh/h)                  | 683   | 691   | 794   | 736   |   |   |  |   |   |   |   |   |
| Control Delay (s)                 | 8.4   | 8.4   | 9.0   | 8.5   |   |   |  |   |   |   |   |   |
| Approach Delay (s)                | 8.4   | 8.4   | 9.0   | 8.5   |   |   |  |   |   |   |   |   |
| Approach LOS                      | A   | A   | A   | A   |   |   |  |   |   |   |   |   |
| Intersection Summary              |   |   |   |   |   |   |  |   |   |   |   |   |
| Delay                             |   |   | 8.7   |   |   |   |  |   |   |   |   |   |
| HCM Level of Service              |   |   | A   |   |   |   |  |   |   |   |   |   |
| Intersection Capacity Utilization |   |   | 38.6%   | ICU Level of Service  | A   |   |  |   |   |   |   |   |
| Analysis Period (min)             |   |   | 15  |   |   |   |  |   |   |   |   |   |

# HCM Unsignalized Intersection Capacity Analysis

## 12: Towne Road & 151st Street

2/13/2012

|                                   |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement                          | EBL   | EBT   | EBR   | WBL   | WBT   | WBR   | NBL   | NBT   | NBR   | SBL   | SBT   | SBR   |
| Lane Configurations               |   |  |   |   |  |   |   |  |   |   |  |   |
| Volume (veh/h)                    | 2   | 1   | 2   | 2   | 1   | 1   | 0   | 214   | 7   | 2   | 64  | 0   |
| Sign Control                      |   | Stop  |   |   | Stop  |   |   | Free  |   |   | Free  |   |
| Grade                             |   | 0%  |   |   | 0%  |   |   | 0%  |   |   | 0%  |   |
| Peak Hour Factor                  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  |
| Hourly flow rate (vph)            | 2   | 1   | 2   | 2   | 1   | 1   | 0   | 238   | 8   | 2   | 71  | 0   |
| Pedestrians                       |   |   |   |   |   |   |   |   |   |   |   |   |
| Lane Width (ft)                   |   |   |   |   |   |   |   |   |   |   |   |   |
| Walking Speed (ft/s)              |   |   |   |   |   |   |   |   |   |   |   |   |
| Percent Blockage                  |   |   |   |   |   |   |   |   |   |   |   |   |
| Right turn flare (veh)            |   |   |   |   |   |   |   |   |   |   |   |   |
| Median type                       |   |   |   |   |   |   |   | None  |   |   | None  |   |
| Median storage veh                |   |   |   |   |   |   |   |   |   |   |   |   |
| Upstream signal (ft)              |   |   |   |   |   |   |   |   |   |   |   |   |
| pX, platoon unblocked             |   |   |   |   |   |   |   |   |   |   |   |   |
| vC, conflicting volume            | 319   | 321   | 71  | 320   | 317   | 242   | 71  |   |   | 246   |   |   |
| vC1, stage 1 conf vol             |   |   |   |   |   |   |   |   |   |   |   |   |
| vC2, stage 2 conf vol             |   |   |   |   |   |   |   |   |   |   |   |   |
| vCu, unblocked vol                | 319   | 321   | 71  | 320   | 317   | 242   | 71  |   |   | 246   |   |   |
| tC, single (s)                    | 7.1   | 6.5   | 6.2   | 7.1   | 6.5   | 6.2   | 4.1   |   |   | 4.1   |   |   |
| tC, 2 stage (s)                   |   |   |   |   |   |   |   |   |   |   |   |   |
| tF (s)                            | 3.5   | 4.0   | 3.3   | 3.5   | 4.0   | 3.3   | 2.2   |   |   | 2.2   |   |   |
| p0 queue free %                   | 100   | 100   | 100   | 100   | 100   | 100   | 100   |   |   | 100   |   |   |
| cM capacity (veh/h)               | 631   | 595   | 991   | 630   | 598   | 797   | 1529  |   |   | 1320  |   |   |
| <b>Direction, Lane #</b>          | <b>EB 1</b>   | <b>WB 1</b>   | <b>NB 1</b>   | <b>SB 1</b>   |   |   |   |   |   |   |   |   |
| Volume Total                      | 6   | 4   | 246   | 73  |   |   |   |   |   |   |   |   |
| Volume Left                       | 2   | 2   | 0   | 2   |   |   |   |   |   |   |   |   |
| Volume Right                      | 2   | 1   | 8   | 0   |   |   |   |   |   |   |   |   |
| cSH                               | 728   | 655   | 1529  | 1320  |   |   |   |   |   |   |   |   |
| Volume to Capacity                | 0.01  | 0.01  | 0.00  | 0.00  |   |   |   |   |   |   |   |   |
| Queue Length 95th (ft)            | 1   | 1   | 0   | 0   |   |   |   |   |   |   |   |   |
| Control Delay (s)                 | 10.0  | 10.5  | 0.0   | 0.2   |   |   |   |   |   |   |   |   |
| Lane LOS                          | A   | B   |   | A   |   |   |   |   |   |   |   |   |
| Approach Delay (s)                | 10.0  | 10.5  | 0.0   | 0.2   |   |   |   |   |   |   |   |   |
| Approach LOS                      | A   | B   |   |   |   |   |   |   |   |   |   |   |
| <b>Intersection Summary</b>       |   |   |   |   |   |   |   |   |   |   |   |   |
| Average Delay                     |   |   | 0.4   |   |   |   |   |   |   |   |   |   |
| Intersection Capacity Utilization |   |   | 21.7%   |   | ICU Level of Service  |   |   |   | A   |   |   |   |
| Analysis Period (min)             |   |   | 15  |   |   |   |   |   |   |   |   |   |

HCM Unsignalized Intersection Capacity Analysis  
 13: Ditch Road & 151st Street

2/13/2012



| Movement                          | EBL  | EBR  | NBL   | NBT                  | SBT  | SBR  |
|-----------------------------------|------|------|-------|----------------------|------|------|
| Lane Configurations               | Y    |      |       | Y                    | Y    |      |
| Volume (veh/h)                    | 2    | 7    | 2     | 362                  | 109  | 0    |
| Sign Control                      | Stop |      |       | Free                 | Free |      |
| Grade                             | 0%   |      |       | 0%                   | 0%   |      |
| Peak Hour Factor                  | 0.90 | 0.90 | 0.90  | 0.90                 | 0.90 | 0.90 |
| Hourly flow rate (vph)            | 2    | 8    | 2     | 402                  | 121  | 0    |
| Pedestrians                       |      |      |       |                      |      |      |
| Lane Width (ft)                   |      |      |       |                      |      |      |
| Walking Speed (ft/s)              |      |      |       |                      |      |      |
| Percent Blockage                  |      |      |       |                      |      |      |
| Right turn flare (veh)            |      |      |       |                      |      |      |
| Median type                       |      |      | None  | None                 |      |      |
| Median storage (veh)              |      |      |       |                      |      |      |
| Upstream signal (ft)              |      |      |       |                      |      |      |
| pX, platoon unblocked             |      |      |       |                      |      |      |
| vC, conflicting volume            | 528  | 121  | 121   |                      |      |      |
| vC1, stage 1 conf vol             |      |      |       |                      |      |      |
| vC2, stage 2 conf vol             |      |      |       |                      |      |      |
| vCu, unblocked vol                | 528  | 121  | 121   |                      |      |      |
| tC, single (s)                    | 6.4  | 6.2  | 4.1   |                      |      |      |
| tC, 2 stage (s)                   |      |      |       |                      |      |      |
| tF (s)                            | 3.5  | 3.3  | 2.2   |                      |      |      |
| p0 queue free %                   | 100  | 99   | 100   |                      |      |      |
| cM capacity (veh/h)               | 510  | 930  | 1466  |                      |      |      |
| <b>Direction, Lane #</b>          |      |      |       |                      |      |      |
|                                   | EB 1 | NB 1 | SB 1  |                      |      |      |
| Volume Total                      | 10   | 404  | 121   |                      |      |      |
| Volume Left                       | 2    | 2    | 0     |                      |      |      |
| Volume Right                      | 8    | 0    | 0     |                      |      |      |
| cSH                               | 786  | 1466 | 1700  |                      |      |      |
| Volume to Capacity                | 0.01 | 0.00 | 0.07  |                      |      |      |
| Queue Length 95th (ft)            | 1    | 0    | 0     |                      |      |      |
| Control Delay (s)                 | 9.6  | 0.1  | 0.0   |                      |      |      |
| Lane LOS                          | A    | A    |       |                      |      |      |
| Approach Delay (s)                | 9.6  | 0.1  | 0.0   |                      |      |      |
| Approach LOS                      | A    |      |       |                      |      |      |
| <b>Intersection Summary</b>       |      |      |       |                      |      |      |
| Average Delay                     |      |      | 0.2   |                      |      |      |
| Intersection Capacity Utilization |      |      | 30.6% | ICU Level of Service | A    |      |
| Analysis Period (min)             |      |      | 15    |                      |      |      |





Run using ARCADY 8.0.0.249 at 2/17/2012 3:30:44 PM

**File summary****File Description**

|             |              |
|-------------|--------------|
| Title       | (untitled)   |
| Location    |              |
| Site Number |              |
| Date        | 2/17/2012    |
| Version     |              |
| Status      | (new file)   |
| Identifier  |              |
| Client      |              |
| Jobnumber   |              |
| Analyst     | ACE\ajohnson |
| Description |              |

**Analysis Options**

| Vehicle Length (ft) | V/C Ratio Threshold | Average Delay Threshold (s) | Queue Threshold (PCE) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type |
|---------------------|---------------------|-----------------------------|-----------------------|---------------------|-----------------------------|---------------------------------|
| 18.86               | 0.85                | 36.00                       | 20.00                 | ✓                   |                             | N/A                             |

**Units**

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|----------------|-------------|---------------------|-----------------------|------------|---------------------|-------------------|---------------------|
| ft             | mph         | Veh                 | Veh                   | perHour    | s                   | -Min              | perMin              |

**(Default Analysis Set) - Scenario 3, AM****Data Errors and Warnings**

| Severity | Area       | Item                                      | Description  |
|----------|------------|---|--|
| Warning  | Geometry   | 146th Street WB - Roundabout Geometry     | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | Geometry   | Ditch Towne Road SB - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | Geometry   | 146th Street EB - Roundabout Geometry     | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | Geometry   | Towne Road NB - Roundabout Geometry       | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | DemandSets | D3 - Scenario 3, AM                       | Time results are shown for central hour only. (Model is run for a 90 minute period.)                             |

**Analysis Set Details**

| Name                   | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|------------------------|---------------------------|-------------|-------------------|----------------------------|-------------------------|--------|---------------------------------|-------------------------------------|----------------------------|
| (Default Analysis Set) | ARCADY                    |             | ✓                 |                            |                         |        | 100.000                         | 85.000                              |                            |

**Demand Set Details**

|  |  |  |  |  |  |  |  |  |  |
|--|--|--|--|--|--|--|--|--|--|
|  |  |  |  |  |  |  |  |  |  |
|--|--|--|--|--|--|--|--|--|--|

| Name           | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|----------------|---------------|------------------|-------------|----------------------|--------------------------|---------------------------|--------------------------------|---------------------------|-------------------------------|--------------------------|--------|-------------------|------------------|--------------|
| Scenario 3, AM | Scenario 3    | AM               |             | ONE HOUR             | 08:00                    | 09:30                     | 90                             | 15                        | ✓                             |                          |        | ✓                 |                  |              |

## Intersection Network

### Intersections

| Name       | Intersection Type | Leg Order | Grade Separated | Large Roundabout | Do Geometric Delay | Intersection Delay (s) | Intersection LOS |
|------------|-------------------|-----------|-----------------|------------------|--------------------|------------------------|------------------|
| (untitled) | Roundabout        | 1,2,3,4   |                 |                  |                    | 2.26                   | A                |

### Intersection Network Options

| Driving Side | Lighting       | Road Surface            | Network Residual Capacity (%) | First Leg Reaching Threshold |
|--------------|----------------|-------------------------|-------------------------------|------------------------------|
| Right        | Normal/unknown | (Mini-roundabouts only) | N/A                           | N/A                          |

## Legs

### Legs

| Name                | Name                | Description |
|---------------------|---------------------|-------------|
| 146th Street WB     | 146th Street WB     |             |
| Ditch Towne Road SB | Ditch Towne Road SB |             |
| 146th Street EB     | 146th Street EB     |             |
| Towne Road NB       | Towne Road NB       |             |

### Capacity Options

| Name                | Minimum Capacity (PCE/hr) | Maximum Capacity (PCE/hr) | Assume Flat Start Profile | Initial Queue (PCE) |
|---------------------|---------------------------|---------------------------|---------------------------|---------------------|
| 146th Street WB     | 0.00                      | 99999.00                  |                           | 0.00                |
| Ditch Towne Road SB | 0.00                      | 99999.00                  |                           | 0.00                |
| 146th Street EB     | 0.00                      | 99999.00                  |                           | 0.00                |
| Towne Road NB       | 0.00                      | 99999.00                  |                           | 0.00                |

### Roundabout Geometry

| Name                | V - Approach road half-width (ft) | E - Entry width (ft) | I' - Effective flare length (ft) | R - Entry radius (ft) | D - Inscribed circle diameter (ft) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---------------------|-----------------------------------|----------------------|----------------------------------|-----------------------|------------------------------------|------------------------------------|-----------|
| 146th Street WB     | 26.00                             | 30.00                | 130.00                           | 92.00                 | 165.00                             | 25.00                              |           |
| Ditch Towne Road SB | 12.00                             | 28.00                | 130.00                           | 50.00                 | 161.00                             | 25.00                              |           |
| 146th Street EB     | 26.00                             | 30.00                | 130.00                           | 50.00                 | 165.00                             | 25.00                              |           |
| Towne Road NB       | 12.00                             | 28.00                | 130.00                           | 50.00                 | 161.00                             | 25.00                              |           |

### Pedestrian Crossings

| Name                | Crossing Type |
|---------------------|---------------|
| 146th Street WB     | None          |
| Ditch Towne Road SB | None          |
| 146th Street EB     | None          |
| Towne Road NB       | None          |

### Leg Slope/ Intercept and Capacity

### Slope and Intercept used in model

| Name                | Enter Directly | Slope        | Intercept (PCE/hr) | Final Slope | Final Intercept (PCE/hr) |
|---------------------|----------------|--------------|--------------------|-------------|--------------------------|
| 146th Street WB     |                | (calculated) | (calculated)       | 0.828       | 2823.404                 |
| Ditch Towne Road SB |                | (calculated) | (calculated)       | 0.703       | 2172.895                 |
| 146th Street EB     |                | (calculated) | (calculated)       | 0.805       | 2743.204                 |
| Towne Road NB       |                | (calculated) | (calculated)       | 0.703       | 2172.895                 |

The slope and intercept shown above include any corrections and adjustments.

## Traffic Flows

### Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCE Factor for a Truck (PCE) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---------------------|------------------------------|------------------------------|-------------------------------|--------------------|------------------------------|-----------------------------|---------------------------------|------------------------------------|------------------------------------|-------------------------------------|
|                     |                              | ✓                            | ✓                             | Truck Percentages  | 2.00                         |                             |                                 |                                    | ✓                                  | ✓                                   |

## Entry Flows

### General Flows Data

| Name                | Profile Type | Use Turning Counts | Average Demand Flow (Veh/hr) | Flow Scaling Factor (%) |
|---------------------|--------------|--------------------|------------------------------|-------------------------|
| 146th Street WB     | ONE HOUR     | ✓                  | 328.00                       | 100.000                 |
| Ditch Towne Road SB | ONE HOUR     | ✓                  | 328.00                       | 100.000                 |
| 146th Street EB     | ONE HOUR     | ✓                  | 248.00                       | 100.000                 |
| Towne Road NB       | ONE HOUR     | ✓                  | 161.00                       | 100.000                 |

## Turning Proportions

### Turning Counts or Proportions (Veh/hr) - (untitled) (for whole period)

|      |   | To      |        |         |         |
|------|---|---------|--------|---------|---------|
|      |   | 1       | 2      | 3       | 4       |
| From | 1 | 0.000   | 7.000  | 219.000 | 102.000 |
|      | 2 | 19.000  | 0.000  | 139.000 | 170.000 |
|      | 3 | 189.000 | 38.000 | 0.000   | 41.000  |
|      | 4 | 75.000  | 67.000 | 19.000  | 0.000   |

### Turning Proportions (Veh) - (untitled) (for whole period)

|      |   | To   |      |      |      |
|------|---|------|------|------|------|
|      |   | 1    | 2    | 3    | 4    |
| From | 1 | 0.00 | 0.02 | 0.67 | 0.31 |
|      | 2 | 0.06 | 0.00 | 0.42 | 0.52 |
|      | 3 | 0.68 | 0.15 | 0.00 | 0.17 |
|      | 4 | 0.47 | 0.42 | 0.12 | 0.00 |

## Vehicle Mix

### Average PCE Per Vehicle - (untitled) (for whole period)

|  |
|--|
|  |
|--|

|  |
|--|
| <b>ARCADY 8</b>  |
| Version: 8.0.0.249 [24 Oct 2011]<br>© Copyright Transport Research Laboratory 2012   |
| For sales and distribution information, program advice and maintenance, contact TRL:<br>Tel: +44 (0)1344 770758 E-mail: software@trl.co.uk Web: http://www.trlsoftware.co.uk |
| The users of this computer program for the solution of an engineering problem are in no way relieved of their responsibility for the correctness of the solution             |

File: P:\2011\01596\C. Calcs\_Data\Traffic Study\Analysis\ARCADY\146th & Ditch.arc8  
Report generation date: 2/17/2012 3:21:53 PM

- « (Default Analysis Set) - Scenario 3, AM
- » Intersection Network
- » Legs
- » Traffic Flows
- » Entry Flows
- » Turning Proportions
- » Vehicle Mix

### Summary of intersection performance

|                        | AM          |                 |           |           |     |                        | PM               |             |                 |           |           |     |                        |
|------------------------|-------------|-----------------|-----------|-----------|-----|------------------------|------------------|-------------|-----------------|-----------|-----------|-----|------------------------|
|                        | Queue (Veh) | 95% Queue (Veh) | Delay (s) | V/C Ratio | LOS | Intersection Delay (s) | Intersection LOS | Queue (Veh) | 95% Queue (Veh) | Delay (s) | V/C Ratio | LOS | Intersection Delay (s) |
| <b>A1 - Scenario 2</b> |             |                 |           |           |     |                        |                  |             |                 |           |           |     |                        |
| <b>146th Street WB</b> | 0.20        | ?               | 1.86      | 0.17      | A   | 2.53                   | A                | 0.28        | ?               | 2.18      | 0.22      | A   | 2.64                   |
| <b>Ditch Road SB</b>   | 0.45        | 1.00            | 3.22      | 0.31      | A   |                        |                  | 0.11        | ?               | 2.50      | 0.10      | A   |                        |
| <b>146th Street EB</b> | 0.12        | ?               | 2.13      | 0.11      | A   |                        |                  | 0.29        | ?               | 2.15      | 0.23      | A   |                        |
| <b>Ditch Road NB</b>   | 0.17        | ?               | 2.50      | 0.14      | A   |                        |                  | 0.52        | 1.00            | 3.55      | 0.34      | A   |                        |
| <b>A1 - Scenario 3</b> |             |                 |           |           |     |                        |                  |             |                 |           |           |     |                        |
| <b>146th Street WB</b> | 0.29        | ?               | 2.12      | 0.23      | A   | 3.64                   | A                | 0.49        | 1.00            | 2.91      | 0.33      | A   | 3.91                   |
| <b>Ditch Road SB</b>   | 1.22        | 1.00            | 5.07      | 0.55      | A   |                        |                  | 0.65        | 1.00            | 3.74      | 0.39      | A   |                        |
| <b>146th Street EB</b> | 0.24        | ?               | 2.66      | 0.19      | A   |                        |                  | 0.50        | 1.00            | 2.85      | 0.34      | A   |                        |
| <b>Ditch Road NB</b>   | 0.32        | ?               | 3.14      | 0.24      | A   |                        |                  | 1.15        | ?               | 5.86      | 0.54      | A   |                        |

Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.

"D1 - Scenario 2, AM" model duration: 8:00 AM - 9:30 AM

"D2 - Scenario 2, PM" model duration: 8:00 AM - 9:30 AM

"D3 - Scenario 3, AM" model duration: 8:00 AM - 9:30 AM

"D4 - Scenario 3, PM" model duration: 8:00 AM - 9:30 AM

Run using ARCADY 8.0.0.249 at 2/17/2012 3:21:40 PM

## File summary

### File Description

|             |              |
|-------------|--------------|
| Title       | (untitled)   |
| Location    |              |
| Site Number |              |
| Date        | 2/17/2012    |
| Version     |              |
| Status      | (new file)   |
| Identifier  |              |
| Client      |              |
| Jobnumber   |              |
| Analyst     | ACE\ajohnson |
| Description |              |

## Analysis Options

| Vehicle Length (ft) | V/C Ratio Threshold | Average Delay Threshold (s) | Queue Threshold (PCE) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type |
|---------------------|---------------------|-----------------------------|-----------------------|---------------------|-----------------------------|---------------------------------|
| 18.86               | 0.85                | 36.00                       | 20.00                 | ✓                   |                             | N/A                             |

## Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|----------------|-------------|---------------------|-----------------------|------------|---------------------|-------------------|---------------------|
| ft             | mph         | Veh                 | Veh                   | perHour    | s                   | -Min              | perMin              |

# (Default Analysis Set) - Scenario 3, AM

## Data Errors and Warnings

| Severity | Area       | Item                                  | Description  |
|----------|------------|---------------------------------------|--|
| Warning  | Geometry   | 146th Street WB - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | Geometry   | Ditch Road SB - Roundabout Geometry   | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | Geometry   | 146th Street EB - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | Geometry   | Ditch Road NB - Roundabout Geometry   | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | DemandSets | D3 - Scenario 3, AM                   | Time results are shown for central hour only. (Model is run for a 90 minute period.)                             |

## Analysis Set Details

| Name                   | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|------------------------|---------------------------|-------------|-------------------|----------------------------|-------------------------|--------|---------------------------------|-------------------------------------|----------------------------|
| (Default Analysis Set) | ARCADY                    |             | ✓                 |                            |                         |        | 100.000                         | 85.000                              |                            |

## Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|------|---------------|------------------|-------------|----------------------|--------------------------|---------------------------|--------------------------------|---------------------------|-------------------------------|--------------------------|--------|-------------------|------------------|--------------|
|------|---------------|------------------|-------------|----------------------|--------------------------|---------------------------|--------------------------------|---------------------------|-------------------------------|--------------------------|--------|-------------------|------------------|--------------|

|                   |               |    |  |             |       |       |    |    |   |  |  |   |  |  |
|-------------------|---------------|----|--|-------------|-------|-------|----|----|---|--|--|---|--|--|
| Scenario<br>3, AM | Scenario<br>3 | AM |  | ONE<br>HOUR | 08:00 | 09:30 | 90 | 15 | ✓ |  |  | ✓ |  |  |
|-------------------|---------------|----|--|-------------|-------|-------|----|----|---|--|--|---|--|--|

## Intersection Network

### Intersections

| Name       | Intersection Type | Leg Order | Grade Separated | Large Roundabout | Do Geometric Delay | Intersection Delay (s) | Intersection LOS |
|------------|-------------------|-----------|-----------------|------------------|--------------------|------------------------|------------------|
| (untitled) | Roundabout        | 1,2,3,4   |                 |                  |                    | 3.64                   | A                |

### Intersection Network Options

| Driving Side | Lighting       | Road Surface            | Network Residual Capacity (%) | First Leg Reaching Threshold |
|--------------|----------------|-------------------------|-------------------------------|------------------------------|
| Right        | Normal/unknown | (Mini-roundabouts only) | N/A                           | N/A                          |

## Legs

### Legs

| Name            | Name            | Description |
|-----------------|-----------------|-------------|
| 146th Street WB | 146th Street WB |             |
| Ditch Road SB   | Ditch Road SB   |             |
| 146th Street EB | 146th Street EB |             |
| Ditch Road NB   | Ditch Road NB   |             |

### Capacity Options

| Name            | Minimum Capacity (PCE/hr) | Maximum Capacity (PCE/hr) | Assume Flat Start Profile | Initial Queue (PCE) |
|-----------------|---------------------------|---------------------------|---------------------------|---------------------|
| 146th Street WB | 0.00                      | 99999.00                  |                           | 0.00                |
| Ditch Road SB   | 0.00                      | 99999.00                  |                           | 0.00                |
| 146th Street EB | 0.00                      | 99999.00                  |                           | 0.00                |
| Ditch Road NB   | 0.00                      | 99999.00                  |                           | 0.00                |

### Roundabout Geometry

| Name            | V - Approach road half-width (ft) | E - Entry width (ft) | I' - Effective flare length (ft) | R - Entry radius (ft) | D - Inscribed circle diameter (ft) | PHI - Conflict (entry) angle (deg) | Exit Only |
|-----------------|-----------------------------------|----------------------|----------------------------------|-----------------------|------------------------------------|------------------------------------|-----------|
| 146th Street WB | 26.00                             | 30.00                | 130.00                           | 92.00                 | 165.00                             | 25.00                              |           |
| Ditch Road SB   | 12.00                             | 28.00                | 130.00                           | 50.00                 | 161.00                             | 25.00                              |           |
| 146th Street EB | 26.00                             | 30.00                | 130.00                           | 50.00                 | 165.00                             | 25.00                              |           |
| Ditch Road NB   | 12.00                             | 28.00                | 130.00                           | 50.00                 | 161.00                             | 25.00                              |           |

### Pedestrian Crossings

| Name            | Crossing Type |
|-----------------|---------------|
| 146th Street WB | None          |
| Ditch Road SB   | None          |
| 146th Street EB | None          |
| Ditch Road NB   | None          |

### Leg Slope/ Intercept and Capacity

Slope and Intercept used in model

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|

| Name            | Enter Directly | Slope        | Intercept (PCE/hr) | Final Slope | Final Intercept (PCE/hr) |
|-----------------|----------------|--------------|--------------------|-------------|--------------------------|
| 146th Street WB |                | (calculated) | (calculated)       | 0.828       | 2823.404                 |
| Ditch Road SB   |                | (calculated) | (calculated)       | 0.703       | 2172.895                 |
| 146th Street EB |                | (calculated) | (calculated)       | 0.805       | 2743.204                 |
| Ditch Road NB   |                | (calculated) | (calculated)       | 0.703       | 2172.895                 |

The slope and intercept shown above include any corrections and adjustments.

## Traffic Flows

### Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCE Factor for a Truck (PCE) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---------------------|------------------------------|------------------------------|-------------------------------|--------------------|------------------------------|-----------------------------|---------------------------------|------------------------------------|------------------------------------|-------------------------------------|
|                     |                              | ✓                            | ✓                             | Truck Percentages  | 2.00                         |                             |                                 |                                    | ✓                                  | ✓                                   |

## Entry Flows

### General Flows Data

| Name            | Profile Type | Use Turning Counts | Average Demand Flow (Veh/hr) | Flow Scaling Factor (%) |
|-----------------|--------------|--------------------|------------------------------|-------------------------|
| 146th Street WB | ONE HOUR     | ✓                  | 447.00                       | 100.000                 |
| Ditch Road SB   | ONE HOUR     | ✓                  | 789.00                       | 100.000                 |
| 146th Street EB | ONE HOUR     | ✓                  | 289.00                       | 100.000                 |
| Ditch Road NB   | ONE HOUR     | ✓                  | 330.00                       | 100.000                 |

## Turning Proportions

### Turning Counts or Proportions (Veh/hr) - (untitled) (for whole period)

|      |   | To      |         |         |         |
|------|---|---------|---------|---------|---------|
|      |   | 1       | 2       | 3       | 4       |
| From | 1 | 0.000   | 87.000  | 210.000 | 150.000 |
|      | 2 | 253.000 | 0.000   | 65.000  | 471.000 |
|      | 3 | 181.000 | 75.000  | 0.000   | 33.000  |
|      | 4 | 140.000 | 146.000 | 44.000  | 0.000   |

### Turning Proportions (Veh) - (untitled) (for whole period)

|      |   | To   |      |      |      |
|------|---|------|------|------|------|
|      |   | 1    | 2    | 3    | 4    |
| From | 1 | 0.00 | 0.19 | 0.47 | 0.34 |
|      | 2 | 0.32 | 0.00 | 0.08 | 0.60 |
|      | 3 | 0.63 | 0.26 | 0.00 | 0.11 |
|      | 4 | 0.42 | 0.44 | 0.13 | 0.00 |

## Vehicle Mix

### Average PCE Per Vehicle - (untitled) (for whole period)

|  |  | To |
|--|--|----|
|  |  |    |



|      |   | 1     | 2     | 3     | 4     |
|------|---|-------|-------|-------|-------|
| From | 1 | 1.000 | 1.000 | 1.020 | 1.000 |
|      | 2 | 1.000 | 1.000 | 1.000 | 1.000 |
|      | 3 | 1.020 | 1.000 | 1.000 | 1.000 |
|      | 4 | 1.000 | 1.000 | 1.000 | 1.000 |

Truck Percentages - (untitled) (for whole period)

|      |   | To    |       |       |       |
|------|---|-------|-------|-------|-------|
|      |   | 1     | 2     | 3     | 4     |
| From | 1 | 0.000 | 0.000 | 2.000 | 0.000 |
|      | 2 | 0.000 | 0.000 | 0.000 | 0.000 |
|      | 3 | 2.000 | 0.000 | 0.000 | 0.000 |
|      | 4 | 0.000 | 0.000 | 0.000 | 0.000 |

|      |   | To    |       |       |       |
|------|---|-------|-------|-------|-------|
|      |   | 1     | 2     | 3     | 4     |
| From | 1 | 1.000 | 1.000 | 1.020 | 1.000 |
|      | 2 | 1.000 | 1.000 | 1.000 | 1.000 |
|      | 3 | 1.020 | 1.000 | 1.000 | 1.000 |
|      | 4 | 1.000 | 1.000 | 1.000 | 1.000 |

Truck Percentages - (untitled) (for whole period)

|      |   | To    |       |       |       |
|------|---|-------|-------|-------|-------|
|      |   | 1     | 2     | 3     | 4     |
| From | 1 | 0.000 | 0.000 | 2.000 | 0.000 |
|      | 2 | 0.000 | 0.000 | 0.000 | 0.000 |
|      | 3 | 2.000 | 0.000 | 0.000 | 0.000 |
|      | 4 | 0.000 | 0.000 | 0.000 | 0.000 |

# HCM Unsignalized Intersection Capacity Analysis

## 10: Towne Road & 156th Street

2/13/2012

|                                   |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|
| Movement                          | WBL   | WBR   | NBT   | NBR   | SBL   | SBT   |
| Lane Configurations               |  |   |  |   |   |  |
| Volume (veh/h)                    | 72  | 22  | 70  | 16  | 32  | 194   |
| Sign Control                      | Stop  |   | Free  |   |   | Free  |
| Grade                             | 0%  |   | 0%  |   |   | 0%  |
| Peak Hour Factor                  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  |
| Hourly flow rate (vph)            | 80  | 24  | 78  | 18  | 36  | 216   |
| Pedestrians                       |   |   |   |   |   |   |
| Lane Width (ft)                   |   |   |   |   |   |   |
| Walking Speed (ft/s)              |   |   |   |   |   |   |
| Percent Blockage                  |   |   |   |   |   |   |
| Right turn flare (veh)            |   |   |   |   |   |   |
| Median type                       |   |   | None  |   |   | None  |
| Median storage veh                |   |   |   |   |   |   |
| Upstream signal (ft)              |   |   |   |   |   |   |
| pX, platoon unblocked             |   |   |   |   |   |   |
| vC, conflicting volume            | 373   | 87  |   |   | 96  |   |
| vC1, stage 1 conf vol             |   |   |   |   |   |   |
| vC2, stage 2 conf vol             |   |   |   |   |   |   |
| vCu, unblocked vol                | 373   | 87  |   |   | 96  |   |
| tC, single (s)                    | 6.4   | 6.2   |   |   | 4.1   |   |
| tC, 2 stage (s)                   |   |   |   |   |   |   |
| tF (s)                            | 3.5   | 3.3   |   |   | 2.2   |   |
| p0 queue free %                   | 87  | 97  |   |   | 98  |   |
| cM capacity (veh/h)               | 617   | 977   |   |   | 1511  |   |
| <b>Direction, Lane #</b>          | <b>WB 1</b>   | <b>NB 1</b>   | <b>SB 1</b>   |   |   |   |
| Volume Total                      | 104   | 96  | 251   |   |   |   |
| Volume Left                       | 80  | 0   | 36  |   |   |   |
| Volume Right                      | 24  | 18  | 0   |   |   |   |
| cSH                               | 675   | 1700  | 1511  |   |   |   |
| Volume to Capacity                | 0.15  | 0.06  | 0.02  |   |   |   |
| Queue Length 95th (ft)            | 14  | 0   | 2   |   |   |   |
| Control Delay (s)                 | 11.3  | 0.0   | 1.2   |   |   |   |
| Lane LOS                          | B   |   | A   |   |   |   |
| Approach Delay (s)                | 11.3  | 0.0   | 1.2   |   |   |   |
| Approach LOS                      | B   |   |   |   |   |   |
| <b>Intersection Summary</b>       |   |   |   |   |   |   |
| Average Delay                     |   |   | 3.3   |   |   |   |
| Intersection Capacity Utilization |   |   | 30.6%   | ICU Level of Service  |   | A   |
| Analysis Period (min)             |   |   | 15  |   |   |   |

|  |
|--|
| <b>ARCADY</b> <input type="checkbox"/> <input type="checkbox"/>  |
| Version: 8.0.0.249 [24 Oct 2011]<br>© Copyright Transport Research Laboratory 2012   |
| For sales and distribution information, program advice and maintenance, contact TRL:<br>Tel: +44 (0)1344 770758 E-mail: software@trl.co.uk Web: http://www.trlsoftware.co.uk |
| The users of this computer program for the solution of an engineering problem are in no way relieved of their responsibility for the correctness of the solution             |

File: P:\2011\01596\C. Calcs\_Data\Traffic Study\Analysis\ARCADY\156th & Towne.arc8  
Report generation date: 2/17/2012 3:13:34 PM

- « (Default Analysis Set) - Scenario AM
- » Intersection Network
- » Legs
- » Traffic Flows
- » Entry Flows
- » Turning Proportions
- » Vehicle Mix

### Summary of intersection performance

|                            | AM          |                 |           |           |     |                        | PM               |             |                 |           |           |     |                        |
|----------------------------|-------------|-----------------|-----------|-----------|-----|------------------------|------------------|-------------|-----------------|-----------|-----------|-----|------------------------|
|                            | Queue (Veh) | 95% Queue (Veh) | Delay (s) | V/C Ratio | LOS | Intersection Delay (s) | Intersection LOS | Queue (Veh) | 95% Queue (Veh) | Delay (s) | V/C Ratio | LOS | Intersection Delay (s) |
| <b>A1 - Scenario 3</b>     |             |                 |           |           |     |                        |                  |             |                 |           |           |     |                        |
| <b>156th Street WB</b>     | 0.10        | ?               | 3.65      | 0.10      | A   | 4.10                   | A                | 0.08        | ?               | 3.71      | 0.08      | A   | 4.09                   |
| <b>Ditch Towne Road SB</b> | 0.31        | ?               | 4.45      | 0.24      | A   |                        |                  | 0.16        | ?               | 3.84      | 0.14      | A   |                        |
| <b>Towne Road NB</b>       | 0.10        | ?               | 3.66      | 0.09      | A   |                        |                  | 0.29        | ?               | 4.36      | 0.23      | A   |                        |

Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.

"D1 - Scenario 3, AM" model duration: 8:00 AM - 9:30 AM  
"D2 - Scenario 3, PM" model duration: 8:00 AM - 9:30 AM

Run using ARCADY 8.0.0.249 at 2/17/2012 3:13:32 PM

### File summary

#### File Description

|             |              |
|-------------|--------------|
| Title       | (untitled)   |
| Location    |              |
| Site Number |              |
| Date        | 2/17/2012    |
| Version     |              |
| Status      | (new file)   |
| Identifier  |              |
| Client      |              |
| Jobnumber   |              |
| Analyst     | ACE\ajohnson |



|  |  |
|--|--|
|  |  |
|--|--|

|       |      |       |       |   |  |     |
|-------|------|-------|-------|---|--|-----|
|       |      |       |       |   |  |     |
| 18.86 | 0.85 | 36.00 | 20.00 | ✓ |  | N/A |

|    |     |     |     |         |   |      |        |
|----|-----|-----|-----|---------|---|------|--------|
| ft | mph | Veh | Veh | perHour | s | -Min | perMin |
|----|-----|-----|-----|---------|---|------|--------|

|         |            |   |  |
|---------|------------|---|--|
| Warning | Geometry   | 156th Street WB - Roundabout Geometry     | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry   | Ditch Towne Road SB - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry   | Towne Road NB - Roundabout Geometry       | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | DemandSets | D1 - Scenario 3, AM                       | Time results are shown for central hour only. (Model is run for a 90 minute period.)                             |

|                        |        |  |   |  |  |         |        |  |
|------------------------|--------|--|---|--|--|---------|--------|--|
| (Default Analysis Set) | ARCADY |  | ✓ |  |  | 100.000 | 85.000 |  |
|------------------------|--------|--|---|--|--|---------|--------|--|

|                |            |    |          |       |       |    |    |   |  |  |  |  |  |  |
|----------------|------------|----|----------|-------|-------|----|----|---|--|--|--|--|--|--|
| Scenario 3, AM | Scenario 3 | AM | ONE HOUR | 08:00 | 09:30 | 90 | 15 | ✓ |  |  |  |  |  |  |
|----------------|------------|----|----------|-------|-------|----|----|---|--|--|--|--|--|--|

|            |            |       |  |  |  |  |      |   |
|------------|------------|-------|--|--|--|--|------|---|
| (untitled) | Roundabout | 1,2,4 |  |  |  |  | 4.10 | A |
|------------|------------|-------|--|--|--|--|------|---|

|       |                |                         |     |     |
|-------|----------------|-------------------------|-----|-----|
| Right | Normal/unknown | (Mini-roundabouts only) | N/A | N/A |
|-------|----------------|-------------------------|-----|-----|



|          |   |        |         |
|----------|---|--------|---------|
| ONE HOUR | ✓ | 94.00  | 100.000 |
| ONE HOUR | ✓ | 226.00 | 100.000 |
| ONE HOUR | ✓ | 86.00  | 100.000 |

## Transfer or

Transfer or

|      |   | To     |        |         |
|------|---|--------|--------|---------|
|      |   | 1      | 2      | 4       |
| From | 1 | 0.000  | 22.000 | 72.000  |
|      | 2 | 32.000 | 0.000  | 194.000 |
|      | 4 | 16.000 | 70.000 | 0.000   |

Transfer or

|      |   | To   |      |      |
|------|---|------|------|------|
|      |   | 1    | 2    | 4    |
| From | 1 | 0.00 | 0.23 | 0.77 |
|      | 2 | 0.14 | 0.00 | 0.86 |
|      | 4 | 0.19 | 0.81 | 0.00 |

Transfer or

Transfer or

|      |   | To    |       |       |
|------|---|-------|-------|-------|
|      |   | 1     | 2     | 4     |
| From | 1 | 1.000 | 1.000 | 1.000 |
|      | 2 | 1.000 | 1.000 | 1.000 |
|      | 4 | 1.000 | 1.000 | 1.000 |

Transfer or

|      |   | To    |       |       |
|------|---|-------|-------|-------|
|      |   | 1     | 2     | 4     |
| From | 1 | 0.000 | 0.000 | 0.000 |
|      | 2 | 0.000 | 0.000 | 0.000 |
|      | 4 | 0.000 | 0.000 | 0.000 |

HCM Unsignalized Intersection Capacity Analysis  
 9: Ditch Road & 156th Street

2/13/2012

|                                   |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|--|---|---|---|---|---|
| Movement                          | EBL   | EBT   | EBR   | WBL   | WBT   | WBR   | NBL  | NBT   | NBR   | SBL   | SBT   | SBR   |
| Lane Configurations               |   |  |   |   |  |   |  |  |   |   |  |   |
| Sign Control                      |   | Stop  |   |   | Stop  |   |  | Stop  |   |   | Stop  |   |
| Volume (vph)                      | 20  | 23  | 42  | 84  | 64  | 32  | 19   | 143   | 44  | 19  | 212   | 8   |
| Peak Hour Factor                  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90   | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  |
| Hourly flow rate (vph)            | 22  | 26  | 47  | 93  | 71  | 36  | 21   | 159   | 49  | 21  | 236   | 9   |
| Direction, Lane #                 | EB 1  | WB 1  | NB 1  | SB 1  |   |   |  |   |   |   |   |   |
| Volume Total (vph)                | 94  | 200   | 229   | 266   |   |   |  |   |   |   |   |   |
| Volume Left (vph)                 | 22  | 93  | 21  | 21  |   |   |  |   |   |   |   |   |
| Volume Right (vph)                | 47  | 36  | 49  | 9   |   |   |  |   |   |   |   |   |
| Hadj (s)                          | -0.25   | 0.00  | -0.10   | 0.02  |   |   |  |   |   |   |   |   |
| Departure Headway (s)             | 5.3   | 5.3   | 5.0   | 5.1   |   |   |  |   |   |   |   |   |
| Degree Utilization, x             | 0.14  | 0.30  | 0.32  | 0.37  |   |   |  |   |   |   |   |   |
| Capacity (veh/h)                  | 599   | 618   | 672   | 667   |   |   |  |   |   |   |   |   |
| Control Delay (s)                 | 9.1   | 10.6  | 10.3  | 11.1  |   |   |  |   |   |   |   |   |
| Approach Delay (s)                | 9.1   | 10.6  | 10.3  | 11.1  |   |   |  |   |   |   |   |   |
| Approach LOS                      | A   | B   | B   | B   |   |   |  |   |   |   |   |   |
| Intersection Summary              |   |   |   |   |   |   |  |   |   |   |   |   |
| Delay                             |   |   | 10.5  |   |   |   |  |   |   |   |   |   |
| HCM Level of Service              |   |   | B   |   |   |   |  |   |   |   |   |   |
| Intersection Capacity Utilization |   |   | 39.4%   | ICU Level of Service  |   |   |  |   |   |   |   | A   |
| Analysis Period (min)             |   |   | 15  |   |   |   |  |   |   |   |   |   |





|             |              |
|-------------|--------------|
| Jobnumber   |              |
| Analyst     | ACE\ajohnson |
| Description |              |

**Analysis Options**

| Vehicle Length (ft) | V/C Ratio Threshold | Average Delay Threshold (s) | Queue Threshold (PCE) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type |
|---------------------|---------------------|-----------------------------|-----------------------|---------------------|-----------------------------|---------------------------------|
| 18.86               | 0.85                | 36.00                       | 20.00                 | ✓                   |                             | N/A                             |

**Units**

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|----------------|-------------|---------------------|-----------------------|------------|---------------------|-------------------|---------------------|
| ft             | mph         | Veh                 | Veh                   | perHour    | s                   | -Min              | perMin              |

**(Default Analysis Set) - Scenario 3, AM**

**Data Errors and Warnings**

| Severity | Area       | Item                                  | Description  |
|----------|------------|---------------------------------------|--|
| Warning  | Geometry   | 156th Street WB - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | Geometry   | Ditch Road SB - Roundabout Geometry   | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | Geometry   | 156th Street EB - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | Geometry   | Ditch Road NB - Roundabout Geometry   | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | DemandSets | D1 - Scenario 3, AM                   | Time results are shown for central hour only. (Model is run for a 90 minute period.)                             |

**Analysis Set Details**

| Name                   | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|------------------------|---------------------------|-------------|-------------------|----------------------------|-------------------------|--------|---------------------------------|-------------------------------------|----------------------------|
| (Default Analysis Set) | ARCADY                    |             | ✓                 |                            |                         |        | 100.000                         | 85.000                              |                            |

**Demand Set Details**

| Name           | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|----------------|---------------|------------------|-------------|----------------------|--------------------------|---------------------------|--------------------------------|---------------------------|-------------------------------|--------------------------|--------|-------------------|------------------|--------------|
| Scenario 3, AM | Scenario 3    | AM               |             | ONE HOUR             | 08:00                    | 09:30                     | 90                             | 15                        | ✓                             |                          |        | ✓                 |                  |              |

**Intersection Network**

**Intersections**

| Name       | Intersection Type | Leg Order | Grade Separated | Large Roundabout | Do Geometric Delay | Intersection Delay (s) | Intersection LOS |
|------------|-------------------|-----------|-----------------|------------------|--------------------|------------------------|------------------|
| (untitled) | Roundabout        | 1,2,3,4   |                 |                  |                    | 4.49                   | A                |

**Intersection Network Options**

|              |          |              |                               |                              |
|--------------|----------|--------------|-------------------------------|------------------------------|
| Driving Side | Lighting | Road Surface | Network Residual Capacity (%) | First Leg Reaching Threshold |
|--------------|----------|--------------|-------------------------------|------------------------------|



| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCE Factor for a Truck (PCE) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---------------------|------------------------------|------------------------------|-------------------------------|--------------------|------------------------------|-----------------------------|---------------------------------|------------------------------------|------------------------------------|-------------------------------------|
|                     |                              | ✓                            | ✓                             | Truck Percentages  | 2.00                         |                             |                                 |                                    | ✓                                  | ✓                                   |

## Entry Flows

### General Flows Data

| Name            | Profile Type | Use Turning Counts | Average Demand Flow (Veh/hr) | Flow Scaling Factor (%) |
|-----------------|--------------|--------------------|------------------------------|-------------------------|
| 156th Street WB | ONE HOUR     | ✓                  | 180.00                       | 100.000                 |
| Ditch Road SB   | ONE HOUR     | ✓                  | 239.00                       | 100.000                 |
| 156th Street EB | ONE HOUR     | ✓                  | 85.00                        | 100.000                 |
| Ditch Road NB   | ONE HOUR     | ✓                  | 206.00                       | 100.000                 |

## Turning Proportions

### Turning Counts or Proportions (Veh/hr) - (untitled) (for whole period)

|      |   | To     |         |        |         |
|------|---|--------|---------|--------|---------|
|      |   | 1      | 2       | 3      | 4       |
| From | 1 | 0.000  | 32.000  | 64.000 | 84.000  |
|      | 2 | 19.000 | 0.000   | 8.000  | 212.000 |
|      | 3 | 23.000 | 20.000  | 0.000  | 42.000  |
|      | 4 | 44.000 | 143.000 | 19.000 | 0.000   |

### Turning Proportions (Veh) - (untitled) (for whole period)

|      |   | To   |      |      |      |
|------|---|------|------|------|------|
|      |   | 1    | 2    | 3    | 4    |
| From | 1 | 0.00 | 0.18 | 0.36 | 0.47 |
|      | 2 | 0.08 | 0.00 | 0.03 | 0.89 |
|      | 3 | 0.27 | 0.24 | 0.00 | 0.49 |
|      | 4 | 0.21 | 0.69 | 0.09 | 0.00 |

## Vehicle Mix

### Average PCE Per Vehicle - (untitled) (for whole period)

|      |   | To    |       |       |       |
|------|---|-------|-------|-------|-------|
|      |   | 1     | 2     | 3     | 4     |
| From | 1 | 1.000 | 1.000 | 1.020 | 1.000 |
|      | 2 | 1.000 | 1.000 | 1.000 | 1.000 |
|      | 3 | 1.020 | 1.000 | 1.000 | 1.000 |
|      | 4 | 1.000 | 1.000 | 1.000 | 1.000 |

### Truck Percentages - (untitled) (for whole period)

|      |   | To    |       |       |       |
|------|---|-------|-------|-------|-------|
|      |   | 1     | 2     | 3     | 4     |
| From | 1 | 0.000 | 0.000 | 2.000 | 0.000 |
|      | 2 | 0.000 | 0.000 | 0.000 | 0.000 |
|      | 3 | 2.000 | 0.000 | 0.000 | 0.000 |



|  |   |       |       |       |       |
|--|---|-------|-------|-------|-------|
|  | 4 | 0.000 | 0.000 | 0.000 | 0.000 |
|--|---|-------|-------|-------|-------|

# HCM Unsignalized Intersection Capacity Analysis

## 12: Towne Road & 151st Street

2/13/2012

|                                   |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|--|---|---|---|---|---|
| Movement                          | EBL   | EBT   | EBR   | WBL   | WBT   | WBR   | NBL  | NBT   | NBR   | SBL   | SBT   | SBR   |
| Lane Configurations               |   |  |   |   |  |   |  |  |   |   |  |   |
| Volume (veh/h)                    | 2   | 0   | 2   | 69  | 1   | 20  | 0  | 64  | 2   | 14  | 256   | 0   |
| Sign Control                      |   | Stop  |   |   | Stop  |   |  | Free  |   |   | Free  |   |
| Grade                             |   | 0%  |   |   | 0%  |   |  | 0%  |   |   | 0%  |   |
| Peak Hour Factor                  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90   | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  |
| Hourly flow rate (vph)            | 2   | 0   | 2   | 77  | 1   | 22  | 0  | 71  | 2   | 16  | 284   | 0   |
| Pedestrians                       |   |   |   |   |   |   |  |   |   |   |   |   |
| Lane Width (ft)                   |   |   |   |   |   |   |  |   |   |   |   |   |
| Walking Speed (ft/s)              |   |   |   |   |   |   |  |   |   |   |   |   |
| Percent Blockage                  |   |   |   |   |   |   |  |   |   |   |   |   |
| Right turn flare (veh)            |   |   |   |   |   |   |  |   |   |   |   |   |
| Median type                       |   |   |   |   |   |   |  | None  |   |   | None  |   |
| Median storage (veh)              |   |   |   |   |   |   |  |   |   |   |   |   |
| Upstream signal (ft)              |   |   |   |   |   |   |  |   |   |   |   |   |
| pX, platoon unblocked             |   |   |   |   |   |   |  |   |   |   |   |   |
| vC, conflicting volume            | 411   | 389   | 284   | 390   | 388   | 72  | 284  |   |   | 73  |   |   |
| vC1, stage 1 conf vol             |   |   |   |   |   |   |  |   |   |   |   |   |
| vC2, stage 2 conf vol             |   |   |   |   |   |   |  |   |   |   |   |   |
| vCu, unblocked vol                | 411   | 389   | 284   | 390   | 388   | 72  | 284  |   |   | 73  |   |   |
| tC, single (s)                    | 7.1   | 6.5   | 6.2   | 7.1   | 6.5   | 6.2   | 4.1  |   |   | 4.1   |   |   |
| tC, 2 stage (s)                   |   |   |   |   |   |   |  |   |   |   |   |   |
| tF (s)                            | 3.5   | 4.0   | 3.3   | 3.5   | 4.0   | 3.3   | 2.2  |   |   | 2.2   |   |   |
| p0 queue free %                   | 100   | 100   | 100   | 86  | 100   | 98  | 100  |   |   | 99  |   |   |
| cM capacity (veh/h)               | 538   | 544   | 759   | 567   | 544   | 996   | 1289   |   |   | 1539  |   |   |
| <b>Direction, Lane #</b>          | <b>EB 1</b>   | <b>WB 1</b>   | <b>NB 1</b>   | <b>SB 1</b>   |   |   |  |   |   |   |   |   |
| Volume Total                      | 4   | 100   | 73  | 300   |   |   |  |   |   |   |   |   |
| Volume Left                       | 2   | 77  | 0   | 16  |   |   |  |   |   |   |   |   |
| Volume Right                      | 2   | 22  | 2   | 0   |   |   |  |   |   |   |   |   |
| cSH                               | 630   | 626   | 1289  | 1539  |   |   |  |   |   |   |   |   |
| Volume to Capacity                | 0.01  | 0.16  | 0.00  | 0.01  |   |   |  |   |   |   |   |   |
| Queue Length 95th (ft)            | 1   | 14  | 0   | 1   |   |   |  |   |   |   |   |   |
| Control Delay (s)                 | 10.8  | 11.8  | 0.0   | 0.5   |   |   |  |   |   |   |   |   |
| Lane LOS                          | B   | B   |   | A   |   |   |  |   |   |   |   |   |
| Approach Delay (s)                | 10.8  | 11.8  | 0.0   | 0.5   |   |   |  |   |   |   |   |   |
| Approach LOS                      | B   | B   |   |   |   |   |  |   |   |   |   |   |
| <b>Intersection Summary</b>       |   |   |   |   |   |   |  |   |   |   |   |   |
| Average Delay                     |   |   |   | 2.9   |   |   |  |   |   |   |   |   |
| Intersection Capacity Utilization |   |   | 35.3%   |   | ICU Level of Service  |   |  |   | A   |   |   |   |
| Analysis Period (min)             |   |   | 15  |   |   |   |  |   |   |   |   |   |

# HCM Unsignalized Intersection Capacity Analysis

## 13: Ditch Road & 151st Street

2/13/2012

|                                   |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement                          | EBL   | EBT   | EBR   | WBL   | WBT   | WBR   | NBL   | NBT   | NBR   | SBL   | SBT   | SBR   |
| Lane Configurations               |   |  |  |   |  |   |   |  |  |   |  |  |
| Volume (veh/h)                    | 22  | 0   | 149   | 83  | 0   | 14  | 58  | 151   | 4   | 4   | 407   | 8   |
| Sign Control                      |   | Stop  |   |   | Stop  |   |   | Free  |   |   | Free  |   |
| Grade                             |   | 0%  |   |   | 0%  |   |   | 0%  |   |   | 0%  |   |
| Peak Hour Factor                  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  |
| Hourly flow rate (vph)            | 24  | 0   | 166   | 92  | 0   | 16  | 64  | 168   | 4   | 4   | 452   | 9   |
| Pedestrians                       |   |   |   |   |   |   |   |   |   |   |   |   |
| Lane Width (ft)                   |   |   |   |   |   |   |   |   |   |   |   |   |
| Walking Speed (ft/s)              |   |   |   |   |   |   |   |   |   |   |   |   |
| Percent Blockage                  |   |   |   |   |   |   |   |   |   |   |   |   |
| Right turn flare (veh)            |   |   |   |   |   |   |   |   |   |   |   |   |
| Median type                       |   |   |   |   |   |   |   | None  |   |   | None  |   |
| Median storage veh                |   |   |   |   |   |   |   |   |   |   |   |   |
| Upstream signal (ft)              |   |   |   |   |   |   |   |   |   |   |   |   |
| pX, platoon unblocked             |   |   |   |   |   |   |   |   |   |   |   |   |
| vC, conflicting volume            | 778   | 767   | 457   | 928   | 767   | 168   | 461   |   |   | 172   |   |   |
| vC1, stage 1 conf vol             |   |   |   |   |   |   |   |   |   |   |   |   |
| vC2, stage 2 conf vol             |   |   |   |   |   |   |   |   |   |   |   |   |
| vCu, unblocked vol                | 778   | 767   | 457   | 928   | 767   | 168   | 461   |   |   | 172   |   |   |
| tC, single (s)                    | 7.1   | 6.5   | 6.2   | 7.1   | 6.5   | 6.2   | 4.1   |   |   | 4.1   |   |   |
| tC, 2 stage (s)                   |   |   |   |   |   |   |   |   |   |   |   |   |
| tF (s)                            | 3.5   | 4.0   | 3.3   | 3.5   | 4.0   | 3.3   | 2.2   |   |   | 2.2   |   |   |
| p0 queue free %                   | 92  | 100   | 73  | 47  | 100   | 98  | 94  |   |   | 100   |   |   |
| cM capacity (veh/h)               | 296   | 315   | 608   | 174   | 315   | 882   | 1111  |   |   | 1417  |   |   |
| <b>Direction, Lane #</b>          | <b>EB 1</b>   | <b>EB 2</b>   | <b>WB 1</b>   | <b>NB 1</b>   | <b>NB 2</b>   | <b>SB 1</b>   |   |   |   |   |   |   |
| Volume Total                      | 24  | 166   | 108   | 232   | 4   | 466   |   |   |   |   |   |   |
| Volume Left                       | 24  | 0   | 92  | 64  | 0   | 4   |   |   |   |   |   |   |
| Volume Right                      | 0   | 166   | 16  | 0   | 4   | 9   |   |   |   |   |   |   |
| cSH                               | 296   | 608   | 197   | 1111  | 1700  | 1417  |   |   |   |   |   |   |
| Volume to Capacity                | 0.08  | 0.27  | 0.55  | 0.06  | 0.00  | 0.00  |   |   |   |   |   |   |
| Queue Length 95th (ft)            | 7   | 28  | 72  | 5   | 0   | 0   |   |   |   |   |   |   |
| Control Delay (s)                 | 18.2  | 13.1  | 43.5  | 2.7   | 0.0   | 0.1   |   |   |   |   |   |   |
| Lane LOS                          | C   | B   | E   | A   |   | A   |   |   |   |   |   |   |
| Approach Delay (s)                | 13.8  |   | 43.5  | 2.7   |   | 0.1   |   |   |   |   |   |   |
| Approach LOS                      | B   |   | E   |   |   |   |   |   |   |   |   |   |
| <b>Intersection Summary</b>       |   |   |   |   |   |   |   |   |   |   |   |   |
| Average Delay                     |   |   | 8.0   |   |   |   |   |   |   |   |   |   |
| Intersection Capacity Utilization |   |   | 55.4%   |   | ICU Level of Service  |   |   |   |   | B   |   |   |
| Analysis Period (min)             |   |   | 15  |   |   |   |   |   |   |   |   |   |

|   |
|---|
| <b>ARCADY 8</b>   |
| Version: 8.0.0.249 [24 Oct 2011]<br>© Copyright Transport Research Laboratory 2012  |
| For sales and distribution information, program advice and maintenance, contact TRL:<br>Tel: +44 (0)1344 770758 E-mail: software@trl.co.uk Web: http://www.trlsoftware.co.uk    |
| <small>The users of this computer program for the solution of an engineering problem are in no way relieved of their responsibility for the correctness of the solution</small> |

File: P:\2011\01596\C. Calcs\_Data\Traffic Study\Analysis\ARCADY\151st & Ditch.arc8  
 Report generation date: 2/17/2012 3:11:52 PM

- « (Default Analysis Set) - Scenario 3, AM
- » Intersection Network
- » Legs
- » Traffic Flows
- » Entry Flows
- » Turning Proportions
- » Vehicle Mix

### Summary of intersection performance

|                        | AM          |                 |           |           |     |                        | PM               |             |                 |           |           |     |                        |
|------------------------|-------------|-----------------|-----------|-----------|-----|------------------------|------------------|-------------|-----------------|-----------|-----------|-----|------------------------|
|                        | Queue (Veh) | 95% Queue (Veh) | Delay (s) | V/C Ratio | LOS | Intersection Delay (s) | Intersection LOS | Queue (Veh) | 95% Queue (Veh) | Delay (s) | V/C Ratio | LOS | Intersection Delay (s) |
| <b>A1 - Scenario 3</b> |             |                 |           |           |     |                        |                  |             |                 |           |           |     |                        |
| <b>151st Street WB</b> | 0.12        | ?               | 4.01      | 0.11      | A   | 5.47                   | A                | 0.02        | ?               | 4.40      | 0.02      | A   | 7.43                   |
| <b>Ditch Road SB</b>   | 0.82        | 1.00            | 6.42      | 0.45      | A   |                        |                  | 0.37        | ?               | 4.90      | 0.27      | A   |                        |
| <b>151st Street EB</b> | 0.29        | ?               | 5.51      | 0.22      | A   |                        |                  | 0.16        | ?               | 4.28      | 0.13      | A   |                        |
| <b>Ditch Road NB</b>   | 0.28        | ?               | 4.25      | 0.22      | A   |                        |                  | 1.71        | 2.00            | 9.12      | 0.63      | A   |                        |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.*

"D1 - Scenario 3, AM" model duration: 8:00 AM - 9:30 AM  
 "D2 - Scenario 3, PM" model duration: 8:00 AM - 9:30 AM

Run using ARCADY 8.0.0.249 at 2/17/2012 3:11:48 PM

### File summary

#### File Description

|             |            |
|-------------|------------|
| Title       | (untitled) |
| Location    |            |
| Site Number |            |
| Date        | 2/17/2012  |
| Version     |            |
| Status      | (new file) |
| Identifier  |            |
| Client      |            |



|             |              |
|-------------|--------------|
| Jobnumber   |              |
| Analyst     | ACEvajohnson |
| Description |              |

### Analysis Options

| Vehicle Length (ft) | V/C Ratio Threshold | Average Delay Threshold (s) | Queue Threshold (PCE) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type |
|---------------------|---------------------|-----------------------------|-----------------------|---------------------|-----------------------------|---------------------------------|
| 18.86               | 0.85                | 36.00                       | 20.00                 | ✓                   |                             | N/A                             |

### Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|----------------|-------------|---------------------|-----------------------|------------|---------------------|-------------------|---------------------|
| ft             | mph         | Veh                 | Veh                   | perHour    | s                   | -Min              | perMin              |

## (Default Analysis Set) - Scenario 3, AM

### Data Errors and Warnings

| Severity | Area       | Item                                  | Description  |
|----------|------------|---------------------------------------|--|
| Warning  | Geometry   | 151st Street WB - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | Geometry   | Ditch Road SB - Roundabout Geometry   | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | Geometry   | 151st Street EB - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | Geometry   | Ditch Road NB - Roundabout Geometry   | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | DemandSets | D1 - Scenario 3, AM                   | Time results are shown for central hour only. (Model is run for a 90 minute period.)                             |

### Analysis Set Details

| Name                   | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|------------------------|---------------------------|-------------|-------------------|----------------------------|-------------------------|--------|---------------------------------|-------------------------------------|----------------------------|
| (Default Analysis Set) | ARCADY                    |             | ✓                 |                            |                         |        | 100.000                         | 85.000                              |                            |

### Demand Set Details

| Name           | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|----------------|---------------|------------------|-------------|----------------------|--------------------------|---------------------------|--------------------------------|---------------------------|-------------------------------|--------------------------|--------|-------------------|------------------|--------------|
| Scenario 3, AM | Scenario 3    | AM               |             | ONE HOUR             | 08:00                    | 09:30                     | 90                             | 15                        | ✓                             |                          |        | ✓                 |                  |              |

## Intersection Network

### Intersections

| Name       | Intersection Type | Leg Order | Grade Separated | Large Roundabout | Do Geometric Delay | Intersection Delay (s) | Intersection LOS |
|------------|-------------------|-----------|-----------------|------------------|--------------------|------------------------|------------------|
| (untitled) | Roundabout        | 1,2,3,4   |                 |                  |                    | 5.47                   | A                |

### Intersection Network Options

|              |          |              |                               |                              |
|--------------|----------|--------------|-------------------------------|------------------------------|
| Driving Side | Lighting | Road Surface | Network Residual Capacity (%) | First Leg Reaching Threshold |
|--------------|----------|--------------|-------------------------------|------------------------------|



| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCE Factor for a Truck (PCE) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---------------------|------------------------------|------------------------------|-------------------------------|--------------------|------------------------------|-----------------------------|---------------------------------|------------------------------------|------------------------------------|-------------------------------------|
|                     |                              | ✓                            | ✓                             | Truck Percentages  | 2.00                         |                             |                                 |                                    | ✓                                  | ✓                                   |

## Entry Flows

### General Flows Data

| Name            | Profile Type | Use Turning Counts | Average Demand Flow (Veh/hr) | Flow Scaling Factor (%) |
|-----------------|--------------|--------------------|------------------------------|-------------------------|
| 151st Street WB | ONE HOUR     | ✓                  | 97.00                        | 100.000                 |
| Ditch Road SB   | ONE HOUR     | ✓                  | 419.00                       | 100.000                 |
| 151st Street EB | ONE HOUR     | ✓                  | 171.00                       | 100.000                 |
| Ditch Road NB   | ONE HOUR     | ✓                  | 213.00                       | 100.000                 |

## Turning Proportions

### Turning Counts or Proportions (Veh/hr) - (untitled) (for whole period)

|      |   | To    |         |        |         |
|------|---|-------|---------|--------|---------|
|      |   | 1     | 2       | 3      | 4       |
| From | 1 | 0.000 | 14.000  | 0.000  | 83.000  |
|      | 2 | 4.000 | 0.000   | 8.000  | 407.000 |
|      | 3 | 0.000 | 22.000  | 0.000  | 149.000 |
|      | 4 | 4.000 | 151.000 | 58.000 | 0.000   |

### Turning Proportions (Veh) - (untitled) (for whole period)

|      |   | To   |      |      |      |
|------|---|------|------|------|------|
|      |   | 1    | 2    | 3    | 4    |
| From | 1 | 0.00 | 0.14 | 0.00 | 0.86 |
|      | 2 | 0.01 | 0.00 | 0.02 | 0.97 |
|      | 3 | 0.00 | 0.13 | 0.00 | 0.87 |
|      | 4 | 0.02 | 0.71 | 0.27 | 0.00 |

## Vehicle Mix

### Average PCE Per Vehicle - (untitled) (for whole period)

|      |   | To    |       |       |       |
|------|---|-------|-------|-------|-------|
|      |   | 1     | 2     | 3     | 4     |
| From | 1 | 1.000 | 1.000 | 1.020 | 1.000 |
|      | 2 | 1.000 | 1.000 | 1.000 | 1.000 |
|      | 3 | 1.020 | 1.000 | 1.000 | 1.000 |
|      | 4 | 1.000 | 1.000 | 1.000 | 1.000 |

### Truck Percentages - (untitled) (for whole period)

|      |   | To    |       |       |       |
|------|---|-------|-------|-------|-------|
|      |   | 1     | 2     | 3     | 4     |
| From | 1 | 0.000 | 0.000 | 2.000 | 0.000 |
|      | 2 | 0.000 | 0.000 | 0.000 | 0.000 |
|      | 3 | 2.000 | 0.000 | 0.000 | 0.000 |

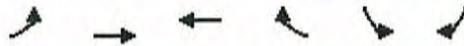


|  |   |       |       |       |       |
|--|---|-------|-------|-------|-------|
|  | 4 | 0.000 | 0.000 | 0.000 | 0.000 |
|--|---|-------|-------|-------|-------|

# HCM Unsignalized Intersection Capacity Analysis

## 30: 146th Street & Access Drive A

2/13/2012



| Movement               | EBL  | EBT  | WBT  | WBR  | SBL  | SBR  |
|------------------------|------|------|------|------|------|------|
| Lane Configurations    |      | ↑↑   | ↑↑   |      |      | ↑    |
| Volume (veh/h)         | 0    | 261  | 281  | 38   | 0    | 36   |
| Sign Control           |      | Free | Free |      | Stop |      |
| Grade                  |      | 0%   | 0%   |      | 0%   |      |
| Peak Hour Factor       | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Hourly flow rate (vph) | 0    | 290  | 312  | 42   | 0    | 40   |
| Pedestrians            |      |      |      |      |      |      |
| Lane Width (ft)        |      |      |      |      |      |      |
| Walking Speed (ft/s)   |      |      |      |      |      |      |
| Percent Blockage       |      |      |      |      |      |      |
| Right turn flare (veh) |      |      |      |      |      |      |
| Median type            |      | None | None |      |      |      |
| Median storage (veh)   |      |      |      |      |      |      |
| Upstream signal (ft)   |      |      |      |      |      |      |
| pX, platoon unblocked  |      |      |      |      |      |      |
| vC, conflicting volume | 354  |      |      |      | 478  | 177  |
| vC1, stage 1 conf vol  |      |      |      |      |      |      |
| vC2, stage 2 conf vol  |      |      |      |      |      |      |
| vCu, unblocked vol     | 354  |      |      |      | 478  | 177  |
| tC, single (s)         | 4.1  |      |      |      | 6.8  | 6.9  |
| tC, 2 stage (s)        |      |      |      |      |      |      |
| tF (s)                 | 2.2  |      |      |      | 3.5  | 3.3  |
| p0 queue free %        | 100  |      |      |      | 100  | 95   |
| cM capacity (veh/h)    | 1215 |      |      |      | 521  | 842  |

| Direction, Lane #      | EB 1 | EB 2 | WB 1 | WB 2 | SB 1 |
|------------------------|------|------|------|------|------|
| Volume Total           | 145  | 145  | 208  | 146  | 40   |
| Volume Left            | 0    | 0    | 0    | 0    | 0    |
| Volume Right           | 0    | 0    | 0    | 42   | 40   |
| cSH                    | 1700 | 1700 | 1700 | 1700 | 842  |
| Volume to Capacity     | 0.09 | 0.09 | 0.12 | 0.09 | 0.05 |
| Queue Length 95th (ft) | 0    | 0    | 0    | 0    | 4    |
| Control Delay (s)      | 0.0  | 0.0  | 0.0  | 0.0  | 9.5  |
| Lane LOS               |      |      |      |      | A    |
| Approach Delay (s)     | 0.0  |      | 0.0  |      | 9.5  |
| Approach LOS           |      |      |      |      | A    |

| Intersection Summary              |  |  |       |                      |   |
|-----------------------------------|--|--|-------|----------------------|---|
| Average Delay                     |  |  | 0.6   |                      |   |
| Intersection Capacity Utilization |  |  | 19.0% | ICU Level of Service | A |
| Analysis Period (min)             |  |  | 15    |                      |   |

# HCM Unsignalized Intersection Capacity Analysis

## 32: Access Drive B & 146th Street

2/13/2012

|                                   | →    | ↘    | ↙     | ←    | ↖                    | ↗    |
|-----------------------------------|------|------|-------|------|----------------------|------|
| Movement                          | EBT  | EBR  | WBL   | WBT  | NBL                  | NBR  |
| Lane Configurations               | ↑↑   |      |       | ↑↑   |                      | ↗    |
| Volume (veh/h)                    | 225  | 36   | 0     | 319  | 0                    | 46   |
| Sign Control                      | Free |      |       | Free | Stop                 |      |
| Grade                             | 0%   |      |       | 0%   | 0%                   |      |
| Peak Hour Factor                  | 0.90 | 0.90 | 0.90  | 0.90 | 0.90                 | 0.90 |
| Hourly flow rate (vph)            | 250  | 40   | 0     | 354  | 0                    | 51   |
| Pedestrians                       |      |      |       |      |                      |      |
| Lane Width (ft)                   |      |      |       |      |                      |      |
| Walking Speed (ft/s)              |      |      |       |      |                      |      |
| Percent Blockage                  |      |      |       |      |                      |      |
| Right turn flare (veh)            |      |      |       |      |                      |      |
| Median type                       | None |      | None  |      |                      |      |
| Median storage veh                |      |      |       |      |                      |      |
| Upstream signal (ft)              |      |      |       |      |                      |      |
| pX, platoon unblocked             |      |      |       |      |                      |      |
| vC, conflicting volume            |      |      | 290   |      | 447                  | 145  |
| vC1, stage 1 conf vol             |      |      |       |      |                      |      |
| vC2, stage 2 conf vol             |      |      |       |      |                      |      |
| vCu, unblocked vol                |      |      | 290   |      | 447                  | 145  |
| tC, single (s)                    |      |      | 4.1   |      | 6.8                  | 6.9  |
| tC, 2 stage (s)                   |      |      |       |      |                      |      |
| tF (s)                            |      |      | 2.2   |      | 3.5                  | 3.3  |
| p0 queue free %                   |      |      | 100   |      | 100                  | 94   |
| cM capacity (veh/h)               |      |      | 1283  |      | 545                  | 882  |
| Direction, Lane #                 | EB 1 | EB 2 | WB 1  | WB 2 | NB 1                 |      |
| Volume Total                      | 167  | 123  | 177   | 177  | 51                   |      |
| Volume Left                       | 0    | 0    | 0     | 0    | 0                    |      |
| Volume Right                      | 0    | 40   | 0     | 0    | 51                   |      |
| cSH                               | 1700 | 1700 | 1700  | 1700 | 882                  |      |
| Volume to Capacity                | 0.10 | 0.07 | 0.10  | 0.10 | 0.06                 |      |
| Queue Length 95th (ft)            | 0    | 0    | 0     | 0    | 5                    |      |
| Control Delay (s)                 | 0.0  | 0.0  | 0.0   | 0.0  | 9.3                  |      |
| Lane LOS                          |      |      |       |      | A                    |      |
| Approach Delay (s)                | 0.0  |      | 0.0   |      | 9.3                  |      |
| Approach LOS                      |      |      |       |      | A                    |      |
| Intersection Summary              |      |      |       |      |                      |      |
| Average Delay                     |      |      | 0.7   |      |                      |      |
| Intersection Capacity Utilization |      |      | 17.4% |      | ICU Level of Service | A    |
| Analysis Period (min)             |      |      | 15    |      |                      |      |

|  |
|--|
| <b>ARCADY</b>  |
| Version: 8.0.0.249 [24 Oct 2011]<br>© Copyright Transport Research Laboratory 2012   |
| For sales and distribution information, program advice and maintenance, contact TRL:<br>Tel: +44 (0)1344 770758 E-mail: software@trl.co.uk Web: http://www.trlsoftware.co.uk |
| The users of this computer program for the solution of an engineering problem are in no way relieved of their responsibility for the correctness of the solution             |

File: P:\2011\01596\C. Calcs\_Data\Traffic Study\Analysis\ARCADY\Drive C-I.arc8  
Report generation date: 2/17/2012 3:07:29 PM

- « (Default Analysis Set) - Scenario 1 AM
- » Intersection Network
- » Legs
- » Traffic Flows
- » Entry Flows
- » Turning Proportions
- » Vehicle Mix

### Summary of intersection performance

|                        | AM          |                 |           |           |     |                        | PM               |             |                 |           |           |     |                   |
|------------------------|-------------|-----------------|-----------|-----------|-----|------------------------|------------------|-------------|-----------------|-----------|-----------|-----|-------------------|
|                        | Queue (Veh) | 95% Queue (Veh) | Delay (s) | V/C Ratio | LOS | Intersection Delay (s) | Intersection LOS | Queue (Veh) | 95% Queue (Veh) | Delay (s) | V/C Ratio | LOS | Interse Delay (s) |
| <b>A1 - Scenario 1</b> |             |                 |           |           |     |                        |                  |             |                 |           |           |     |                   |
| Soerlle Drive WB       | 0.09        | ?               | 4.27      | 0.08      | A   | 9.37                   | A                | 0.07        | ?               | 6.95      | 0.06      | A   | 5.43              |
| Ditch Road SB          | 2.58        | 6.00            | 13.19     | 0.73      | B   |                        |                  | 0.77        | 1.00            | 7.44      | 0.44      | A   |                   |
| Drive C                | 0.25        | ?               | 6.55      | 0.20      | A   |                        |                  | 0.18        | ?               | 5.57      | 0.15      | A   |                   |
| Drive I                | 1.23        | ?               | 10.43     | 0.55      | B   |                        |                  | 0.82        | 200.00          | 6.77      | 0.45      | A   |                   |
| Ditch Road NB          | 0.20        | ?               | 2.15      | 0.17      | A   |                        |                  | 1.08        | ?               | 3.99      | 0.52      | A   |                   |

Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.

"D1 - Scenario 1, PM" model duration: 8:00 AM - 9:30 AM  
"D2 - Scenario 1, AM " model duration: 8:00 AM - 9:30 AM

Run using ARCADY 8.0.0.249 at 2/17/2012 3:07:23 PM

### File summary

#### File Description

|             |              |
|-------------|--------------|
| Title       | (untitled)   |
| Location    |              |
| Site Number |              |
| Date        | 2/17/2012    |
| Version     |              |
| Status      | (new file)   |
| Identifier  |              |
| Client      |              |
| Jobnumber   |              |
| Analyst     | ACE\ajohnson |





Truck Percentages

| Truck Percentages | Factor |   |
|-------------------|--------|-------------------|--------|-------------------|--------|-------------------|--------|-------------------|--------|---|
|                   |        | ✓                 | ✓      | Truck Percentages | 2.00   |                   |        |                   | ✓      | ✓ |

Truck Percentages

Truck Percentages

| Truck Percentages | Factor | Truck Percentages | Factor  |
|-------------------|--------|-------------------|---------|
| ONE HOUR          | ✓      | 68.00             | 100.000 |
| ONE HOUR          | ✓      | 643.00            | 100.000 |
| ONE HOUR          | ✓      | 121.00            | 100.000 |
| ONE HOUR          | ✓      | 382.00            | 100.000 |
| ONE HOUR          | ✓      | 302.00            | 100.000 |

Truck Percentages

Truck Percentages

|      |   | To    |         |        |         |         |
|------|---|-------|---------|--------|---------|---------|
|      |   | 1     | 2       | 3      | 4       | 5       |
| From | 1 | 0.000 | 14.000  | 0.000  | 0.000   | 54.000  |
|      | 2 | 2.000 | 0.000   | 6.000  | 87.000  | 548.000 |
|      | 3 | 0.000 | 9.000   | 0.000  | 77.000  | 35.000  |
|      | 4 | 0.000 | 35.000  | 30.000 | 0.000   | 317.000 |
|      | 5 | 8.000 | 155.000 | 11.000 | 128.000 | 0.000   |

Truck Percentages

|      |   | To   |      |      |      |      |
|------|---|------|------|------|------|------|
|      |   | 1    | 2    | 3    | 4    | 5    |
| From | 1 | 0.00 | 0.21 | 0.00 | 0.00 | 0.79 |
|      | 2 | 0.00 | 0.00 | 0.01 | 0.14 | 0.85 |
|      | 3 | 0.00 | 0.07 | 0.00 | 0.64 | 0.29 |
|      | 4 | 0.00 | 0.09 | 0.08 | 0.00 | 0.83 |
|      | 5 | 0.03 | 0.51 | 0.04 | 0.42 | 0.00 |

Truck Percentages

Truck Percentages

|      |   | To    |       |       |       |       |
|------|---|-------|-------|-------|-------|-------|
|      |   | 1     | 2     | 3     | 4     | 5     |
| From | 1 | 1.000 | 1.020 | 1.020 | 1.020 | 1.020 |
|      | 2 | 1.020 | 1.000 | 1.020 | 1.020 | 1.020 |
|      | 3 | 1.020 | 1.020 | 1.000 | 1.020 | 1.020 |
|      | 4 | 1.020 | 1.020 | 1.020 | 1.000 | 1.020 |
|      | 5 | 1.020 | 1.020 | 1.020 | 1.020 | 1.000 |



Tr

|      |   | To    |       |       |       |       |
|------|---|-------|-------|-------|-------|-------|
|      |   | 1     | 2     | 3     | 4     | 5     |
| From | 1 | 0.000 | 2.000 | 2.000 | 2.000 | 2.000 |
|      | 2 | 2.000 | 0.000 | 2.000 | 2.000 | 2.000 |
|      | 3 | 2.000 | 2.000 | 0.000 | 2.000 | 2.000 |
|      | 4 | 2.000 | 2.000 | 2.000 | 0.000 | 2.000 |
|      | 5 | 2.000 | 2.000 | 2.000 | 2.000 | 0.000 |

HCM Unsignalized Intersection Capacity Analysis  
 26: Access Drive D & 151st Street

2/13/2012

|                                   | →    | ↘     | ↙    | ←                    | ↖    | ↗    |
|-----------------------------------|------|-------|------|----------------------|------|------|
| Movement                          | EBT  | EBR   | WBL  | WBT                  | NBL  | NBR  |
| Lane Configurations               | ↘    |       |      | ↖                    | ↘    | ↗    |
| Volume (veh/h)                    | 161  | 0     | 3    | 63                   | 1    | 10   |
| Sign Control                      | Free |       |      | Free                 | Stop |      |
| Grade                             | 0%   |       |      | 0%                   | 0%   |      |
| Peak Hour Factor                  | 0.90 | 0.90  | 0.90 | 0.90                 | 0.90 | 0.90 |
| Hourly flow rate (vph)            | 179  | 0     | 3    | 70                   | 1    | 11   |
| Pedestrians                       |      |       |      |                      |      |      |
| Lane Width (ft)                   |      |       |      |                      |      |      |
| Walking Speed (ft/s)              |      |       |      |                      |      |      |
| Percent Blockage                  |      |       |      |                      |      |      |
| Right turn flare (veh)            |      |       |      |                      |      |      |
| Median type                       | None |       |      | None                 |      |      |
| Median storage veh                |      |       |      |                      |      |      |
| Upstream signal (ft)              |      |       |      |                      |      |      |
| pX, platoon unblocked             |      |       |      |                      |      |      |
| vC, conflicting volume            |      |       | 179  |                      | 256  | 179  |
| vC1, stage 1 conf vol             |      |       |      |                      |      |      |
| vC2, stage 2 conf vol             |      |       |      |                      |      |      |
| vCu, unblocked vol                |      |       | 179  |                      | 256  | 179  |
| tC, single (s)                    |      |       | 4.1  |                      | 6.4  | 6.2  |
| tC, 2 stage (s)                   |      |       |      |                      |      |      |
| tF (s)                            |      |       | 2.2  |                      | 3.5  | 3.3  |
| p0 queue free %                   |      |       | 100  |                      | 100  | 99   |
| cM capacity (veh/h)               |      |       | 1409 |                      | 736  | 869  |
| Direction, Lane #                 | EB 1 | WB 1  | NB 1 |                      |      |      |
| Volume Total                      | 179  | 73    | 12   |                      |      |      |
| Volume Left                       | 0    | 3     | 1    |                      |      |      |
| Volume Right                      | 0    | 0     | 11   |                      |      |      |
| cSH                               | 1700 | 1409  | 855  |                      |      |      |
| Volume to Capacity                | 0.11 | 0.00  | 0.01 |                      |      |      |
| Queue Length 95th (ft)            | 0    | 0     | 1    |                      |      |      |
| Control Delay (s)                 | 0.0  | 0.4   | 9.3  |                      |      |      |
| Lane LOS                          |      | A     | A    |                      |      |      |
| Approach Delay (s)                | 0.0  | 0.4   | 9.3  |                      |      |      |
| Approach LOS                      |      |       | A    |                      |      |      |
| Intersection Summary              |      |       |      |                      |      |      |
| Average Delay                     |      |       | 0.5  |                      |      |      |
| Intersection Capacity Utilization |      | 18.5% |      | ICU Level of Service |      | A    |
| Analysis Period (min)             |      |       | 15   |                      |      |      |

# HCM Unsignalized Intersection Capacity Analysis

## 23: Access Drive E & 151st Street

2/13/2012

|                                   |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement                          | EBL   | EBT   | EBR   | WBL   | WBT   | WBR   | NBL   | NBT   | NBR   | SBL   | SBT   | SBR   |
| Lane Configurations               |   |  |   |   |  |   |   |  |   |   |  |   |
| Volume (veh/h)                    | 3   | 90  | 30  | 5   | 38  | 21  | 17  | 13  | 15  | 57  | 36  | 11  |
| Sign Control                      |   | Free  |   |   | Free  |   |   | Stop  |   |   | Stop  |   |
| Grade                             |   | 0%  |   |   | 0%  |   |   | 0%  |   |   | 0%  |   |
| Peak Hour Factor                  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  |
| Hourly flow rate (vph)            | 3   | 100   | 33  | 6   | 42  | 23  | 19  | 14  | 17  | 63  | 40  | 12  |
| Pedestrians                       |   |   |   |   |   |   |   |   |   |   |   |   |
| Lane Width (ft)                   |   |   |   |   |   |   |   |   |   |   |   |   |
| Walking Speed (ft/s)              |   |   |   |   |   |   |   |   |   |   |   |   |
| Percent Blockage                  |   |   |   |   |   |   |   |   |   |   |   |   |
| Right turn flare (veh)            |   |   |   |   |   |   |   |   |   |   |   |   |
| Median type                       |   | None  |   |   | None  |   |   |   |   |   |   |   |
| Median storage veh                |   |   |   |   |   |   |   |   |   |   |   |   |
| Upstream signal (ft)              |   |   |   |   |   |   |   |   |   |   |   |   |
| pX, platoon unblocked             |   |   |   |   |   |   |   |   |   |   |   |   |
| vC, conflicting volume            | 66  |   |   | 133   |   |   | 221   | 200   | 117   | 212   | 205   | 54  |
| vC1, stage 1 conf vol             |   |   |   |   |   |   |   |   |   |   |   |   |
| vC2, stage 2 conf vol             |   |   |   |   |   |   |   |   |   |   |   |   |
| vCu, unblocked vol                | 66  |   |   | 133   |   |   | 221   | 200   | 117   | 212   | 205   | 54  |
| tC, single (s)                    | 4.1   |   |   | 4.1   |   |   | 7.1   | 6.5   | 6.2   | 7.1   | 6.5   | 6.2   |
| tC, 2 stage (s)                   |   |   |   |   |   |   |   |   |   |   |   |   |
| tF (s)                            | 2.2   |   |   | 2.2   |   |   | 3.5   | 4.0   | 3.3   | 3.5   | 4.0   | 3.3   |
| p0 queue free %                   | 100   |   |   | 100   |   |   | 97  | 98  | 98  | 91  | 94  | 99  |
| cM capacity (veh/h)               | 1549  |   |   | 1464  |   |   | 695   | 695   | 941   | 721   | 691   | 1019  |
| <b>Direction, Lane #</b>          | <b>EB 1</b>   | <b>WB 1</b>   | <b>NB 1</b>   | <b>SB 1</b>   |   |   |   |   |   |   |   |   |
| Volume Total                      | 137   | 71  | 50  | 116   |   |   |   |   |   |   |   |   |
| Volume Left                       | 3   | 6   | 19  | 63  |   |   |   |   |   |   |   |   |
| Volume Right                      | 33  | 23  | 17  | 12  |   |   |   |   |   |   |   |   |
| cSH                               | 1549  | 1464  | 762   | 733   |   |   |   |   |   |   |   |   |
| Volume to Capacity                | 0.00  | 0.00  | 0.07  | 0.16  |   |   |   |   |   |   |   |   |
| Queue Length 95th (ft)            | 0   | 0   | 5   | 14  |   |   |   |   |   |   |   |   |
| Control Delay (s)                 | 0.2   | 0.6   | 10.1  | 10.8  |   |   |   |   |   |   |   |   |
| Lane LOS                          | A   | A   | B   | B   |   |   |   |   |   |   |   |   |
| Approach Delay (s)                | 0.2   | 0.6   | 10.1  | 10.8  |   |   |   |   |   |   |   |   |
| Approach LOS                      |   |   | B   | B   |   |   |   |   |   |   |   |   |
| <b>Intersection Summary</b>       |   |   |   |   |   |   |   |   |   |   |   |   |
| Average Delay                     |   |   | 4.9   |   |   |   |   |   |   |   |   |   |
| Intersection Capacity Utilization |   |   | 22.8%   |   | ICU Level of Service  |   |   |   | A   |   |   |   |
| Analysis Period (min)             |   |   | 15  |   |   |   |   |   |   |   |   |   |

# HCM Unsignalized Intersection Capacity Analysis

## 21: 151st Street & Access Drive F

2/13/2012



| Movement               | EBL  | EBT  | WBT  | WBR  | SBL  | SBR  |
|------------------------|------|------|------|------|------|------|
| Lane Configurations    |      | ↕    | ↕    |      | ↕    |      |
| Volume (veh/h)         | 5    | 91   | 53   | 13   | 32   | 15   |
| Sign Control           |      | Free | Free |      | Stop |      |
| Grade                  |      | 0%   | 0%   |      | 0%   |      |
| Peak Hour Factor       | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Hourly flow rate (vph) | 6    | 101  | 59   | 14   | 36   | 17   |
| Pedestrians            |      |      |      |      |      |      |
| Lane Width (ft)        |      |      |      |      |      |      |
| Walking Speed (ft/s)   |      |      |      |      |      |      |
| Percent Blockage       |      |      |      |      |      |      |
| Right turn flare (veh) |      |      |      |      |      |      |
| Median type            |      | None | None |      |      |      |
| Median storage veh     |      |      |      |      |      |      |
| Upstream signal (ft)   |      |      |      |      |      |      |
| pX, platoon unblocked  |      |      |      |      |      |      |
| vC, conflicting volume | 73   |      |      |      | 178  | 66   |
| vC1, stage 1 conf vol  |      |      |      |      |      |      |
| vC2, stage 2 conf vol  |      |      |      |      |      |      |
| vCu, unblocked vol     | 73   |      |      |      | 178  | 66   |
| tC, single (s)         | 4.1  |      |      |      | 6.4  | 6.2  |
| tC, 2 stage (s)        |      |      |      |      |      |      |
| tF (s)                 | 2.2  |      |      |      | 3.5  | 3.3  |
| p0 queue free %        | 100  |      |      |      | 96   | 98   |
| cM capacity (veh/h)    | 1539 |      |      |      | 813  | 1003 |

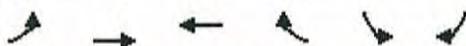
| Direction, Lane #      | EB 1 | WB 1 | SB 1 |
|------------------------|------|------|------|
| Volume Total           | 107  | 73   | 52   |
| Volume Left            | 6    | 0    | 36   |
| Volume Right           | 0    | 14   | 17   |
| cSH                    | 1539 | 1700 | 865  |
| Volume to Capacity     | 0.00 | 0.04 | 0.06 |
| Queue Length 95th (ft) | 0    | 0    | 5    |
| Control Delay (s)      | 0.4  | 0.0  | 9.4  |
| Lane LOS               | A    |      | A    |
| Approach Delay (s)     | 0.4  | 0.0  | 9.4  |
| Approach LOS           |      |      | A    |

| Intersection Summary              |  |       |                        |
|-----------------------------------|--|-------|------------------------|
| Average Delay                     |  | 2.3   |                        |
| Intersection Capacity Utilization |  | 18.9% | ICU Level of Service A |
| Analysis Period (min)             |  | 15    |                        |

# HCM Unsignalized Intersection Capacity Analysis

## 19: 151st Street & Access Drive G

2/13/2012



| Movement                          | EBL         | EBT         | WBT         | WBR                  | SBL  | SBR  |
|-----------------------------------|-------------|-------------|-------------|----------------------|------|------|
| Lane Configurations               |             | ↕           | ↕           |                      | ↕    |      |
| Volume (veh/h)                    | 16          | 20          | 42          | 26                   | 75   | 47   |
| Sign Control                      |             | Free        | Free        |                      | Stop |      |
| Grade                             |             | 0%          | 0%          |                      | 0%   |      |
| Peak Hour Factor                  | 0.90        | 0.90        | 0.90        | 0.90                 | 0.90 | 0.90 |
| Hourly flow rate (vph)            | 18          | 22          | 47          | 29                   | 83   | 52   |
| Pedestrians                       |             |             |             |                      |      |      |
| Lane Width (ft)                   |             |             |             |                      |      |      |
| Walking Speed (ft/s)              |             |             |             |                      |      |      |
| Percent Blockage                  |             |             |             |                      |      |      |
| Right turn flare (veh)            |             |             |             |                      |      |      |
| Median type                       |             | None        | None        |                      |      |      |
| Median storage (veh)              |             |             |             |                      |      |      |
| Upstream signal (ft)              |             |             |             |                      |      |      |
| pX, platoon unblocked             |             |             |             |                      |      |      |
| vC, conflicting volume            | 76          |             |             |                      | 119  | 61   |
| vC1, stage 1 conf vol             |             |             |             |                      |      |      |
| vC2, stage 2 conf vol             |             |             |             |                      |      |      |
| vCu, unblocked vol                | 76          |             |             |                      | 119  | 61   |
| tC, single (s)                    | 4.1         |             |             |                      | 6.4  | 6.2  |
| tC, 2 stage (s)                   |             |             |             |                      |      |      |
| tF (s)                            | 2.2         |             |             |                      | 3.5  | 3.3  |
| p0 queue free %                   | 99          |             |             |                      | 90   | 95   |
| cM capacity (veh/h)               | 1536        |             |             |                      | 871  | 1010 |
| <b>Direction, Lane #</b>          | <b>EB 1</b> | <b>WB 1</b> | <b>SB 1</b> |                      |      |      |
| Volume Total                      | 40          | 76          | 136         |                      |      |      |
| Volume Left                       | 18          | 0           | 83          |                      |      |      |
| Volume Right                      | 0           | 29          | 52          |                      |      |      |
| cSH                               | 1536        | 1700        | 920         |                      |      |      |
| Volume to Capacity                | 0.01        | 0.04        | 0.15        |                      |      |      |
| Queue Length 95th (ft)            | 1           | 0           | 13          |                      |      |      |
| Control Delay (s)                 | 3.3         | 0.0         | 9.6         |                      |      |      |
| Lane LOS                          | A           |             | A           |                      |      |      |
| Approach Delay (s)                | 3.3         | 0.0         | 9.6         |                      |      |      |
| Approach LOS                      |             |             | A           |                      |      |      |
| <b>Intersection Summary</b>       |             |             |             |                      |      |      |
| Average Delay                     |             |             | 5.7         |                      |      |      |
| Intersection Capacity Utilization |             |             | 22.3%       | ICU Level of Service |      | A    |
| Analysis Period (min)             |             |             | 15          |                      |      |      |

HCM Unsignalized Intersection Capacity Analysis  
 17: Access Drive H & 156th Street

2/13/2012

|                                   | →    | ↘    | ↙     | ←                    | ↖    | ↗    |
|-----------------------------------|------|------|-------|----------------------|------|------|
| Movement                          | EBT  | EBR  | WBL   | WBT                  | NBL  | NBR  |
| Lane Configurations               | ↖    |      |       | ↖                    | ↘    |      |
| Volume (veh/h)                    | 42   | 6    | 14    | 77                   | 17   | 43   |
| Sign Control                      | Free |      |       | Free                 | Stop |      |
| Grade                             | 0%   |      |       | 0%                   | 0%   |      |
| Peak Hour Factor                  | 0.90 | 0.90 | 0.90  | 0.90                 | 0.90 | 0.90 |
| Hourly flow rate (vph)            | 47   | 7    | 16    | 86                   | 19   | 48   |
| Pedestrians                       |      |      |       |                      |      |      |
| Lane Width (ft)                   |      |      |       |                      |      |      |
| Walking Speed (ft/s)              |      |      |       |                      |      |      |
| Percent Blockage                  |      |      |       |                      |      |      |
| Right turn flare (veh)            |      |      |       |                      |      |      |
| Median type                       | None |      | None  |                      |      |      |
| Median storage veh                |      |      |       |                      |      |      |
| Upstream signal (ft)              |      |      |       |                      |      |      |
| pX, platoon unblocked             |      |      |       |                      |      |      |
| vC, conflicting volume            |      |      | 53    |                      | 167  | 50   |
| vC1, stage 1 conf vol             |      |      |       |                      |      |      |
| vC2, stage 2 conf vol             |      |      |       |                      |      |      |
| vCu, unblocked vol                |      |      | 53    |                      | 167  | 50   |
| tC, single (s)                    |      |      | 4.1   |                      | 6.4  | 6.2  |
| tC, 2 stage (s)                   |      |      |       |                      |      |      |
| tF (s)                            |      |      | 2.2   |                      | 3.5  | 3.3  |
| p0 queue free %                   |      |      | 99    |                      | 98   | 95   |
| cM capacity (veh/h)               |      |      | 1565  |                      | 820  | 1024 |
| Direction, Lane #                 | EB 1 | WB 1 | NB 1  |                      |      |      |
| Volume Total                      | 53   | 101  | 67    |                      |      |      |
| Volume Left                       | 0    | 16   | 19    |                      |      |      |
| Volume Right                      | 7    | 0    | 48    |                      |      |      |
| cSH                               | 1700 | 1565 | 957   |                      |      |      |
| Volume to Capacity                | 0.03 | 0.01 | 0.07  |                      |      |      |
| Queue Length 95th (ft)            | 0    | 1    | 6     |                      |      |      |
| Control Delay (s)                 | 0.0  | 1.2  | 9.0   |                      |      |      |
| Lane LOS                          |      | A    | A     |                      |      |      |
| Approach Delay (s)                | 0.0  | 1.2  | 9.0   |                      |      |      |
| Approach LOS                      |      | A    | A     |                      |      |      |
| Intersection Summary              |      |      |       |                      |      |      |
| Average Delay                     |      |      | 3.3   |                      |      |      |
| Intersection Capacity Utilization |      |      | 21.7% | ICU Level of Service |      | A    |
| Analysis Period (min)             |      |      | 15    |                      |      |      |





Run using ARCADY 8.0.0.249 at 2/17/2012 3:31:16 PM

**File summary****File Description**

|                    |              |
|--------------------|--------------|
| <b>Title</b>       | (untitled)   |
| <b>Location</b>    |              |
| <b>Site Number</b> |              |
| <b>Date</b>        | 2/17/2012    |
| <b>Version</b>     |              |
| <b>Status</b>      | (new file)   |
| <b>Identifier</b>  |              |
| <b>Client</b>      |              |
| <b>Jobnumber</b>   |              |
| <b>Analyst</b>     | ACE\ejohnson |
| <b>Description</b> |              |

**Analysis Options**

| Vehicle Length (ft) | V/C Ratio Threshold | Average Delay Threshold (s) | Queue Threshold (PCE) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type |
|---------------------|---------------------|-----------------------------|-----------------------|---------------------|-----------------------------|---------------------------------|
| 18.86               | 0.85                | 36.00                       | 20.00                 | ✓                   |                             | N/A                             |

**Units**

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|----------------|-------------|---------------------|-----------------------|------------|---------------------|-------------------|---------------------|
| ft             | mph         | Veh                 | Veh                   | perHour    | s                   | -Min              | perMin              |

**(Default Analysis Set) - Scenario 3, PM****Data Errors and Warnings**

| Severity | Area       | Item                                      | Description  |
|----------|------------|---|--|
| Warning  | Geometry   | 146th Street WB - Roundabout Geometry     | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | Geometry   | Ditch Towne Road SB - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | Geometry   | 146th Street EB - Roundabout Geometry     | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | Geometry   | Towne Road NB - Roundabout Geometry       | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | DemandSets | D4 - Scenario 3, PM                       | Time results are shown for central hour only. (Model is run for a 90 minute period.)                             |

**Analysis Set Details**

| Name                   | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|------------------------|---------------------------|-------------|-------------------|----------------------------|-------------------------|--------|---------------------------------|-------------------------------------|----------------------------|
| (Default Analysis Set) | ARCADY                    |             | ✓                 |                            |                         |        | 100.000                         | 85.000                              |                            |

**Demand Set Details**

|  |
|--|
|  |
|--|



| Name           | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|----------------|---------------|------------------|-------------|----------------------|--------------------------|---------------------------|--------------------------------|---------------------------|-------------------------------|--------------------------|--------|-------------------|------------------|--------------|
| Scenario 3, PM | Scenario 3    | PM               |             | ONE HOUR             | 08:00                    | 09:30                     | 90                             | 15                        | ✓                             |                          |        | ✓                 |                  |              |

## Intersection Network

### Intersections

| Name       | Intersection Type | Leg Order | Grade Separated | Large Roundabout | Do Geometric Delay | Intersection Delay (s) | Intersection LOS |
|------------|-------------------|-----------|-----------------|------------------|--------------------|------------------------|------------------|
| (untitled) | Roundabout        | 1,2,3,4   |                 |                  |                    | 2.62                   | A                |

### Intersection Network Options

| Driving Side | Lighting       | Road Surface            | Network Residual Capacity (%) | First Leg Reaching Threshold |
|--------------|----------------|-------------------------|-------------------------------|------------------------------|
| Right        | Normal/unknown | (Mini-roundabouts only) | N/A                           | N/A                          |

## Legs

### Legs

| Name                | Name                | Description |
|---------------------|---------------------|-------------|
| 146th Street WB     | 146th Street WB     |             |
| Ditch Towne Road SB | Ditch Towne Road SB |             |
| 146th Street EB     | 146th Street EB     |             |
| Towne Road NB       | Towne Road NB       |             |

### Capacity Options

| Name                | Minimum Capacity (PCE/hr) | Maximum Capacity (PCE/hr) | Assume Flat Start Profile | Initial Queue (PCE) |
|---------------------|---------------------------|---------------------------|---------------------------|---------------------|
| 146th Street WB     | 0.00                      | 99999.00                  |                           | 0.00                |
| Ditch Towne Road SB | 0.00                      | 99999.00                  |                           | 0.00                |
| 146th Street EB     | 0.00                      | 99999.00                  |                           | 0.00                |
| Towne Road NB       | 0.00                      | 99999.00                  |                           | 0.00                |

### Roundabout Geometry

| Name                | V - Approach road half-width (ft) | E - Entry width (ft) | I' - Effective flare length (ft) | R - Entry radius (ft) | D - Inscribed circle diameter (ft) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---------------------|-----------------------------------|----------------------|----------------------------------|-----------------------|------------------------------------|------------------------------------|-----------|
| 146th Street WB     | 26.00                             | 30.00                | 130.00                           | 92.00                 | 165.00                             | 25.00                              |           |
| Ditch Towne Road SB | 12.00                             | 28.00                | 130.00                           | 50.00                 | 161.00                             | 25.00                              |           |
| 146th Street EB     | 26.00                             | 30.00                | 130.00                           | 50.00                 | 165.00                             | 25.00                              |           |
| Towne Road NB       | 12.00                             | 28.00                | 130.00                           | 50.00                 | 161.00                             | 25.00                              |           |

### Pedestrian Crossings

| Name                | Crossing Type |
|---------------------|---------------|
| 146th Street WB     | None          |
| Ditch Towne Road SB | None          |
| 146th Street EB     | None          |
| Towne Road NB       | None          |

### Leg Slope/ Intercept and Capacity

### Slope and Intercept used in model

| Name                | Enter Directly | Slope        | Intercept (PCE/hr) | Final Slope | Final Intercept (PCE/hr) |
|---------------------|----------------|--------------|--------------------|-------------|--------------------------|
| 146th Street WB     |                | (calculated) | (calculated)       | 0.828       | 2823.404                 |
| Ditch Towne Road SB |                | (calculated) | (calculated)       | 0.703       | 2172.895                 |
| 146th Street EB     |                | (calculated) | (calculated)       | 0.805       | 2743.204                 |
| Towne Road NB       |                | (calculated) | (calculated)       | 0.703       | 2172.895                 |

The slope and intercept shown above include any corrections and adjustments.

## Traffic Flows

### Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCE Factor for a Truck (PCE) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---------------------|------------------------------|------------------------------|-------------------------------|--------------------|------------------------------|-----------------------------|---------------------------------|------------------------------------|------------------------------------|-------------------------------------|
|                     |                              | ✓                            | ✓                             | Truck Percentages  | 2.00                         |                             |                                 |                                    | ✓                                  | ✓                                   |

## Entry Flows

### General Flows Data

| Name                | Profile Type | Use Turning Counts | Average Demand Flow (Veh/hr) | Flow Scaling Factor (%) |
|---------------------|--------------|--------------------|------------------------------|-------------------------|
| 146th Street WB     | ONE HOUR     | ✓                  | 461.00                       | 100.000                 |
| Ditch Towne Road SB | ONE HOUR     | ✓                  | 122.00                       | 100.000                 |
| 146th Street EB     | ONE HOUR     | ✓                  | 526.00                       | 100.000                 |
| Towne Road NB       | ONE HOUR     | ✓                  | 423.00                       | 100.000                 |

## Turning Proportions

### Turning Counts or Proportions (Veh/hr) - (untitled) (for whole period)

|      |   | To      |         |         |         |
|------|---|---------|---------|---------|---------|
|      |   | 1       | 2       | 3       | 4       |
| From | 1 | 0.000   | 18.000  | 282.000 | 161.000 |
|      | 2 | 8.000   | 0.000   | 44.000  | 70.000  |
|      | 3 | 384.000 | 121.000 | 0.000   | 21.000  |
|      | 4 | 195.000 | 191.000 | 37.000  | 0.000   |

### Turning Proportions (Veh) - (untitled) (for whole period)

|      |   | To   |      |      |      |
|------|---|------|------|------|------|
|      |   | 1    | 2    | 3    | 4    |
| From | 1 | 0.00 | 0.04 | 0.61 | 0.35 |
|      | 2 | 0.07 | 0.00 | 0.36 | 0.57 |
|      | 3 | 0.73 | 0.23 | 0.00 | 0.04 |
|      | 4 | 0.46 | 0.45 | 0.09 | 0.00 |

## Vehicle Mix

### Average PCE Per Vehicle - (untitled) (for whole period)

|  |
|--|
|  |
|--|



|      |   | To    |       |       |       |
|------|---|-------|-------|-------|-------|
|      |   | 1     | 2     | 3     | 4     |
| From | 1 | 1.000 | 1.000 | 1.020 | 1.000 |
|      | 2 | 1.000 | 1.000 | 1.000 | 1.000 |
|      | 3 | 1.020 | 1.000 | 1.000 | 1.000 |
|      | 4 | 1.000 | 1.000 | 1.000 | 1.000 |

Truck Percentages - (untitled) (for whole period)

|      |   | To    |       |       |       |
|------|---|-------|-------|-------|-------|
|      |   | 1     | 2     | 3     | 4     |
| From | 1 | 0.000 | 0.000 | 2.000 | 0.000 |
|      | 2 | 0.000 | 0.000 | 0.000 | 0.000 |
|      | 3 | 2.000 | 0.000 | 0.000 | 0.000 |
|      | 4 | 0.000 | 0.000 | 0.000 | 0.000 |

|  |
|--|
| <b>ARCADY 8</b>  |
| Version: 8.0.0.249 [24 Oct 2011]<br>© Copyright Transport Research Laboratory 2012   |
| For sales and distribution information, program advice and maintenance, contact TRL:<br>Tel: +44 (0)1344 770758 E-mail: software@trl.co.uk Web: http://www.trlsoftware.co.uk |
| The users of this computer program for the solution of an engineering problem are in no way relieved of their responsibility for the correctness of the solution             |

File: P:\2011\01596\C. Calcs\_Data\Traffic Study\Analysis\ARCADY\146th & Ditch.arc8  
Report generation date: 2/17/2012 3:23:20 PM

- « (Default Analysis Set) - Scenario 3, PM
- » Intersection Network
- » Legs
- » Traffic Flows
- » Entry Flows
- » Turning Proportions
- » Vehicle Mix

### Summary of intersection performance

|                        | AM          |                 |           |           |     |                        | PM               |             |                 |           |           |     |                        |
|------------------------|-------------|-----------------|-----------|-----------|-----|------------------------|------------------|-------------|-----------------|-----------|-----------|-----|------------------------|
|                        | Queue (Veh) | 95% Queue (Veh) | Delay (s) | V/C Ratio | LOS | Intersection Delay (s) | Intersection LOS | Queue (Veh) | 95% Queue (Veh) | Delay (s) | V/C Ratio | LOS | Intersection Delay (s) |
| <b>A1 - Scenario 2</b> |             |                 |           |           |     |                        |                  |             |                 |           |           |     |                        |
| <b>146th Street WB</b> | 0.20        | ?               | 1.86      | 0.17      | A   | 2.53                   | A                | 0.28        | ?               | 2.18      | 0.22      | A   | 2.64                   |
| <b>Ditch Road SB</b>   | 0.45        | 1.00            | 3.22      | 0.31      | A   |                        |                  | 0.11        | ?               | 2.50      | 0.10      | A   |                        |
| <b>146th Street EB</b> | 0.12        | ?               | 2.13      | 0.11      | A   |                        |                  | 0.29        | ?               | 2.15      | 0.23      | A   |                        |
| <b>Ditch Road NB</b>   | 0.17        | ?               | 2.50      | 0.14      | A   |                        |                  | 0.52        | 1.00            | 3.55      | 0.34      | A   |                        |
| <b>A1 - Scenario 3</b> |             |                 |           |           |     |                        |                  |             |                 |           |           |     |                        |
| <b>146th Street WB</b> | 0.29        | ?               | 2.12      | 0.23      | A   | 3.64                   | A                | 0.49        | 1.00            | 2.91      | 0.33      | A   | 3.91                   |
| <b>Ditch Road SB</b>   | 1.22        | 1.00            | 5.07      | 0.55      | A   |                        |                  | 0.65        | 1.00            | 3.74      | 0.39      | A   |                        |
| <b>146th Street EB</b> | 0.24        | ?               | 2.66      | 0.19      | A   |                        |                  | 0.50        | 1.00            | 2.85      | 0.34      | A   |                        |
| <b>Ditch Road NB</b>   | 0.32        | ?               | 3.14      | 0.24      | A   |                        |                  | 1.15        | ?               | 5.86      | 0.54      | A   |                        |

Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.

"D1 - Scenario 2, AM" model duration: 8:00 AM - 9:30 AM  
 "D2 - Scenario 2, PM" model duration: 8:00 AM - 9:30 AM  
 "D3 - Scenario 3, AM" model duration: 8:00 AM - 9:30 AM  
 "D4 - Scenario 3, PM" model duration: 8:00 AM - 9:30 AM

Run using ARCADY 8.0.0.249 at 2/17/2012 3:23:12 PM

## File summary

### File Description

|             |              |
|-------------|--------------|
| Title       | (untitled)   |
| Location    |              |
| Site Number |              |
| Date        | 2/17/2012    |
| Version     |              |
| Status      | (new file)   |
| Identifier  |              |
| Client      |              |
| Jobnumber   |              |
| Analyst     | ACE\ajohnson |
| Description |              |

## Analysis Options

| Vehicle Length (ft) | V/C Ratio Threshold | Average Delay Threshold (s) | Queue Threshold (PCE) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type |
|---------------------|---------------------|-----------------------------|-----------------------|---------------------|-----------------------------|---------------------------------|
| 18.86               | 0.85                | 36.00                       | 20.00                 | ✓                   |                             | N/A                             |

## Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|----------------|-------------|---------------------|-----------------------|------------|---------------------|-------------------|---------------------|
| ft             | mph         | Veh                 | Veh                   | perHour    | s                   | -Min              | perMin              |

# (Default Analysis Set) - Scenario 3, PM

## Data Errors and Warnings

| Severity | Area       | Item                                  | Description  |
|----------|------------|---------------------------------------|--|
| Warning  | Geometry   | 146th Street WB - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | Geometry   | Ditch Road SB - Roundabout Geometry   | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | Geometry   | 146th Street EB - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | Geometry   | Ditch Road NB - Roundabout Geometry   | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | DemandSets | D4 - Scenario 3, PM                   | Time results are shown for central hour only. (Model is run for a 90 minute period.)                             |

## Analysis Set Details

| Name                   | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|------------------------|---------------------------|-------------|-------------------|----------------------------|-------------------------|--------|---------------------------------|-------------------------------------|----------------------------|
| (Default Analysis Set) | ARCADY                    |             | ✓                 |                            |                         |        | 100.000                         | 85.000                              |                            |

## Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|------|---------------|------------------|-------------|----------------------|--------------------------|---------------------------|--------------------------------|---------------------------|-------------------------------|--------------------------|--------|-------------------|------------------|--------------|
|------|---------------|------------------|-------------|----------------------|--------------------------|---------------------------|--------------------------------|---------------------------|-------------------------------|--------------------------|--------|-------------------|------------------|--------------|

|                |            |    |          |       |       |    |    |   |  |  |   |  |  |
|----------------|------------|----|----------|-------|-------|----|----|---|--|--|---|--|--|
| Scenario 3, PM | Scenario 3 | FM | ONE HOUR | 08:00 | 09:30 | 90 | 15 | ✓ |  |  | ✓ |  |  |
|----------------|------------|----|----------|-------|-------|----|----|---|--|--|---|--|--|

## Intersection Network

### Intersections

| Name       | Intersection Type | Leg Order | Grade Separated | Large Roundabout | Do Geometric Delay | Intersection Delay (s) | Intersection LOS |
|------------|-------------------|-----------|-----------------|------------------|--------------------|------------------------|------------------|
| (untitled) | Roundabout        | 1,2,3,4   |                 |                  |                    | 3.91                   | A                |

### Intersection Network Options

| Driving Side | Lighting       | Road Surface            | Network Residual Capacity (%) | First Leg Reaching Threshold |
|--------------|----------------|-------------------------|-------------------------------|------------------------------|
| Right        | Normal/unknown | (Mini-roundabouts only) | N/A                           | N/A                          |

## Legs

### Legs

| Name            | Name            | Description |
|-----------------|-----------------|-------------|
| 146th Street WB | 146th Street WB |             |
| Ditch Road SB   | Ditch Road SB   |             |
| 146th Street EB | 146th Street EB |             |
| Ditch Road NB   | Ditch Road NB   |             |

### Capacity Options

| Name            | Minimum Capacity (PCE/hr) | Maximum Capacity (PCE/hr) | Assume Flat Start Profile | Initial Queue (PCE) |
|-----------------|---------------------------|---------------------------|---------------------------|---------------------|
| 146th Street WB | 0.00                      | 99999.00                  |                           | 0.00                |
| Ditch Road SB   | 0.00                      | 99999.00                  |                           | 0.00                |
| 146th Street EB | 0.00                      | 99999.00                  |                           | 0.00                |
| Ditch Road NB   | 0.00                      | 99999.00                  |                           | 0.00                |

### Roundabout Geometry

| Name            | V - Approach road half-width (ft) | E - Entry width (ft) | I' - Effective flare length (ft) | R - Entry radius (ft) | D - Inscribed circle diameter (ft) | PHI - Conflict (entry) angle (deg) | Exit Only |
|-----------------|-----------------------------------|----------------------|----------------------------------|-----------------------|------------------------------------|------------------------------------|-----------|
| 146th Street WB | 26.00                             | 30.00                | 130.00                           | 92.00                 | 165.00                             | 25.00                              |           |
| Ditch Road SB   | 12.00                             | 28.00                | 130.00                           | 50.00                 | 161.00                             | 25.00                              |           |
| 146th Street EB | 26.00                             | 30.00                | 130.00                           | 50.00                 | 165.00                             | 25.00                              |           |
| Ditch Road NB   | 12.00                             | 28.00                | 130.00                           | 50.00                 | 161.00                             | 25.00                              |           |

### Pedestrian Crossings

| Name            | Crossing Type |
|-----------------|---------------|
| 146th Street WB | None          |
| Ditch Road SB   | None          |
| 146th Street EB | None          |
| Ditch Road NB   | None          |

### Leg Slope/ Intercept and Capacity

Slope and Intercept used in model

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|--|--|--|--|--|--|--|--|--|--|--|--|--|--|

| Name            | Enter Directly | Slope        | Intercept (PCE/hr) | Final Slope | Final Intercept (PCE/hr) |
|-----------------|----------------|--------------|--------------------|-------------|--------------------------|
| 146th Street WB |                | (calculated) | (calculated)       | 0.828       | 2823.404                 |
| Ditch Road SB   |                | (calculated) | (calculated)       | 0.703       | 2172.895                 |
| 146th Street EB |                | (calculated) | (calculated)       | 0.805       | 2743.204                 |
| Ditch Road NB   |                | (calculated) | (calculated)       | 0.703       | 2172.895                 |

The slope and intercept shown above include any corrections and adjustments.

## Traffic Flows

### Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCE Factor for a Truck (PCE) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---------------------|------------------------------|------------------------------|-------------------------------|--------------------|------------------------------|-----------------------------|---------------------------------|------------------------------------|------------------------------------|-------------------------------------|
|                     |                              | ✓                            | ✓                             | Truck Percentages  | 2.00                         |                             |                                 |                                    | ✓                                  | ✓                                   |

## Entry Flows

### General Flows Data

| Name            | Profile Type | Use Turning Counts | Average Demand Flow (Veh/hr) | Flow Scaling Factor (%) |
|-----------------|--------------|--------------------|------------------------------|-------------------------|
| 146th Street WB | ONE HOUR     | ✓                  | 550.00                       | 100.000                 |
| Ditch Road SB   | ONE HOUR     | ✓                  | 566.00                       | 100.000                 |
| 146th Street EB | ONE HOUR     | ✓                  | 573.00                       | 100.000                 |
| Ditch Road NB   | ONE HOUR     | ✓                  | 648.00                       | 100.000                 |

## Turning Proportions

### Turning Counts or Proportions (Veh/hr) - (untitled) (for whole period)

|      |   | To      |         |         |         |
|------|---|---------|---------|---------|---------|
|      |   | 1       | 2       | 3       | 4       |
| From | 1 | 0.000   | 224.000 | 228.000 | 98.000  |
|      | 2 | 234.000 | 0.000   | 92.000  | 240.000 |
|      | 3 | 341.000 | 207.000 | 0.000   | 25.000  |
|      | 4 | 142.000 | 440.000 | 66.000  | 0.000   |

### Turning Proportions (Veh) - (untitled) (for whole period)

|      |   | To   |      |      |      |
|------|---|------|------|------|------|
|      |   | 1    | 2    | 3    | 4    |
| From | 1 | 0.00 | 0.41 | 0.41 | 0.18 |
|      | 2 | 0.41 | 0.00 | 0.16 | 0.42 |
|      | 3 | 0.60 | 0.36 | 0.00 | 0.04 |
|      | 4 | 0.22 | 0.68 | 0.10 | 0.00 |

## Vehicle Mix

### Average PCE Per Vehicle - (untitled) (for whole period)

|  |  | To |
|--|--|----|
|  |  |    |



|      |   | 1     | 2     | 3     | 4     |
|------|---|-------|-------|-------|-------|
| From | 1 | 1.000 | 1.000 | 1.020 | 1.000 |
|      | 2 | 1.000 | 1.000 | 1.000 | 1.000 |
|      | 3 | 1.020 | 1.000 | 1.000 | 1.000 |
|      | 4 | 1.000 | 1.000 | 1.000 | 1.000 |

Truck Percentages - (untitled) (for whole period)

|      |   | To    |       |       |       |
|------|---|-------|-------|-------|-------|
|      |   | 1     | 2     | 3     | 4     |
| From | 1 | 0.000 | 0.000 | 2.000 | 0.000 |
|      | 2 | 0.000 | 0.000 | 0.000 | 0.000 |
|      | 3 | 2.000 | 0.000 | 0.000 | 0.000 |
|      | 4 | 0.000 | 0.000 | 0.000 | 0.000 |

# HCM Unsignalized Intersection Capacity Analysis

## 10: Towne Road & 156th Street

2/13/2012

|                                   |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|
| Movement                          | WBL   | WBR   | NBT   | NBR   | SBL   | SBT   |
| Lane Configurations               |  |   |  |   |   |  |
| Volume (veh/h)                    | 19  | 53  | 147   | 74  | 50  | 83  |
| Sign Control                      | Stop  |   | Free  |   |   | Free  |
| Grade                             | 0%  |   | 0%  |   |   | 0%  |
| Peak Hour Factor                  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  |
| Hourly flow rate (vph)            | 21  | 59  | 163   | 82  | 56  | 92  |
| Pedestrians                       |   |   |   |   |   |   |
| Lane Width (ft)                   |   |   |   |   |   |   |
| Walking Speed (ft/s)              |   |   |   |   |   |   |
| Percent Blockage                  |   |   |   |   |   |   |
| Right turn flare (veh)            |   |   |   |   |   |   |
| Median type                       |   |   | None  |   |   | None  |
| Median storage veh                |   |   |   |   |   |   |
| Upstream signal (ft)              |   |   |   |   |   |   |
| pX, platoon unblocked             |   |   |   |   |   |   |
| vC, conflicting volume            | 408   | 204   |   |   | 246   |   |
| vC1, stage 1 conf vol             |   |   |   |   |   |   |
| vC2, stage 2 conf vol             |   |   |   |   |   |   |
| vCu, unblocked vol                | 408   | 204   |   |   | 246   |   |
| tC, single (s)                    | 6.4   | 6.2   |   |   | 4.1   |   |
| tC, 2 stage (s)                   |   |   |   |   |   |   |
| tF (s)                            | 3.5   | 3.3   |   |   | 2.2   |   |
| p0 queue free %                   | 96  | 93  |   |   | 96  |   |
| cM capacity (veh/h)               | 578   | 841   |   |   | 1332  |   |
| <b>Direction, Lane #</b>          | <b>WB 1</b>   | <b>NB 1</b>   | <b>SB 1</b>   |   |   |   |
| Volume Total                      | 80  | 246   | 148   |   |   |   |
| Volume Left                       | 21  | 0   | 56  |   |   |   |
| Volume Right                      | 59  | 82  | 0   |   |   |   |
| cSH                               | 751   | 1700  | 1332  |   |   |   |
| Volume to Capacity                | 0.11  | 0.14  | 0.04  |   |   |   |
| Queue Length 95th (ft)            | 9   | 0   | 3   |   |   |   |
| Control Delay (s)                 | 10.4  | 0.0   | 3.2   |   |   |   |
| Lane LOS                          | B   |   | A   |   |   |   |
| Approach Delay (s)                | 10.4  | 0.0   | 3.2   |   |   |   |
| Approach LOS                      | B   |   |   |   |   |   |
| <b>Intersection Summary</b>       |   |   |   |   |   |   |
| Average Delay                     |   |   | 2.7   |   |   |   |
| Intersection Capacity Utilization |   |   | 33.7%   |   | ICU Level of Service  | A   |
| Analysis Period (min)             |   |   | 15  |   |   |   |

|  |
|--|
| <b>ARCADY 8</b>  |
| Version: 8.0.0.249 [24 Oct 2011]<br>© Copyright Transport Research Laboratory 2012   |
| For sales and distribution information, program advice and maintenance, contact TRL:<br>Tel: +44 (0)1344 770758 E-mail: software@trl.co.uk Web: http://www.trlsoftware.co.uk |
| The users of this computer program for the solution of an engineering problem are in no way relieved of their responsibility for the correctness of the solution             |

File: P:\2011\01596\C. Calcs\_Data\Traffic Study\Analysis\ARCADY\156th & Towne.arc8  
Report generation date: 2/17/2012 3:14:33 PM

- « (Default Analysis Set) - Scenario 3, PM
- » Intersection Network
- » Legs
- » Traffic Flows
- » Entry Flows
- » Turning Proportions
- » Vehicle Mix

### Summary of intersection performance

|                           | AM          |                 |           |           |     |                        | PM               |             |                 |           |           |     |                        |
|---------------------------|-------------|-----------------|-----------|-----------|-----|------------------------|------------------|-------------|-----------------|-----------|-----------|-----|------------------------|
|                           | Queue (Veh) | 95% Queue (Veh) | Delay (s) | V/C Ratio | LOS | Intersection Delay (s) | Intersection LOS | Queue (Veh) | 95% Queue (Veh) | Delay (s) | V/C Ratio | LOS | Intersection Delay (s) |
| <b>A1 - Scenario 3</b>    |             |                 |           |           |     |                        |                  |             |                 |           |           |     |                        |
| <b>156th Street WB</b>    | 0.10        | ?               | 3.65      | 0.10      | A   | 4.10                   | A                | 0.08        | ?               | 3.71      | 0.08      | A   | 4.09                   |
| <b>Ditch Lane Road SB</b> | 0.31        | ?               | 4.45      | 0.24      | A   |                        |                  | 0.16        | ?               | 3.84      | 0.14      | A   |                        |
| <b>Ditch Lane Road NB</b> | 0.10        | ?               | 3.66      | 0.09      | A   |                        |                  | 0.29        | ?               | 4.36      | 0.23      | A   |                        |

Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.

"D1 - Scenario 3, AM" model duration: 8:00 AM - 9:30 AM  
"D2 - Scenario 3, PM " model duration: 8:00 AM - 9:30 AM

Run using ARCADY 8.0.0.249 at 2/17/2012 3:14:31 PM

### File summary

#### File Description

|                    |              |
|--------------------|--------------|
| <b>Title</b>       | (untitled)   |
| <b>Location</b>    |              |
| <b>Site Number</b> |              |
| <b>Date</b>        | 2/17/2012    |
| <b>Version</b>     |              |
| <b>Status</b>      | (new file)   |
| <b>Identifier</b>  |              |
| <b>Client</b>      |              |
| <b>Jobnumber</b>   |              |
| <b>Analyst</b>     | ACE\ajohnson |





|          |   |        |         |
|----------|---|--------|---------|
| ONE HOUR | ✓ | 72.00  | 100.000 |
| ONE HOUR | ✓ | 133.00 | 100.000 |
| ONE HOUR | ✓ | 221.00 | 100.000 |

### Transfer or

Transfer or

|      |   | To     |         |        |
|------|---|--------|---------|--------|
|      |   | 1      | 2       | 4      |
| From | 1 | 0.000  | 53.000  | 19.000 |
|      | 2 | 50.000 | 0.000   | 83.000 |
|      | 4 | 74.000 | 147.000 | 0.000  |

Transfer or

|      |   | To   |      |      |
|------|---|------|------|------|
|      |   | 1    | 2    | 4    |
| From | 1 | 0.00 | 0.74 | 0.26 |
|      | 2 | 0.38 | 0.00 | 0.62 |
|      | 4 | 0.33 | 0.67 | 0.00 |

Transfer or

Transfer or

|      |   | To    |       |       |
|------|---|-------|-------|-------|
|      |   | 1     | 2     | 4     |
| From | 1 | 1.000 | 1.000 | 1.000 |
|      | 2 | 1.000 | 1.000 | 1.000 |
|      | 4 | 1.000 | 1.000 | 1.000 |

Transfer or

|      |   | To    |       |       |
|------|---|-------|-------|-------|
|      |   | 1     | 2     | 4     |
| From | 1 | 0.000 | 0.000 | 0.000 |
|      | 2 | 0.000 | 0.000 | 0.000 |
|      | 4 | 0.000 | 0.000 | 0.000 |

HCM Unsignalized Intersection Capacity Analysis  
 9: Ditch Road & 156th Street

2/13/2012

|                                   |  |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|--|---|---|---|---|---|--|
| Movement                          | EBL   | EBT   | EBR   | WBL   | WBT   | WBR   | NBL  | NBT   | NBR   | SBL   | SBT   | SBR   |  |
| Lane Configurations               |   |  |   |   |  |   |  |  |   |   |  |   |  |
| Sign Control                      |   | Stop  |   |   | Stop  |   |  | Stop  |   |   | Stop  |   |  |
| Volume (vph)                      | 16  | 61  | 42  | 71  | 24  | 17  | 58   | 153   | 94  | 22  | 145   | 21  |  |
| Peak Hour Factor                  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90   | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  |  |
| Hourly flow rate (vph)            | 18  | 68  | 47  | 79  | 27  | 19  | 64   | 170   | 104   | 24  | 161   | 23  |  |
| Direction, Lane #                 | EB 1  | WB 1  | NB 1  | SB 1  |   |   |  |   |   |   |   |   |  |
| Volume Total (vph)                | 132   | 124   | 339   | 209   |   |   |  |   |   |   |   |   |  |
| Volume Left (vph)                 | 18  | 79  | 64  | 24  |   |   |  |   |   |   |   |   |  |
| Volume Right (vph)                | 47  | 19  | 104   | 23  |   |   |  |   |   |   |   |   |  |
| Hadj (s)                          | -0.18   | 0.04  | -0.11   | -0.04   |   |   |  |   |   |   |   |   |  |
| Departure Headway (s)             | 5.3   | 5.5   | 4.8   | 5.0   |   |   |  |   |   |   |   |   |  |
| Degree Utilization, x             | 0.19  | 0.19  | 0.45  | 0.29  |   |   |  |   |   |   |   |   |  |
| Capacity (veh/h)                  | 605   | 581   | 716   | 666   |   |   |  |   |   |   |   |   |  |
| Control Delay (s)                 | 9.6   | 9.8   | 11.7  | 10.1  |   |   |  |   |   |   |   |   |  |
| Approach Delay (s)                | 9.6   | 9.8   | 11.7  | 10.1  |   |   |  |   |   |   |   |   |  |
| Approach LOS                      | A   | A   | B   | B   |   |   |  |   |   |   |   |   |  |
| Intersection Summary              |   |   |   |   |   |   |  |   |   |   |   |   |  |
| Delay                             |   |   | 10.7  |   |   |   |  |   |   |   |   |   |  |
| HCM Level of Service              |   |   | B   |   |   |   |  |   |   |   |   |   |  |
| Intersection Capacity Utilization |   |   | 46.5%   | ICU Level of Service  | A   |   |  |   |   |   |   |   |  |
| Analysis Period (min)             |   |   | 15  |   |   |   |  |   |   |   |   |   |  |





|             |              |
|-------------|--------------|
| Jobnumber   |              |
| Analyst     | ACE\ajohnson |
| Description |              |

### Analysis Options

| Vehicle Length (ft) | V/C Ratio Threshold | Average Delay Threshold (s) | Queue Threshold (PCE) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type |
|---------------------|---------------------|-----------------------------|-----------------------|---------------------|-----------------------------|---------------------------------|
| 18.86               | 0.85                | 36.00                       | 20.00                 | ✓                   |                             | N/A                             |

### Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|----------------|-------------|---------------------|-----------------------|------------|---------------------|-------------------|---------------------|
| ft             | mph         | Veh                 | Veh                   | perHour    | s                   | -Min              | perMin              |

## (Default Analysis Set) - Scenario 3, PM

### Data Errors and Warnings

| Severity | Area       | Item                                  | Description  |
|----------|------------|---------------------------------------|--|
| Warning  | Geometry   | 156th Street WB - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | Geometry   | Ditch Road SB - Roundabout Geometry   | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | Geometry   | 156th Street EB - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | Geometry   | Ditch Road NB - Roundabout Geometry   | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | DemandSets | D2 - Scenario 3, PM                   | Time results are shown for central hour only. (Model is run for a 90 minute period.)                             |

### Analysis Set Details

| Name                   | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|------------------------|---------------------------|-------------|-------------------|----------------------------|-------------------------|--------|---------------------------------|-------------------------------------|----------------------------|
| (Default Analysis Set) | ARCADY                    |             | ✓                 |                            |                         |        | 100.000                         | 85.000                              |                            |

### Demand Set Details

| Name           | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|----------------|---------------|------------------|-------------|----------------------|--------------------------|---------------------------|--------------------------------|---------------------------|-------------------------------|--------------------------|--------|-------------------|------------------|--------------|
| Scenario 3, PM | Scenario 3    | PM               |             | ONE HOUR             | 08:00                    | 09:30                     | 90                             | 15                        | ✓                             |                          |        | ✓                 |                  |              |

## Intersection Network

### Intersections

| Name       | Intersection Type | Leg Order | Grade Separated | Large Roundabout | Do Geometric Delay | Intersection Delay (s) | Intersection LOS |
|------------|-------------------|-----------|-----------------|------------------|--------------------|------------------------|------------------|
| (untitled) | Roundabout        | 1,2,3,4   |                 |                  |                    | 4.64                   | A                |

### Intersection Network Options

|              |          |              |                               |                              |
|--------------|----------|--------------|-------------------------------|------------------------------|
| Driving Side | Lighting | Road Surface | Network Residual Capacity (%) | First Leg Reaching Threshold |
|--------------|----------|--------------|-------------------------------|------------------------------|



| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCE Factor for a Truck (PCE) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---------------------|------------------------------|------------------------------|-------------------------------|--------------------|------------------------------|-----------------------------|---------------------------------|------------------------------------|------------------------------------|-------------------------------------|
|                     |                              | ✓                            | ✓                             | Truck Percentages  | 2.00                         |                             |                                 |                                    | ✓                                  | ✓                                   |

## Entry Flows

### General Flows Data

| Name            | Profile Type | Use Turning Counts | Average Demand Flow (Veh/hr) | Flow Scaling Factor (%) |
|-----------------|--------------|--------------------|------------------------------|-------------------------|
| 156th Street WB | ONE HOUR     | ✓                  | 112.00                       | 100.000                 |
| Ditch Road SB   | ONE HOUR     | ✓                  | 188.00                       | 100.000                 |
| 156th Street EB | ONE HOUR     | ✓                  | 119.00                       | 100.000                 |
| Ditch Road NB   | ONE HOUR     | ✓                  | 305.00                       | 100.000                 |

## Turning Proportions

### Turning Counts or Proportions (Veh/hr) - (untitled) (for whole period)

|      |   | To     |         |        |         |
|------|---|--------|---------|--------|---------|
|      |   | 1      | 2       | 3      | 4       |
| From | 1 | 0.000  | 17.000  | 24.000 | 71.000  |
|      | 2 | 22.000 | 0.000   | 21.000 | 145.000 |
|      | 3 | 61.000 | 16.000  | 0.000  | 42.000  |
|      | 4 | 94.000 | 153.000 | 58.000 | 0.000   |

### Turning Proportions (Veh) - (untitled) (for whole period)

|      |   | To   |      |      |      |
|------|---|------|------|------|------|
|      |   | 1    | 2    | 3    | 4    |
| From | 1 | 0.00 | 0.15 | 0.21 | 0.63 |
|      | 2 | 0.12 | 0.00 | 0.11 | 0.77 |
|      | 3 | 0.51 | 0.13 | 0.00 | 0.35 |
|      | 4 | 0.31 | 0.50 | 0.19 | 0.00 |

## Vehicle Mix

### Average PCE Per Vehicle - (untitled) (for whole period)

|      |   | To    |       |       |       |
|------|---|-------|-------|-------|-------|
|      |   | 1     | 2     | 3     | 4     |
| From | 1 | 1.000 | 1.000 | 1.020 | 1.000 |
|      | 2 | 1.000 | 1.000 | 1.000 | 1.000 |
|      | 3 | 1.020 | 1.000 | 1.000 | 1.000 |
|      | 4 | 1.000 | 1.000 | 1.000 | 1.000 |

### Truck Percentages - (untitled) (for whole period)

|      |   | To    |       |       |       |
|------|---|-------|-------|-------|-------|
|      |   | 1     | 2     | 3     | 4     |
| From | 1 | 0.000 | 0.000 | 2.000 | 0.000 |
|      | 2 | 0.000 | 0.000 | 0.000 | 0.000 |
|      | 3 | 2.000 | 0.000 | 0.000 | 0.000 |



|  |   |       |       |       |       |
|--|---|-------|-------|-------|-------|
|  | 4 | 0.000 | 0.000 | 0.000 | 0.000 |
|--|---|-------|-------|-------|-------|

# HCM Unsignalized Intersection Capacity Analysis

## 12: Towne Road & 151st Street

2/13/2012

|                                   |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|--|---|---|---|---|---|
| Movement                          | EBL   | EBT   | EBR   | WBL   | WBT   | WBR   | NBL  | NBT   | NBR   | SBL   | SBT   | SBR   |
| Lane Configurations               |   |  |   |   |  |   |  |  |   |   |  |   |
| Volume (veh/h)                    | 2   | 1   | 2   | 41  | 1   | 14  | 0  | 204   | 73  | 24  | 64  | 0   |
| Sign Control                      |   | Stop  |   |   | Stop  |   |  | Free  |   |   | Free  |   |
| Grade                             |   | 0%  |   |   | 0%  |   |  | 0%  |   |   | 0%  |   |
| Peak Hour Factor                  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90   | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  |
| Hourly flow rate (vph)            | 2   | 1   | 2   | 46  | 1   | 16  | 0  | 227   | 81  | 27  | 71  | 0   |
| Pedestrians                       |   |   |   |   |   |   |  |   |   |   |   |   |
| Lane Width (ft)                   |   |   |   |   |   |   |  |   |   |   |   |   |
| Walking Speed (ft/s)              |   |   |   |   |   |   |  |   |   |   |   |   |
| Percent Blockage                  |   |   |   |   |   |   |  |   |   |   |   |   |
| Right turn flare (veh)            |   |   |   |   |   |   |  |   |   |   |   |   |
| Median type                       |   |   |   |   |   |   |  | None  |   |   | None  |   |
| Median storage veh                |   |   |   |   |   |   |  |   |   |   |   |   |
| Upstream signal (ft)              |   |   |   |   |   |   |  |   |   |   |   |   |
| pX, platoon unblocked             |   |   |   |   |   |   |  |   |   |   |   |   |
| vC, conflicting volume            | 408   | 432   | 71  | 394   | 392   | 267   | 71   |   |   | 308   |   |   |
| vC1, stage 1 conf vol             |   |   |   |   |   |   |  |   |   |   |   |   |
| vC2, stage 2 conf vol             |   |   |   |   |   |   |  |   |   |   |   |   |
| vCu, unblocked vol                | 408   | 432   | 71  | 394   | 392   | 267   | 71   |   |   | 308   |   |   |
| tC, single (s)                    | 7.1   | 6.5   | 6.2   | 7.1   | 6.5   | 6.2   | 4.1  |   |   | 4.1   |   |   |
| tC, 2 stage (s)                   |   |   |   |   |   |   |  |   |   |   |   |   |
| tF (s)                            | 3.5   | 4.0   | 3.3   | 3.5   | 4.0   | 3.3   | 2.2  |   |   | 2.2   |   |   |
| p0 queue free %                   | 100   | 100   | 100   | 92  | 100   | 98  | 100  |   |   | 98  |   |   |
| cM capacity (veh/h)               | 533   | 505   | 991   | 554   | 533   | 771   | 1529   |   |   | 1253  |   |   |
| <b>Direction, Lane #</b>          | <b>EB 1</b>   | <b>WB 1</b>   | <b>NB 1</b>   | <b>SB 1</b>   |   |   |  |   |   |   |   |   |
| Volume Total                      | 6   | 62  | 308   | 98  |   |   |  |   |   |   |   |   |
| Volume Left                       | 2   | 46  | 0   | 27  |   |   |  |   |   |   |   |   |
| Volume Right                      | 2   | 16  | 81  | 0   |   |   |  |   |   |   |   |   |
| cSH                               | 645   | 595   | 1529  | 1253  |   |   |  |   |   |   |   |   |
| Volume to Capacity                | 0.01  | 0.10  | 0.00  | 0.02  |   |   |  |   |   |   |   |   |
| Queue Length 95th (ft)            | 1   | 9   | 0   | 2   |   |   |  |   |   |   |   |   |
| Control Delay (s)                 | 10.6  | 11.8  | 0.0   | 2.3   |   |   |  |   |   |   |   |   |
| Lane LOS                          | B   | B   |   | A   |   |   |  |   |   |   |   |   |
| Approach Delay (s)                | 10.6  | 11.8  | 0.0   | 2.3   |   |   |  |   |   |   |   |   |
| Approach LOS                      | B   | B   |   |   |   |   |  |   |   |   |   |   |
| <b>Intersection Summary</b>       |   |   |   |   |   |   |  |   |   |   |   |   |
| Average Delay                     |   |   | 2.1   |   |   |   |  |   |   |   |   |   |
| Intersection Capacity Utilization |   |   | 35.4%   |   | ICU Level of Service  |   |  |   | A   |   |   |   |
| Analysis Period (min)             |   |   | 15  |   |   |   |  |   |   |   |   |   |

# HCM Unsignalized Intersection Capacity Analysis

## 13: Ditch Road & 151st Street

2/13/2012

|                                   |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement                          | EBL   | EBT   | EBR   | WBL   | WBT   | WBR   | NBL   | NBT   | NBR   | SBL   | SBT   | SBR   |
| Lane Configurations               |   |  |  |   |  |   |   |  |  |   |  |  |
| Volume (veh/h)                    | 15  | 0   | 104   | 8   | 0   | 6   | 155   | 387   | 79  | 16  | 213   | 22  |
| Sign Control                      |   | Stop  |   |   | Stop  |   |   | Free  |   |   | Free  |   |
| Grade                             |   | 0%  |   |   | 0%  |   |   | 0%  |   |   | 0%  |   |
| Peak Hour Factor                  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  |
| Hourly flow rate (vph)            | 17  | 0   | 116   | 9   | 0   | 7   | 172   | 430   | 88  | 18  | 237   | 24  |
| Pedestrians                       |   |   |   |   |   |   |   |   |   |   |   |   |
| Lane Width (ft)                   |   |   |   |   |   |   |   |   |   |   |   |   |
| Walking Speed (ft/s)              |   |   |   |   |   |   |   |   |   |   |   |   |
| Percent Blockage                  |   |   |   |   |   |   |   |   |   |   |   |   |
| Right turn flare (veh)            |   |   |   |   |   |   |   |   |   |   |   |   |
| Median type                       |   |   |   |   |   |   |   | None  |   |   | None  |   |
| Median storage veh                |   |   |   |   |   |   |   |   |   |   |   |   |
| Upstream signal (ft)              |   |   |   |   |   |   |   |   |   |   |   |   |
| pX, platoon unblocked             |   |   |   |   |   |   |   |   |   |   |   |   |
| vC, conflicting volume            | 1066  | 1147  | 249   | 1174  | 1071  | 430   | 261   |   |   | 518   |   |   |
| vC1, stage 1 conf vol             |   |   |   |   |   |   |   |   |   |   |   |   |
| vC2, stage 2 conf vol             |   |   |   |   |   |   |   |   |   |   |   |   |
| vCu, unblocked vol                | 1066  | 1147  | 249   | 1174  | 1071  | 430   | 261   |   |   | 518   |   |   |
| tC, single (s)                    | 7.1   | 6.5   | 6.2   | 7.1   | 6.5   | 6.2   | 4.1   |   |   | 4.1   |   |   |
| tC, 2 stage (s)                   |   |   |   |   |   |   |   |   |   |   |   |   |
| tF (s)                            | 3.5   | 4.0   | 3.3   | 3.5   | 4.0   | 3.3   | 2.2   |   |   | 2.2   |   |   |
| p0 queue free %                   | 91  | 100   | 85  | 93  | 100   | 99  | 87  |   |   | 98  |   |   |
| cM capacity (veh/h)               | 178   | 172   | 795   | 129   | 190   | 629   | 1315  |   |   | 1058  |   |   |
| <b>Direction, Lane #</b>          | <b>EB 1</b>   | <b>EB 2</b>   | <b>WB 1</b>   | <b>NB 1</b>   | <b>NB 2</b>   | <b>SB 1</b>   |   |   |   |   |   |   |
| Volume Total                      | 17  | 116   | 16  | 602   | 88  | 279   |   |   |   |   |   |   |
| Volume Left                       | 17  | 0   | 9   | 172   | 0   | 18  |   |   |   |   |   |   |
| Volume Right                      | 0   | 116   | 7   | 0   | 88  | 24  |   |   |   |   |   |   |
| cSH                               | 178   | 795   | 196   | 1315  | 1700  | 1058  |   |   |   |   |   |   |
| Volume to Capacity                | 0.09  | 0.15  | 0.08  | 0.13  | 0.05  | 0.02  |   |   |   |   |   |   |
| Queue Length 95th (ft)            | 8   | 13  | 6   | 11  | 0   | 1   |   |   |   |   |   |   |
| Control Delay (s)                 | 27.4  | 10.3  | 25.0  | 3.4   | 0.0   | 0.7   |   |   |   |   |   |   |
| Lane LOS                          | D   | B   | C   | A   |   | A   |   |   |   |   |   |   |
| Approach Delay (s)                | 12.5  |   | 25.0  | 2.9   |   | 0.7   |   |   |   |   |   |   |
| Approach LOS                      | B   |   | C   |   |   |   |   |   |   |   |   |   |
| <b>Intersection Summary</b>       |   |   |   |   |   |   |   |   |   |   |   |   |
| Average Delay                     |   |   | 3.8   |   |   |   |   |   |   |   |   |   |
| Intersection Capacity Utilization |   |   | 59.8%   |   | ICU Level of Service  |   |   |   |   | B   |   |   |
| Analysis Period (min)             |   |   | 15  |   |   |   |   |   |   |   |   |   |

|  |
|--|
| <b>ARCADY 8</b>  |
| Version: 8.0.0.249 [24 Oct 2011]<br>© Copyright Transport Research Laboratory 2012   |
| For sales and distribution information, program advice and maintenance, contact TRL:<br>Tel: +44 (0)1344 770758 E-mail: software@trl.co.uk Web: http://www.trlsoftware.co.uk |
| The users of this computer program for the solution of an engineering problem are in no way relieved of their responsibility for the correctness of the solution             |

File: P:\2011\01596\C. Calcs\_Data\Traffic Study\Analysis\ARCADY\151st & Ditch.arc8  
Report generation date: 2/17/2012 3:12:27 PM

- « (Default Analysis Set) - Scenario 3, PM
- » Intersection Network
- » Legs
- » Traffic Flows
- » Entry Flows
- » Turning Proportions
- » Vehicle Mix

### Summary of intersection performance

|                        | AM          |                 |           |           |     |                        | PM               |             |                 |           |           |     |                        |
|------------------------|-------------|-----------------|-----------|-----------|-----|------------------------|------------------|-------------|-----------------|-----------|-----------|-----|------------------------|
|                        | Queue (Veh) | 95% Queue (Veh) | Delay (s) | V/C Ratio | LOS | Intersection Delay (s) | Intersection LOS | Queue (Veh) | 95% Queue (Veh) | Delay (s) | V/C Ratio | LOS | Intersection Delay (s) |
| <b>A1 - Scenario 3</b> |             |                 |           |           |     |                        |                  |             |                 |           |           |     |                        |
| <b>151st Street WB</b> | 0.12        | ?               | 4.01      | 0.11      | A   | 5.47                   | A                | 0.02        | ?               | 4.40      | 0.02      | A   | 7.43                   |
| <b>Ditch Road SB</b>   | 0.82        | 1.00            | 6.42      | 0.45      | A   |                        |                  | 0.37        | ?               | 4.90      | 0.27      | A   |                        |
| <b>151st Street EB</b> | 0.29        | ?               | 5.51      | 0.22      | A   |                        |                  | 0.16        | ?               | 4.28      | 0.13      | A   |                        |
| <b>Ditch Road NB</b>   | 0.28        | ?               | 4.25      | 0.22      | A   |                        |                  | 1.71        | 2.00            | 9.12      | 0.63      | A   |                        |

Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.

"D1 - Scenario 3, AM" model duration: 8:00 AM - 9:30 AM  
"D2 - Scenario 3, PM " model duration: 8:00 AM - 9:30 AM

Run using ARCADY 8.0.0.249 at 2/17/2012 3:12:23 PM

### File summary

#### File Description

|             |            |
|-------------|------------|
| Title       | (untitled) |
| Location    |            |
| Site Number |            |
| Date        | 2/17/2012  |
| Version     |            |
| Status      | (new file) |
| Identifier  |            |
| Client      |            |

|             |              |
|-------------|--------------|
| Jobnumber   |              |
| Analyst     | ACElajohnson |
| Description |              |

### Analysis Options

| Vehicle Length (ft) | V/C Ratio Threshold | Average Delay Threshold (s) | Queue Threshold (PCE) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type |
|---------------------|---------------------|-----------------------------|-----------------------|---------------------|-----------------------------|---------------------------------|
| 18.86               | 0.85                | 36.00                       | 20.00                 | ✓                   |                             | N/A                             |

### Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|----------------|-------------|---------------------|-----------------------|------------|---------------------|-------------------|---------------------|
| ft             | mph         | Veh                 | Veh                   | perHour    | s                   | -Min              | perMin              |

## (Default Analysis Set) - Scenario 3, PM

### Data Errors and Warnings

| Severity | Area       | Item                                  | Description  |
|----------|------------|---------------------------------------|--|
| Warning  | Geometry   | 151st Street WB - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | Geometry   | Ditch Road SB - Roundabout Geometry   | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | Geometry   | 151st Street EB - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | Geometry   | Ditch Road NB - Roundabout Geometry   | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | DemandSets | D2 - Scenario 3, PM                   | Time results are shown for central hour only. (Model is run for a 90 minute period.)                             |

### Analysis Set Details

| Name                   | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|------------------------|---------------------------|-------------|-------------------|----------------------------|-------------------------|--------|---------------------------------|-------------------------------------|----------------------------|
| (Default Analysis Set) | ARCADY                    |             | ✓                 |                            |                         |        | 100.000                         | 85.000                              |                            |

### Demand Set Details

| Name           | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|----------------|---------------|------------------|-------------|----------------------|--------------------------|---------------------------|--------------------------------|---------------------------|-------------------------------|--------------------------|--------|-------------------|------------------|--------------|
| Scenario 3, PM | Scenario 3    | PM               |             | ONE HOUR             | 08:00                    | 09:30                     | 90                             | 15                        | ✓                             |                          |        | ✓                 |                  |              |

## Intersection Network

### Intersections

| Name       | Intersection Type | Leg Order | Grade Separated | Large Roundabout | Do Geometric Delay | Intersection Delay (s) | Intersection LOS |
|------------|-------------------|-----------|-----------------|------------------|--------------------|------------------------|------------------|
| (untitled) | Roundabout        | 1,2,3,4   |                 |                  |                    | 7.43                   | A                |

### Intersection Network Options

| Driving Side | Lighting | Road Surface | Network Residual Capacity (%) | First Leg Reaching Threshold |
|--------------|----------|--------------|-------------------------------|------------------------------|
|--------------|----------|--------------|-------------------------------|------------------------------|



| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCE Factor for a Truck (PCE) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---------------------|------------------------------|------------------------------|-------------------------------|--------------------|------------------------------|-----------------------------|---------------------------------|------------------------------------|------------------------------------|-------------------------------------|
|                     |                              | ✓                            | ✓                             | Truck Percentages  | 2.00                         |                             |                                 |                                    | ✓                                  | ✓                                   |

## Entry Flows

### General Flows Data

| Name            | Profile Type | Use Turning Counts | Average Demand Flow (Veh/hr) | Flow Scaling Factor (%) |
|-----------------|--------------|--------------------|------------------------------|-------------------------|
| 151st Street WB | ONE HOUR     | ✓                  | 14.00                        | 100.000                 |
| Ditch Road SB   | ONE HOUR     | ✓                  | 251.00                       | 100.000                 |
| 151st Street EB | ONE HOUR     | ✓                  | 119.00                       | 100.000                 |
| Ditch Road NB   | ONE HOUR     | ✓                  | 621.00                       | 100.000                 |

## Turning Proportions

### Turning Counts or Proportions (Veh/hr) - (untitled) (for whole period)

|      |   | To     |         |         |         |
|------|---|--------|---------|---------|---------|
|      |   | 1      | 2       | 3       | 4       |
| From | 1 | 0.000  | 6.000   | 0.000   | 8.000   |
|      | 2 | 16.000 | 0.000   | 22.000  | 213.000 |
|      | 3 | 0.000  | 15.000  | 0.000   | 104.000 |
|      | 4 | 79.000 | 387.000 | 155.000 | 0.000   |

### Turning Proportions (Veh) - (untitled) (for whole period)

|      |   | To   |      |      |      |
|------|---|------|------|------|------|
|      |   | 1    | 2    | 3    | 4    |
| From | 1 | 0.00 | 0.43 | 0.00 | 0.57 |
|      | 2 | 0.06 | 0.00 | 0.09 | 0.85 |
|      | 3 | 0.00 | 0.13 | 0.00 | 0.87 |
|      | 4 | 0.13 | 0.62 | 0.25 | 0.00 |

## Vehicle Mix

### Average PCE Per Vehicle - (untitled) (for whole period)

|      |   | To    |       |       |       |
|------|---|-------|-------|-------|-------|
|      |   | 1     | 2     | 3     | 4     |
| From | 1 | 1.000 | 1.000 | 1.020 | 1.000 |
|      | 2 | 1.000 | 1.000 | 1.000 | 1.000 |
|      | 3 | 1.020 | 1.000 | 1.000 | 1.000 |
|      | 4 | 1.000 | 1.000 | 1.000 | 1.000 |

### Truck Percentages - (untitled) (for whole period)

|      |   | To    |       |       |       |
|------|---|-------|-------|-------|-------|
|      |   | 1     | 2     | 3     | 4     |
| From | 1 | 0.000 | 0.000 | 2.000 | 0.000 |
|      | 2 | 0.000 | 0.000 | 0.000 | 0.000 |
|      | 3 | 2.000 | 0.000 | 0.000 | 0.000 |



|  |   |       |       |       |       |
|--|---|-------|-------|-------|-------|
|  | 4 | 0.000 | 0.000 | 0.000 | 0.000 |
|--|---|-------|-------|-------|-------|

# HCM Unsignalized Intersection Capacity Analysis

## 30: 146th Street & Access Drive A

2/13/2012



| Movement               | EBL  | EBT  | WBT  | WBR  | SBL  | SBR  |
|------------------------|------|------|------|------|------|------|
| Lane Configurations    |      | ↑↑   | ↑↓   |      |      | ↗    |
| Volume (veh/h)         | 0    | 574  | 399  | 86   | 0    | 99   |
| Sign Control           |      | Free | Free |      | Stop |      |
| Grade                  |      | 0%   | 0%   |      | 0%   |      |
| Peak Hour Factor       | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Hourly flow rate (vph) | 0    | 638  | 443  | 96   | 0    | 110  |
| Pedestrians            |      |      |      |      |      |      |
| Lane Width (ft)        |      |      |      |      |      |      |
| Walking Speed (ft/s)   |      |      |      |      |      |      |
| Percent Blockage       |      |      |      |      |      |      |
| Right turn flare (veh) |      |      |      |      |      |      |
| Median type            |      | None | None |      |      |      |
| Median storage (veh)   |      |      |      |      |      |      |
| Upstream signal (ft)   |      |      |      |      |      |      |
| pX, platoon unblocked  |      |      |      |      |      |      |
| vC, conflicting volume | 539  |      |      |      | 810  | 269  |
| vC1, stage 1 conf vol  |      |      |      |      |      |      |
| vC2, stage 2 conf vol  |      |      |      |      |      |      |
| vCu, unblocked vol     | 539  |      |      |      | 810  | 269  |
| tC, single (s)         | 4.1  |      |      |      | 6.8  | 6.9  |
| tC, 2 stage (s)        |      |      |      |      |      |      |
| tF (s)                 | 2.2  |      |      |      | 3.5  | 3.3  |
| p0 queue free %        | 100  |      |      |      | 100  | 85   |
| cM capacity (veh/h)    | 1040 |      |      |      | 322  | 735  |

| Direction, Lane #      | EB 1 | EB 2 | WB 1 | WB 2 | SB 1 |
|------------------------|------|------|------|------|------|
| Volume Total           | 319  | 319  | 296  | 243  | 110  |
| Volume Left            | 0    | 0    | 0    | 0    | 0    |
| Volume Right           | 0    | 0    | 0    | 96   | 110  |
| cSH                    | 1700 | 1700 | 1700 | 1700 | 735  |
| Volume to Capacity     | 0.19 | 0.19 | 0.17 | 0.14 | 0.15 |
| Queue Length 95th (ft) | 0    | 0    | 0    | 0    | 13   |
| Control Delay (s)      | 0.0  | 0.0  | 0.0  | 0.0  | 10.8 |
| Lane LOS               |      |      |      |      | B    |
| Approach Delay (s)     | 0.0  |      | 0.0  |      | 10.8 |
| Approach LOS           |      |      |      |      | B    |

| Intersection Summary              |  |  |       |                      |   |
|-----------------------------------|--|--|-------|----------------------|---|
| Average Delay                     |  |  | 0.9   |                      |   |
| Intersection Capacity Utilization |  |  | 26.6% | ICU Level of Service | A |
| Analysis Period (min)             |  |  | 15    |                      |   |

HCM Unsignalized Intersection Capacity Analysis  
 32: Access Drive B & 146th Street

2/13/2012

|                                   | →    | ↘    | ↙     | ←                    | ↖    | ↗    |
|-----------------------------------|------|------|-------|----------------------|------|------|
| Movement                          | EBT  | EBR  | WBL   | WBT                  | NBL  | NBR  |
| Lane Configurations               | ↑↑   |      |       | ↑↑                   |      | ↗    |
| Volume (veh/h)                    | 438  | 38   | 0     | 377                  | 0    | 37   |
| Sign Control                      | Free |      |       | Free                 | Stop |      |
| Grade                             | 0%   |      |       | 0%                   | 0%   |      |
| Peak Hour Factor                  | 0.90 | 0.90 | 0.90  | 0.90                 | 0.90 | 0.90 |
| Hourly flow rate (vph)            | 487  | 42   | 0     | 419                  | 0    | 41   |
| Pedestrians                       |      |      |       |                      |      |      |
| Lane Width (ft)                   |      |      |       |                      |      |      |
| Walking Speed (ft/s)              |      |      |       |                      |      |      |
| Percent Blockage                  |      |      |       |                      |      |      |
| Right turn flare (veh)            |      |      |       |                      |      |      |
| Median type                       | None |      | None  |                      |      |      |
| Median storage veh                |      |      |       |                      |      |      |
| Upstream signal (ft)              |      |      |       |                      |      |      |
| pX, platoon unblocked             |      |      |       |                      |      |      |
| vC, conflicting volume            |      |      | 529   |                      | 717  | 264  |
| vC1, stage 1 conf vol             |      |      |       |                      |      |      |
| vC2, stage 2 conf vol             |      |      |       |                      |      |      |
| vCu, unblocked vol                |      |      | 529   |                      | 717  | 264  |
| tC, single (s)                    |      |      | 4.1   |                      | 6.8  | 6.9  |
| tC, 2 stage (s)                   |      |      |       |                      |      |      |
| tF (s)                            |      |      | 2.2   |                      | 3.5  | 3.3  |
| p0 queue free %                   |      |      | 100   |                      | 100  | 94   |
| cM capacity (veh/h)               |      |      | 1049  |                      | 369  | 740  |
| Direction, Lane #                 | EB 1 | EB 2 | WB 1  | WB 2                 | NB 1 |      |
| Volume Total                      | 324  | 204  | 209   | 209                  | 41   |      |
| Volume Left                       | 0    | 0    | 0     | 0                    | 0    |      |
| Volume Right                      | 0    | 42   | 0     | 0                    | 41   |      |
| cSH                               | 1700 | 1700 | 1700  | 1700                 | 740  |      |
| Volume to Capacity                | 0.19 | 0.12 | 0.12  | 0.12                 | 0.06 |      |
| Queue Length 95th (ft)            | 0    | 0    | 0     | 0                    | 4    |      |
| Control Delay (s)                 | 0.0  | 0.0  | 0.0   | 0.0                  | 10.2 |      |
| Lane LOS                          |      |      |       |                      | B    |      |
| Approach Delay (s)                | 0.0  |      | 0.0   |                      | 10.2 |      |
| Approach LOS                      |      |      |       |                      | B    |      |
| Intersection Summary              |      |      |       |                      |      |      |
| Average Delay                     |      |      | 0.4   |                      |      |      |
| Intersection Capacity Utilization |      |      | 23.3% | ICU Level of Service | A    |      |
| Analysis Period (min)             |      |      | 15    |                      |      |      |

|  |
|--|
| <b>ARCADY</b> □ □  |
| Version: 8.0.0.249 [24 Oct 2011]<br>© Copyright Transport Research Laboratory 2012   |
| For sales and distribution information, program advice and maintenance, contact TRL:<br>Tel: +44 (0)1344 770758 E-mail: software@trl.co.uk Web: http://www.trlsoftware.co.uk |
| The users of this computer program for the solution of an engineering problem are in no way relieved of their responsibility for the correctness of the solution             |

File: P:\2011\01596\C. Calcs\_Data\Traffic Study\Analysis\ARCADY\Drive C-I.arc8  
 Report generation date: 2/17/2012 3:07:29 PM

- « (Default Analysis Set) - Scenario 1 AM
- » Intersection Network
- » Legs
- » Traffic Flows
- » Entry Flows
- » Turning Proportions
- » Vehicle Mix

### Summary of intersection performance

|                            | AM          |                 |           |           |     |                        |                  | PM          |                 |           |           |     |                   |
|----------------------------|-------------|-----------------|-----------|-----------|-----|------------------------|------------------|-------------|-----------------|-----------|-----------|-----|-------------------|
|                            | Queue (Veh) | 95% Queue (Veh) | Delay (s) | V/C Ratio | LOS | Intersection Delay (s) | Intersection LOS | Queue (Veh) | 95% Queue (Veh) | Delay (s) | V/C Ratio | LOS | Interse Delay (s) |
| <b>A1 - Scenario 1</b>     |             |                 |           |           |     |                        |                  |             |                 |           |           |     |                   |
| <b>Somerville Drive WB</b> | 0.09        | ?               | 4.27      | 0.08      | A   | 9.37                   | A                | 0.07        | ?               | 6.95      | 0.06      | A   | 5.43              |
| <b>Ditch Road SB</b>       | 2.58        | 6.00            | 13.19     | 0.73      | B   |                        |                  | 0.77        | 1.00            | 7.44      | 0.44      | A   |                   |
| <b>Drive C</b>             | 0.25        | ?               | 6.55      | 0.20      | A   |                        |                  | 0.18        | ?               | 5.57      | 0.15      | A   |                   |
| <b>Drive I</b>             | 1.23        | ?               | 10.43     | 0.55      | B   |                        |                  | 0.82        | 200.00          | 6.77      | 0.45      | A   |                   |
| <b>Ditch Road NB</b>       | 0.20        | ?               | 2.15      | 0.17      | A   |                        |                  | 1.08        | ?               | 3.99      | 0.52      | A   |                   |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.*

"D1 - Scenario 1, PM" model duration: 8:00 AM - 9:30 AM  
 "D2 - Scenario 1, AM " model duration: 8:00 AM - 9:30 AM

Run using ARCADY 8.0.0.249 at 2/17/2012 3:07:23 PM

### File summary

#### File Description

|                    |              |
|--------------------|--------------|
| <b>Title</b>       | (untitled)   |
| <b>Location</b>    |              |
| <b>Site Number</b> |              |
| <b>Date</b>        | 2/17/2012    |
| <b>Version</b>     |              |
| <b>Status</b>      | (new file)   |
| <b>Identifier</b>  |              |
| <b>Client</b>      |              |
| <b>Jobnumber</b>   |              |
| <b>Analyst</b>     | ACE\ajohnson |



|             |
|-------------|
| Description |
|-------------|

### Analysis Options

| Vehicle Length (ft) | V/C Ratio Threshold | Average Delay Threshold (s) | Queue Threshold (PCE) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type |
|---------------------|---------------------|-----------------------------|-----------------------|---------------------|-----------------------------|---------------------------------|
| 18.86               | 0.85                | 36.00                       | 20.00                 | ✓                   |                             | N/A                             |

### Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|----------------|-------------|---------------------|-----------------------|------------|---------------------|-------------------|---------------------|
| ft             | mph         | Veh                 | Veh                   | perHour    | s                   | -Min              | perHour             |

## (Default Analysis Set) - Scenario AM

### Data Errors and Warnings

| Severity | Area       | Item                                      | Description  |
|----------|------------|---|--|
| Warning  | Geometry   | Somerville Drive WB - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | Geometry   | Ditch Road SB - Roundabout Geometry       | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | Geometry   | Drive C - Roundabout Geometry             | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | Geometry   | Drive I - Roundabout Geometry             | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | Geometry   | Ditch Road NB - Roundabout Geometry       | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning  | DemandSets | D2 - Scenario 1, AM                       | Time results are shown for central hour only. (Model is run for a 90 minute period.)                             |

### Analysis Set Details

| Name                   | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|------------------------|---------------------------|-------------|-------------------|----------------------------|-------------------------|--------|---------------------------------|-------------------------------------|----------------------------|
| (Default Analysis Set) | ARCADY                    |             | ✓                 |                            |                         |        | 100.000                         | 85.000                              |                            |

### Demand Set Details

| Name           | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|----------------|---------------|------------------|-------------|----------------------|--------------------------|---------------------------|--------------------------------|---------------------------|-------------------------------|--------------------------|--------|-------------------|------------------|--------------|
| Scenario 1, AM | Scenario 1    | AM               |             | ONE HOUR             | 08:00                    | 09:30                     | 90                             | 15                        | ✓                             |                          |        | ✓                 |                  |              |

## Intersection Network

### Intersections

| Name       | Intersection Type | Leg Order | Grade Separated | Large Roundabout | Do Geometric Delay | Intersection Delay (s) | Intersection LOS |
|------------|-------------------|-----------|-----------------|------------------|--------------------|------------------------|------------------|
| (untitled) | Roundabout        | 1,2,3,4,5 |                 |                  |                    | 9.37                   | A                |

### Intersection Network Options

| Driving Side | Lighting | Road Surface | Network Residual Capacity (%) | First Leg Reaching Threshold |
|--------------|----------|--------------|-------------------------------|------------------------------|
|--------------|----------|--------------|-------------------------------|------------------------------|

|       |  |     |     |
|-------|--|-----|-----|
| Right | Normal/unknown (Mini-roundabouts only) | N/A | N/A |
|-------|--|-----|-----|

## Legs

### Legs

| Name                | Name                | Description |
|---------------------|---------------------|-------------|
| Somerville Drive WB | Somerville Drive WB |             |
| Ditch Road SB       | Ditch Road SB       |             |
| Drive C             | Drive C             |             |
| Drive I             | Drive I             |             |
| Ditch Road NB       | Ditch Road NB       |             |

### Capacity Options

| Name                | Minimum Capacity (PCE/hr) | Maximum Capacity (PCE/hr) | Assume Flat Start Profile | Initial Queue (PCE) |
|---------------------|---------------------------|---------------------------|---------------------------|---------------------|
| Somerville Drive WB | 0.00                      | 99999.00                  |                           | 0.00                |
| Ditch Road SB       | 0.00                      | 99999.00                  |                           | 0.00                |
| Drive C             | 0.00                      | 99999.00                  |                           | 0.00                |
| Drive I             | 0.00                      | 99999.00                  |                           | 0.00                |
| Ditch Road NB       | 0.00                      | 99999.00                  |                           | 0.00                |

### Roundabout Geometry

| Name                | V - Approach road half-width (ft) | E - Entry width (ft) | I' - Effective flare length (ft) | R - Entry radius (ft) | D - Inscribed circle diameter (ft) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---------------------|-----------------------------------|----------------------|----------------------------------|-----------------------|------------------------------------|------------------------------------|-----------|
| Somerville Drive WB | 12.00                             | 14.00                | 130.00                           | 65.00                 | 160.00                             | 25.00                              |           |
| Ditch Road SB       | 12.00                             | 14.00                | 130.00                           | 65.00                 | 160.00                             | 25.00                              |           |
| Drive C             | 12.00                             | 14.00                | 130.00                           | 65.00                 | 160.00                             | 25.00                              |           |
| Drive I             | 12.00                             | 14.00                | 130.00                           | 65.00                 | 160.00                             | 25.00                              |           |
| Ditch Road NB       | 24.00                             | 26.00                | 130.00                           | 65.00                 | 160.00                             | 25.00                              |           |

### Pedestrian Crossings

| Name                | Crossing Type |
|---------------------|---------------|
| Somerville Drive WB | None          |
| Ditch Road SB       | None          |
| Drive C             | None          |
| Drive I             | None          |
| Ditch Road NB       | None          |

### Leg Slope/ Intercept and Capacity

#### Slope and Intercept used in model

| Name                | Enter Directly | Slope        | Intercept (PCE/hr) | Final Slope | Final Intercept (PCE/hr) |
|---------------------|----------------|--------------|--------------------|-------------|--------------------------|
| Somerville Drive WB |                | (calculated) | (calculated)       | 0.543       | 1305.981                 |
| Ditch Road SB       |                | (calculated) | (calculated)       | 0.543       | 1305.981                 |
| Drive C             |                | (calculated) | (calculated)       | 0.543       | 1305.981                 |
| Drive I             |                | (calculated) | (calculated)       | 0.543       | 1305.981                 |
| Ditch Road NB       |                | (calculated) | (calculated)       | 0.759       | 2432.948                 |

The slope and intercept shown above include any corrections and adjustments.

## Traffic Flows

### Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCE Factor for a Truck (PCE) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---------------------|------------------------------|------------------------------|-------------------------------|--------------------|------------------------------|-----------------------------|---------------------------------|------------------------------------|------------------------------------|-------------------------------------|
|                     |                              | ✓                            | ✓                             | Truck Percentages  | 2.00                         |                             |                                 |                                    | ✓                                  | ✓                                   |

## Entry Flows

### General Flows Data

| Name                | Profile Type | Use Turning Counts | Average Demand Flow (Veh/hr) | Flow Scaling Factor (%) |
|---------------------|--------------|--------------------|------------------------------|-------------------------|
| Somerville Drive WB | ONE HOUR     | ✓                  | 68.00                        | 100.000                 |
| Ditch Road SB       | ONE HOUR     | ✓                  | 643.00                       | 100.000                 |
| Drive C             | ONE HOUR     | ✓                  | 121.00                       | 100.000                 |
| Drive I             | ONE HOUR     | ✓                  | 382.00                       | 100.000                 |
| Ditch Road NB       | ONE HOUR     | ✓                  | 302.00                       | 100.000                 |

## Turning Proportions

### Turning Counts or Proportions (Veh/hr) - (untitled) (for whole period)

|      |   | To    |         |        |         |         |
|------|---|-------|---------|--------|---------|---------|
|      |   | 1     | 2       | 3      | 4       | 5       |
| From | 1 | 0.000 | 14.000  | 0.000  | 0.000   | 54.000  |
|      | 2 | 2.000 | 0.000   | 6.000  | 87.000  | 548.000 |
|      | 3 | 0.000 | 9.000   | 0.000  | 77.000  | 35.000  |
|      | 4 | 0.000 | 35.000  | 30.000 | 0.000   | 317.000 |
|      | 5 | 8.000 | 155.000 | 11.000 | 128.000 | 0.000   |

### Turning Proportions (Veh) - (untitled) (for whole period)

|      |   | To   |      |      |      |      |
|------|---|------|------|------|------|------|
|      |   | 1    | 2    | 3    | 4    | 5    |
| From | 1 | 0.00 | 0.21 | 0.00 | 0.00 | 0.79 |
|      | 2 | 0.00 | 0.00 | 0.01 | 0.14 | 0.85 |
|      | 3 | 0.00 | 0.07 | 0.00 | 0.64 | 0.29 |
|      | 4 | 0.00 | 0.09 | 0.08 | 0.00 | 0.83 |
|      | 5 | 0.03 | 0.51 | 0.04 | 0.42 | 0.00 |

## Vehicle Mix

### Average PCE Per Vehicle - (untitled) (for whole period)

|      |   | To    |       |       |       |       |
|------|---|-------|-------|-------|-------|-------|
|      |   | 1     | 2     | 3     | 4     | 5     |
| From | 1 | 1.000 | 1.020 | 1.020 | 1.020 | 1.020 |
|      | 2 | 1.020 | 1.000 | 1.020 | 1.020 | 1.020 |
|      | 3 | 1.020 | 1.020 | 1.000 | 1.020 | 1.020 |
|      | 4 | 1.020 | 1.020 | 1.020 | 1.000 | 1.020 |
|      | 5 | 1.020 | 1.020 | 1.020 | 1.020 | 1.000 |



Truck Percentages - (untitled) (for whole period)

|      |   | To    |       |       |       |       |
|------|---|-------|-------|-------|-------|-------|
|      |   | 1     | 2     | 3     | 4     | 5     |
| From | 1 | 0.000 | 2.000 | 2.000 | 2.000 | 2.000 |
|      | 2 | 2.000 | 0.000 | 2.000 | 2.000 | 2.000 |
|      | 3 | 2.000 | 2.000 | 0.000 | 2.000 | 2.000 |
|      | 4 | 2.000 | 2.000 | 2.000 | 0.000 | 2.000 |
|      | 5 | 2.000 | 2.000 | 2.000 | 2.000 | 0.000 |

HCM Unsignalized Intersection Capacity Analysis  
 26: Access Drive D & 151st Street

2/13/2012

|                                   | →           | ↘           | ↙           | ←                    | ↖    | ↗    |
|-----------------------------------|-------------|-------------|-------------|----------------------|------|------|
| Movement                          | EBT         | EBR         | WBL         | WBT                  | NBL  | NBR  |
| Lane Configurations               | ↘           |             |             | ↖                    | ↙    |      |
| Volume (veh/h)                    | 112         | 1           | 11          | 166                  | 1    | 7    |
| Sign Control                      | Free        |             |             | Free                 | Stop |      |
| Grade                             | 0%          |             |             | 0%                   | 0%   |      |
| Peak Hour Factor                  | 0.90        | 0.90        | 0.90        | 0.90                 | 0.90 | 0.90 |
| Hourly flow rate (vph)            | 124         | 1           | 12          | 184                  | 1    | 8    |
| Pedestrians                       |             |             |             |                      |      |      |
| Lane Width (ft)                   |             |             |             |                      |      |      |
| Walking Speed (ft/s)              |             |             |             |                      |      |      |
| Percent Blockage                  |             |             |             |                      |      |      |
| Right turn flare (veh)            |             |             |             |                      |      |      |
| Median type                       | None        |             | None        |                      |      |      |
| Median storage veh                |             |             |             |                      |      |      |
| Upstream signal (ft)              |             |             |             |                      |      |      |
| pX, platoon unblocked             |             |             |             |                      |      |      |
| vC, conflicting volume            |             |             | 126         |                      | 334  | 125  |
| vC1, stage 1 conf vol             |             |             |             |                      |      |      |
| vC2, stage 2 conf vol             |             |             |             |                      |      |      |
| vCu, unblocked vol                |             |             | 126         |                      | 334  | 125  |
| tC, single (s)                    |             |             | 4.1         |                      | 6.4  | 6.2  |
| tC, 2 stage (s)                   |             |             |             |                      |      |      |
| tF (s)                            |             |             | 2.2         |                      | 3.5  | 3.3  |
| p0 queue free %                   |             |             | 99          |                      | 100  | 99   |
| cM capacity (veh/h)               |             |             | 1473        |                      | 660  | 931  |
| <b>Direction, Lane #</b>          | <b>EB 1</b> | <b>WB 1</b> | <b>NB 1</b> |                      |      |      |
| Volume Total                      | 126         | 197         | 9           |                      |      |      |
| Volume Left                       | 0           | 12          | 1           |                      |      |      |
| Volume Right                      | 1           | 0           | 8           |                      |      |      |
| cSH                               | 1700        | 1473        | 885         |                      |      |      |
| Volume to Capacity                | 0.07        | 0.01        | 0.01        |                      |      |      |
| Queue Length 95th (ft)            | 0           | 1           | 1           |                      |      |      |
| Control Delay (s)                 | 0.0         | 0.5         | 9.1         |                      |      |      |
| Lane LOS                          |             | A           | A           |                      |      |      |
| Approach Delay (s)                | 0.0         | 0.5         | 9.1         |                      |      |      |
| Approach LOS                      |             |             | A           |                      |      |      |
| <b>Intersection Summary</b>       |             |             |             |                      |      |      |
| Average Delay                     |             |             | 0.6         |                      |      |      |
| Intersection Capacity Utilization |             |             | 26.0%       | ICU Level of Service | A    |      |
| Analysis Period (min)             |             |             | 15          |                      |      |      |

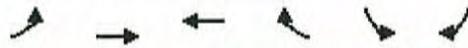
HCM Unsignalized Intersection Capacity Analysis  
 23: Access Drive E & 151st Street

2/13/2012

|                                   |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|--|---|---|---|---|---|
| Movement                          | EBL   | EBT   | EBR   | WBL   | WBT   | WBR   | NBL  | NBT   | NBR   | SBL   | SBT   | SBR   |
| Lane Configurations               |   |  |   |   |  |   |  |  |   |   |  |   |
| Volume (veh/h)                    | 11  | 67  | 32  | 16  | 92  | 59  | 35   | 44  | 10  | 37  | 30  | 6   |
| Sign Control                      |   | Free  |   |   | Free  |   |  | Stop  |   |   | Stop  |   |
| Grade                             |   | 0%  |   |   | 0%  |   |  | 0%  |   |   | 0%  |   |
| Peak Hour Factor                  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90   | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  |
| Hourly flow rate (vph)            | 12  | 74  | 36  | 18  | 102   | 66  | 39   | 49  | 11  | 41  | 33  | 7   |
| Pedestrians                       |   |   |   |   |   |   |  |   |   |   |   |   |
| Lane Width (ft)                   |   |   |   |   |   |   |  |   |   |   |   |   |
| Walking Speed (ft/s)              |   |   |   |   |   |   |  |   |   |   |   |   |
| Percent Blockage                  |   |   |   |   |   |   |  |   |   |   |   |   |
| Right turn flare (veh)            |   |   |   |   |   |   |  |   |   |   |   |   |
| Median type                       |   | None  |   |   | None  |   |  |   |   |   |   |   |
| Median storage veh                |   |   |   |   |   |   |  |   |   |   |   |   |
| Upstream signal (ft)              |   |   |   |   |   |   |  |   |   |   |   |   |
| pX, platoon unblocked             |   |   |   |   |   |   |  |   |   |   |   |   |
| vC, conflicting volume            | 168   |   |   | 110   |   |   | 311  | 320   | 92  | 323   | 305   | 135   |
| vC1, stage 1 conf vol             |   |   |   |   |   |   |  |   |   |   |   |   |
| vC2, stage 2 conf vol             |   |   |   |   |   |   |  |   |   |   |   |   |
| vCu, unblocked vol                | 168   |   |   | 110   |   |   | 311  | 320   | 92  | 323   | 305   | 135   |
| tC, single (s)                    | 4.1   |   |   | 4.1   |   |   | 7.1  | 6.5   | 6.2   | 7.1   | 6.5   | 6.2   |
| tC, 2 stage (s)                   |   |   |   |   |   |   |  |   |   |   |   |   |
| tF (s)                            | 2.2   |   |   | 2.2   |   |   | 3.5  | 4.0   | 3.3   | 3.5   | 4.0   | 3.3   |
| p0 queue free %                   | 99  |   |   | 99  |   |   | 94   | 92  | 99  | 93  | 94  | 99  |
| cM capacity (veh/h)               | 1422  |   |   | 1493  |   |   | 604  | 588   | 971   | 578   | 599   | 919   |
| <b>Direction, Lane #</b>          | <b>EB 1</b>   | <b>WB 1</b>   | <b>NB 1</b>   | <b>SB 1</b>   |   |   |  |   |   |   |   |   |
| Volume Total                      | 122   | 186   | 99  | 81  |   |   |  |   |   |   |   |   |
| Volume Left                       | 12  | 18  | 39  | 41  |   |   |  |   |   |   |   |   |
| Volume Right                      | 36  | 66  | 11  | 7   |   |   |  |   |   |   |   |   |
| cSH                               | 1422  | 1493  | 622   | 605   |   |   |  |   |   |   |   |   |
| Volume to Capacity                | 0.01  | 0.01  | 0.16  | 0.13  |   |   |  |   |   |   |   |   |
| Queue Length 95th (ft)            | 1   | 1   | 14  | 12  |   |   |  |   |   |   |   |   |
| Control Delay (s)                 | 0.8   | 0.8   | 11.9  | 11.9  |   |   |  |   |   |   |   |   |
| Lane LOS                          | A   | A   | B   | B   |   |   |  |   |   |   |   |   |
| Approach Delay (s)                | 0.8   | 0.8   | 11.9  | 11.9  |   |   |  |   |   |   |   |   |
| Approach LOS                      |   |   | B   | B   |   |   |  |   |   |   |   |   |
| <b>Intersection Summary</b>       |   |   |   |   |   |   |  |   |   |   |   |   |
| Average Delay                     |   |   | 4.9   |   |   |   |  |   |   |   |   |   |
| Intersection Capacity Utilization |   |   | 24.6%   |   | ICU Level of Service  |   |  |   | A   |   |   |   |
| Analysis Period (min)             |   |   | 15  |   |   |   |  |   |   |   |   |   |

HCM Unsignalized Intersection Capacity Analysis  
 21: 151st Street & Access Drive F

2/13/2012



| Movement               | EBL  | EBT  | WBT  | WBR  | SBL  | SBR  |
|------------------------|------|------|------|------|------|------|
| Lane Configurations    |      | ↕    | ↕    |      | ↕    |      |
| Volume (veh/h)         | 15   | 85   | 97   | 36   | 25   | 9    |
| Sign Control           |      | Free | Free |      | Stop |      |
| Grade                  |      | 0%   | 0%   |      | 0%   |      |
| Peak Hour Factor       | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Hourly flow rate (vph) | 17   | 94   | 108  | 40   | 28   | 10   |
| Pedestrians            |      |      |      |      |      |      |
| Lane Width (ft)        |      |      |      |      |      |      |
| Walking Speed (ft/s)   |      |      |      |      |      |      |
| Percent Blockage       |      |      |      |      |      |      |
| Right turn flare (veh) |      |      |      |      |      |      |
| Median type            |      | None | None |      |      |      |
| Median storage (veh)   |      |      |      |      |      |      |
| Upstream signal (ft)   |      |      |      |      |      |      |
| pX, platoon unblocked  |      |      |      |      |      |      |
| vC, conflicting volume | 148  |      |      |      | 256  | 128  |
| vC1, stage 1 conf vol  |      |      |      |      |      |      |
| vC2, stage 2 conf vol  |      |      |      |      |      |      |
| vCu, unblocked vol     | 148  |      |      |      | 256  | 128  |
| tC, single (s)         | 4.1  |      |      |      | 6.4  | 6.2  |
| tC, 2 stage (s)        |      |      |      |      |      |      |
| tF (s)                 | 2.2  |      |      |      | 3.5  | 3.3  |
| p0 queue free %        | 99   |      |      |      | 96   | 99   |
| cM capacity (veh/h)    | 1446 |      |      |      | 729  | 928  |

| Direction, Lane #      | EB 1 | WB 1 | SB 1 |
|------------------------|------|------|------|
| Volume Total           | 111  | 148  | 38   |
| Volume Left            | 17   | 0    | 28   |
| Volume Right           | 0    | 40   | 10   |
| cSH                    | 1446 | 1700 | 773  |
| Volume to Capacity     | 0.01 | 0.09 | 0.05 |
| Queue Length 95th (ft) | 1    | 0    | 4    |
| Control Delay (s)      | 1.2  | 0.0  | 9.9  |
| Lane LOS               | A    |      | A    |
| Approach Delay (s)     | 1.2  | 0.0  | 9.9  |
| Approach LOS           |      |      | A    |

| Intersection Summary              |  |       |                        |
|-----------------------------------|--|-------|------------------------|
| Average Delay                     |  | 1.7   |                        |
| Intersection Capacity Utilization |  | 25.9% | ICU Level of Service A |
| Analysis Period (min)             |  | 15    |                        |

# HCM Unsignalized Intersection Capacity Analysis

## 19: 151st Street & Access Drive G

2/13/2012



| Movement               | EBL  | EBT  | WBT  | WBR  | SBL  | SBR  |
|------------------------|------|------|------|------|------|------|
| Lane Configurations    |      | ↕    | ↕    |      | ↕    |      |
| Volume (veh/h)         | 48   | 50   | 25   | 81   | 51   | 28   |
| Sign Control           |      | Free | Free |      | Stop |      |
| Grade                  |      | 0%   | 0%   |      | 0%   |      |
| Peak Hour Factor       | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Hourly flow rate (vph) | 53   | 56   | 28   | 90   | 57   | 31   |
| Pedestrians            |      |      |      |      |      |      |
| Lane Width (ft)        |      |      |      |      |      |      |
| Walking Speed (ft/s)   |      |      |      |      |      |      |
| Percent Blockage       |      |      |      |      |      |      |
| Right turn flare (veh) |      |      |      |      |      |      |
| Median type            |      | None | None |      |      |      |
| Median storage veh     |      |      |      |      |      |      |
| Upstream signal (ft)   |      |      |      |      |      |      |
| pX, platoon unblocked  |      |      |      |      |      |      |
| vC, conflicting volume | 118  |      |      |      | 235  | 73   |
| vC1, stage 1 conf vol  |      |      |      |      |      |      |
| vC2, stage 2 conf vol  |      |      |      |      |      |      |
| vCu, unblocked vol     | 118  |      |      |      | 235  | 73   |
| tC, single (s)         | 4.1  |      |      |      | 6.4  | 6.2  |
| tC, 2 stage (s)        |      |      |      |      |      |      |
| tF (s)                 | 2.2  |      |      |      | 3.5  | 3.3  |
| p0 queue free %        | 96   |      |      |      | 92   | 97   |
| cM capacity (veh/h)    | 1483 |      |      |      | 730  | 995  |

| Direction, Lane #      | EB 1 | WB 1 | SB 1 |
|------------------------|------|------|------|
| Volume Total           | 109  | 118  | 88   |
| Volume Left            | 53   | 0    | 57   |
| Volume Right           | 0    | 90   | 31   |
| cSH                    | 1483 | 1700 | 806  |
| Volume to Capacity     | 0.04 | 0.07 | 0.11 |
| Queue Length 95th (ft) | 3    | 0    | 9    |
| Control Delay (s)      | 3.8  | 0.0  | 10.0 |
| Lane LOS               | A    |      | B    |
| Approach Delay (s)     | 3.8  | 0.0  | 10.0 |
| Approach LOS           |      |      | B    |

| Intersection Summary              |  |       |                        |
|-----------------------------------|--|-------|------------------------|
| Average Delay                     |  | 4.1   |                        |
| Intersection Capacity Utilization |  | 23.2% | ICU Level of Service A |
| Analysis Period (min)             |  | 15    |                        |

HCM Unsignalized Intersection Capacity Analysis  
 17: Access Drive H & 156th Street

2/13/2012

|                                   | →    | ↘    | ↙     | ←                    | ↖    | ↗    |
|-----------------------------------|------|------|-------|----------------------|------|------|
| Movement                          | EBT  | EBR  | WBL   | WBT                  | NBL  | NBR  |
| Lane Configurations               | ↘    |      |       | ↖                    | ↙    |      |
| Volume (veh/h)                    | 92   | 17   | 44    | 59                   | 10   | 26   |
| Sign Control                      | Free |      |       | Free                 | Stop |      |
| Grade                             | 0%   |      |       | 0%                   | 0%   |      |
| Peak Hour Factor                  | 0.90 | 0.90 | 0.90  | 0.90                 | 0.90 | 0.90 |
| Hourly flow rate (vph)            | 102  | 19   | 49    | 66                   | 11   | 29   |
| Pedestrians                       |      |      |       |                      |      |      |
| Lane Width (ft)                   |      |      |       |                      |      |      |
| Walking Speed (ft/s)              |      |      |       |                      |      |      |
| Percent Blockage                  |      |      |       |                      |      |      |
| Right turn flare (veh)            |      |      |       |                      |      |      |
| Median type                       | None |      | None  |                      |      |      |
| Median storage veh                |      |      |       |                      |      |      |
| Upstream signal (ft)              |      |      |       |                      |      |      |
| pX, platoon unblocked             |      |      |       |                      |      |      |
| vC, conflicting volume            |      |      | 121   |                      | 275  | 112  |
| vC1, stage 1 conf vol             |      |      |       |                      |      |      |
| vC2, stage 2 conf vol             |      |      |       |                      |      |      |
| vCu, unblocked vol                |      |      | 121   |                      | 275  | 112  |
| tC, single (s)                    |      |      | 4.1   |                      | 6.4  | 6.2  |
| tC, 2 stage (s)                   |      |      |       |                      |      |      |
| tF (s)                            |      |      | 2.2   |                      | 3.5  | 3.3  |
| p0 queue free %                   |      |      | 97    |                      | 98   | 97   |
| cM capacity (veh/h)               |      |      | 1479  |                      | 695  | 947  |
| Direction, Lane #                 | EB 1 | WB 1 | NB 1  |                      |      |      |
| Volume Total                      | 121  | 114  | 40    |                      |      |      |
| Volume Left                       | 0    | 49   | 11    |                      |      |      |
| Volume Right                      | 19   | 0    | 29    |                      |      |      |
| cSH                               | 1700 | 1479 | 860   |                      |      |      |
| Volume to Capacity                | 0.07 | 0.03 | 0.05  |                      |      |      |
| Queue Length 95th (ft)            | 0    | 3    | 4     |                      |      |      |
| Control Delay (s)                 | 0.0  | 3.4  | 9.4   |                      |      |      |
| Lane LOS                          |      | A    | A     |                      |      |      |
| Approach Delay (s)                | 0.0  | 3.4  | 9.4   |                      |      |      |
| Approach LOS                      |      | A    | A     |                      |      |      |
| Intersection Summary              |      |      |       |                      |      |      |
| Average Delay                     |      |      | 2.8   |                      |      |      |
| Intersection Capacity Utilization |      |      | 22.2% | ICU Level of Service | A    |      |
| Analysis Period (min)             |      |      | 15    |                      |      |      |

Appendix C  
Trip Distribution Figures



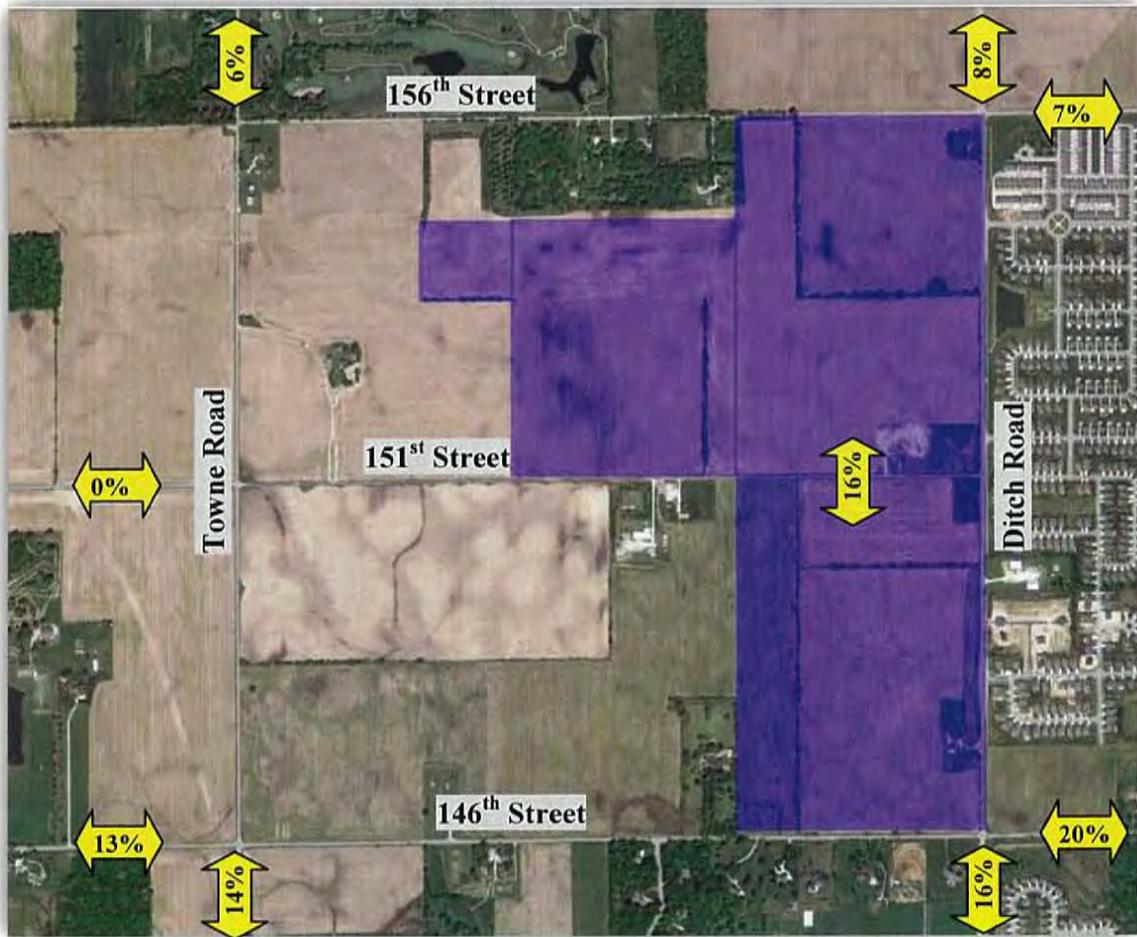


Figure B – Trip Distribution for Multi-Use Land Uses

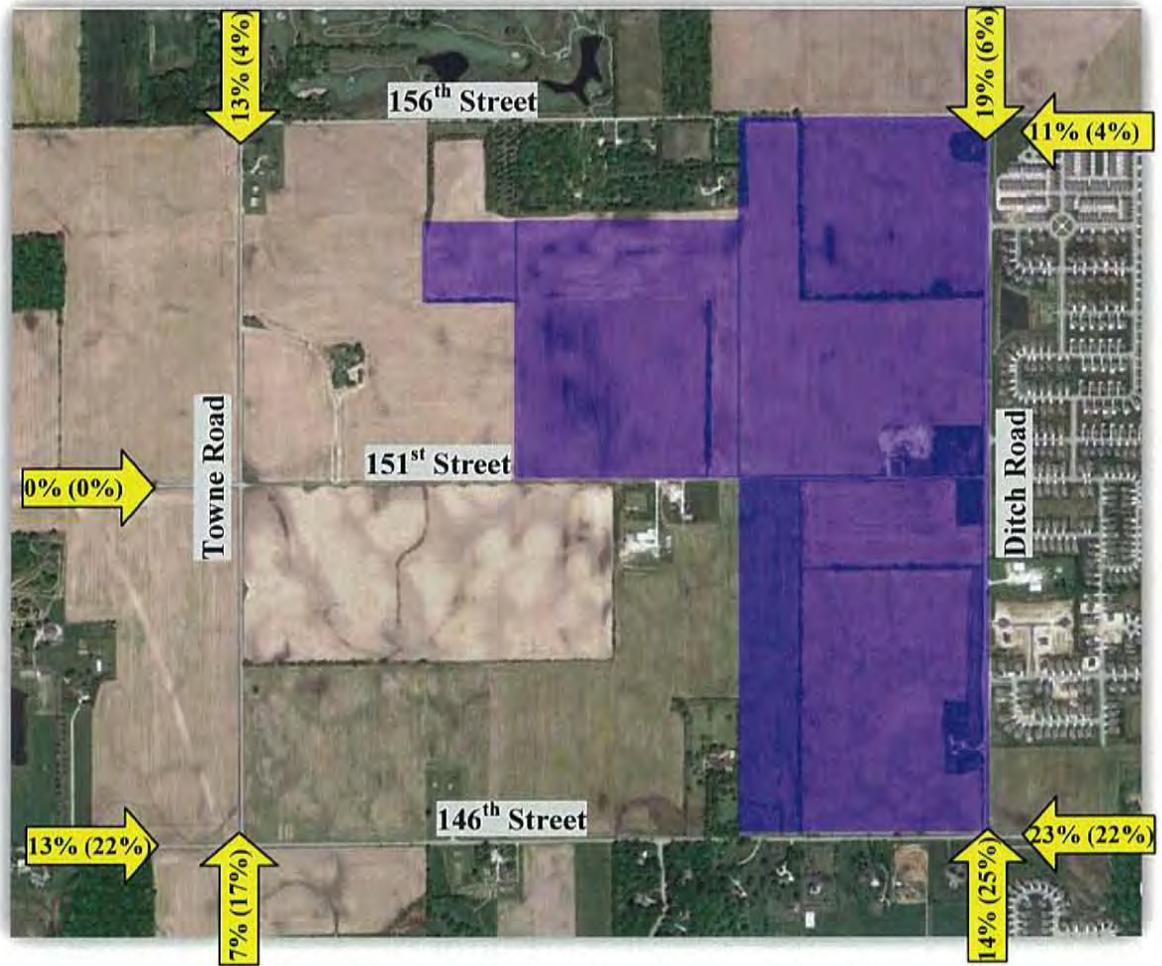


Figure C – Pass-By Trip Distribution: AM (PM)

Appendix D  
Meeting Notes



AMERICAN  
**STRUCTUREPOINT**  
INC.

7260 Shadeland Station, Indianapolis, Indiana 46256  
TEL 317.547.5580 FAX 317.543.0270

www.structurepoint.com

---

## MEETING NOTES

**Location:** City of Westfield Public  
Works Building  
**Date:** February 7, 2012  
**Project:** Harmony TIS

| <b>Attendees:</b> | <b><u>Name</u></b>       | <b><u>Representing</u></b>       |
|-------------------|--------------------------|----------------------------------|
|                   | Neil VanTrees, P.E.      | City of Westfield                |
|                   | Kevin Todd, AICP         | City of Westfield                |
|                   | Jeromy Grenard, PE, PTOE | American Structurepoint,<br>Inc. |
|                   | Amanda Johnson, EI       | American Structurepoint,<br>Inc. |

## ITEMS DISCUSSED:

### 1. Site Plan

- a. Neil and Kevin stated that it was their understanding that not even right-in/right-out drives were likely to be granted on 146<sup>th</sup> Street when it is widened to four lanes.

*Amanda followed up with Bryan Stumpf (Director of Planning, American Structurepoint, Inc.). He has been meeting with Hamilton County for some time regarding right-in/right-out access along 146<sup>th</sup> Street and was somewhat confident access would be provided. He advised to continue study with right-in/right-out access as shown on the current site plan. Therefore, the two right-in/right-out drives were included in the analysis.*

- b. Proposed distribution percentages were examined and agreed to be acceptable.

### 2. Road Network

- a. Per Neil, both Ditch Road and Towne Road between 146<sup>th</sup> Street and 156<sup>th</sup> Street are likely to remain the same as existing: two-lane undivided roads, not upgraded to four-lane roads.
- b. Neil requested that at the intersections of 156<sup>th</sup> & Ditch and 156<sup>th</sup> & Towne be analyzed as roundabouts in addition to existing stop-controlled intersection configurations.

- c. Neil requested that American Structurepoint check with UNITED Consulting to see the latest 146<sup>th</sup> Street plans.

*Jeromy followed up with Chris Hammond (UNITED). 146<sup>th</sup> Street is currently split into two phases through the study area. Phase I is from Springmill Road to Ditch Road (including the intersection), and is currently funded. Phase II is from Ditch Road to Towne Road (including the intersection), and is currently not funded. It is definite that Phase I will be complete by 2022, and likely that Phase II will be funded and built by 2022. For this project it was assumed that the proposed 146<sup>th</sup> conditions would be extended to Towne Road, including the frontage roads.*

### 3. Traffic Volumes

- a. Neil requested that American Structurepoint check with HNTB for future traffic projections along 146<sup>th</sup> Street that were used in the Impact Fee Study. The purpose of this would be primarily to verify the growth rate used.

*Jeromy followed up with Matt Miller (HNTB), who subsequently provided all information from the Impact Fee Study pertaining to the study area.*

- b. The year 2022 was determined to be the horizon year to coincide with the impact fee study and to provide a 10 year horizon year.



# Additional Analysis on the Right-In/Right-Outs on 146<sup>th</sup> Street 03.06.12

## Background

This document summarizes an analysis of the Harmony development with and without right-in/right-out drives along 146<sup>th</sup> Street. Three scenarios were studied:

- Two right-in/right-out drives along 146<sup>th</sup> Street
- No right-in/right-out drives along 146<sup>th</sup> Street
- One right-in/right-out drive along 146<sup>th</sup> Street, one right-in/right-out drive along Ditch Road

Traffic forecasting, along with trip generation, assignment, and distribution were based on procedures described in the Draft Traffic Impact Analysis. The software program TRAFFIX was used to help facilitate the trip distribution for each scenario.

## Capacity Analysis

The inclusion of right-in/right-out drives only had a significant operational impact on the intersections of 146<sup>th</sup> Street & Ditch Road and Access Drive C/I & Ditch Road. The remaining study area intersections did not experience a significant volume shift; therefore, they are not included within this document. The tables below summarize the operational impacts of right-in/right-out drives.

### 146<sup>th</sup> & Ditch – Intersection Total

The following table shows the intersection results for each of the scenarios. The intersection geometries that were described in the Traffic Impact Analysis were used and will remain the same for each scenario. This table shows that overall, delay will increase if right-in/right-out drives are not constructed.

|            | LOS<br><i>AM (PM)</i> | Delay (sec)<br><i>AM (PM)</i> | Queue (veh)<br><i>AM (PM)</i> |
|------------|-----------------------|-------------------------------|-------------------------------|
| Scenario 1 | A (A)                 | 3.67 (3.91)                   | 1.23 (1.15)                   |
| Scenario 2 | A (A)                 | 3.73 (4.18)                   | 1.31 (1.26)                   |
| Scenario 3 | A (A)                 | 3.79 (4.18)                   | 1.33 (1.16)                   |

### 146<sup>th</sup> & Ditch – Southbound (Northbound)

The southbound approach experiences the most delay during the AM peak hour and the northbound approach experiences the most delay during the PM peak hour. To demonstrate how the worst approaches at the intersection will be affected by a right-in/right-out drive, the following table shows the capacity analysis results for the AM peak southbound movement and the PM peak northbound movement. The table below demonstrates that the worst approaches at the intersection operate better with right-in/right-out drives.

|            | LOS<br><i>AM (PM)</i> | Delay (sec)<br><i>AM (PM)</i> | Queue (veh)<br><i>AM (PM)</i> |
|------------|-----------------------|-------------------------------|-------------------------------|
| Scenario 1 | A (A)                 | 5.1 (5.9)                     | 1.23 (1.15)                   |
| Scenario 2 | A (A)                 | 5.2 (6.3)                     | 1.31 (1.26)                   |
| Scenario 3 | A (A)                 | 5.3 (6.2)                     | 1.33 (1.16)                   |

*Drive C/I & Ditch – Intersection Total*

The following table shows the intersection results for each of the scenarios. The intersection geometries that were described in the Traffic Impact Analysis were used and will remain the same for each scenario. This table shows that overall, this intersection will operate worse if right-in/right-out drives are not constructed.

|            | LOS<br><i>AM (PM)</i> | Delay (sec)<br><i>AM (PM)</i> | Queue (veh)<br><i>AM (PM)</i> |
|------------|-----------------------|-------------------------------|-------------------------------|
| Scenario 1 | A (A)                 | 8.76 (6.38)                   | 2.70 (1.75)                   |
| Scenario 2 | A (A)                 | 9.04 (8.41)                   | 2.86 (2.99)                   |
| Scenario 3 | A (A)                 | 9.26 (8.28)                   | 2.97 (2.99)                   |

*Drive C/I & Ditch – Intersection Total*

The following table shows the approach results for each of the scenarios. The only approach not included is the westbound approach. This approach only serves an existing neighborhood and the traffic volumes will not change between scenarios. This intersection would be the only access to the proposed multi-use portion of the development if a right-in/right-out drive is not constructed along 146<sup>th</sup> Street. The table shows that delay and queues along approaches to this intersection will increase without a right-in/right-out drive.

| <b>Scenario 1</b> | <b>LOS<br/><i>AM (PM)</i></b> | <b>Delay (sec)<br/><i>AM (PM)</i></b> | <b>Queue (veh)<br/><i>AM (PM)</i></b> |
|-------------------|-------------------------------|---------------------------------------|---------------------------------------|
| Ditch SB          | B (A)                         | 13.8 (7.7)                            | 2.7 (<1)                              |
| Drive C           | A (A)                         | 6.5 (5.7)                             | <1 (<1)                               |
| Drive I           | A (B)                         | 6.8 (10.2)                            | <1 (1.8)                              |
| Ditch NB          | A (A)                         | 2.0 (3.7)                             | <1 (1.1)                              |
| <b>Scenario 2</b> | <b>LOS<br/><i>AM (PM)</i></b> | <b>Delay (sec)<br/><i>AM (PM)</i></b> | <b>Queue (veh)<br/><i>AM (PM)</i></b> |
| Ditch SB          | B (A)                         | 14.7 (9.2)                            | 2.9 (1.0)                             |
| Drive C           | A (A)                         | 6.7 (6.3)                             | <1 (<1)                               |
| Drive I           | A (C)                         | 7.3 (15.0)                            | <1 (3.0)                              |
| Ditch NB          | A (A)                         | 2.1 (4.1)                             | <1 (1.3)                              |
| <b>Scenario 3</b> | <b>LOS<br/><i>AM (PM)</i></b> | <b>Delay (sec)<br/><i>AM (PM)</i></b> | <b>Queue (veh)<br/><i>AM (PM)</i></b> |
| Ditch SB          | C (A)                         | 15.1 (8.5)                            | 3.0 (<1)                              |
| Drive C           | A (A)                         | 6.7 (6.1)                             | <1 (<1)                               |
| Drive I           | A (B)                         | 7.3 (15.0)                            | <1 (3.0)                              |
| Ditch NB          | A (A)                         | 2.1 (4.1)                             | <1 (1.3)                              |

#### *Access Drive A – Southbound Approach*

The table below shows that the southbound approach at the proposed right-in/right-out intersection will operate above acceptable levels of service during the peak hours. Since movements along 146<sup>th</sup> Street are free-flowing, LOS and delay are not available for the eastbound and westbound approaches.

|            | LOS<br><i>AM (PM)</i> | Delay (sec)<br><i>AM (PM)</i> | Queue (veh)<br><i>AM (PM)</i> |
|------------|-----------------------|-------------------------------|-------------------------------|
| Scenario 1 | A (B)                 | 9.5 (10.8)                    | <1 (<1)                       |

#### *Access Drive B*

The table below shows that the northbound approach at the proposed right-in/right-out intersection will operate above acceptable levels of service during the peak hours. Since movements along 146<sup>th</sup> Street are free-flowing, LOS and delay are not available for the eastbound and westbound approaches.

|            | LOS<br><i>AM (PM)</i> | Delay (sec)<br><i>AM (PM)</i> | Queue (veh)<br><i>AM (PM)</i> |
|------------|-----------------------|-------------------------------|-------------------------------|
| Scenario 1 | A (B)                 | 9.4 (10.4)                    | <1 (<1)                       |
| Scenario 2 | N/A                   | N/A                           | N/A                           |
| Scenario 3 | A (B)                 | 9.7 (11.1)                    | <1 (<1)                       |

#### *Ditch Road & Old 146<sup>th</sup> Street*

The table below shows the capacity results for the westbound approach for each scenario. The westbound approach experiences the most delay during each scenario. Scenario 1 and 2 show the operational results if the intersection is constructed as a full-access stop controlled intersection with the eastbound approach stopping for Ditch Road. Scenario 3 shows the operational results if the intersection is constructed as a right-in/right-out intersection. The table below demonstrates that a right-in/right-out intersection at this location provides the best operational results.

|            | LOS<br><i>AM (PM)</i> | Delay (sec)<br><i>AM (PM)</i> | Queue (veh)<br><i>AM (PM)</i> |
|------------|-----------------------|-------------------------------|-------------------------------|
| Scenario 1 | D (C)                 | 26.5 (24.0)                   | 2.0 (1.6)                     |
| Scenario 2 | D (D)                 | 29.6 (25.5)                   | 2.8 (2.0)                     |
| Scenario 3 | B (B)                 | 13.9 (10.5)                   | <1 (<1)                       |

#### **Operations**

The capacity analysis findings are listed below:

- A right-in/right-out drive will not significantly affect the operations along 146<sup>th</sup> Street.
- The intersections of Ditch Road & 146<sup>th</sup> Street and Ditch Road & Access Drive C/I operate best with two right-in/right-out drives along 146<sup>th</sup> Street.
- Delay and queues increase along certain approaches when a right-in/right-out is not constructed.
- All intersection geometries remain the same for all scenarios, with the exception of Old 146<sup>th</sup> Street & Ditch Road. This intersection geometry changes to a right-in/right-out only during Scenario 3.

## **Safety**

Two safety concerns are described below:

- Vehicles along 146<sup>th</sup> Street slowing to turn right into the drive.
  - An exclusive right-turn lane could be constructed along 146<sup>th</sup> Street to allow proper deceleration of right-turning vehicles, thus removing the conflict of slowing vehicles in a through lane.
- Vehicles turning right out of the drive onto the 146<sup>th</sup> Street.
  - Although the right-turn exiting vehicle is a potential conflict point, it should be noted that there is only one conflict point associated with a right-in/right-out drive. A full access drive, which allows left-turn movements, presents multiple conflict points.

## **Summary**

A right-in/right-out drive will not significantly affect the operations along 146<sup>th</sup> Street. The addition of a right-in/right-out drive along 146<sup>th</sup> Street will actually improve operations at the adjacent study intersections; most notably at the access drive to the proposed development and at the intersection of Ditch Road & 146<sup>th</sup> Street. Vehicles may slow down to turn into a right-in/right-out drive which could cause operational issues and safety issues, but if a right-turn lane is constructed these issues become obsolete. In addition, although a right-in/right-out access is less safe than allowing no access, it presents only one conflict point, making it a much safer alternative than a full access drive.

It is desirable for commercial developments to have more than one access drive. If a fire or an accident is blocking one access, a secondary access can be used for evacuation, or for emergency vehicles. The City of Westfield Zoning Ordinance states that multi-family developments must provide two access points to local streets to allow adequate accessibility for emergency vehicles. Both of the commercial development areas within the Harmony development would be served by only one access point if the right-in/right-out drives are not constructed along 146<sup>th</sup> Street.