



500 West Big Beaver  
Troy, MI 48084  
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planning@troymi.gov

## **PLANNING COMMISSION MEETING AGENDA REGULAR MEETING**

Tom Krent, Chairman, David Lambert, Vice Chairman  
Carlton Faison, Michael W. Hutson, Lakshmi Malalahalli,  
Marianna Perakis, Sadek Rahman, Jerry Rauch and John J. Tagle

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**January 12, 2021**

**7:00 P.M.**

**Remote Meeting**

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***Public Comment may be communicated to the Planning Commission via telephone voice mail by calling 248.524.1305 or by sending an email to [planning@troymi.gov](mailto:planning@troymi.gov). All comments will be provided to the Planning Commission.***

1. ROLL CALL
2. SUSPENSION OF PLANNING COMMISSION BYLAWS
3. APPROVAL OF AGENDA
4. APPROVAL OF MINUTES – December 8, 2020
5. PUBLIC COMMENT – For Items Submitted via Email or Telephone Message

### **SPECIAL USE APPROVAL**

6. SPECIAL USE APPROVAL LONG LAKE & DEQUINDRE SHELL(File Number SP2020-0001) – Proposed Long Lake Shell Addition, Southwest corner of Long Lake and Dequindre, Section 13, Currently Zoned NN (Neighborhood Node “J”) District.

### **PLANNED UNIT DEVELOPMENT (PUD)**

7. PLANNED UNIT DEVELOPMENT (File Number PUD2020-0018) – Proposed Concept Development Plan (CDP) for Long Lake and Crooks Masterplan Development, Southwest corner of Long Lake and Crooks, Section 8, Currently Zoned O Office.

### **OTHER ITEMS**

8. MISCELANNEOUS BUSINESS – Correspondence from ZBA
9. ELECTION OF OFFICERS
10. PLANNING COMMISSION COMMENT
11. ADJOURN

**NOTICE:** People with disabilities needing accommodations for effective participation in this meeting should contact the City Clerk by e-mail at [clerk@troymi.gov](mailto:clerk@troymi.gov) or by calling (248) 524-3317 at least two working days in advance of the meeting. An attempt will be made to make reasonable accommodations.

Televised Live, Government Channel WTRY (10 WideOpenWest and 17 Comcast) Replayed Wednesdays 3:00 pm, 6:00 pm and 11:00 pm

## **PROPOSED RESOLUTION**

### **PROPOSED RESOLUTION TO TEMPORARILY SUSPEND THE PLANNING COMMISSION RULES OF PROCEDURE**

#### **Resolution # PC-2021-01-**

Moved by:

Seconded by:

WHEREAS, the Michigan Department of Health and Human Services (MDHHS) Director Robert Gordon issued an Order on October 5, 2020 under MCL 333.2253 restricting indoor gathering sizes to protect public health and safety, and

WHEREAS Public Act 254 of 2020 permits public meetings to be held by electronic means where an in person meeting could detrimentally increase exposure of board members and the general public to COVID-19,

THEREFORE BE IT RESOLVED, That as allowed by Planning Commission Rules of Procedure Article IV, Section 6, the Troy Planning Commission hereby **TEMPORARILY SUSPENDS** the requirement of holding a meeting at the Troy City Hall and **ALLOWS** all Troy Planning Commission Members to electronically participate in any Planning Commission meeting through March 31, 2021.

Members participating electronically will be considered present and in attendance at the meeting and may participate in the meeting as if physically present. However, members must avoid using email, texting, instant messaging, and other such electronic forms of communication to make a decision or deliberate toward a decision.

RESOLVED, As allowed by Planning Commission By-laws and Rules of Procedure Article X, the Troy Planning Commission hereby **TEMPORARILY SUSPENDS AND MODIFIES** the By-laws and Rules of Procedure concerning the Order of the Agenda, as set forth in Article V, Section 3, to consolidate the Public Comment sections of the meeting for any meeting held through March 31, 2021.

RESOLVED, As allowed by Planning Commission By-laws and Rules of Procedure Article X, the Troy Planning Commission hereby **TEMPORARILY SUSPENDS AND ALLOWS** two methods of receiving Public Comment for virtual meetings. Public comments can be submitted for the Planning Commission meeting by sending an email to: [planning@troymi.gov](mailto:planning@troymi.gov). Emails received prior to 4:00 pm on the day of the Planning Commission meeting, will be read at the meeting and made part of the public record. Public comments can also be submitted by calling the following phone number and leaving a voicemail message: (248) 524-1305. Recorded voicemail messages received prior to 4:00 pm on the day of the Planning Commission meeting will be played at the meeting. For emails and recorded messages received after the deadline, reasonable efforts will be made to read emails and play recorded messages received during the meeting. Email and voicemail public comments will be limited to three minutes each.



Chair Krent called the virtual Regular meeting of the Troy City Planning Commission to order at 7:00 p.m. on December 8, 2020. Chair Krent introduced the procedure to be followed for a remote meeting.

1. ROLL CALL

Present:

Ollie Apahidean  
Karen Crusse  
Carlton M. Faison  
Michael W. Hutson  
Tom Krent  
David Lambert  
Sadek Rahman  
John J. Tagle

Absent:

Marianna Perakis

Also Present:

R. Brent Savidant, Community Development Director  
Ben Carlisle, Carlisle Wortman Associates  
Julie Quinlan Dufrane, Assistant City Attorney  
Jackie Ferencz, Planning Department Administrative Assistant  
Kathy L. Czarnecki, Recording Secretary

2. SUSPENSION OF PLANNING COMMISSION BYLAWS

**Resolution # PC-2020-12-032**

Moved by: Krent

Support by: Lambert

WHEREAS, the Michigan Department of Health and Human Services (MDHHS) Director Robert Gordon issued an Order on October 5, 2020 under MCL 333.2253 restricting indoor gathering sizes to protect public health and safety, and

WHEREAS, Public Act 228 of 2020 permits public meetings to be held by electronic means where an in-person meeting could detrimentally increase exposure of board members and the general public to COVID-19,

THEREFORE BE IT RESOLVED, That as allowed by Planning Commission Rules of Procedure Article IV, Section 6, the Troy Planning Commission hereby **TEMPORARILY SUSPENDS** the requirement of holding a meeting at the Troy City Hall and **ALLOWS** all Troy Planning Commission Members to electronically participate in any Planning Commission meeting through December 31, 2020.

Members participating electronically will be considered present and in attendance at the meeting and may participate in the meeting as if physically present. However, members must avoid using email, texting, instant messaging, and other such electronic forms of communication to make a decision or deliberate toward a decision.

RESOLVED, As allowed by Planning Commission By-laws and Rules of Procedure Article X, the Troy Planning Commission hereby **TEMPORARILY SUSPENDS AND MODIFIES** the By-laws and Rules of Procedure concerning the Order of the Agenda, as set forth in Article V, Section 3, to consolidate the Public Comment sections of the meeting for any meeting held through December 31, 2020.

RESOLVED, As allowed by Planning Commission By-laws and Rules of Procedure Article X, the Troy Planning Commission hereby **TEMPORARILY SUSPENDS AND ALLOWS** two methods of receiving Public Comment for virtual meetings. Public comments can be submitted for the Planning Commission meeting by sending an email to: [planning@troymi.gov](mailto:planning@troymi.gov). Emails received prior to 4:30 p.m. on the day preceding the Planning Commission meeting will be incorporated into the official record by attaching the emails to the agenda for review and consideration by Planning Commission members and interested persons. Public comments can also be submitted by calling the following phone number and leaving a voicemail message: (248) 524-1305. Recorded voicemail messages received prior to 4:30 p.m. on the day of the Planning Commission meeting will be played at the meeting. Email and voicemail public comments will be limited to three minutes each.

Yes: All present (8)  
Absent: Perakis

### **MOTION CARRIED**

#### 3. APPROVAL OF AGENDA

##### **Resolution # PC-2020-12-033**

Moved by: Faison  
Support by: Hutson

**RESOLVED**, To approve the Agenda as prepared.

Yes: All present (8)  
Absent: Perakis

### **MOTION CARRIED**

#### 4. APPROVAL OF MINUTES

##### **Resolution # PC-2020-12-034**

Moved by: Lambert  
Support by: Rahman

**RESOLVED**, To approve the minutes of the November 10, 2020 Regular meeting as submitted.

Yes: All present (8)  
Absent: Perakis

### **MOTION CARRIED**

#### **5. PUBLIC COMMENT – For Items Submitted via Email or Telephone Message**

Mr. Savidant stated a revised Agenda packet was posted on the City website incorporating email messages received prior to 4:30 p.m. Monday, December 7, 2020, as stipulated by Resolution # PC-2020-12-032.

Mr. Savidant and Ms. Ferencz read the following email messages received after 4:30 p.m. Monday, December 7, 2020 through 4:30 p.m. today, December 8, 2020.

Email messages received, in response to Agenda item #6.

- Ashish Bajaj, 6313 Country Ridge Drive; in opposition.
- Paul Balas, 4087 Parkstone Court; in opposition.
- Sandeep Bhatti, no address; in opposition.
- Mary Branch, Miracle Drive; in opposition.
- Sanjay Chawla, Villas of Troy resident; in opposition.
- Joe Cole, President of WSE HOA; in opposition.
- Sarah Compton, Huron Drive; in opposition.
- Ryan and Stephanie Giorio, 4460 Lehigh; in opposition.
- Sudhanshu Grover, 4886 Seasons; in opposition.
- Priti Gupta and family, no address; in opposition.
- Randall Hicks, Troy resident; in opposition.
- Judith Holmburg, 1351 Bradbury Drive; in opposition.
- Jing Huang, 3588 Oriole Drive; in opposition.
- Tony Huang, 772 Palermo; in opposition.
- Sanjay Kumar; resident Coolidge and Wattles; in opposition.
- Joy Lackey, no address; in opposition.
- Laura Lipinski, 4233 Carson; in opposition.
- Jonathan Maksabo, no address; in opposition.
- F. Marnandus, Alpine Road; in opposition.
- Kathy Metevier, no address; in opposition.
- Mike and Yvette Metz, 1239 Bradbury; in opposition.
- Ashish Modi, resident Long Lake and Livernois; in opposition.
- Marilyn Papandrea, no address; in opposition.
- Mark and Diane Paul, 3844 Root; in opposition.
- Jayashree Rao, 4415 Wintergreen Drive; in opposition.
- Daniel Raubinger, 4083 Penrose, President Woodlands HOA; in opposition.
- Jeanne Stine, no address; in opposition.
- Aish Ramesh, 4609 Colling Drive; in opposition.
- Raymond Richard, 344 Colebrook Drive; in opposition.

- Rovita A., no address; in opposition.
- Arun K. Sekhri, 3539 Delaware; in opposition.
- Patricia Serafini, Troy resident; in opposition.
- Anshul Shah, 4609 Colling Drive; in opposition.
- Aashka Shah, 4088 Parkstone Court; in opposition.
- Ananya Shah, no address; in opposition.
- Jigna Shah, 4088 Parkstone Court; in opposition.
- Bhaskar Thota, 788 Palermo; in opposition.
- Vandan Kumar Manni, 740 Palermo; in opposition.
- Susan Voytal, Troy resident; in opposition.
- Jinming Xu, 4179 Carson; in opposition.
- Ringo Zhang, Whisperway; in opposition.

Ms. Ferencz played the following voicemail messages. The messages were not audible to the Board; she therefore identified the following names and addresses:

- Shah (last name), no address; in opposition.
- Vandan Kumar Manni, 740 Palermo; in opposition.
- David Rusing, 1425 Bradbury; in opposition.

### **PRELIMINARY SITE PLAN APPROVAL**

6. **PRELIMINARY SITE PLAN REVIEW (File Number SP JPLN2019-0045) – Proposed The Westington, South side of Wattles, East of Crooks, Section 21, Currently Zoned NN (Neighborhood Node “I”) District**

Mr. Carlisle briefly reviewed the Preliminary Site Plan application that was before the Planning Commission on October 27, 2020, at which time the Board postponed action on the item asking the applicant to address concerns relating to access, massing and traffic. Mr. Carlisle addressed three significant revisions to the plan: 1) the building fronting Wattles is broken up into two buildings; 2) the number of units is reduced from 108 to 102; and 3) the drive access is shifted further east on Wattles.

Mr. Carlisle addressed the Fire Department requirements for the EVA (emergency vehicle access) and the traffic consultant (OHM) review of the traffic report noting support of the changes in the application. Mr. Carlisle reported the application meets all the “hard” requirements of the Zoning Ordinance and is an appropriate use. He indicated compatibility and transition of the proposed development is the jurisdiction of the Planning Commission.

Mr. Carlisle recommended Preliminary Site Plan approval with the condition that the Fire Department requirements relating to the proposed EVA are addressed prior to Final Site Plan approval.

Project Architect Peter Stuhldreier of DesignHaus and Attorney Greg Obloy of Carson Fischer were present. Mr. Stuhldreier indicated project engineers and the applicant are present as well.

Mr. Stuhldreier addressed revisions to the site plan with respect to access, breaking up the building fronting Wattles into two buildings, parking, play area for children and the proposed emergency vehicle access (EVA). Mr. Stuhldreier indicated he would be happy to respond to the public comment should the Board wish.

Mr. Obloy briefly explained the ownership of Barilane and how it relates to the proposed EVA. Mr. Obloy expressed confidence that the access for emergency vehicles can be accomplished during Final Site Plan approval.

There was discussion on:

- Children play area; approximate 80'x120' area on east side of development, grill area and pavilion.
- Emergency Vehicle Access (EVA); road ownership, Fire Department requirements.
- Massing of building fronting Wattles; adequately addressed by applicant allowing light and air between proposed two buildings.
- Troy School Superintendent on record that new residential development does not negatively impact schools.
- Traffic Study submitted by applicant; review by City's traffic consultant in support of revisions to plan, finding negligible traffic impact.
- Public comment relating to changes in the Master Plan.
- Density of development.

**Resolution # PC-2020-12-035**

Moved by: Faison

Support by: Tagle

**RESOLVED**, That Preliminary Site Plan Approval, pursuant to Article 8 of the Zoning Ordinance, as requested for the proposed The Westington Apartment Project, 102 units, located on the South side of Wattles, East of Crooks (Parcels 88-20-21-101-004, -005 and -008), Section 21, Zoned NN (Neighborhood Node "I") District, be granted, subject to the following condition:

1. Address Fire Department requirements with regards to proposed Emergency Vehicle Access (EVA) prior to Final Site Plan Approval.

Yes: Apahidean, Crusse, Faison, Hutson, Krent, Lambert, Tagle

No: Rahman

Absent: Perakis

**MOTION CARRIED**

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**OTHER ITEMS****7. MISCELLANEOUS BUSINESS – Planning Commission 2021 Meeting Schedule**

It was the consensus of the Board to omit the November 23 date because of the Thanksgiving holiday.

**Resolution # PC-2020-12-036**

Moved by: Lambert

Support by: Faison

**RESOLVED**, To approve the 2021 Planning Commission regular meeting dates as presented with the omission of the November 23, 2021 date.

Yes: All present (8)

Absent: Perakis

**MOTION CARRIED****8. PLANNING COMMISSION COMMENT**

There were general Planning Commission comments, some relating to:

- Density of development projects in Neighborhood Node districts.
- Roles of Community Development Director and Planning Commission.
- Planning Commission members appointed, not elected officials.
- Master Plan; timeline of update, process as relates to State statute.
- Status of proposed Zoning Ordinance text amendments for City Council action.
- Recent crime within City.

Ms. Dufrane updated the Board on the Eureka lawsuit relating to proposed rezonings at the northwest corner of Rochester and Sylvanwood; favorable opinion granted by Court to dismiss the matter.

A happy and safe holiday season and a brighter 2021 New Year was wished to all.

The virtual Regular meeting of the Planning Commission adjourned at 8:58 p.m.

Respectfully submitted,

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Tom Krent, Chair

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Kathy L. Czarnecki, Recording Secretary

DATE: January 7, 2020

TO: Planning Commission

FROM: R. Brent Savidant, Community Development Director

SUBJECT: SPECIAL USE REQUEST (File Number SP2020-0001) – Proposed Long Lake Shell Addition, Southwest corner of Long Lake and Dequindre, Section 13, Currently Zoned NN (Neighborhood Node “J”) District.

The petitioner Art Kalajian submitted the above referenced Special Use Approval and Preliminary Site Plan Approval application for an addition to an existing gas station.

The Planning Commission held a public hearing on this item on February 11, 2020. No action was taken since the application required variances from the Zoning Board of Appeals. The Zoning Board of Appeals granted the following variances on November 11, 2020: (1) Expansion of a nonconforming building (2) To construct a building addition 77 feet from the Dequindre property line where the Zoning Ordinance requires a 10 foot “build to” line, and (3) To construct a building addition 13.61 feet from the west property line where the Zoning Ordinance requires a 30-foot setback. The application is before the Planning Commission again for action.

The attached report prepared by Carlisle/Wortman Associates, Inc. (CWA), the City's Planning Consultant, summarizes the application. CWA prepared the report with input from various City departments including Planning, Engineering, Public Works and Fire. City Management supports the findings of fact contained in the report and recommends approval of the project, as noted.

Attachments:

1. Maps
2. Minutes from February 11, 2020 Planning Commission Regular meeting (excerpt).
3. Minutes from November 11, 2020 Zoning Board of Appeals Regular meeting (excerpt).
4. Report prepared by Carlisle/Wortman Associates, Inc.

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## PROPOSED RESOLUTION

SPECIAL USE APPROVAL LONG LAKE & DEQUINDRE SHELL (File Number SP2020-0001) – Proposed Long Lake Shell Addition, Southwest corner of Long Lake and Dequindre, Section 13, Currently Zoned NN (Neighborhood Node “J”) District.

### **Resolution # PC-2021-01-**

Moved by:

Seconded by:

**RESOLVED**, That Special Use Approval and Preliminary Site Plan Approval for the proposed Long Lake Shell Addition, Southwest corner of Long Lake and Dequindre, Section 13, Currently Zoned NN (Neighborhood Node “J”) District, be (granted, subject to the following conditions):

\_\_\_\_\_ ) or

(denied, for the following reasons: \_\_\_\_\_) or

(postponed, for the following reasons: \_\_\_\_\_)

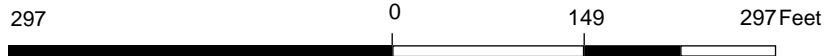
Yes:

No:

Absent:

## MOTION CARRIED / FAILED

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Note: The information provided by this application has been compiled from recorded deeds, plats, tax maps, surveys, and other public records and data. It is not a legally recorded map survey. Users of this data are hereby notified that the source information represented should be consulted for verification.





297 0 149 297 Feet



Note: The information provided by this application has been compiled from recorded deeds, plats, tax maps, surveys, and other public records and data. It is not a legally recorded map survey. Users of this data are hereby notified that the source information represented should be consulted for verification.

**SITE PLAN APPROVAL**

6. **PUBLIC HEARING - SPECIAL USE REQUEST (File Number SP2020-0001) – Proposed Long Lake Shell Addition, Southwest corner of Long Lake and Dequindre, Section 13, Currently Zoned NN (Neighborhood Node J”) District**

Mr. Carlisle stated the Planning Commission would take no action on the Special Use Request this evening because the applicant must seek a variance from the Zoning Board of Appeals. He indicated the variance sought by the applicant relates to the required setback along the western (rear) property line. The applicant is seeking an expansion to an existing non-conforming building.

Mr. Carlisle said the reinvestment in the site with the proposed façade and landscaping improvements is significant. Mr. Carlisle identified site plan issues relating to outdoor storage, parked cars in alley area, number of parking spaces, trash storage and removal, parking lot screening, blocking alley area, blocking access to/from Dequindre and intent of the proposed waiting area.

Mr. Carlisle expressed support of the reinvestment in the site. He recommended the Planning Commission hold a Public Hearing, consider public testimony, and postpone action for the application to be considered by the Zoning Board of Appeals. Mr. Carlisle asked the applicant to address the number of outstanding issues identified in his report dated February 6, 2020 and to amend the site plan accordingly.

Present were project architect Art Kalajian and owner Sam Askar.

Mr. Kalajian distributed to the Board revised plans based on comments in the Planning Consultant report. He addressed:

- Alley area parking; vehicular maneuvering for repair work, trash removal.
- Trash removal; existing dumpster on site.
- Clean-up of outdoor storage.
- Convenience store expansion; accommodate range of products.
- Waiting area; for repair center clients, similar to dealership service area.
- Office space; 300 square feet, remainder square footage to be used for light storage.
- Calculation of required number of parking spaces as relates to square footage of office space.
- Parking requirement; number, configuration of spaces, compact car spaces.
- Bike rack; incorporated on site plan.
- Landscaping; planters, masonry wall on Dequindre in lieu of landscaping.
- Calculations of open space as relates to non-conformity.
- Recessed lighting.
- Entrance.
- Building materials; renderings.

Mr. Askar said the service station offers minor auto repairs such as oil changes, brake service and tire repair. He addressed trash removal, landscaping, office use, outdoor

storage, parking and waiting area. He said there has never been a parking concern except for the line that forms for the free air. Mr. Askar referenced the submission of signatures in support of the proposed site improvements.

#### PUBLIC HEARING OPENED

Mark Deagle, 2866 English; spoke in support of the improvements, expressed high regard for the owner.

#### PUBLIC HEARING CLOSED

There was discussion on:

- Variance request to expand building; legal non-conforming structure.
- Existing dumpster on site; location, no enclosure.
- Building height of addition.
- Shared parking with adjacent retail.
- Parking in alley area; operable vehicles or vehicles in repair, not included in parking space calculations, screening.
- Vehicular circulation; blocking, visibility.
- Parking requirement; calculations of number required, compact cars.
- Occupancy calculations; building code, relates to occupancy.

Mr. Savidant informed the Board his department has received no complaints about the proprietorship of the property, how it is managed, or concerns with parking in the alley area.

Mr. Carlisle said he would do a recalculation of the number of required parking spaces. He noted his concern is viable parking spaces for repair service and dedicated spaces for customers. He asked the applicant to provide additional information on the dumpster and trash removal to assist in his determination.

1. HEARING OF CASES:

- A. VARIANCE REQUEST, ARTHUR KALAJIAN, 2970 E LONG LAKE: A variance request to 1) to expand a nonconforming building, 2) to construct a building addition 77 feet from the Dequindre property line where the Zoning Ordinance requires a 10 foot “build to” line, and 3) to construct a building addition 13.61 feet from the west property line where the Zoning Ordinance requires a 30 foot setback.

MOTION by Eisenbacher  
Second by Desmond

RESOLVED, to approve the request.

MOTION by Clark  
Second by Eisenbacher

RESOLVED, to amend motion requesting additional screening of shrubbery to further enhance landscaping and create a greenbelt around property with emphasis on the west side of property.

Yes: Clark, Eisenbacher  
No: McCauley, Rahman, Bossenbroek, Green, Desmond

MOTION FAILS

MOTION by Eisenbacher  
Second by Desmond

RESOLVED, to approve the request.

Yes: Rahman, Clark, Desmond, Bossenbroek, Eisenbacher, McCauley  
No: Green

MOTION PASSED



**Carlisle | Wortman**  
ASSOCIATES, INC.

117 NORTH FIRST STREET SUITE 70 ANN ARBOR, MI 48104 734.662.2200 734.662.1935 FAX

Date: February 6, 2020  
December 15, 2020  
January 7, 2021

## **Preliminary Site Plan and Special Use Review For City of Troy, Michigan**

<b>Project Name:</b>	Shell Gas Station
<b>Plan Date:</b>	January 4, 2021
<b>Location:</b>	2970 E. Long Lake (Southwest corner of Long Lake and Dequindre)
<b>Zoning:</b>	NN, Neighborhood Node
<b>Action Requested:</b>	Site Plan and Special Use Approval

### **PROJECT AND SITE DESCRIPTION**

The applicant is proposing to construct a 1,618 sq/ft ground floor addition and a 760 sq/ft second floor addition to the existing gas station at the southwest corner of Long Lake and Dequindre. The ground floor addition is for the purpose of both expanding the existing convenience store and to add additional indoor auto and part storage area. The second story addition is a private office. The proposed expansion is located on the rear of the existing building.

The expansion requires three variances:

1. Expand a nonconforming building;
2. Construct a building addition 77 feet from the Dequindre property line where the Zoning Ordinance requires a 10 foot "build to" line; and



3. Construct a building addition 13.61 feet from the west property line where the Zoning Ordinance requires a 30-foot setback.

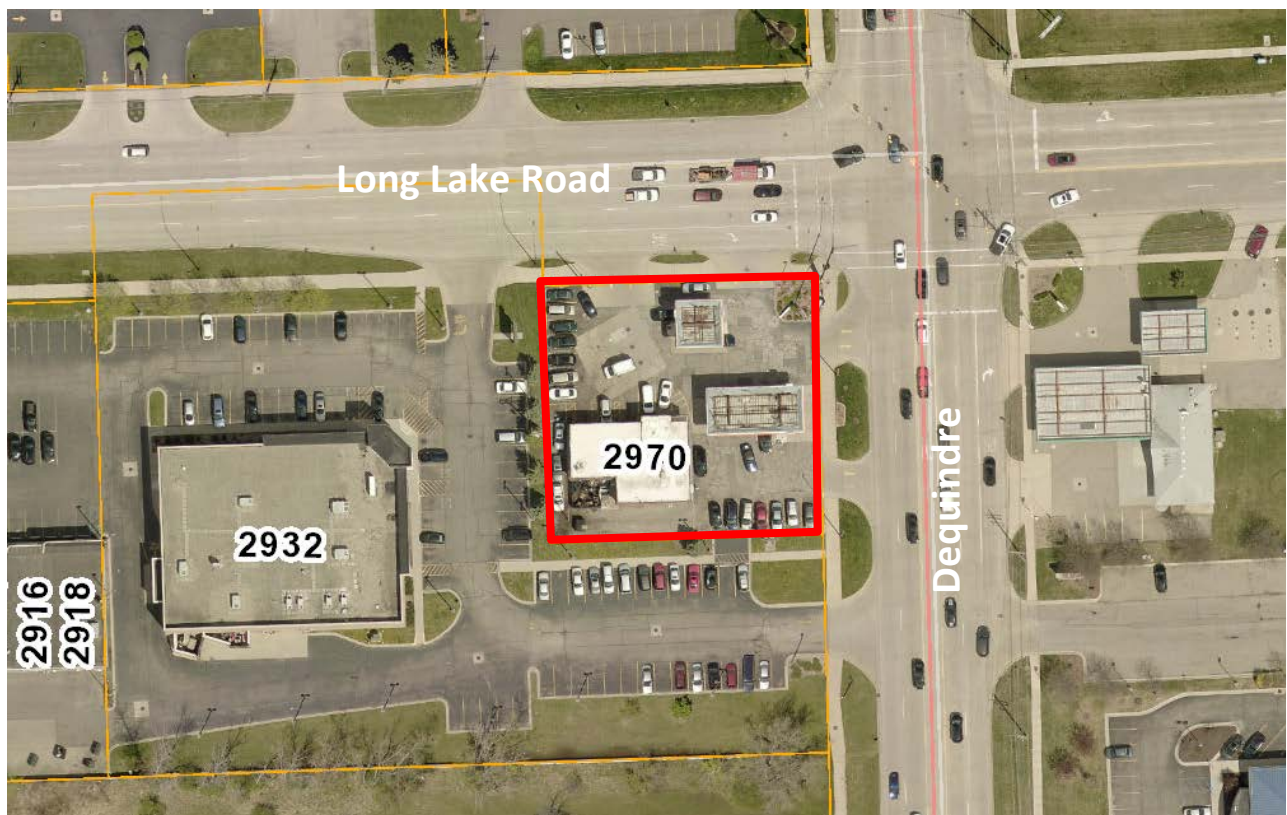
The applicant received the three variances from the Zoning Board of Appeals on November 17, 2020.

The applicant is not proposing any changes to building orientation, canopy orientation, or site access. However, as part of the site reinvestment, the applicant proposes significant façade improvements, and site landscaping improvements.

The site is located in Neighborhood Node J, site type A. The auto repair expansion requires a Special Use.

Location of Subject Property:

2970 Long Lake



Size of Subject Property:

1.01 acres in area (gross)  
0.58 acres in area (net)

Proposed Uses of Subject Parcel:

Gas Station (expansion)

Current Zoning:

The property is currently zoned NN, Neighborhood Node

Surrounding Property Details

Direction	Zoning	Use
North	NN, Neighborhood Node	Commercial
South	NN, Neighborhood Node	Parking for Commercial
East	Sterling Heights	Gas Station
West	Neighborhood Node	Commercial

**PLANNING COMMISSION CONSIDERATION**

This item was last considered by the Planning Commission at their February 11, 2020 meeting. Discussion included:

- Variance request to expand the building, legal non-conforming structure
- Existing dumpster on site; location, no enclosure
- Building height of addition
- Shared parking with adjacent retail
- Parking in alley area; operable vehicles or vehicles in repair, not included in parking space calculations, screening
- Vehicular circulation; blocking, visibility
- Parking requirement, calculations of number required, compact cars
- Occupancy calculations, building code, relates to occupancy

At the meeting the Planning Commission held a public hearing but postponed action to allow the applicant to be considered by the Zoning Board of Appeals for the noted variances.

**ZONING BOARD OF APPEALS**

On November 17, 2020, the Zoning Board of Appeals granted the following variances:

1. Expand a nonconforming building;
2. Allow an building addition 77-feet from the Dequindre property line where the Zoning Ordinance requires a 10-foot "build to" line; an
3. Allow an building addition 13.61-feet from the west property line where the Zoning Ordinance requires a 30-foot setback.

The applicant obtained the required variances for the project to be approved if the Planning Commission approves the Special Use and preliminary site plan.

## **BUILDING ARRANGEMENT**

The applicant is proposing to construct a 1,618 sq/ft ground floor addition and a 760 sq/ft second floor addition to the existing gas station at the southwest corner of Long Lake and Dequindre. The ground floor addition is for the purpose of both expanding the existing convenience store and to add additional indoor auto and part storage area. The second story addition is a private office. The proposed expansion is located on the rear of the existing building.

As seen by the aerial photo the site has parking and vehicle storage along the southern property line, the western property line, and in the rear of the building. Though the applicant is not proposing any changes to building orientation, canopy orientation, or site access, they are adding intensity to the small site by increasing the square footage for convenience store and storage area. To confirm the adequacy of access, circulation, and parking, we offer the following comments for the Planning Commission to consider and for the applicant to address (see site plan below that highlights comments):

- 1 The current site includes vehicle storage in an “alley” located between the western property line and the building. Is the applicant planning on keeping cars in this alley area?
- 2 Section 6.26 of the Zoning Ordinance states that for auto repair facilities: Outdoor storage shall be enclosed by an opaque fence up to eight (8) feet in height and/or landscape screening meeting the standards set forth in Section 13.02.B.” The applicant doesn’t indicate any screening. Is overnight parking of vehicles repaired appropriate for this site. Planning Commission can consider condition that does not permit overnight parking.
- 3 Automobile oriented uses requires the screening of either 1 tree every 10 feet or a wall screening from office uses. There is an existing office use adjacent to the west. Where the applicant proposes the “alley” that property line is supposed to be screened either with a wall or landscaping.

## AREA, WIDTH, HEIGHT, SETBACKS

### Required and Provided Dimensions:

The site is being developed as Building Form A. Table 5.03.B1 establishes the dimensional requirements for the Building Form A:

	Required	Provided	Compliance
Front (Maple Road)	10-foot build-to-line	75-feet	Legal non-conforming
Front (Dequindre)	10-foot build-to-line	77-feet	Legal non-conforming
Side	0	0-feet	Complies
Rear	30-feet	13-feet	Received Variance from Zoning Board of Appeals
Open Space	30 percent	78%	Complies
Building Height	Minimum 14 feet Maximum 45 feet	18 feet	Complies
Parking	Not located in front yard + screening	Not located in front yard and screened.	Applicant is screening parking from Long Lake with landscaping and from Dequindre with screen wall

The applicant proposes to expand the building in the rear. The western property line is considered the rear property line, and as such it requires a 30-foot setback. The existing building is non-conforming with only a 13-foot setback. The applicant is seeking to expand (lengthen) the existing non-conforming. The applicant received a variance from the Zoning Board of Appeals.

***Items to be Addressed: None***

## SITE ACCESS AND CIRCULATION

### Vehicular access and Circulation:

Access to the site will be the existing curb cuts on Long Long and Dequindre. Both are County roads. Any work will require permit from the County. The County in their review may require the applicant to remove a curb-cut.

The Fire Department has reviewed circulation and notes that it is sufficient. As noted earlier, we have expressed concern with the parking adjacent to the building.

***Items to be Addressed: None***

## PARKING

Gas Station/Auto Repair ordinance requires as set forth in table 13.06.a:

	Required	Provided
Vehicle Fueling Station: 1 space for each 125 square feet of net floor area, plus 2 parking spaces per fueling station	10 spaces at 5 fueling stations + $1,220 \text{ square feet} / 125 = 10 \text{ spaces}$	17 spaces + 10 fueling stations
Vehicle Repair Station 2 spaces for each service bay, plus 1 space for each tow truck if applicable, plus adequate spaces for overnight parking, plus 1 space per 1 employee on the largest typical shift	3 bays = 6 spaces  3 employees = 3 spaces	
Office: 1 space for each 300 square feet of gross floor area	$250 \text{ square feet} / 300 = 1 \text{ spaces}$	
Barrier Free	1	1
Bicycle Parking	2	0
<b>Total</b>	<b>20 automobile + 2 bicycle</b>	<b>17 automobile + 10 at fueling stations + 2 bicycle</b>

The use is under parked by at least 3 spaces. The applicant is proposing three (3) spaces parallel to the westside of the building, that are stacked and prevent access to the trash dumpster. Though they may serve as functional spaces for the applicant, these spaces do not meet the requirements for parking in the zoning ordinance. Planning Commission should consider these spaces in light of our early questions, and determine if such parking should be permitted and if additional parking should be required.

**Items to be Addressed:** Planning Commission to consider parking

## LANDSCAPING

The applicant has provided additional landscaping but a detailed landscape plan and landscape calculations was not provided. For example, there are areas highlighted with landscaping but size and species were not indicated.

The applicant notes 6' masonry wall to screen trash enclosure.

**Items to be Addressed:** *Provide landscape details*

## PHOTOMETRICS

The applicant indicated that they are not adding any additional site lighting. It is assumed that based upon a new façade, new lighting will be provided on the building. The applicant should provide building lighting fixture details.

**Items to be Addressed:** *Provide building lighting fixture details.*

## ELEVATIONS AND FLOOR PLANS

The applicant has submitted elevations and floor plans. The applicant is making a significant investment in the façade. The proposed materials include painted brick veneer (existing), glass, cement fiber wall panels, and decorative CMU units.

**Items to be Addressed:** *None*

## DESIGN STANDARDS

Developments within the Maple Road form-based district must comply with Design Standards outlined in section 5.05.

### Building Orientation and Entrance

- a. *Primary Entrance: The primary building entrance shall be clearly identifiable and useable and located in the front façade parallel to the street. **The primary entrance is located in the front façade facing Long Lake.***
- b. *Recessed Doorways. Where the building entrance is located on or within five (5) feet of a lot line, doorways shall be recessed into the face of the building. **Not applicable***
- c. *Residential Dwellings. Entrances for all residential dwellings shall be clearly defined by at least one (1) of the following:*
  - I. *Projecting or recessed entrance. A recessed entrance is required if the building entrance is located on or within five (5) feet of the lot line.*
  - II. *Stoop or enclosed or covered porch.*
  - III. *Transom and/or side light window panels framing the door opening.*
  - IV. *Architectural trim or unique color treatments framing the door opening*

**Not Applicable**

Ground Story Activation

- a. *The first floor of any front façade facing a right-of-way shall be no less than fifty (50) percent windows and doors, and the minimum transparency for facades facing a side street, side yard, or parking area shall be no less than 30 percent of the façade. Transparency alternatives are permitted up to 80% of the 50% total along the front of buildings, and up to 100% of the sides of buildings. The minimum transparency requirement shall apply to all sides of a building that abut an open space, including a side yard, or public right-of-way. Transparency requirements shall not apply to sides which abut an alley.*

***The applicant has met the transparency requirements on the Dequindre and Long Lake elevation.***

Transitional Features

- a. *Transitional features are architectural elements, site features, or alterations to building massing that are used to provide a transition between higher intensity uses and low- or moderate-density residential areas. These features assist in mitigating potential conflicts between those uses. Transitional features are intended to be used in combination with landscape buffers or large setbacks.*

***Provided that the noted site plan issues are addressed, transitional features are provided.***

Site Access and Parking

- a. *Required Parking. Off-street parking shall be provided in accordance with the standards set forth in Article 13, Site Design Standards.*

***The applicant needs relief from parking.***

- b. *Location.*
  - I. *When parking is located in a side yard (behind the front building line) but fronts on the required building line, no more than fifty (50) percent of the total site's linear feet along the required building line or one hundred (100) feet, whichever is less, shall be occupied by parking.*

**Not Applicable**

- II. *For a corner lot, shall be no more than fifty (50) percent of the site's cumulative linear feet along the required building lines or one hundred (100) feet, whichever is less, shall be occupied by parking. The building shall be located in the corner of the lot adjacent to the intersection.*

**Complies**



- III. *For a double frontage lot or a lot that has frontage on three (3) streets, the cumulative total of all frontages occupied by parking shall be no more than sixty-five (65) percent of the total site's linear feet along a required building line or one hundred and twenty-five (125) feet, whichever is less.*

**Not Applicable**

- IV. *Where off-street parking is visible from a street, it should be screened in accordance with the standards set forth in Section 13.02.C.*

**Complies**

**Items to be Addressed:** Address site plan issues noted.

For any special use, according to Section 9.02.D, the Planning Commission shall "...review the request, supplementary materials either in support or opposition thereto, as well as the Planning Department's report, at a Public Hearing established for that purpose, and shall either grant or deny the request, table action on the request, or grant the request subject to specific conditions."

Section 9.03 states that before approving any requests for Special Use Approval, the Planning Commission shall consider:

1. *Compatibility with Adjacent Uses.*
2. *Compatibility with the Master Plan.*
3. *Traffic Impact.*
4. *Impact on Public Services.*
5. *Compliance with Zoning Ordinance Standards.*
6. *Impact on the Overall Environment. The proposed Special Use shall no*
7. *Special Use Approval Specific Requirements.*

We support the increased investment of the site. Provided site plan issues can be addressed to the satisfaction of the Planning Commission we find that the standards have been met.

**Items to be addressed:** None

## RECOMMENDATION

We support the reinvestment in the site but there are outstanding issues that the Planning Commission should discuss and the applicant must address:

1. The current site includes vehicle storage in an "alley" located between the western property line and the building. The applicant is proposing this area as employee parking.

2. Section 6.26 of the Zoning Ordinance states that for auto repair facilities: Outdoor storage shall be enclosed by an opaque fence up to eight (8) feet in height and/or landscape screening meeting the standards set forth in Section 13.02.B.” The applicant doesn’t indicate any screening. Is overnight parking of vehicles repaired appropriate for this site. Planning Commission can consider condition that does not permit overnight parking.
3. Automobile oriented uses requires the screening of either 1 tree every 10 feet or a wall screening from office uses. There is an existing office use adjacent to the west. Where the applicant proposes the “alley” is supposed to be screened either with a wall or landscaping.
4. Provide landscape details.
5. Building lighting fixture details.

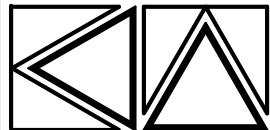
We recommend that the Planning Commission discuss the issues noted above and allow the applicant to amend the site plan as noted in the report.



---

CARLISLE/WORTMAN ASSOC., INC.  
Benjamin R. Carlisle, LEED AP, AICP





KALAJIAN  
ARCHITECTURE & DESIGN LLC

1871 AUSTIN DRIVE  
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48063

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aekalajian@sbcglobal.net

## PROPOSED BUILDING RENOVATION & ADDITION

OWNER &  
CONTACT PERSON  
SAM ASKAR

PH: 248-961-3010  
E-MAIL  
bdaskar@gmail.com

SHELL GAS STATION  
2970 EAST LONG LAKE TROY, MI. 48065

DESCRIPTION:

COVER SHEET &  
ARCHITECTURAL  
SITE &  
LANDSCAPING  
PLAN

JOB NO.  
SGS-19

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DATE	DRAWN BY
12-18-2019	M.A.
12-28-2019	AEK
2-12-2020	AEK
1-4-2021	AEK

SP-0

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ARCHITECTURE & DESIGN LLC.

### Legal Description (as furnished by owner):

Part of the Northeast quarter of Section 13, Township, 2 North, Range 11 East, City of Troy, Oakland County, Michigan, described as: Beginning at the Northeast corner of Section 13, thence along the East line of said Section South 00 degrees 20 minutes 50 seconds West 205 feet; thence due West 215 feet; thence North 00 degrees 20 minutes 50 seconds East 205 feet; thence along the North line of said Section Due East 215 feet to the point of beginning subject, however, to the rights of the public for roadway purposes and of any governmental unit over the North 60 feet and the East 60 feet thereof.

PID: 882013228011

NORTHEAST CORNER  
SECTION 13, T2N, R11E  
(L. 17277, P. 681)

DEQUINDRE ROAD  
EAST LINE SECTION 13  
S00°23'50"W 205.00'

### LEGEND:

PROPERTY LINE

EXISTING ELEVATION

UTILITY POLE

LIGHT POLE

TRAFFIC SIGNAL POLE

SIGN

MONITORING WELL

EX. CATCH BASIN

TRAFFIC SIGNAL MH

STORM SEWER MH

MAIN WATER MH

SANITARY MH

WATER STOP BOX

FIRE HYDRANT

EX. TREE

PROPOSED AND EXISTING  
LANDSCAPED AREAS

### GENERAL SITE AND BUILDING INFORMATION

- ZONING** - NODE NN-J  
STREET-HIGH INTENSITY NN-A
- USE GROUP** - GAS STATION WITH REPAIR FACILITY

- SITE AREA** - 44,015 SF. (1.01 ACRES)  
SITE AREA EXCLUDING ROW = 22,415 SF (0.52 ACRES)

- OPEN SPACE**  
REQUIRED OPEN SPACE - 30%  
PROVIDED OPEN SPACE  
(EXISTING UNCHANGED) = 2,034/22,415 = 9%

- FORM BASE SETBACKS** (BUILD'G. FORM A)  
REQUIRED FRONT - 10' - PROVIDED - 15.1' & 11.1'  
REQUIRED SIDES - 0' - PROVIDED - 0.53'  
REQUIRED REAR - 30' - PROVIDED - 13.6'

#### BUILDING AREAS

EXISTING BUILDING	- 2,528 GSF.
PROPOSED GROUND FLOOR	- 1,618 GSF.
ADDITION	- 1,618 GSF.
PROPOSED SECOND FLOOR	- 1,618 GSF.
TOTAL BUILDING	- 4,306 GSF.

#### PARKING REQUIREMENTS

GAS STATION - 2 SPACES PER FUELING STATION PLUS  
EACH 125 SF. OF NET FLOOR AREA

REPAIR STATION - 2 SPACES/ EA. BAY PLUS 1 SPACE  
PER EACH EMPLOYEE PLUS ADEQUATE SPACES  
FOR OVERNIGHT PARKING

COMMERCIAL RETAIL AREA - 1 SPACE PER EA. 250 GSF

3 BAYS X 2 =	6 SPACES
OFFICE 3288 SF =	1 SPACE
PLUS 3 EMPLOYEES =	3 SPACES
PLUS RETAIL (150 SF) EXISTING +	
PROPOSED RETAIL (410 SF) = (220 SF)	
1,130 SF / 125 SF =	9 SPACES
TOTAL CAR SPACES REQUIRED =	19 SPACES

(DOES NOT COUNT FILLING STATION PARKING AREAS)

OVERNIGHT CAR STORAGE WITHIN PROPOSED INTERIOR  
EMPLOYEE PARKING ALONG REAR ALLEY

REQUIRED LANDSCAPING AREAS  
20% OF SITE AREA TO BE COMPRISED OF LANDSCAPE  
MATERIAL.

10 FT. WIDE FRONTAGE GREENBELT ALONG STREET  
FRONTAGE

(1) TREE PER 30 LF. OF STREET FRONTAGE  
145 FT. ALONG LONG LAKE = (5) TREES REQUIRED  
150 FT. ALONG DEQUINDRE RD. = (5) TREES REQUIRED

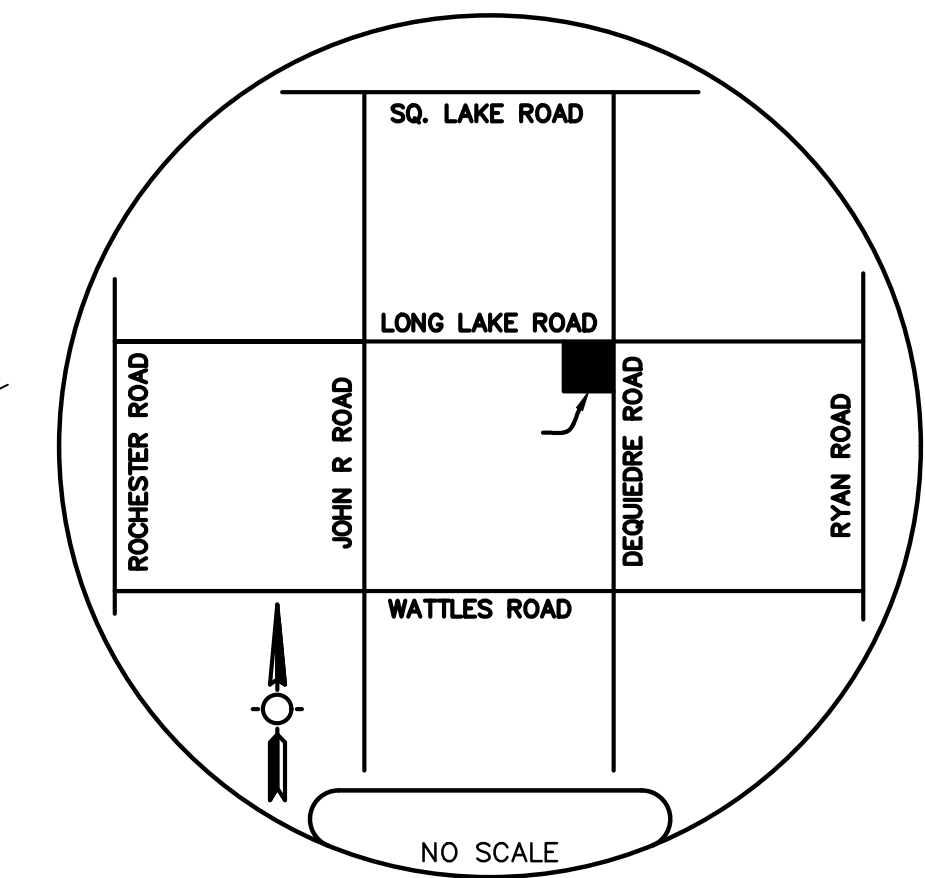
(1) TREE PER 8 PARKING SPACES = 20/8 = 2 1/2 TREES

20% SITE AREA NOR FRONTAGE TREES ARE CURRENTLY  
POSSIBLE DUE TO THE PRE-EXISTING CONDITION WHERE  
THE REQUIRED 10 FT.

10 FT. WIDE FRONTAGE GREENBELT DOES NOT EXIST.

LOW EVERGREEN SHRUBS WITH LANDSCAPING AND BLOCK  
EDGING ARE PROVIDED ALONG THE SITE'S PERIMETER  
ROW. ALONG WITH A BUILT UP RAISED LANDSCAPE  
CORNER AT THE NORTH EAST CORNER OF THE PROPERTY.

THERE IS APPROXIMATELY 4% (993 SF/22,415 SF.) OF  
LANDSCAPE AREA.



#### SITE LIGHTING

EXISTING SITE LIGHTING ARE (4) LED LIGHT FIXTURES ON  
20' HIGH POLES AT THE (4) ENTRANCE/EGRESS DRIVES  
AND FROM GAS PUMP SURF. MOUNTED PUMP STATION  
CANOPIES.  
THERE ARE ALSO EXISTING PERIMETER BUILDING INDIRECT  
STRIP LIGHTS AS WELL AS PROPOSED RECESSED DOWN  
LIGHTING UNDER THE PROPOSED ENTRANCE CANOPY.

#### LANDSCAPING (15% REQUIRED)

EXISTING LANDSCAPING ARE FRONTAGE GREENBELTS  
AND RAISED PLANTING AREAS WITH DECIDUOUS AND  
EVERGREEN SHRUBS AND LARGE POTTED PLANTS ALONG  
THE EXISTING BUILDING EXTERIOR.

ADDITIONAL POTTED PLANTS ARE PROPOSED ALONG THE  
MAIN ENTRANCE AND A RAISED LANDSCAPING PLANTER  
ALONG THE EAST SIDE OF THE PROPOSED ADDITION.  
3' WIDE X 15' LONG

SEE ENLARGED FLOOR PLAN SHEET A-10 AND A-11

PROPOSED 30" HIGH BRICK SCREEN WALL ALONG  
SOUTHERN CAR SPACE ADJACENT TO DEQUINDRE RD.  
SEE SHEET A-11 FOR SCREEN WALL DETAILS

#### SIGNS

EXISTING GROUND SIGN APPROXIMATELY 45 SF. OCCURS  
AT NORTH EAST CORNER OF PROPERTY ON A 2' HIGH  
RAISED LANDSCAPING AREA WHICH IS TO REMAIN AS IS.

THE PROPOSED RE-FACING OF THE BUILDING NORTH  
ELEVATION IS TO RE-USE THE EXISTING SIGNAGE  
CURRENTLY ON THE EXISTING FACADE.

NO NEW SIGNS ARE CURRENTLY BEING PROPOSED.

#### EXTERIOR ELEVATION FRONTAGE

TRANSPARENCY (BUILDING FORM A)

50% TRANSPARENCY IS REQUIRED BETWEEN FOR ROW  
FRONTAGE AND 30% FOR SIDES MEASURED BETWEEN 2'-8'  
ABOVE FINISH FLOOR.

THE NORTH ELEVATION ALONG LONG LAKE ROW FRONTAGE  
HAS A EXISTING 53% (50% REQ'D.) TRANSPARENCY TO  
REMAIN AS IS.

THE EAST ELEVATION ALONG DEQUINDRE ROAD ROW  
FRONTAGE HAS A 10% (50% REQ'D.) TOTAL  
TRANSPARENCY WHICH INCLUDES THE EXISTING EXTERIOR  
AREA WITH THE PROPOSED ADDITION.

THE WEST SIDE ELEVATION FACING THE ADJACENT SITE HAS  
A SIDE TRANSPARENCY OF 56% (30% REQ'D.) OF THE WALL  
AREA

## SHEET INDEX

SHT. NO. SHEET DESCRIPTION

SP-0 COVER SHEET & ARCHITECTURAL SITE

SP-1.0 EXISTING TOPOGRAPHIC SURVEY

C-1 SITE DRAINAGE SYSTEM & CALCULATIONS

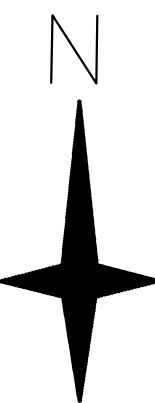
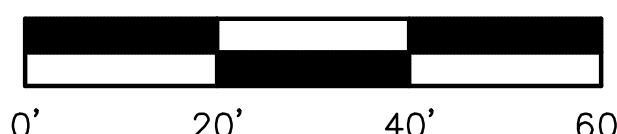
A-1.0 FIRST & SECOND FLOOR PLANS

A-1.2 SITE ELEMENT DETAILS, PROPOSED EXTERIOR  
LIGHTING FIXTURES & BUILDING PERSPECTIVE VIEWS

A-2.0 EXTERIOR ELEVATIONS & EXTERIOR PERSPECTIVE

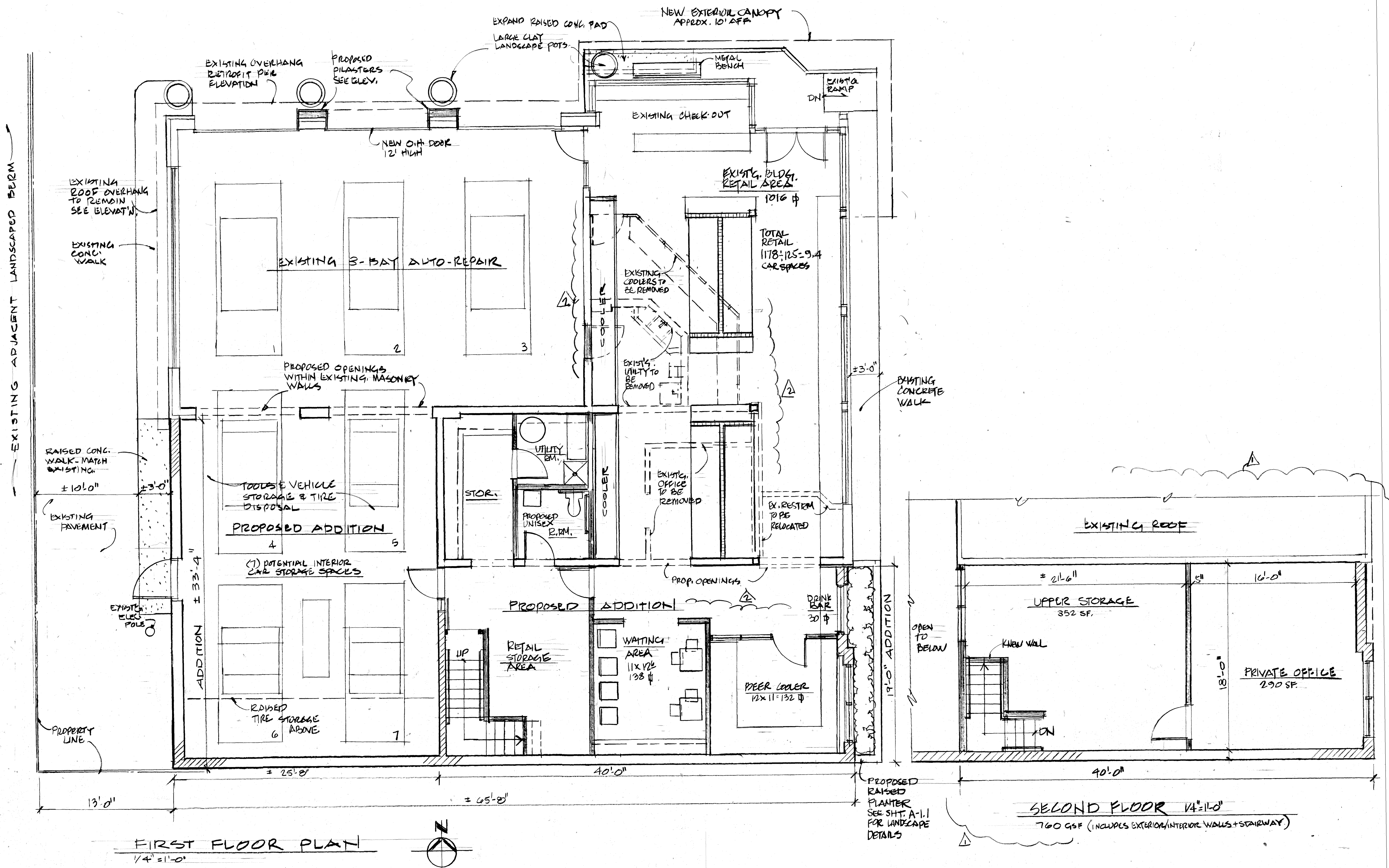
## SITE & LANDSCAPING PLAN


SCALE 1" = 20'



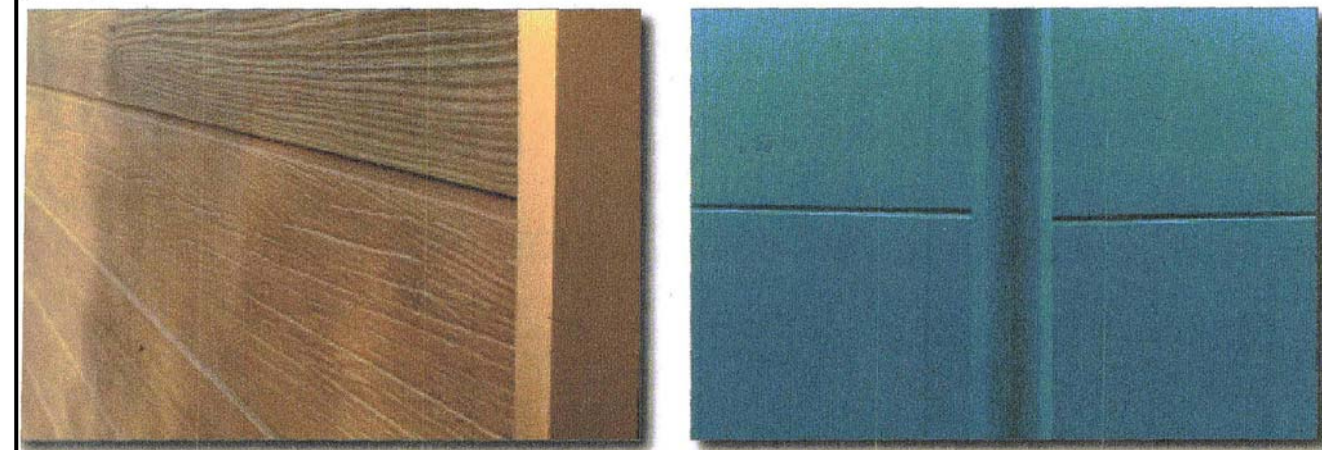
EAST 1/4 CORNER  
SECTION 13, T2N, R11E  
(L. 17277, P. 708)





 <p>KALAJIAN ARCHITECTURE &amp; DESIGN LLC 1871 AUSTIN DRIVE TROY MICHIGAN 48063 OFFICE: 248-524-3616 FAX: 248-524-0217 aekalajian@ebcglobel.net</p>	<p>PROPOSED BUILDING RENOVATION &amp; ADDITION</p>	<p><b>SHELL GAS STATION</b> 2970 EAST LONG LAKE TROY, MI. 48065</p>	<p>DESCRIPTION: <b>FIRST &amp; SECOND FLOOR PLANS</b></p>	<p>SEAL:</p>	<table border="1"> <tr> <th>DATE</th><th>BY</th><th>CHK</th><th>APP</th><th>REV</th><th>NO.</th></tr> <tr> <td>11-30-2019</td><td>SP</td><td>APP</td><td>AEK</td><td></td><td></td></tr> <tr> <td>12-11-2019</td><td>REV</td><td>AEK</td><td></td><td></td><td></td></tr> <tr> <td>1-4-2020</td><td>REV</td><td>AEK</td><td></td><td></td><td></td></tr> </table> <p>OWNER &amp; CONTACT PERSON SAM ASKAR PH: 248-961-3010 E-MAIL bdaskar@gmail.com</p> <p><b>A-1.0</b></p> <p>COPYRIGHT 2019</p>	DATE	BY	CHK	APP	REV	NO.	11-30-2019	SP	APP	AEK			12-11-2019	REV	AEK				1-4-2020	REV	AEK			
DATE	BY	CHK	APP	REV	NO.																								
11-30-2019	SP	APP	AEK																										
12-11-2019	REV	AEK																											
1-4-2020	REV	AEK																											





For our popular panels such as VintageWood, we took it a step further by color matching all of our trim profiles to have in stock for fast delivery.

Thanks to our ColorXpressions system, Nichiha can customize our trim to match any color you use on our Illumination Panels.

Nichiha's customized Tamlyn trim adds the finishing touches to any project. It's not only simple and sleek, but also a cost-effective and time-efficient solution to finishing corners, windows and door trims. Choose from 6 trim profiles specifically designed for Nichiha's Architectural Wall Panels. Tamlyn trim provides weather-resistant coatings so you can expect low maintenance and long-lasting beauty.

**CORNER KEY**  
 DIMENSIONS (NOM. FT. - ACTUAL MM)  
 3" x 10" (76.2mm x 3,030mm)  
 WEIGHT (LBS. PER PIECE) 3.89  
 PACKAGING (LN. FT. PER PACK) 50

**OPEN OUTSIDE CORNER**  
 DIMENSIONS (NOM. FT. - ACTUAL MM)  
 2.95" x 10" (75mm x 3,030mm)  
 WEIGHT (LBS. PER PIECE) 2.93  
 PACKAGING (LN. FT. PER PACK) 50

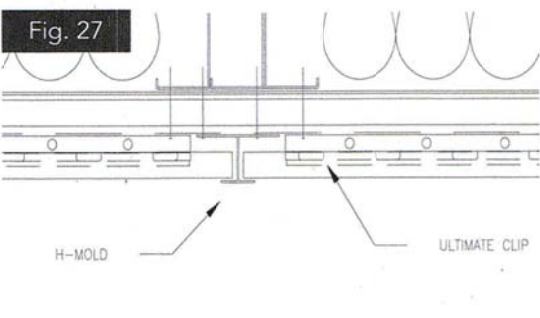
**H-MOLD**  
 DIMENSIONS (NOM. FT. - ACTUAL MM)  
 2" x 10" (50.8mm x 3,030mm)  
 WEIGHT (LBS. PER PIECE) 2.42  
 PACKAGING (LN. FT. PER PACK) 50

**J-MOLD**  
 DIMENSIONS (NOM. FT. - ACTUAL MM)  
 3.75" x 10" (95mm x 3,030mm)  
 WEIGHT (LBS. PER PIECE) 1.4  
 PACKAGING (LN. FT. PER PACK) 50

**STRUCTURAL INSULATING PANELS (SIP)**  
 In general, the steps mirror those for stud wall applications. However, double fastening per each Panel Clip (minimum of four screws, evenly spaced per clip) is required as there are fewer or no studs to secure the system. There must be four clips per AWP-3030 edge.

**PRE-ENGINEERED METAL BUILDINGS (PEMB)**  
 Refer again to general requirements concerning PEMB installations in the *Framing and Sheathing Requirements* section.

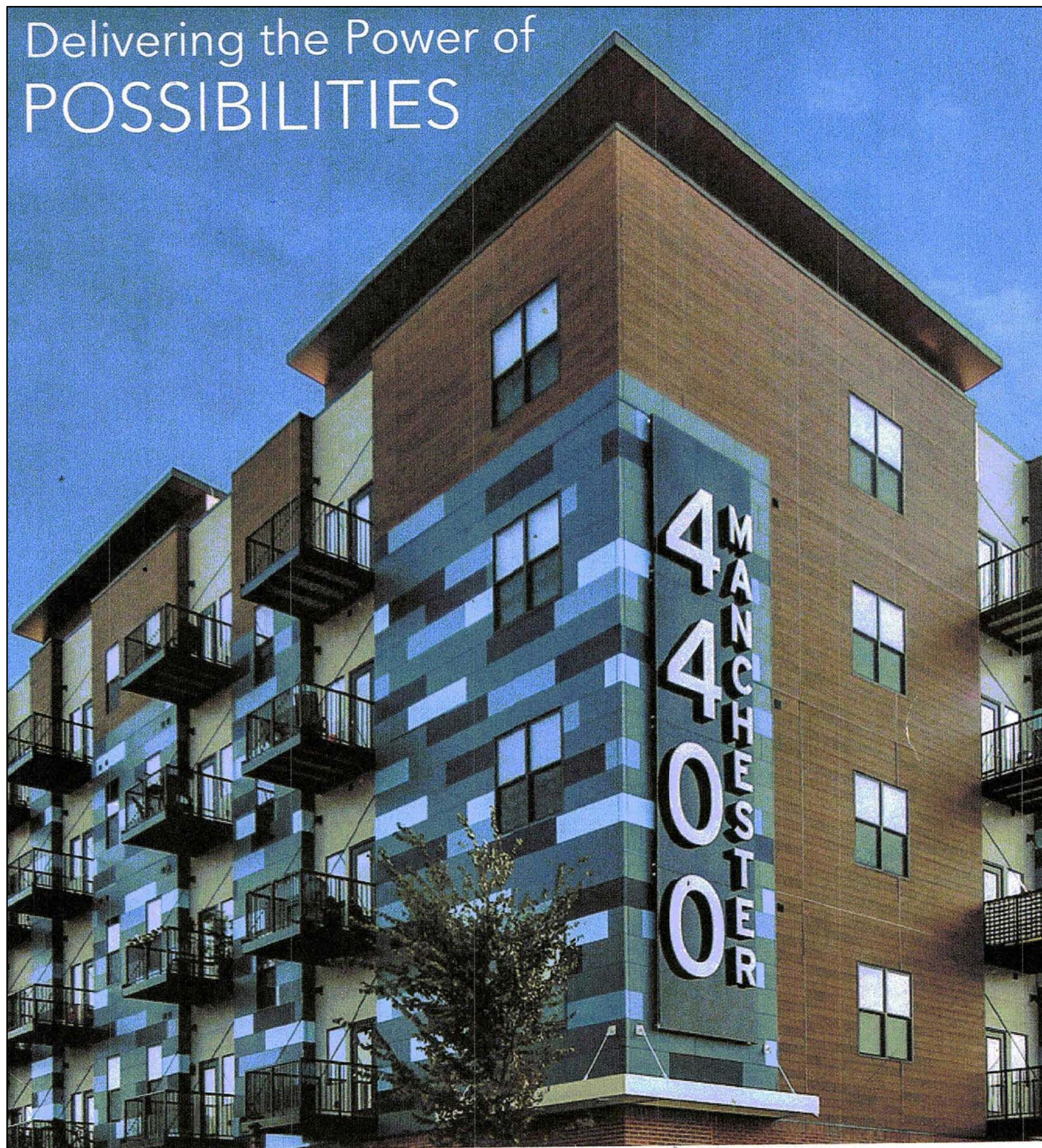
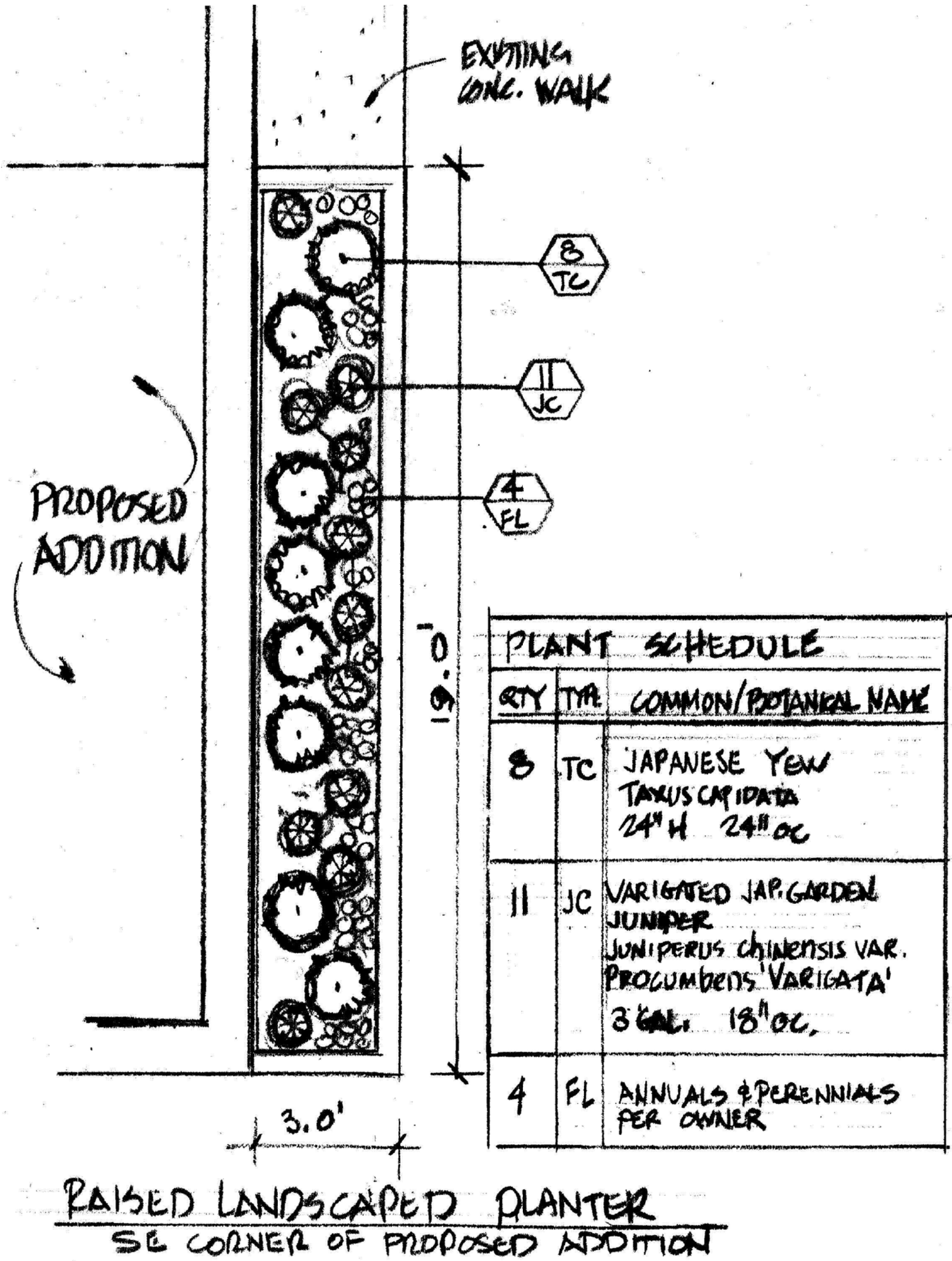
With metal panel ribs spaced no more than 12" o.c., install AWP in the same manner as with stud wall applications but with Panel Clips fastened to each rib they reach. Screws (#10 x 1") applied at no more than 12" o.c. There must be four clips per AWP-3030 long edge.



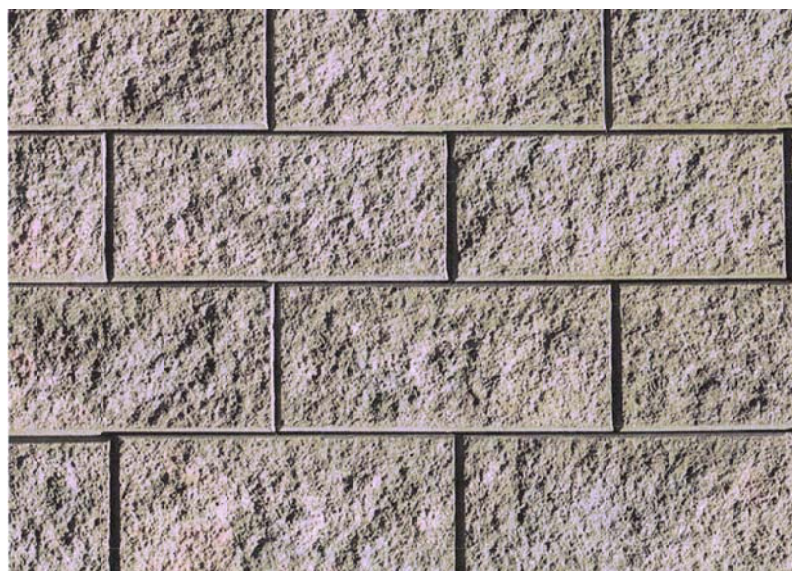
ARCHITECTURALBLOCK™		AWP 1818
DIMENSIONS (ACTUAL MM)		17-7/8" (H) x 71-9/16" (L) (455mm (H) x 1,818mm (L))
THICKNESS (ACTUAL MM)		5/8" (16mm)
WEIGHT (LBS. PER PANEL)		35.2
WEIGHT (LBS. PER SQ. FT.)		3.9
EXPOSED COVERAGE (SQ. FT. PER PANEL)		8.88 SQ. FT.
PACKAGING (PIECES PER PACK)		2 (17.76 SQ. FT.)
VARIANCE AND TEXTURE MAY VARY BY COLOR		
COLORS		GRAY, MOCHA, TURCAN

TUFFBLOCK™		AWP 1818
DIMENSIONS (ACTUAL MM)		17-7/8" (H) x 71-9/16" (L) (455mm (H) x 1,818mm (L))
THICKNESS (ACTUAL MM)		5/8" (16mm)
WEIGHT (LBS. PER PANEL)		35.2
WEIGHT (LBS. PER SQ. FT.)		3.9
EXPOSED COVERAGE (SQ. FT. PER PANEL)		8.88 SQ. FT.
PACKAGING (PIECES PER PACK)		2 (17.76 SQ. FT.)
VARIANCE AND TEXTURE MAY VARY BY COLOR		
COLORS		STEEL, BAMBOO, WALNUT, PEWTER



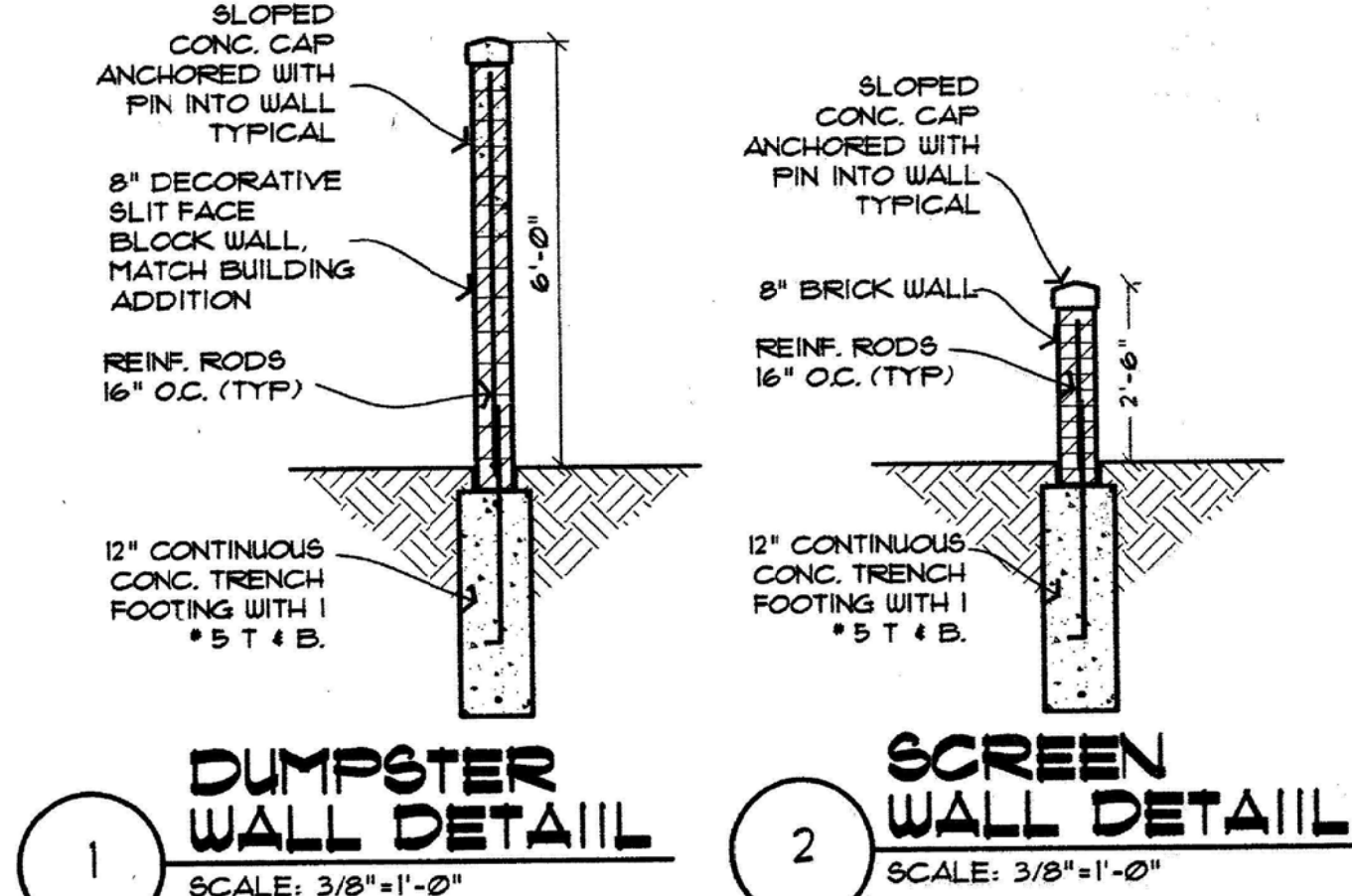
ARCHITECTURAL WALL PANELS  
**Commercial Full Line Catalog**



**EXTERIOR DECORATIVE  
 BLOCK WALL**



**PROPOSED LANDSCAPING SHRUBS**



**EXTERIOR MASONRY WALLS**



1871 AUSTIN DRIVE  
 TROY MICHIGAN 48063  
 OFFICE: 248-524-3616  
 FAX: 248-524-0217  
 aekalajian@sbcglobal.net

**PROPOSED  
 BUILDING  
 RENOVATION &  
 ADDITION**

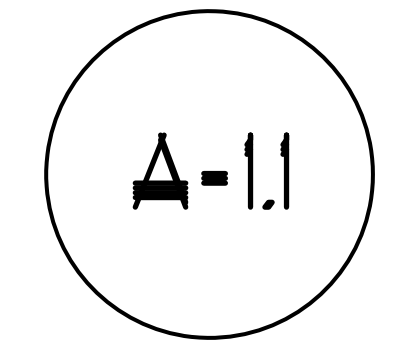
OWNER &  
 CONTACT PERSON  
 SAM ASKAR  
 PH: 248-961-3010  
 E-MAIL  
 bdaskar@gmail.com

**SHELL GAS STATION**  
 2970 EAST LONG LAKE TROY, MI. 48065

DESCRIPTION:  
**EXTERIOR WALL  
 MATERIALS AND  
 PROPOSED  
 LANDSCAPING  
 PLAN-SPECS**

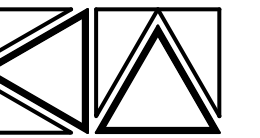
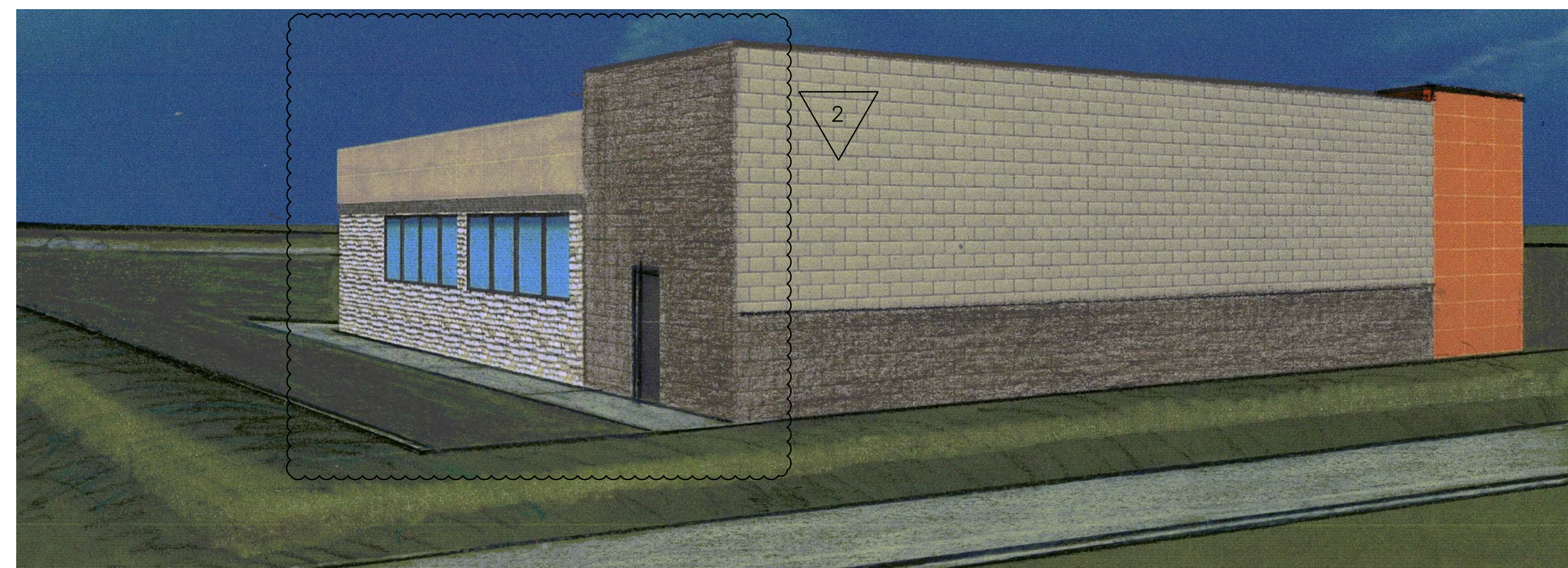
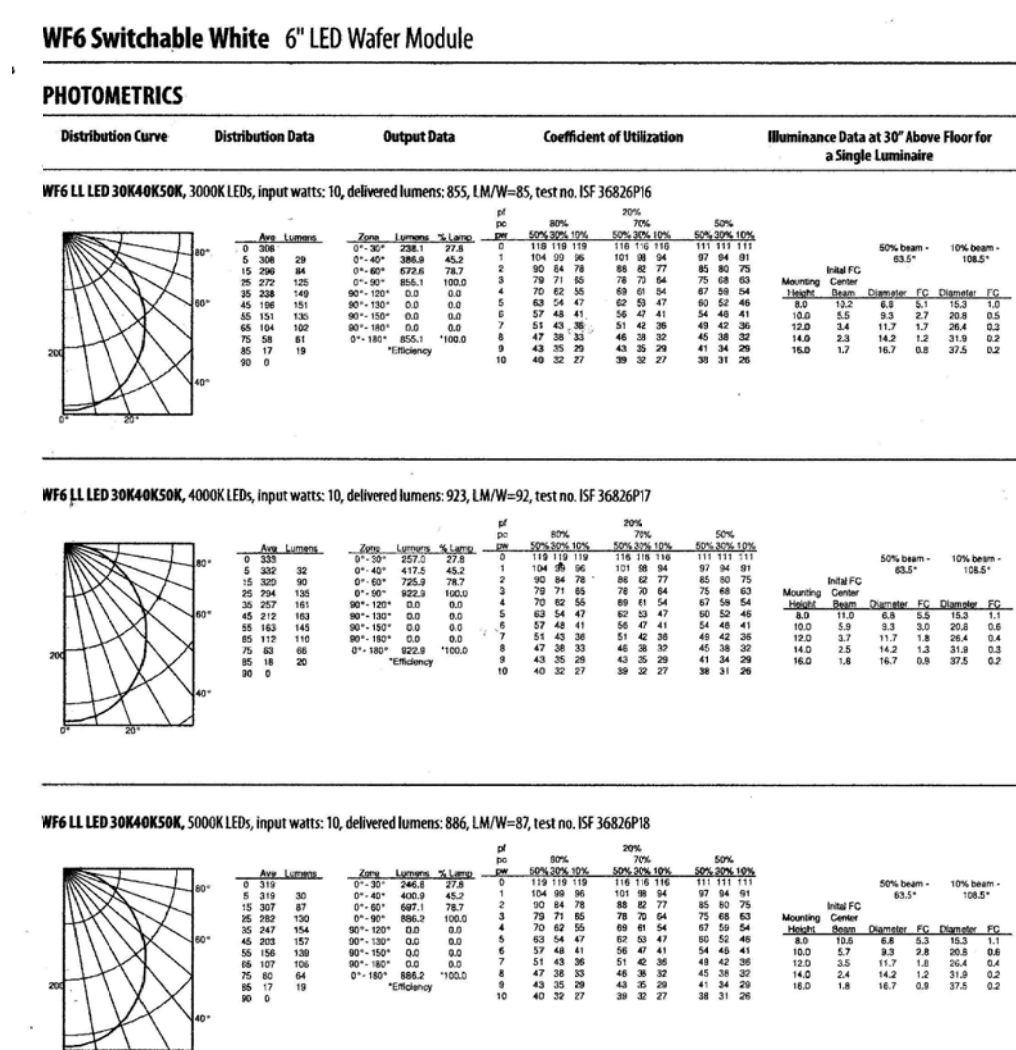
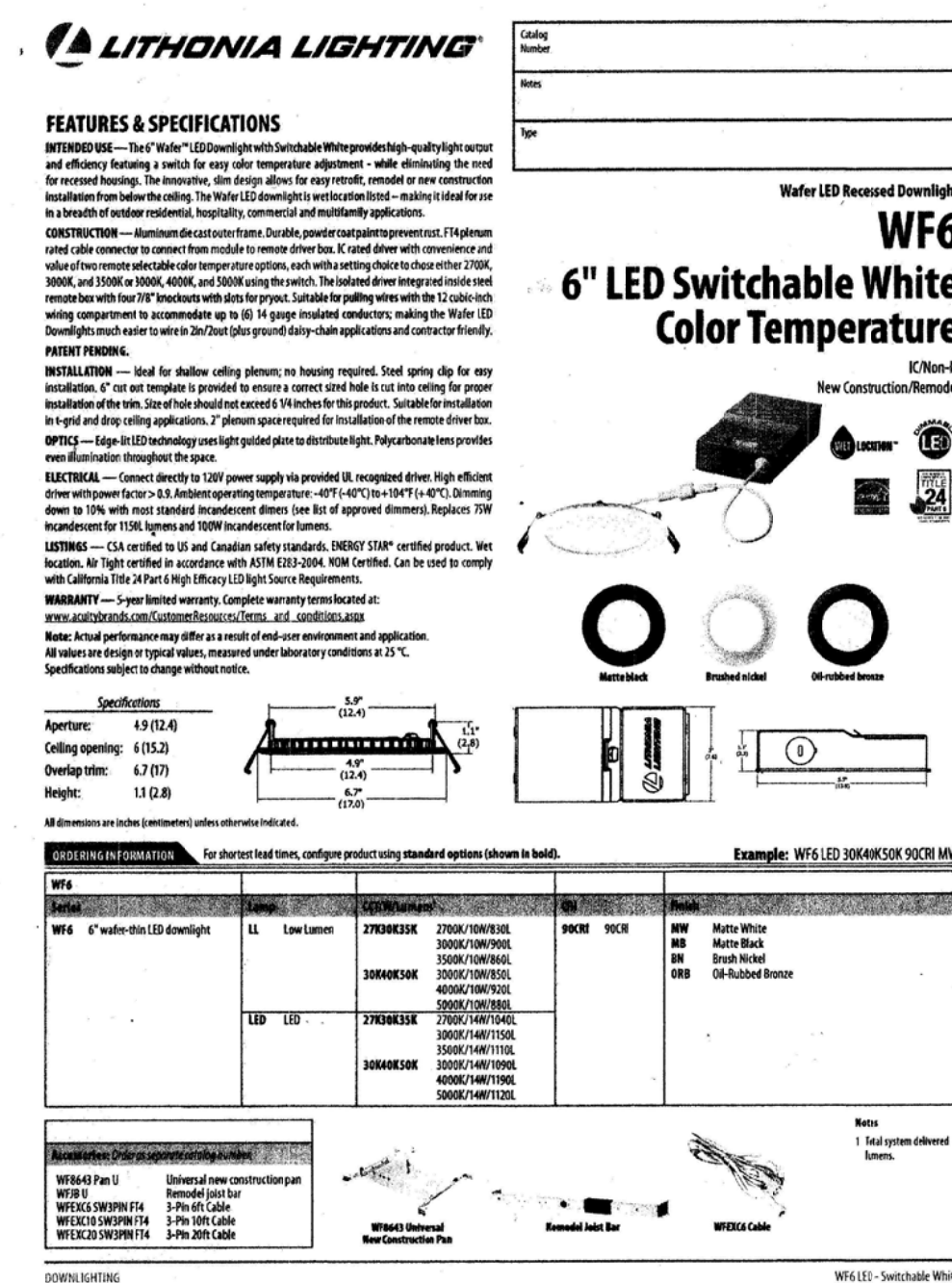
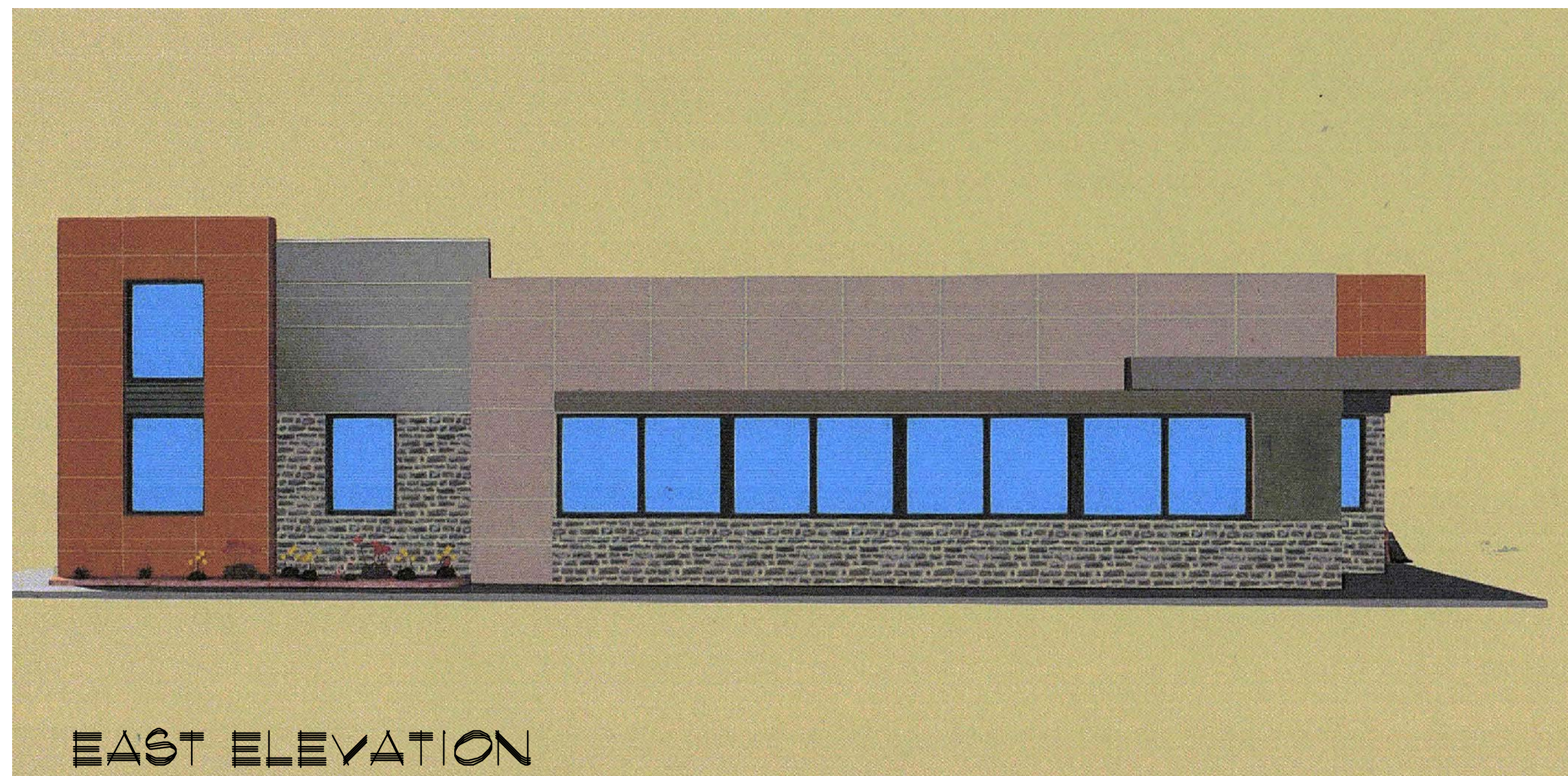
JOB NO. 666-19

DATE	ISSUE	DRAWN BY
12-18-2013	SP	M.A.
12-18-2013	REV	AEK
1-4-2014	REV	AEK



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CHITECTURE & DESIGN LLC

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FAX: 248-524-0217

kalajian@sbcglobal.net

# PROPOSED BUILDING RENOVATION & ADDITION

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248-961-3010  
E-MAIL  
skar@gmail.com

2970 EAST LONG LAKE TROY, MI. 48385

DESCRIPTION:  
EXTERIOR BLDG.  
ELEVATION,  
PERSPECTIVE  
VIEWS, LIGHT  
FIXTURE & BIKE  
RACK

DB NO. SGS-19

	ISSUE	DRAWN BY
3-2019		M.A.
3-2019	SP	AEK
2-2020	REV	AEK
2021	REV	AEK

## A-2.1

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 PERMISSION OF KALAJIAN  
 ARCHITECTURE & DESIGN LLC.





1871 AUSTIN DR., TROY, MI. 48083  
o : 248-524- 3616 f: 248-524-0217  
e : aekalajian@sbcglobal.net

## **Long Lake /Dequindre Shell Station**

### **Re: Project at 2970 E. Long Lake Rd. Troy, Mi.48385**

January 03, 2020

#### **Architectural Design Concept**

Attn: Brent Savident  
Planning Director

The Owner to this facility, Sam Askar of Elbassim LLC., is desirous to give a new look to the existing gas station/retail/repair facility of 2,528 sf. as well as adding to the side/rear of existing facility with a ground floor addition of approximately 1,618 gsf. and a second floor 760 gsf.

**Project Scope:** this project is further addressed below as outlined in part 6 sections A-F within the site Plan Application Form :

**6.A. Character of the Ares :** The Site is currently a fully developed hard surface area with some frontage landscaping as shown within the site plan. A additional catch basin is proposed in order improve the storm detention system to current standards.

The (4) existing entrance/egress into the site are to remain as is which was reviewed by the City Traffic Engineer. The primary change that is being proposed will occur to the existing building which occurs within the SW portion of the site.

**B. Design Concept:** The primary design goals are to enhance the look of the existing building into a more contemporary looking structure and expand the building within the current outdoor storage area along the southwest portion of the site which fronts the parking spaces of the adjacent drug store.

**C. Achieving the Design Concept:** This proposed addition not only provides additional retail to a small and tight retail area but provides a waiting area for the patrons that may wait as their car is being serviced and provides an enclosed area for the current outdoor storage of tires and some of the vehicles undergoing repair.

The proposed building face lift as well as the proposed addition will enhance the visual impact of the building and cleanup the overall site. The middle service bay overhead door is also being proposed with an increased in height to facilitate taller vehicles.

**D. Description of the intended uses:** The addition moves the present Owners private office onto a larger second floor area within the proposed addition. The proposed ground floor addition of 1,618 gsf. will expand the present retail area , provide a waiting area for customers and add storage to the rear to 2 of the 3 repair auto bays which can store equipment, tires and vehicles being repaired.



**E. Description of the building materials:** The proposed addition along the street frontage will have cement fiber board wall panels with glazing. The rear and sides of the proposed addition will be decorative cmu blocks.

The exterior sides of the existing building will have a new façade fiber cement wall panels above the existing glazing and entrance. A larger projected entrance canopy of cement fiber panel is proposed over the existing entrance and the existing brick and overhead doors are to be repainted.

The primary change is to the façade material is the replacement of the sloped current EIFS. mansard with a vertical fiber cement wall system with various textures and coloration as shown within the proposed perspective and elevations..

**F. Form base district transparency requirements:** This project has been primarily developed prior to the current form base zoning guidelines. This proposed project fits the designation of Building Form A where the ROW building elevation frontage require a 50% transparency and the sides a 30% transparency as measured from 2'-8' above finish floor.

The frontage facing Long Lake(North Elevation) has a transparency of 53% of the total exterior elevation wall area and is comprised of all the existing window glazing and glass doors.

The frontage facing Dequindre Rd.(East Elevation) has a glazing transparency of approximately 70% of the total proposed and existing exterior elevation where 70% of this exterior is existing.

The side elevation (West Elevation) has a transparency of 56%.

Sincerely,



Arthur E. Kalajian R.A





Beer & Wine

AUTO CARE

2970

ATM

OPEN



DATE: January 7, 2021

TO: Planning Commission

FROM: R. Brent Savidant, Planning Director

SUBJECT: PLANNED UNIT DEVELOPMENT (File Number PUD2020-0018) – Proposed Concept Development Plan for Long Lake and Crooks Masterplan Development, Southwest corner of Long Lake and Crooks, Section 8, Currently Zoned O Office.

The applicant Gensler submitted a Concept Development Plan (CDP) application for a Planned Unit Development (PUD) for the subject property. The site is currently vacant and is 24.88 acres in size. The mixed use project is summarized in the attached report.

A PUD is a development option that provides flexibility in the design and use of mixed-use projects. It is a multi-step process. The first step in the process is the CDP. For this step, the applicant seeks the following: (1) Approval of the overall concept; (2) Approval of the PUD Agreement; and, (3) Rezoning of the parcel to PUD. The next step in the process will be the Preliminary Development Plan (PDP). During the PDP step, detailed site plans are submitted for each phase of the project. For this project, we can expect numerous PDP's to be submitted over several years. The Planning Commission is a recommending body for PUD's; City Council is responsible for approving the CDP and PDP.

The Traffic Impact Study was included in the application and adds significant length to the document. At this point of time we are at the CDP stage. Traffic issues are important but will need to be addressed at the PDP stage. **For this meeting discussion should focus on the proposed concept, including use, layout and form.**

The attached report prepared by Carlisle/Wortman Associates, Inc. (CWA), the City's Planning Consultant, summarizes the project as revised. CWA prepared the report with input from various City departments including Planning, Engineering, Public Works and Fire. City Management supports the findings of fact contained in the report and the recommendations included therein.

The applicant intends to introduce the application to the Planning Commission and seeks feedback in terms of direction. The Planning Commission is not required to take specific action at this time.

Attachments:

1. Maps
2. Report prepared by Carlisle/Wortman Associates, Inc.
3. Application (Concept/Traffic)
4. Traffic Review Memorandum from OHM, dated December 16, 2020.



2,379 0 1,189 2,379 Feet



Note: The information provided by this application has been compiled from recorded deeds, plats, tax maps, surveys, and other public records and data. It is not a legally recorded map survey. Users of this data are hereby notified that the source information represented should be consulted for verification.





Note: The information provided by this application has been compiled from recorded deeds, plats, tax maps, surveys, and other public records and data. It is not a legally recorded map survey. Users of this data are hereby notified that the source information represented should be consulted for verification.





**Carlisle | Wortman**  
ASSOCIATES, INC.

117 NORTH FIRST STREET SUITE 70 ANN ARBOR, MI 48104 734.662.2200 734.662.1935 FAX

---

**TO:** Troy Planning Commission  
Brent Savidant, Community Development Director

**FROM:** Benjamin Carlisle, AICP

**DATE:** December 29, 2020

**RE:** Long Lake-Crooks PUD

---

A recent Planned Unit Development (PUD) application was submitted to the City for the development of a mixed-use development at the northwest corner of Long Lake and Crooks. The 24-acre site is currently vacant with significant tree cover and four wetlands.



Richard K. Carlisle, *President* Douglas J. Lewan, *Executive Vice President* John L. Enos, *Principal*  
David Scurto, *Principal* Benjamin R. Carlisle, *Principal* Sally M. Elmiger, *Principal* Craig Strong, *Principal* R. Donald Wortman, *Principal*  
Laura K. Kreps, *Associate* Paul Montagno, *Associate*

### Proposed Development

Though conceptual and subject to changes, the applicant is proposing the following mix of uses:

1. Six and eight-story office complex in two buildings (540,000 gross floor area)
2. Parking – Surface and Deck
3. Three (9,000) sq/ft retail or restaurant buildings
4. Five-story hotel (220 rooms) + restaurant
5. Site amenities: Outdoor activity area, pedestrian amenities, public water feature and activity area

## MASTER PLAN





Zoning:

The site is currently zoned O, Office. The site is surrounded by a mix of different zoning districts including O, Office to the north and west, O, Office and R-1B, Single Family to the south, and RC, Research Center and OM, Office Mixed Use to the east.



The Office District permits the office and parking, but does not permit the retail, restaurants, or hotel use. The applicant is seeking a rezoning to allow for the mix of uses.



North Troy Master Plan:

The site is identified as Northfield (North Troy) in the future land use plan. As part of the most recent Master Plan update a special area study was completed for North Troy. Key strategies for North Troy identified in the study include:

Strategy 1: Provide a Compatible and Vibrant Mix of Uses:

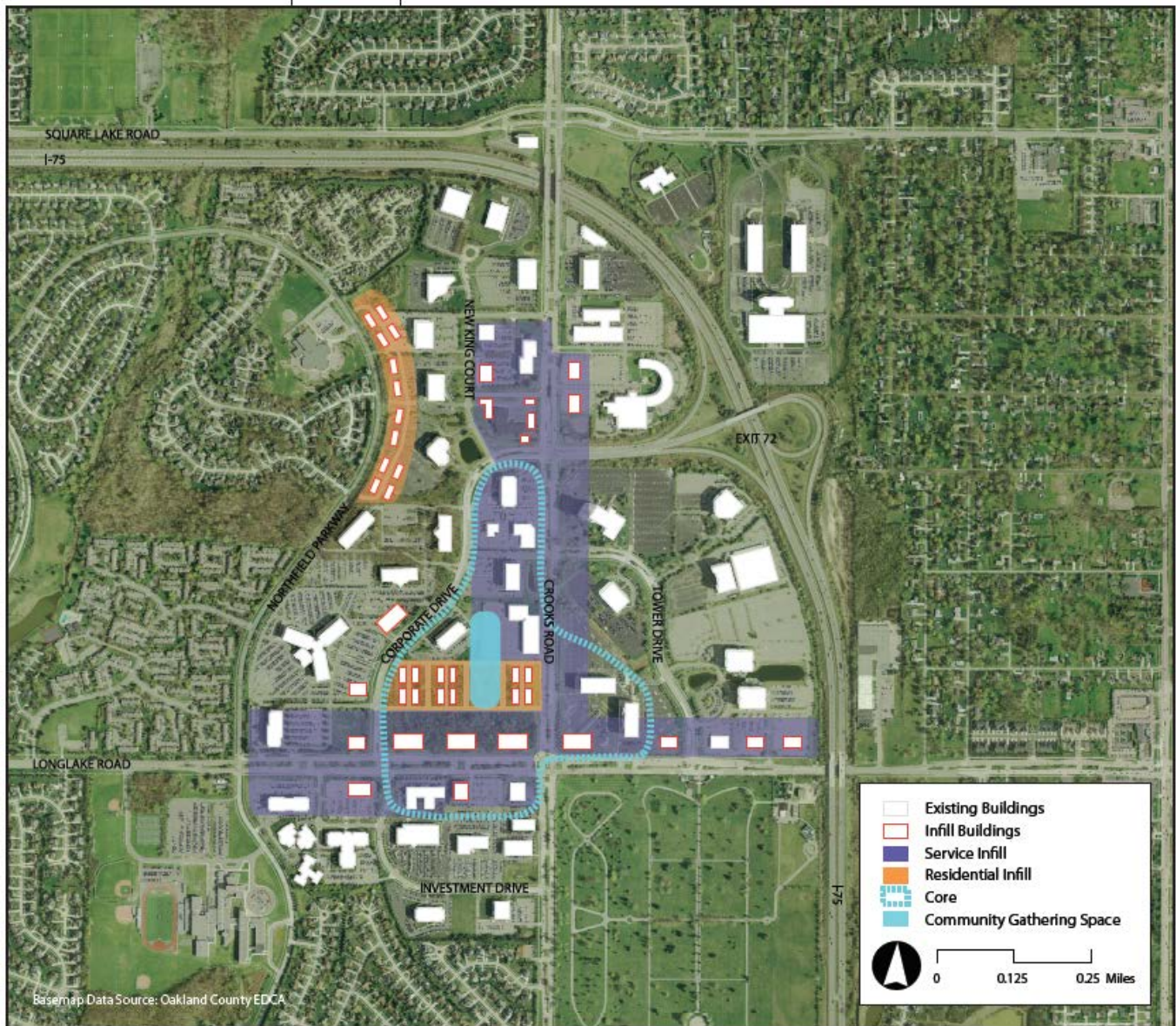
- Promote service infill through property repurposing
- Promote residential infill through property repurposing
- Develop and strengthen core
- Create a community gathering space

Strategy 2: Improve Multi-modal Circulation and Safety:

- Study and implement road diets
- Introduce pedestrian mid-block crossings
- Establish consistent landscape buffer and setbacks

Strategy 3: Inspire Tactical Placemaking to Create a Lively Place

- Create an identity through gateways and wayfinding
- Facilitate health and wellness initiative
- Encourage creative programming



CHAPTER 10: SPECIAL AREA PLANS

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CHAPTER 10: SPECIAL AREA PLANS

The proposed development incorporates many of the master plan including:

- Mix of uses
- Service and accessory uses to complement the office market
- Pedestrian amenities

Additional elements that should be considered by the applicant as noted in the master plan include:

- Residential use on the site
- Creation of a community gathering space
- Wayfinding
- Multi-modal transportation improvements

Design Layout:

The bulk of the development is located at the northeast corner of the site and a water feature planned for the hard corner of Corporate and Long Lake. Design layout considerations for the Planning Commission to consider:

1. There is limited development that lines/fronts Long Lake. Are two (2) one-story commercial/restaurant buildings on Long Lake a missed opportunity?
2. Does the Planning Commission support the water feature at the hard corner of Crooks and Long Lake?
3. Does the Planning Commission support a height of up to 8-stories?

Development Flexibility:

As noted, the Developer is looking for flexibility with regards to phasing, uses, and design features. The developers application notes:

*The Developer needs the flexibility to choose the locations of each permitted use, the sequence of development, and the specific features and boundaries of each area depicted in the Concept Development Plan. Market forces and user requirements are constantly changing. As a result, the PUD zoning concept, together with an appropriate Development Agreement, will facilitate this flexibility and encourage development without adversely impacting the preliminary and final development plan approval processes required by the City under the Zoning Ordinance.*

As this project moves forward, the applicant should provide a firmer commitment to the Planning Commission on phasing, uses, and other details.

Traffic:

The applicant has completed a Traffic Impact Study. The study includes an evaluation of the highest trip generation for the potential uses of the site. Details of the study are included in the application.

Trip Generation:

Land Use	Amount	Units	Average Daily Traffic	Am Peak Hour			PM Peak Hour		
				In	Out	Total	In	Out	Total
Quality Restaurant	24,600	GFA SQ	2.062	14	4	18	129	63	192
Hotel	220	Rooms	2,057	62	43	105	71	68	139
Medical-Dental Office	540,000	GFA SQ	20,659	782	220	1,002	513	1,320	1,833
Total Trip			24,778	858	267	1,125	713	1,451	2,164

#### Traffic Improvements:

As a result of the development, future road improvements are necessary. These include significant improvements to the Crooks Road & Corporate Drive / I-75 Ramp intersection.

#### Natural Features:

It appears from the concept plan that the site will be entirely clear cut and mass graded.

#### Woodlands:

The applicant has surveyed one thousand one hundred-eighty (1,180) trees that were tagged based upon the City's tree ordinance of 6-inch diameter at breast height. They note that most of these trees were either invasive and prohibited or are of low or poor quality. They note of the 1,180 trees on site only 239 were of high quality. The applicant will be required to mitigate tree removal based on the ordinance requirements.

#### Wetlands:

The site includes four (4) wetlands, two of which are regulated by EGLE. Any development of this site will require EGLE permits.

#### Questions for the Planning Commission Consideration

1. Does the Planning Commission support the proposed mix of uses? Is there a use missing that the Planning Commission thinks should be considered?
2. Are there other master plan recommendations that should be incorporated:
  - a. Residential use on the site
  - b. Creation of a community gathering space
  - c. Wayfinding
  - d. Multi-modal transportation improvements
3. Design layout considerations for the Planning Commission to consider:
  - a. There is limited development that lines/fronts Long Lake. Are two (2) one-story commercial/restaurant buildings on Long Lake a missed opportunity?
  - b. Does the Planning Commission support the water feature at the hard corner of Crooks and Long Lake?
  - c. Does the Planning Commission support a height of up to 8-stories?
4. Could the applicant better preserve or protect onsite natural features?
5. How much development flexibility is the Planning Commission willing to consider?
6. Are there additional design or amenities that should be considered?

Sincerely,

A handwritten signature in black ink, reading "Ben R. Carlisle". The signature is written in a cursive style with a horizontal line underneath it.

**CARLISLE/WORTMAN ASSOC., INC.**  
**Benjamin R. Carlisle, AICP, LEED AP**  
**Principal**

**CITY OF TROY  
PLANNED UNIT DEVELOPMENT  
CONCEPT DEVELOPMENT PLAN (CDP) APPLICATION  
AND APPLICATION TO AMEND THE ZONING DISTRICT MAP**

**CITY OF TROY PLANNING DEPARTMENT  
500 W. BIG BEAVER  
TROY, MICHIGAN 48064  
PHONE: 248-524-3364  
E-MAIL: [planning@troymi.gov](mailto:planning@troymi.gov)**



**CONCEPT DEVELOPMENT PLAN FEE  
\$3,000.00**

**ESCROW FEE  
\$5,000.00**

PRIOR TO THE SUBMISSION OF AN APPLICATION FOR APPROVAL OF A PLANNED UNIT DEVELOPMENT, THE APPLICANT SHALL HOLD A PRE-APPLICATION MEETING WITH THE PLANNING DEPARTMENT OF THE CITY AND ANY CITY STAFF AND OUTSIDE CONSULTANTS AS DEEMED APPROPRIATE BY THE CITY.

DATE OF PRE-APPLICATION MEETING: September 25, 2020

REGULAR MEETINGS OF THE CITY PLANNING COMMISSION ARE HELD ON THE SECOND AND FOURTH TUESDAYS OF EACH MONTH AT 7:00 P.M. AT CITY HALL.

1. NAME OF THE PROPOSED DEVELOPMENT: Long Lake & Crooks Masterplan Development

2. LOCATION OF THE SUBJECT PROPERTY: Northwest corner - Long Lake & Crooks

3. ZONING CLASSIFICATION(S) OF THE SUBJECT PROPERTY: Current Zoning - Office

4. TAX IDENTIFICATION NUMBER(S) OF SUBJECT PROPERTY: \_\_\_\_\_

5. APPLICANT: \_\_\_\_\_ PROPERTY OWNER: \_\_\_\_\_

NAME Chris Beck NAME Tony Antone

COMPANY Gensler COMPANY Long Lake Crooks Development Associates

ADDRESS 150 West Jefferson, Suite 1700 ADDRESS 39400 Woodward Ave, Suite 250

CITY Detroit STATE MI ZIP 48226 CITY Bloomfield Hills STATE MI ZIP 48304

TELEPHONE 313.496.8966 TELEPHONE 248.644.7600

E-MAIL chris\_beck@gensler.com E-MAIL tantone@Kojaian.com

6. THE APPLICANT BEARS THE FOLLOWING RELATIONSHIP TO THE OWNER OF THE SUBJECT PROPERTY:  
Owner's Architect

7. ATTACHED HERETO IS A SIGNED STATEMENT BY THE APPLICANT INDICATING THE APPLICANT HAS THE AUTHORITY TO EXECUTE A BINDING AGREEMENT COVERING ALL PARCELS IN THE PROPOSED P.U.D.

8. SIGNATURE OF APPLICANT  DATE 11.18.20

9. SIGNATURE OF PROPERTY OWNER  DATE 11/17/2020

BY THIS SIGNATURE, THE PROPERTY OWNER AUTHORIZES PLACEMENT OF A SIGN ON THE PROPERTY TO INFORM THE PUBLIC AS TO THIS REQUEST FOR PLANNED UNIT DEVELOPMENT.

# **PLANNED UNIT DEVELOPMENT CONCEPT DEVELOPMENT PLAN (CDP) PRE-APPLICATION MEETING CHECKLIST**

THE APPLICANT SHALL PROVIDE A MINIMUM OF THREE (3) COPIES OF THE FOLLOWING ITEMS, PLUS ONE (1) CD CONTAINING AN ELECTRONIC VERSION OF THE APPLICATION, TO THE PLANNING DEPARTMENT AT OR BEFORE THE PRE-APPLICATION MEETING. SEE SECTION 11.06(A).

- A SKETCH PLAN OF THE PROPOSED PLANNED UNIT DEVELOPMENT
- LEGAL DESCRIPTION OF THE PROPERTY, SCALE DRAWING AND THE TOTAL NUMBER OF ACRES IN THE PROJECT
- TOPOGRAPHICAL MAP OF THE PROJECT SITE
- A STATEMENT OF ALL PROPOSED USES IN THE PROJECT
- THE KNOWN DEVIATIONS SOUGHT FROM THE ORDINANCE REGULATIONS OTHERWISE APPLICABLE
- THE NUMBER OF ACRES TO BE PRESERVED AS OPEN OR RECREATIONAL SPACE AND THE INTENDED USES OF SUCH SPACE
- ALL KNOWN NATURAL RESOURCES, NATURAL FEATURES, HISTORIC RESOURCES AND HISTORIC FEATURES; WHICH ARE TO BE PRESERVED
- A LISTING AND SPECIFICATION OF ALL SITE DEVELOPMENT CONSTRAINTS



# PLANNED UNIT DEVELOPMENT CONCEPT DEVELOPMENT PLAN (CDP) CHECKLIST

THE FOLLOWING INFORMATION AND MATERIALS ARE NECESSARY FOR SUBMISSION. FOR A DETAILED DESCRIPTION OF REQUIRED ITEMS, SEE SECTION 11.06(C) OF THE ZONING ORDINANCE.

- REQUIRED FEE
- ONE (1) CD CONTAINING AN ELECTRONIC VERSION OF THE APPLICATION AND ONE (1) COPY OF THE DRAFT DEVELOPMENT AGREEMENT (PDF Format)

**The application shall include TWO (2) hard copies of the following information and materials, which shall be in a plan format together with a narrative explanation.**

- ☐ Date(s) and location of all meetings with representatives of adjoining neighborhoods, minutes and attendance record(s) of such meeting(s).
- Certified boundary survey including legal description of the property, scale drawing and the total number of acres in the project.
- *Development concept:* A summary explanation of the development concept shall describe the project and explain how the project will meet the intent of the PUD option as set forth in Section 11.01 and the criteria for consideration as a PUD as set forth in Section 11.03 hereof, as those sections reasonably apply to the site.
- *Density:* The maximum density of the overall project and the maximum density for each proposed use and phase.
- *Road system:* A general description of the road system and circulation pattern; the location of roads, entrances, exits and pedestrian walkways; a statement whether roads are intended to be public or private. Efforts shall be made to ensure that multiple transportation modes are safely and effectively accommodated in an effort to provide alternate modes of access and alleviate vehicle traffic congestion particularly as it pertains to the improvements along major roads.
- *Utilities:* A general description and location of both on-site and off-site utilities including proposed water, sanitary sewer, storm sewer systems and utility lines; a general indication of the size and location of stormwater detention and retention ponds, and a map and text showing off-site utilities, existing and proposed, which will provide services to the project.
- *Open space/common areas:* A general description of proposed open space and common areas; the total area of open space; the total area of open space in each proposed phase; the proposed uses of open space and common areas.
- *Uses:* A list of all proposed uses; the location, type and land area to be devoted to each use, both overall and in each phase; a demonstration that all of the proposed uses are permitted under this Article.
- *Development guidelines:* A plan of the site organization, including typical setback and lot dimensions; the minimum lot sizes for each use; typical minimum and maximum building height and size; massing models; conceptual building design; and the general character and arrangement of parking; fencing; lighting; berming; and building materials.
- *Parking and Traffic:* A study of the parking requirements and needs; a traffic impact study and analysis.
- *Landscaping:* A general landscaping plan; a landscape plan for entrances; a landscape plan for overall property perimeters; any theme/streetscape design; any proposed irrigation.
- *Natural resources and features:* Floodway/floodplain locations and elevations; wetlands and watercourses; woodlands; location and description of other natural resources and natural features.



# PLANNED UNIT DEVELOPMENT CONCEPT DEVELOPMENT PLAN (CDP) CHECKLIST (page 2)

■ *Phasing information:* The approximate location, area and boundaries of each phase; the proposed sequence of development, including phasing areas and improvements; and the projected timing for commencement and completion of each phase.

■ *Public services and facilities:* A description of the anticipated demand to be generated by the development for public sewer, water, off-site roads, schools, solid waste disposal, off-site drainage, police and fire; a description of the sufficiency of each service and facility to accommodate such demands; the anticipated means by which any insufficient services and facilities will be addressed and provided.

■ *Historical resources and structures:* Their location, description and proposed preservation plan.

■ *Site topography.*

■ *Signage:* General character and location of entrance and internal road system signage; project identification signage; and temporary or permanent signage proposed for any other locations.

■ *Amenities.*

■ *Zoning classification:* Existing zoning classifications on and surrounding the site.

■ *Specification of deviations:* A specification of all deviations proposed from the regulations which would otherwise be applicable to the underlying zoning and to the proposed uses, which are proposed and sought for any phase or component of the Planned Unit Development; the safeguards, features and/or planning mechanisms proposed to achieve the objectives intended to be accomplished by any regulation from which a deviation is being sought.

■ *Community impact statement:* A community impact statement, which shall provide an assessment of the developmental, ecological, social, economic and physical impacts of the project on the natural environmental and physical improvements on and surrounding the development site. Information required for compliance with other ordinance provisions need not be duplicated in the community impact statement.

**ALL HARD COPY DRAWINGS SHALL BE FOLDED, STAPLED, SEALED AND SIGNED  
BY A STATE OF MICHIGAN PROFESSIONAL ENGINEER, REGISTERED ARCHITECT,  
REGISTERED LANDSCAPE ARCHITECT, OR PROFESSIONAL COMMUNITY PLANNER**

**PLANNING COMMISSION AGENDAS ARE ELECTRONIC**

# LONG LAKE & CROOKS MASTERPLAN DEVELOPMENT

KOJAIAN + GENSLE + PEA GROUP + FLEIS & VANDENBRINK | NOVEMBER 20, 2020 | CDP

Planned Unit Development – Concept Development (CDP) Submittal

Project: Long Lake & Crooks Masterplan Development  
Date: November 20, 2020

City of Troy, Planning Department  
City of Troy, 500 W. Big Beaver Rd., Troy, MI 48084



Kojaian  
Long Lake Crooks Development Associates, LLC  
[tantone@kojaian.com](mailto:tantone@kojaian.com)  
39400 Woodward Avenue, Suite 250  
Bloomfield Hills, MI 48304  
(248) 644-7600  
Contact: Anthony G. Antone, Vice President



Gensler  
150 West Jefferson, Suite 1700  
Detroit, MI 48226  
(313) 496-8966  
Contact: Chris Beck, Project Manager



Fleis & Vandenbrink  
27725 Stansbury Blvd., Suite 195  
Farmington Hills, MI 48334  
(248) 342-5786  
Contact: Julie Kroll, PE, PTOE



PEA Group  
2430 Rochester Court, Suite 100  
Troy, MI 48083  
(248) 528-7369  
Contact: James Butler, PE



Dawda, Mann, Mulcahy, & Sadler  
39533 Woodward, Suite 200  
Bloomfield Hills, MI 48304  
(248) 642-4248  
Contact: Tyler D. Tennent

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## **A. Certified Boundary Survey – Refer to Appendix: Sheet C-1**

### **Legal Description of Property**

A parcel of land in a part of the southeast quarter of Section 8, T.02N., R.11 E., City of Troy, County of Oakland, State of Michigan described as follows:

Commencing at the Southeast corner of Section 8, T.02N., R.11 E., City of Troy, County of Oakland, State of Michigan, thence South 87 degrees 15 minutes 31 seconds West 130.00 feet; thence North 02 degrees 37 minutes 54 seconds West 100.00 feet to the north line of Long Lake Road (width varies) and the POINT OF BEGINNING; thence along the said north line the following three (3) courses and distances 1) South 87 degrees 15 minutes 31 seconds West 894. 70 feet; 2) North 02 degrees 30 minutes 26 seconds West 10.00 feet; 3) South 87 degrees 15 minutes 31 seconds West 364.00 feet; thence North 47 degrees 37 minutes 28 Seconds West 42.26 feet to the easterly line of Corporate Drive (120' wide); thence North 02 degrees 30 minutes 26 seconds West 424.81 feet to a point of curvature; thence 353.35 feet along a curve to right, said curve having a radius 710.00 feet, a central angle of 28 degrees 30 minutes 52 seconds, and a chord that bears North 11 degrees 45 minutes 00 seconds East 349.71 feet; thence North 87 degrees 15 minutes 31 seconds East 1240. 77 feet to the west line of Crooks Road (width varies); thence along said west line the following three (3) courses and distances: 1) South 02 degrees 37 minutes 54 seconds East 463.36 feet; 2) South 87 degrees 22 minutes 06 seconds West 10.00 feet; 3) South 02 degrees 37 minutes 54 seconds East 310.00 feet; thence South 42 degrees 18 minutes 48 seconds West 42.47 feet to the POINT OF BEGINNING.

Parcel 20-08-477-001 Vacant Land

## **B. Development Concept:**

Long Lake Crooks Development Associates, L.L.C. (the "Developer") proposes a mixed-use development within the 24.08-acre site bound by Long Lake Road to the south, Crooks Road to the east and Corporate Drive to the west. In concept, this development is envisioned to offer various needed services to the Long Lake corridor and surrounding community and create a development of mixed horizontal and vertical forms. The Site has the potential to be comprised of workplace / medical office space, retail, entertainment, commercial, residential, and hospitality uses, with the desired overall potential of maximizing the developmental area and providing interconnectivity for vehicles and pedestrians.

The overall phasing of the development will be dependent on the Developer's success and cadence in acquiring prospective users. Final site configurations will be contingent on such cadence and specific user requirements, both of which will influence final building massing, location and overall site character. Final development solutions for each use will be individually issued for approval as part of the preliminary and final development approval process during future timeframes.

The basis of the documentation included within this concept development plan application is to demonstrate the desired intent of the overall site over a period of time. It is conceptual in nature, however, demonstrates a thoughtful and desired solution to the property for which a planned unit development zoning status is needed. The descriptions and illustrations within this application form the basis of the development concept.

The concept development plan envisions several site components marked as development areas (refer to Appendix: Sheet A-6). The largest areas are proposed for workplace / medical office and/or residential development and are generally intended to be the anchor development within the overall site. These areas will support the functional needs of prospective users and/or residents, bringing significant growth opportunities for the City and further energizing the area. If developed for either single anchor or multi-tenant configurations, these buildings will support the flexible workplace environment tenants seek within Class-A office/flex-tech space. As a residential location, added development will further support the increasing demands of the city's housing needs.

Other areas shown on the concept development plan provide retail/entertainment and/or medical office opportunities which will align along the pedestrian corridors, providing potential restaurant, shopping, or entertainment destinations to the surrounding community while supporting the proposed office and residential uses on site. These smaller scale developments are intended to energize the Long Lake and Corporate Drive frontage to both vehicular and pedestrian foot traffic. They will engage and support both the site's workplace development, providing a walkable alternative for food, beverage, and other entertainment offerings while also being a favorite 'go-to' location for the local community. These areas also provide valuable opportunities for medical and office locations given their immediate location off of high traffic vehicle routes, if future tenants warrant such facility types.

One area offers the final component of lodging with an intended inclusion of a 220 key anchor hotel. Currently located on the southwestern corner of the site, final location of the hotel may occur further to the north along Corporate Drive to allow for retail to occupy the more pedestrian accessible Long Lake and Corporate corner. As with the retail and office components, the hotel is deemed as an asset to both the immediate site as well as the broader community.

A combination of surface and parking decks will support the overall site development. Surface parking will support the needs of the short-term visitors of office, retail and hotel uses, while parking decks, situated away from the high visibility of Long Lake and Crooks will support the daily occupants of the larger office and mixed-use buildings.

The Developer needs the flexibility to choose the locations of each permitted use, the sequence of development, and the specific features and boundaries of each area depicted in the Concept Development Plan. Market forces and user requirements are constantly changing. As a result, the PUD zoning concept, together with an appropriate Development Agreement, will facilitate this flexibility and encourage development without adversely impacting the preliminary and final development plan approval processes required by the City under the Zoning Ordinance.

**C. Location Map – Refer to Appendix: Sheet C-2.0**

**D. Land Use Map – Refer to Appendix: Sheet A-1**

Properties adjacent to site are: Office, Retail/Restaurant and Cemetery

**E. Certified Boundary Survey – Refer to Appendix: Sheet C-1 Topographic Survey**

#### **F. Density Analysis:**

	<b>Zoning</b>	<b>Proposed</b>
<b>District</b>	<b>Max. % of Building Coverage</b>	
<b>OM – Office Mixed Use</b>	<b>40%</b>	<b>37%</b>
<b>UR – Urban Residential</b>	<b>50%</b>	<b>N/A</b>
<b>GB – General Business</b>	<b>N/A</b>	<b>10%</b>
<b>Overall Site</b>	<b>N/A</b>	<b>27%</b>

#### **G. Road/Circulation System**

- Private Roads within site
- Entrances
  - Crooks Road Boulevard
    - Main Entry with deceleration lane / Exit
  - Long Lake Road Boulevard
    - Main Entry with deceleration lane / Exit
    - Retail / Restaurant entry with deceleration lane / Exit
  - Corporate Drive Boulevard
    - Main Entry with deceleration lane / Exit
    - Hotel entry with deceleration lane / Exit
- Circulation Pattern
  - Main routes are East to West from Crooks Road to Corporate Drive
  - Intersecting route from Long Lake Road
- Pedestrian walkways throughout the site to provide walkability and easy access to amenities

#### **H. Utilities – Refer to Appendix: Sheet C-3 Conceptual Utility Plan**

- Gas – Connect to existing from Crooks Road
- Electric - Connect to existing from Long Lake Road
- Water / Fire
  - Connect to existing watermain from Corporate Drive
  - Connect to existing watermain from Crooks Road
- Sanitary Sewer – Connect to existing from Long Lake Road
- Communications – Connect to existing from Long Lake Road
- Storm
  - Connect to the existing structure at the corner of Crooks Road and Long Lake
  - Underground detention area in parking lot near Detention Pond
  - Detention Area will feature a natural pond with walking path and landscaping



## **I. Open Space/Common Areas:**

The site is currently vacant and not accessible to the public. The Concept Development Plan envisions that a portion of the site will provide a park like setting with a water feature and access to the pedestrian boulevards and retail/restaurants, which can be used at the leisure of residents and visitors. This interconnectivity to the site features and outdoor amenities is a recognizable public benefit.

Open space is incorporated to the greatest extent possible while balancing building, parking and circulation needs within the boundaries of the property. Open, vegetated areas are located to minimize large scale hardscape zones. Public access is focused primarily to the southern end of the site, along the Long Lake corridor, culminating in the southeast corner at Long Lake and Crooks where a large water retention feature can be leveraged and used as both user and public amenity space.

Continuous paved walking paths wrap the development zone connecting open spaces, as well as the incorporation of a potential natural pathways and seating areas around the water feature.

Native, high quality, vegetation replaces the current low value tree stock and is intended to be incorporated throughout the development area within open/common spaces, softening the more formal approach of the buildings and balancing human scale to surrounding built environment.

Refer to Appendix: Sheet C-2.0 and Sheet A-10 for conceptual site plan and site amenity diagraming

## **J. Uses: Refer to Appendix: Sheet A-6, A-7, A-8, A-9, A-10**

- Lodging
- Retail/Entertainment
- Office/Medical/Residential
- Parking - Surface/Deck

The proposed uses are to be a mixture of commercial, retail, residential, medical and office uses, as depicted on the Concept Development Plan, and described as follows:

- A. Office uses permitted as of right, requiring special approval, and accessory uses consistent with the OM - Office Mixed Use District, consistent with the O - Office District, and consistent with the GB-General Business District, all identified in the Zoning Ordinance;
- B. Residential uses permitted as of right, requiring special approval, and accessory uses consistent with the UR – Urban Residential District in the Zoning Ordinance;
- C. Retail, Entertainment, and Service uses permitted as of right, requiring special approval, and accessory uses consistent with the GB – General Business District in the Zoning Ordinance;
- D. Lodging and Extended Stay Facility uses permitted as of right, requiring special approval, and accessory uses consistent with the GB – General Business District in the Zoning Ordinance.
- E. Conference, Meeting, and Banquet Facility uses permitted as of right, requiring special approval, and accessory uses consistent with the GB - General Business District in the Zoning Ordinance; and,
- F. All of the above uses utilizing any associated parking structure, surface parking, and outdoor water features.

#### K. Development Guidelines:

District	Minimum Yard Setback			Maximum Bldg. Height		Max. % of Building Coverage
	Front Setback	Side Setbacks	Rear Setback	In Stories	In Feet	
OM – Office Mixed Use	10 Feet	20 Feet (least) 60 Feet (Total)	30 Feet	5	75	40%
UR – Urban Residential	10 Feet	0 Feet 30 Ft between buildings	0 Feet	No limit	No Limit	50%
GB – General Business	10 Feet	20 Feet (least) 40 Feet (Total)	30 Feet	5	75	N/A

#### L. Traffic Impact Study:

This report presents the results of a Traffic Impact Study (TIS) for the proposed master plan development. This analysis is based on the conceptual development plan included with the application. This study includes an evaluation of the highest trip generation for the potential uses of the site, thereby providing a conservative analysis. The land uses included herein were assumed for analysis purposes and do not necessarily reflect the actual proposed land uses on this site.

The proposed conceptual plan evaluated in this study includes the development of the approximately 23-acre parcel with office, hotel, and retail/restaurant land uses. Parking for the site was assumed to be provided through a combination of parking structures and surface parking. The site access will be finalized at the site plan phase of the project, however for this analysis access was assumed via five (5) site driveways; one (1) on SB Crooks Road, two (2) on Long Lake Road, and two (2) on Corporate Drive. Long Lake Road and Crooks Road are under the jurisdiction of the Road Commission of Oakland County (RCOC), whereas Corporate Drive is under the jurisdiction of the City of Troy.

The scope of this study was developed based on Fleis & VandenBrink's (F&V) knowledge of the study area, understanding of the development program, accepted traffic engineering practice and information published by the Institute of Transportation Engineers (ITE), and pursuant to the requirements of City of Troy and the Road Commission for Oakland County (RCOC). Additionally, F&V solicited input regarding the scope of work from the City of Troy's traffic engineering consultant (OHM Advisors).

#### Background Data

Due to the impacts of COVID-19 and the subsequent closures of business and schools, current traffic volume data is not representative of "typical" operations. In addition, the on-going construction on I-75 has significant impacts on the traffic volumes throughout the study network. Therefore, the traffic volume data necessary for this study was obtained from multiple sources:

- SCATS count data from RCOC was obtained at the signalized study intersections for use in this study. The SCATS data used was from the week of September 13, 2018, prior to COVID and I-75 construction impacts.
- F&V subconsultant Traffic Data Collection, Inc. (TDC) performed weekday AM (7:00 AM to 9:00 AM) and PM (4:00 PM to 6:00 PM) turning movement counts on Wednesday, October 6, 2020 at the unsignalized study intersection.

A 0.5% annual background growth rate was applied to the 2018 traffic volumes to calculate the baseline 'existing' 2020 traffic volumes. Adjustment factors were applied at the unsignalized intersections to calculate the baseline 'existing' 2020 traffic volumes. The traffic volumes were then balanced through the network. 'Dummy nodes' were added at locations to account for sink and source volumes between intersections.

### Trip Generation

The number of weekday daily, AM, and PM peak hour vehicle trips that would be generated by the proposed development was forecast based on data published by ITE in the *Trip Generation Manual, 10<sup>th</sup> Edition*. The site trip generation forecast is summarized in **Table 1**. The proposed trip generation included in this analysis was reviewed with the City Traffic Engineer prior to use in the study. *Note: Internal trip capture and pass-by trip reductions were not included in this study to provide a conservative analysis.*

**Table 1: Trip Generation Summary**

Land Use	ITE Code	Amount	Units	Average Daily Traffic (vpd)	AM Peak Hour (vph)			PM Peak Hour (vph)		
					In	Out	Total	In	Out	Total
Quality Restaurant	931	24,600	GFA SF	2,062	14	4	18	129	63	192
Hotel	310	220	Rooms	2,057	62	43	105	71	68	139
Medical-Dental Office Building	720	540,000	GFA SF	20,659	782	220	1,002	513	1,320	1,833
<b>Total Trips</b>				<b>24,778</b>	<b>858</b>	<b>267</b>	<b>1,125</b>	<b>713</b>	<b>1,451</b>	<b>2,164</b>

### Site Trip Distribution

The vehicular trips that would be generated by the proposed development were assigned to the study roads based on the proposed site access plan, the existing peak hour traffic patterns on the adjacent roadway network, and the methodologies published by ITE. The adjacent street traffic volumes were used to develop the trip distribution. The site trip distribution used in the analysis is summarized in **Table 2**.

**Table 2: Trip Distribution**

New Trips			
From/To	Via	AM	PM
North	Crooks Road	28%	30%
South	Crooks Road	14%	19%
East	Long Lake Road	18%	17%
East	I-75 Ramp	28%	18%
West	Long Lake Road	12%	16%
<b>Total</b>		<b>100%</b>	<b>100%</b>

## Conclusions

The conclusions of this TIS are as follows:

### 1. Existing Conditions

Overall, the study intersections currently operate acceptably during the AM and PM peak hours. The Syncho/SimTraffic analysis was reviewed to determine if mitigation measures would improve existing conditions. Improvements were investigated at the Crooks Road & Corporate Drive / I-75 Ramp and the following mitigation measures were found to improve existing operations:

- Eliminate direct left-turns, utilize cross-over to the south at Tower Dr.
- Construct additional westbound left-turn lane

### 2. Background Conditions

The results of the background conditions analysis show that the intersection approaches and movements will continue to operate in a manner similar to existing conditions, with minor increases in delay at the study intersections.

### 3. Future Conditions

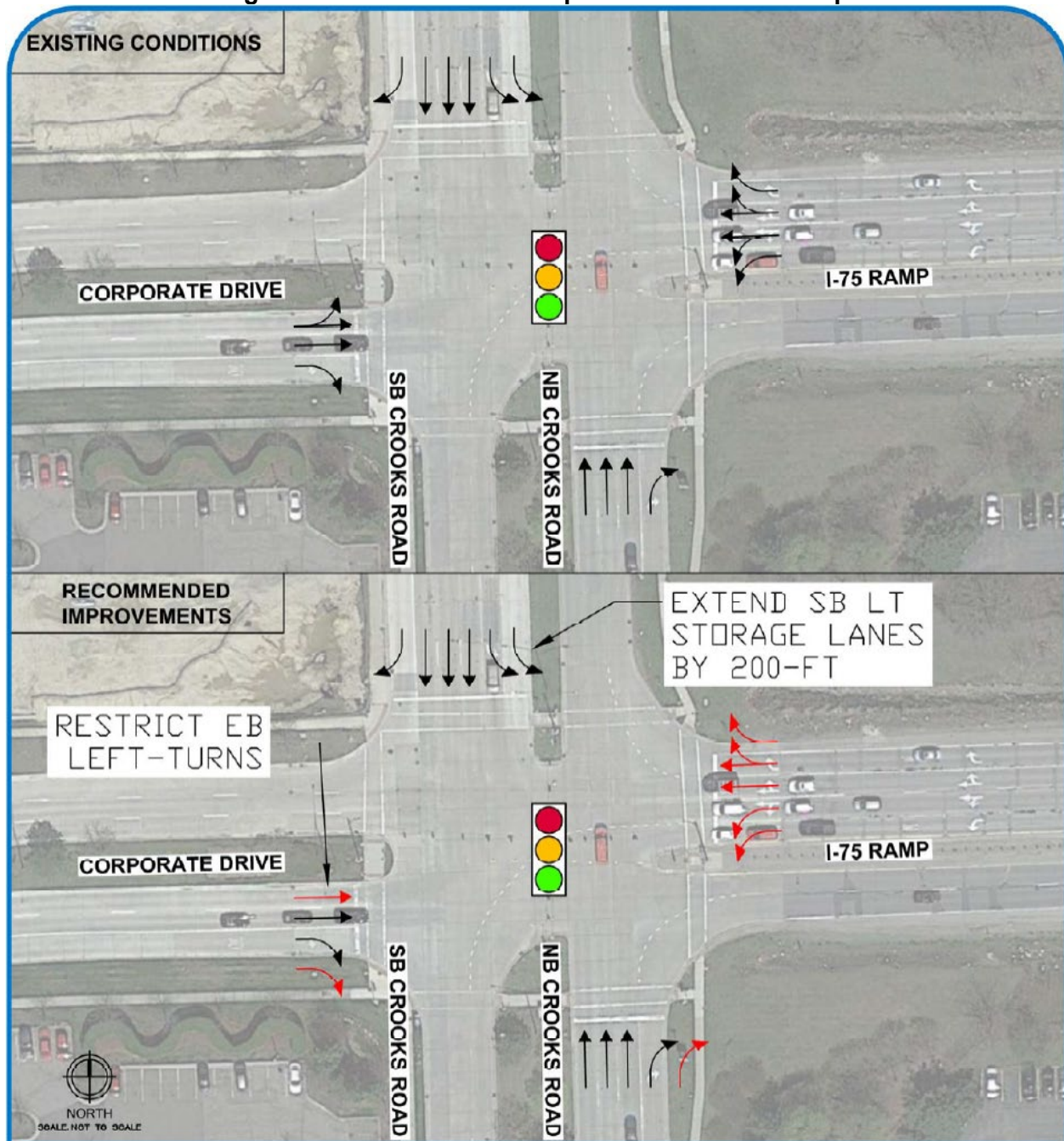
The results of the future conditions analysis show mitigation measures are necessary to accommodate the projected traffic volumes generated by the proposed development. Overall, the study intersections currently operate acceptably during the AM and PM peak hours. The Synchro/SimTraffic analysis was reviewed to determine if mitigation measures would improve existing conditions. Improvements were investigated at the study intersections were found to improve future operations and mitigate the impact of the proposed development. The recommended improvements are summarized in **Table 3**.

## Recommendations

The recommended improvements are summarized in **Table 3** and shown on **Figures 1-4**.

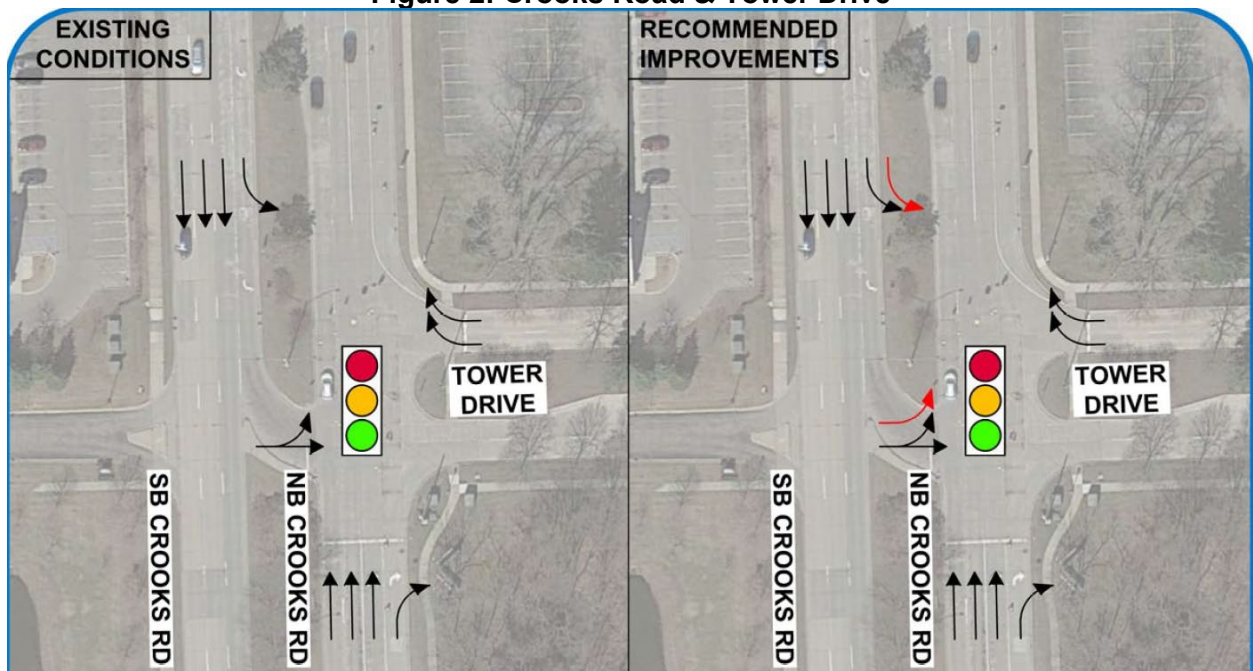
Int #	Study Intersection	Existing (2020)	Background (2025)	Future (2025)
<b># 10</b>	<b>Crooks Road &amp; Corporate Drive / I-75 Ramp</b>			
	Eliminate direct left-turns, utilize cross-over to the south at Tower Dr.	X		
	Construct additional westbound left-turn lane	X		
	Extend southbound left-turn storage length (~200 feet)			X
	Construct additional eastbound right-turn lane			X
	Construct additional northbound right-turn lane			X
<b># 30</b>	<b>Crooks Road &amp; Tower Drive</b>			
	Add additional southbound left-turn lane.			X
<b># 50</b>	<b>NB Crooks Rd &amp; SB to NB X/O N. of Long Lake</b>			
	Add additional southbound left-turn lane.			X
<b># 120</b>	<b>WB Long Lake Road &amp; Corporate Drive</b>			
	Construct additional eastbound left-turn lane.			X
<b>Var</b>	<b>Site Driveway Intersections: Crooks Road Long Lake Road (2) Corporate Drive – Main Ent</b>			
	Construct exclusive right-turn lane.			X

Figure 1: Crooks Road & Corporate Drive / I-75 Ramp

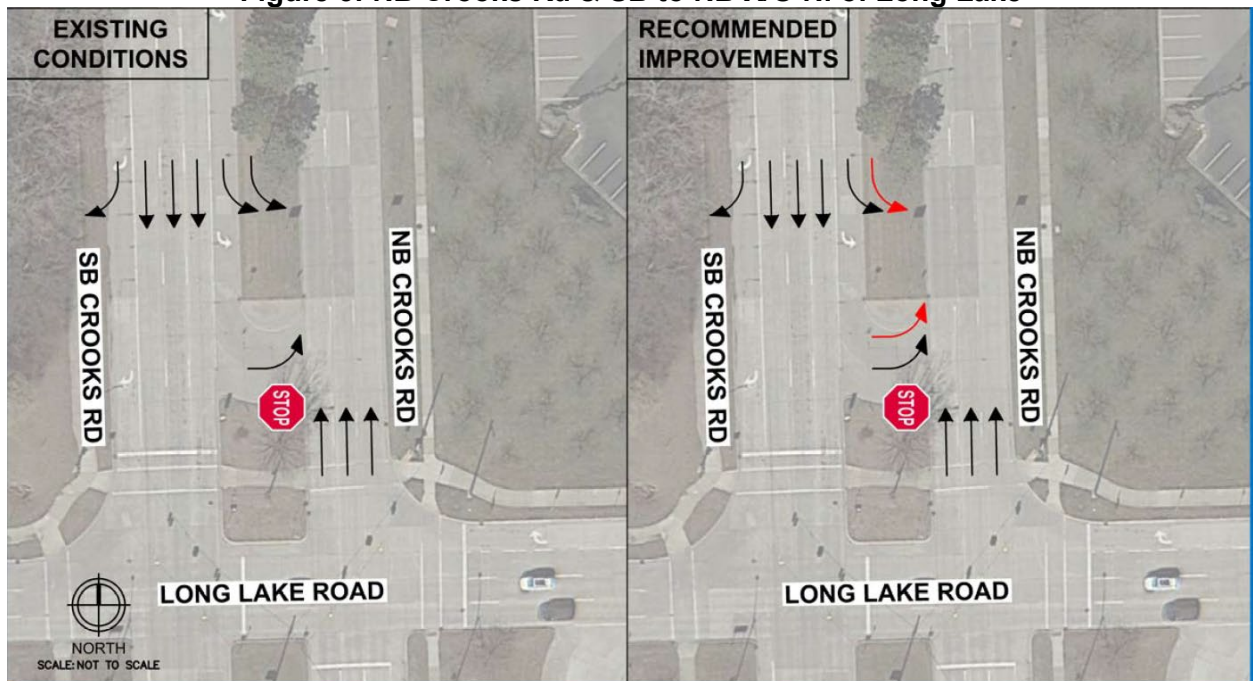




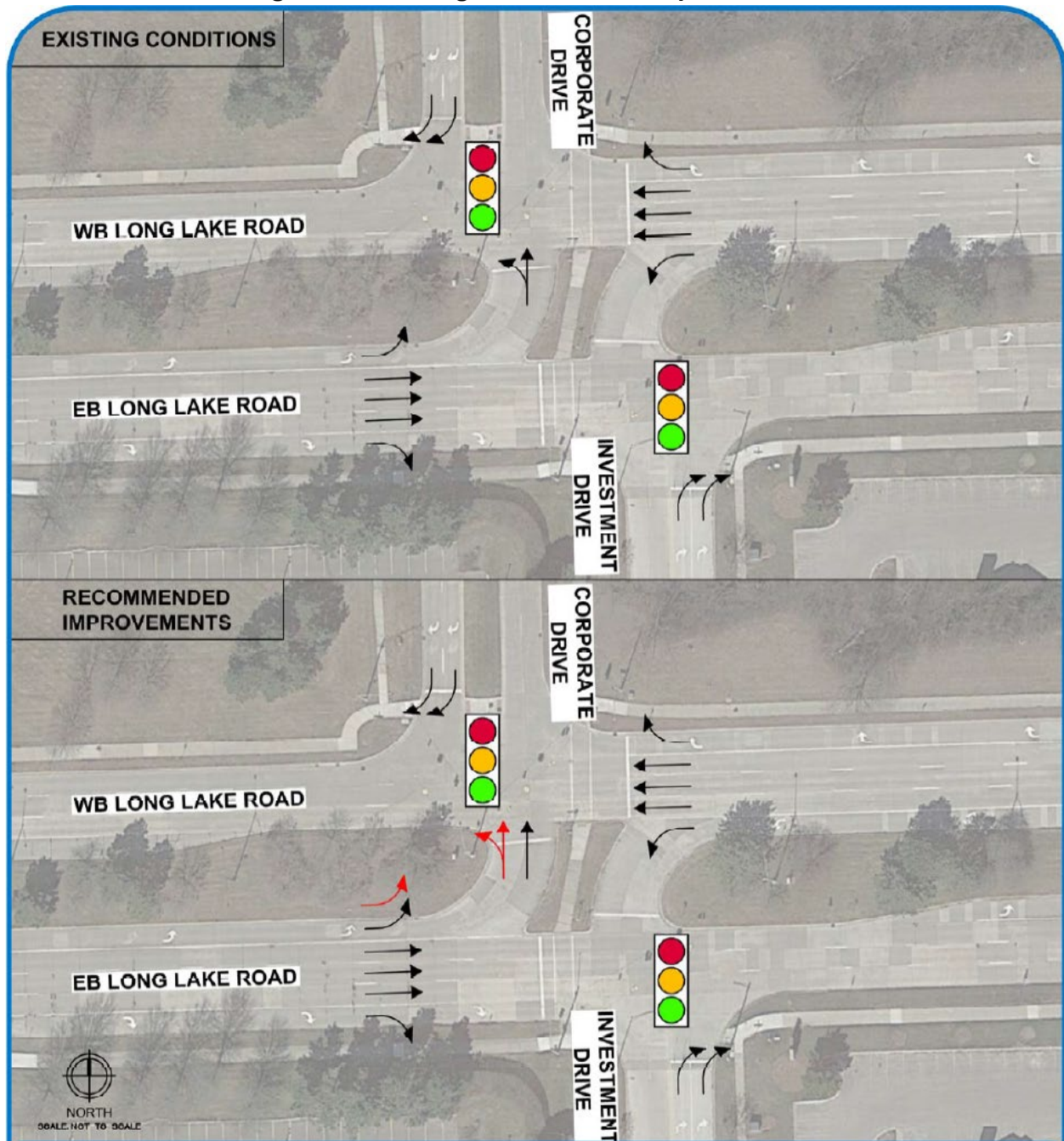
**Figure 2: Crooks Road & Tower Drive**



**Figure 3: NB Crooks Rd & SB to NB X/O N. of Long Lake**



**Figure 4: WB Long Lake Road & Corporate Drive**



Refer to Appendix: Sheet: V-1 Traffic Impact Study

**M. Landscaping: Refer to Appendix: Sheets: L-1, T-1, T-2 and T-3**

- Landscaping will be designed per Article 13 of the City of Troy Zoning Ordinance.
- Tree Survey Originally completed May 15, 2019
  - 1179 trees 6" DBH or greater were identified and tagged (18 on adjacent property)
  - One (1) tree on the property is in Good condition (Silver Maple)
  - Remaining trees are noted as Fair, Poor or Very Poor

## **N. Natural Resources/Features:**

The site topography is gently sloping from the west to the east (elevation 800 to 774). Most of the site drains to the southeast property corner and outlets into an existing culvert. Several areas of the property were shown to be disturbed with mounding, digging and evidence of earthwork/contour changes. No buildings or roads exist on the site.

### **Wetlands – Refer to Appendix: Sheet A-2, C-1**

Based upon the wetland delineation in March 2019, four (4) wetlands were found on the property. Two (2) wetlands were determined to be regulated by the Michigan Department of Environment, Energy & Great Lakes (EGLE). Wetland A and Wetland D is regulated by the City of Troy and EGLE and will need use permits for any impacts. Wetland A is dominantly scrub shrub with a dominance of common buckthorn (*Rhamnus cathartica*), riverbank grape (*Vitis riparia*) and silver maple (*Acer saccharinum*). Wetland D is primarily a scrub shrub wetland with a dominance of glossy buckthorn. The parcel did get processed through the State of Michigan's Wetland Assessment in June 2019. As determined by EGLE, a small stream was identified within the southern edge of Wetland A and drains directly into the existing storm end section. The on-site water travels within the storm pipe along Long Lake and discharges into the Sturgis Drain. It was this relationship to Sturgis Drain that EGLE determined the on-site water feature a stream and thus regulating Wetland A and D. Refer to Wetland Map below and review the included wetland report. Therefore, the City of Troy\* and EGLE will require a use permit for Wetland A.

*Refer to Wetlands Summary Report dated April 2, 2019 and Wetlands Identification Report from EGLE dated July 29, 2019*

### **Woodlands – Refer to Appendix: Sheet A-4, T-1, T-2, T-3**

Approximately, eighty-three percent (83%) of the 24-acre parcel is wooded. The woodland is split between upland and wetland. The table below provides a break-down of tree species counts and overall tree health condition. Based upon the 2019 tree survey, one thousand one hundred-eighty (1,180) trees were tagged based upon the City's tree ordinance of 6-inch diameter at breast height. Twenty-five (25) different tree species were identified on the parcel with 98.9% being deciduous and 1.1% being evergreen. A majority of the tagged trees showed signs of stress which lead to a poor to very poor overall health (82.8% trees were considered poor to very poor). Factors that contribute to a poor to very poor health condition include trunk rot, trunk alignment, pests/ disease, excessive vine coverings, lack of crown, major limb damage and limited twig growth. The higher quality trees which consists primarily of hardwoods are shown in the chart with bold text. They represent only approximately 20% of the woodland. Most of these trees were located within an old utility corridor in the western portion of the property. In addition, scrub shrub habitat was dominant on the parcel consisting mostly of common buckthorn (*Rhamnus cathartica*). Based upon the statistical data, the woodland represents a low-quality woodlot with a dominance of prohibited trees species as listed by the City (box elder, cottonwood, white and green ash, black locust, silver maple, white poplar, etc.). Tree replacements should focus on high-quality hardwood native and/or cultivars of native trees for re-establishment.



Table 1.0 – 2019 Tree Survey Health & Diversity Chart

Tree Type	Total Count	Poor/VP	Percentage of Total
<b>American Beech</b>	1	0	0.08%
American Elm	130	105	11.02%
Austrian Pine	5	5	0.42%
<b>Basswood</b>	60	38	5.08%
Black Locust	425	416	36.02%
<b>Black Walnut</b>	126	75	10.68%
Black Willow	1	1	0.08%
<b>Blue Spruce</b>	6	0	0.51%
Box elder	127	121	10.76%
Cottonwood	30	20	2.54%
Domestic Apple	8	8	0.68%
Green Ash	78	72	6.61%
<b>Norway Maple</b>	12	1	1.02%
Paper Birch	1	1	0.08%
Pear	1	1	0.08%
<b>Red Maple</b>	2	0	0.17%
Scotch Pine	2	2	0.17%
<b>Shagbark Hickory</b>	1	1	0.08%
Silver Maple	96	50	8.14%
<b>Sugar Maple</b>	8	2	0.68%
Thornapple/Hawthorne	25	25	2.12%
White Ash	1	1	0.08%
White Poplar	1	1	0.08%
<b>Wild Black Cherry</b>	23	22	1.95%
Yellow Birch	10	9	0.85%
TOTALS	1180	977 (82.80%)	100.00%

**High Quality Tree Species**                      239                      139 (58.16%)                      20.25%

Deciduous Trees                      1.10%  
Evergreen Trees                      98.90%

#### O. Parking Counts:

A parking analysis was performed for this site to calculate the recommended parking supply. The parking demand for the PUD was calculated to determine how much parking will be generated by the proposed development. This data was then used to determine the recommended parking supply to accommodate the projected parking demand.

#### Parking Demand

The parking demand for the site was calculated by matching the potential land uses and sizes included in the PUD plan for this site to the City of Troy Zoning Ordinance land uses. The zoning ordinance was used to determine the baseline parking requirements for this site with land use anticipated within the PUD. These baseline calculations were further evaluated based on the shared parking methodology as outlined in Urban Land Institute (ULI) in *Shared Parking, 3<sup>rd</sup> Edition*. This methodology assumes that a single parking space may be utilized by two or more individual land uses without conflict based on the hourly, daily, and seasonal variations in parking demand. In accordance with the City ordinance, the parking demand was calculated according

the ordinance rates and was distributed according to the ULI distributions by month, day, and hour to determine the projected shared parking demand for this PUD.

For purposes of this analysis, it was assumed the PUD would include the highest and best use of the property. Therefore, a hotel, with a total of 220 hotel rooms, two office buildings, and three fine dining restaurants were included in the analysis. The proposed land uses and sizes included in this study are as follows:

Land Use	Size
Office Space (Medical/Dental Office)	540,000 SF (Gross Floor Area)
Hotel	220 hotel rooms
Hotel (Employees)	12
Hotel (Restaurant)	100 Seats
Retail (Fine Dining Restaurants)	735 Seats

These land uses were developed for use in this study based on the following assumptions:

- The City of Troy Zoning ordinance has two parking requirements for office uses, medical office building (MOB) and general office building. The MOB parking calculations are more conservative; therefore, it was assumed that 100% of the office space would be MOB.
- A maximum seating capacity of 245 per restaurant was assumed for each of the three (3) proposed fine/casual dining restaurants.
- The hotel is anticipated to be a business type hotel with 220 keys and based on similar size hotels, 12 employees are assumed. The hotel was also assumed to include a 100 seat fine dining restaurant.

The parking demand calculations for this PUD are summarized in Table 1 which show the Ordinance requirements and the shared parking reduction in parking demand.

**Table 1: Parking Demand Summary**

Land Use	Size	City Ordinance Rates	City Ordinance Parking Demand (no shared)	Shared Parking Peak Demand (2:00 PM)
Office Space (MOB)	540,000 SF (GFA)	1 space per 200 GFA	2,700	2,700
Hotel	220 rooms	1 space per room	220	73
Hotel Employees	12	1 space per emp	12	11
Hotel Restaurant (Fine Dining)	100 Seats	1 space per 2 seats	50	1
Restaurant (Fine Dining)	735 Seats	1 space per 2 seats	368	223
<b>Total Parking (spaces)</b>			<b>3,350</b>	<b>3,008</b>

### Parking Supply

A parking lot is typically designed to accommodate 85-95% occupancy, depending on the proposed land use(s), layout, and parking management (self-parking, valet, active parking management, etc.). As vehicles traversing through the parking lot search for the open spaces or wait for vehicles to exit providing a buffer between supply and demand allows for easier turnover in the parking lot and less congestion. The proposed PUD includes the addition of 496 surface parking spaces and the remaining parking to be provided in one or more parking structures. For purposes of this analysis it was assumed that the surface parking would accommodate a 90%

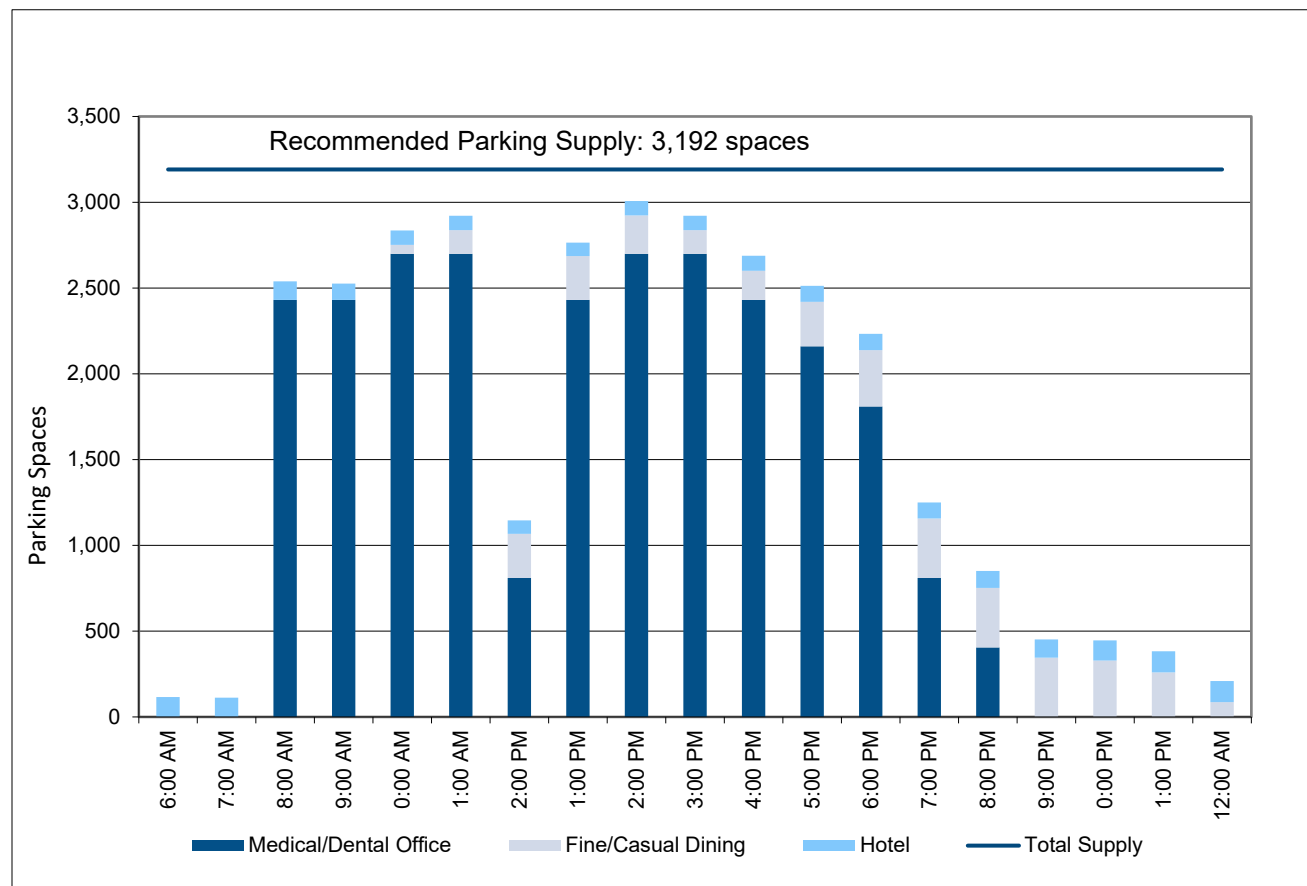
occupancy and the parking structures will have active parking management (*Active parking management is the dynamic management of parking to optimize performance and utilization of those facilities*), therefore could accommodate a 95% occupancy.

F&V used the peak shared parking demand to calculate the recommended parking for this PUD. The results of the analysis are summarized in Table 2 and the resulting hourly variations in parking demand are shown on Chart 1.

**Table 2: Parking Supply Summary**

Parking Spaces	Utilization Rate	Effective Parking Supply	Recommended Parking Supply
Surface Parking	90%	446	496
Parking Garage	95%	2,562	2,696
<b>Total</b>		<b>3,008</b>	<b>3,192</b>

**Chart 1: Recommended Parking Supply and Hourly Variation**



Note: ULI assumes medical offices are closed during lunch hour (12:00 PM – 1:00 PM)

## P. Project Phasing:

There is no identifiable phasing plan at this juncture of the proposed development. The overall development is assumed to be phased over time, based on end-user opportunities and economic viability. As various areas are developed, a phasing plan will be formulated in a manner where all parking and building requirements are met throughout each phase.

**Q. Public Services/Facilities:**

Anticipated demand will be dependent upon the type of development and their uses. City of Troy has sufficient infrastructure to sufficiently support a development of this size and variety.

Much of the stormwater generated from the development will be collected and conveyed via an enclosed storm sewer network to an underground stormwater detention system. The underground detention system provides management of the stormwater rate and quality prior to its discharge into the Sturgis Drain. A portion of the stormwater generated from the development will be collected and routed to the proposed water feature.

**R. Historical Resources and Structures:**

Based upon available online resources and field observations, no known historic architecture, buildings, foundations and/or archeological features exist on the subject property. Historic aerial imagery suggests that the property was used primarily as agricultural property since 1940 to 1980.

From 1980, the site use changed to fallow field and developed into the wetlands and woodlands you see today. In 1963 – 1964, Interstate 75 was constructed, and Crooks Road entrance/ exit ramp was established. The introduction of the highway system energized the immediate surrounding area to develop into commercial and office/ mixed-use zoning.

Around 1999, the northern portion of the property was disturbed due to construction activity for the development of the office and mixed-use buildings and parking areas. In addition, the National Parks Services has only two sites listed on the historic register. The two listings are as follows:

- Brooks Farm: 3521 Big Beaver Road
- Caswell House: 60 West Wattles Road

Both historic sites are over 2.0 miles from the subject property. The proposed development will not adversely affect the listed historic parcels. The following figures show the progression of the subject parcel from 1940 through 1999. In summary, the parcel was heavily farmed for at least forty years with the last forty years being left to naturalized based upon its surroundings. Through that time period, one house and accessory buildings have been shown to exist for approximately ten years.

Figure 4: 1940 B&W Aerial, Source: Oakland County Property Gateway. Property is utilized as agricultural.



Figure 5: 1963 B&W Aerial, Source: Oakland County Property Gateway. Introduction of Interstate 75, house located in the southeast corner of property; overall property is utilized as agricultural.





Figure 6: 1963 – Detail of house located at the southeast corner. House appears to be removed by 1974.

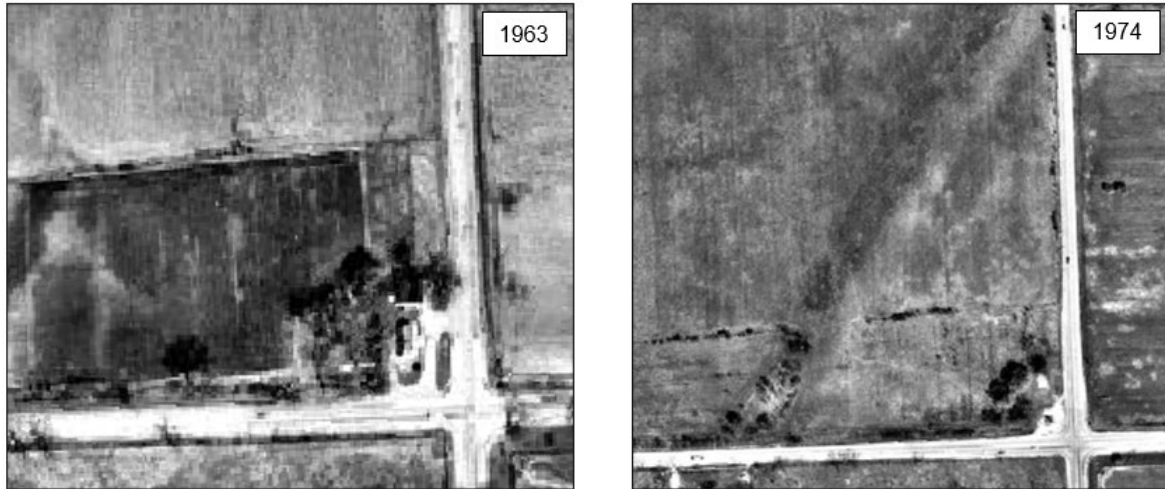


Figure 7: 1974 B&W Aerial, Source: Oakland County Property Gateway. Parcel continues as agricultural use



Figure 8: 1980 B&W Aerial, Source: Oakland County Property Gateway. It appears the parcel is not being farmed.



Figure 9: 1990 B&W Aerial, Source: Oakland County Property Gateway. Significant development surrounding the subject property with office and mix-use. From 1980 to 1990, Corporate Drive is constructed and Long Lake and Crooks Road becomes wider as a boulevard to address future traffic and growth.





Figure 10: 1999 B&W Aerial, Source - Google Earth. Parcel has developed wetlands and woodland area since approximately 1980 due to inactivity on the property (i.e. no farming, maintenance, etc.) Northern portion of the site receives impacts from the construction activity to the north.



In summary, the Long Lake and Crooks Road 24-acre shares a similar history as most surrounding properties in Troy, Michigan. Once historically farmed, the site was abandoned from farming and set aside for the future growth and development of the Detroit Metropolitan Area. As shown, this is one of the last large-scale pieces of property within the office and mixed-use zoning in the City of Troy. The resources on the site are of poor quality due to the lack of land management or planning. As the surrounding properties were developed, this parcel received secondary impacts and disturbance which promotes pioneer plant and tree species to dominant.

#### **S. Site Topography: Refer to Appendix: Sheet C-1**

The site topography is gently sloping from the west to the east (elevation 800 to 774). Most of the site drains to the southeast property corner and outlets into an existing culvert. Several areas of the property were shown to be disturbed with mounding, digging and evidence of earthwork/contour changes. No buildings or roads were observed on the subject property.

#### **T. Signage: Refer to Appendix: Sheet C-2**

Final signage, based on individual area developments, will adhere to all city requirements / regulations as identified in City ordinances. In general, the following signage opportunities are assumed:

- Monument Signs – Four (4) monument signs will be provided
  - Main Entrances on Crooks Road, Long Lake Road and Corporate Drive with tenant signage
  - Corner of Long Lake and Crooks with development signage
- Building Signs – Signage will be provided for each of the structures within the property
- Directional Signs – Signage will be provided within the property related to parking, fire lanes, one-way traffic, etc.



#### U. Amenities:

- Outdoor plazas to encourage interaction and engagement outside of the workplace.
- Outdoor dining areas opportunities within Retail / Entertainment locations as well as along 'pedestrian boulevard' where daily retail pop-ups could be incorporated.
- Pedestrian boulevard and continuous circulation paths throughout the property for walkability, relaxation and encouragement of a healthy environment.
- Water feature and accompanying walking paths and activity areas for public access and integration within the development.

#### V. Existing Zoning Classification:

O - Office Building District Zoning

*Development to support office uses and limited related retail and service uses which support an office environment.*

*Not supportive of prominent retail or other commercial components*

Maximum height – 3 stories/ 36'

Density restrictions

Restaurants – not permitted

Hotel/Lodging – not permitted

Parking Decks – special approval only

#### W. Specification of Deviations:

- Rezone from O – Office Building to Office Mixed-Use, Urban Residential, and General Business
- Building Height – Office/Medical/Residential Buildings

District	Maximum Bldg. Height	
	In Stories	In Feet
O – Office Mixed Use	5	75
<b>OM – Office Mixed Use Proposed</b>	<b>6 (Building 1)</b> <b>8 (Building 2)</b>	<b>90</b> <b>120</b>

#### X. Community Impact Statement:

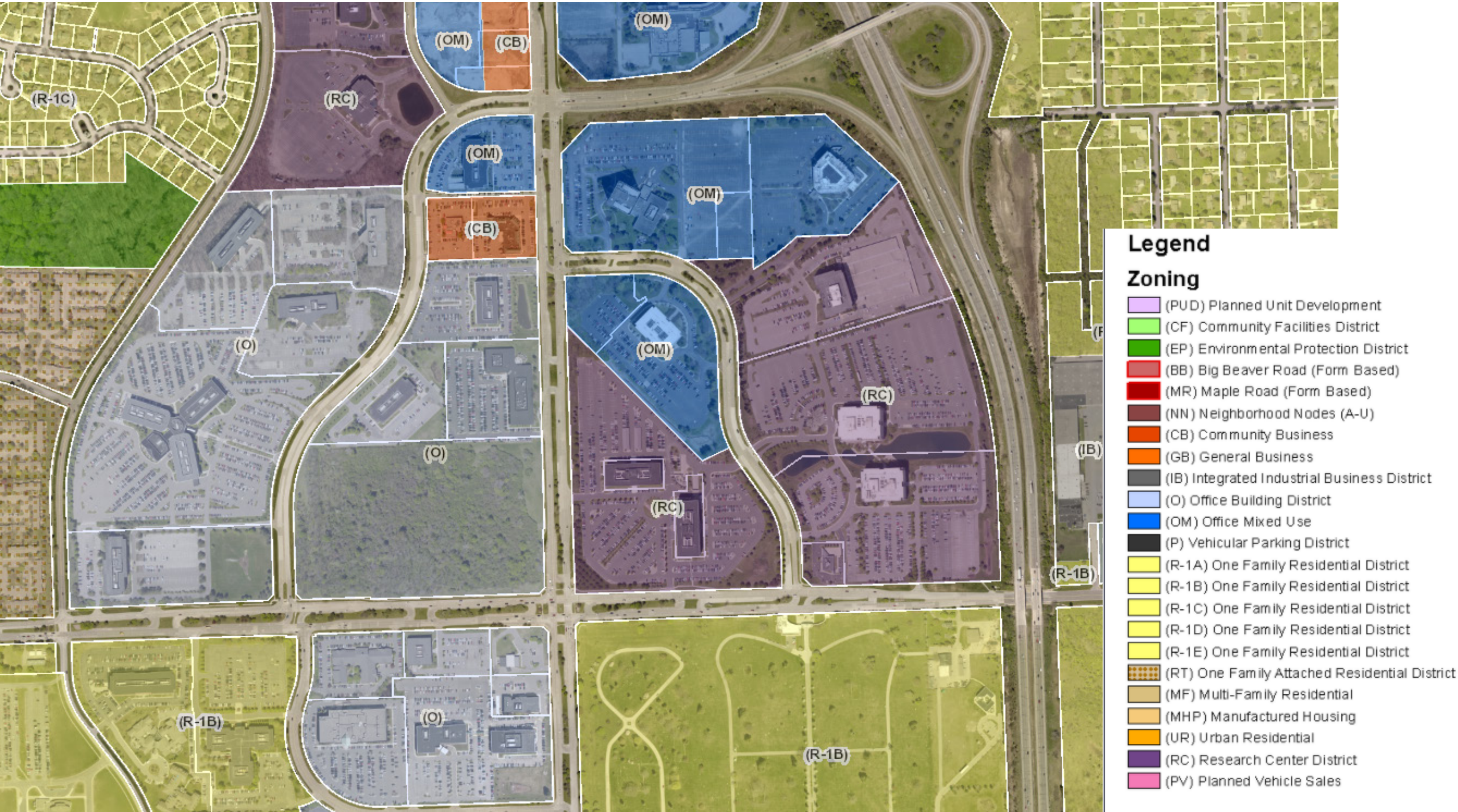
As part of the North Troy Master Plan, the integration of mixed-use developments will help encourage the public to remain in the area outside of the typical 9 to 5 office hours, which in turn will grow and strengthen the local economy and develop a larger presence for the Northfield district. Given the location of the site, this development is intended to act as a gateway into the district, spearheading North Troy's positioning within the larger city context. It is hoped that the development of this vacant site will encourage further strategic redevelopment of properties within the surrounding area as the next generation of growth.

The development will be pedestrian-friendly and readily accessible, encouraging users to move from building to building in a campus / park-like setting. By enhancing site walkability and creating desirable public and private destinations, this gateway corner will be rejuvenated with new life and vibrancy that the district has currently been void of.

# APPENDIX



# LAND USE



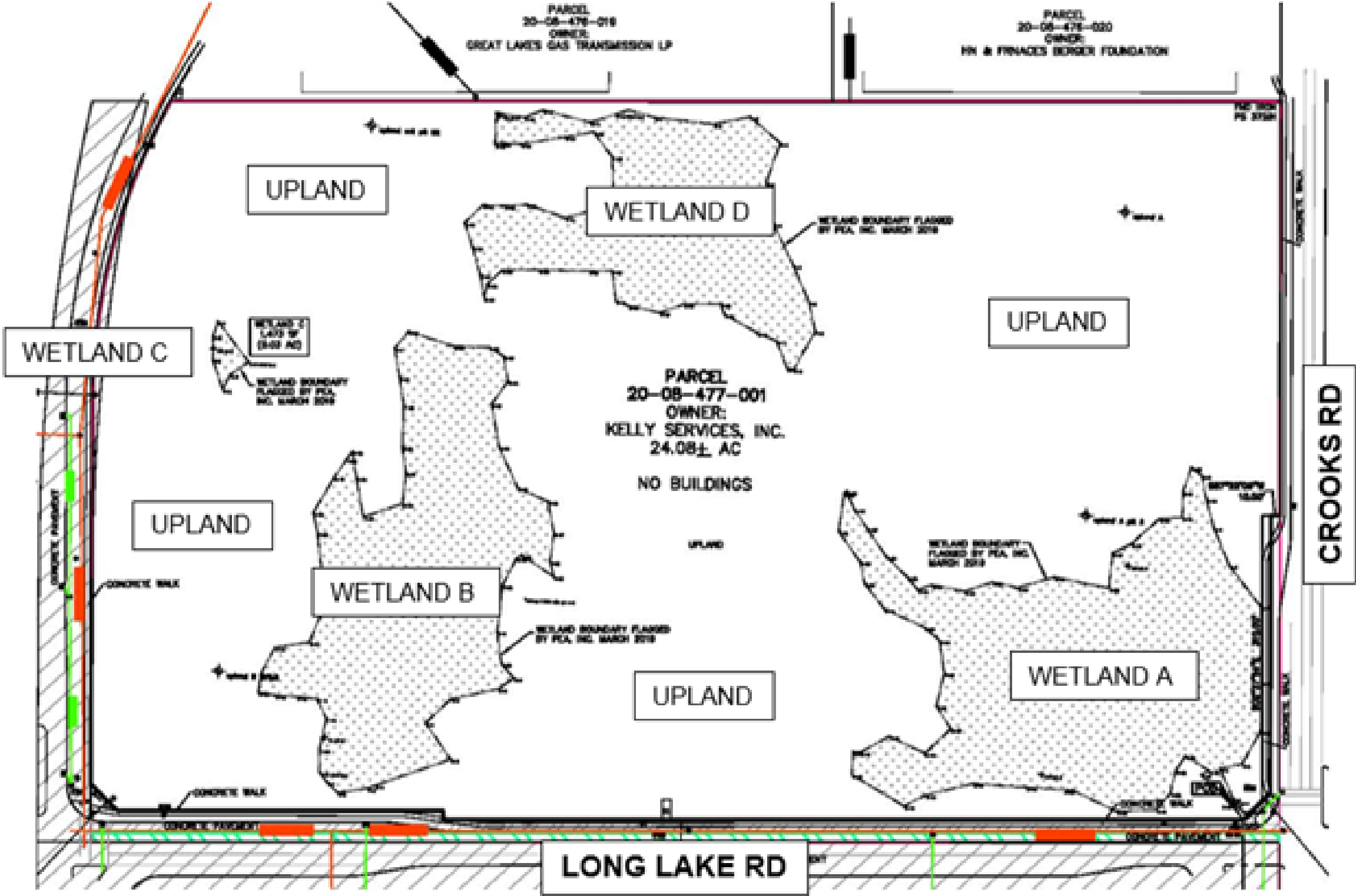


# WETLANDS



FIGURE 1: SOURCE - OAKLAND COUNTY PROPERTY GATEWAY

# WETLAND MAP



\*City of Troy wetlands ordinance only regulates those wetlands regulated by the State of Michigan.

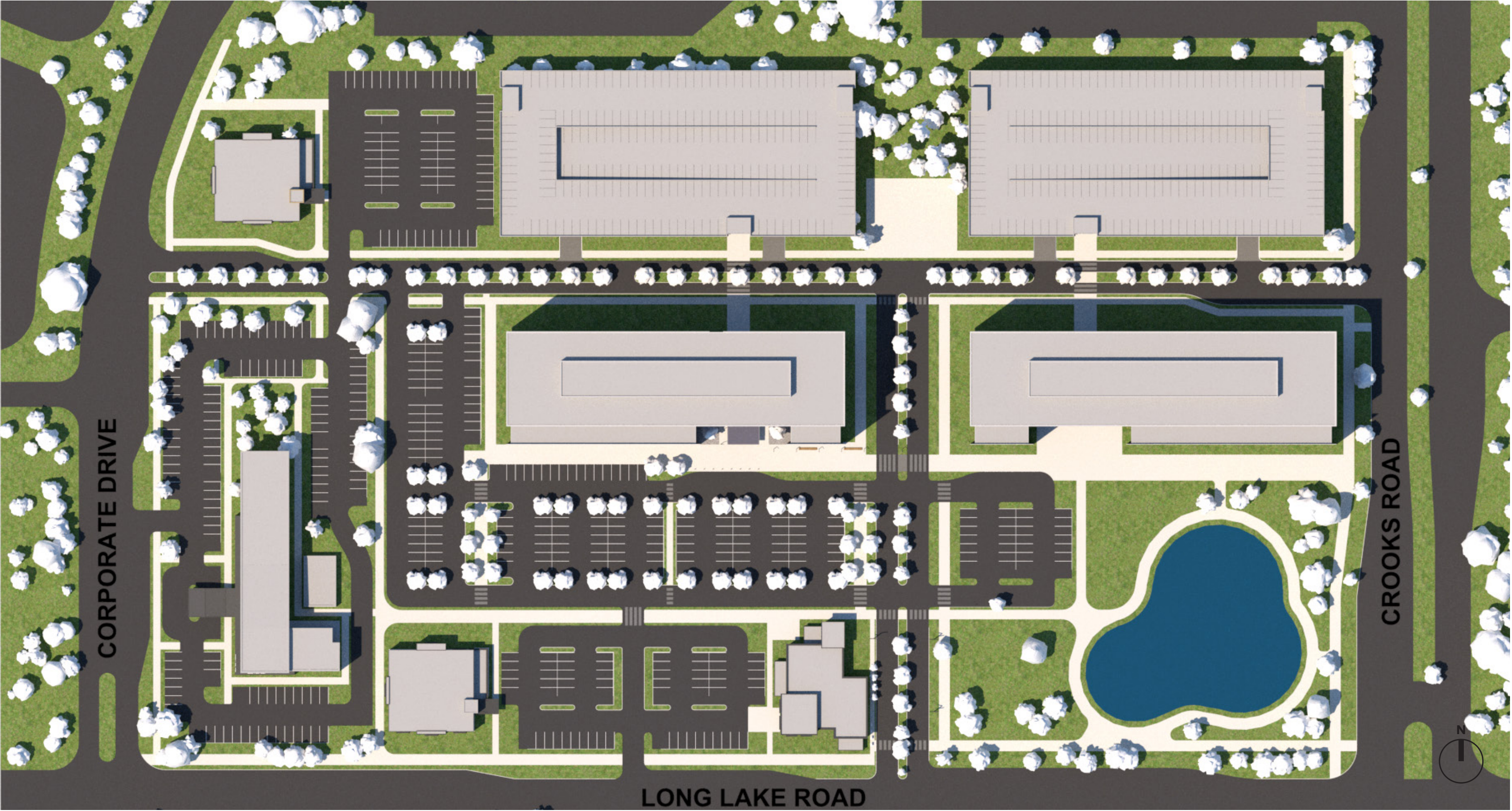
# WOODLANDS



FIGURE 3: SOURCE - GOOGLE EARTH

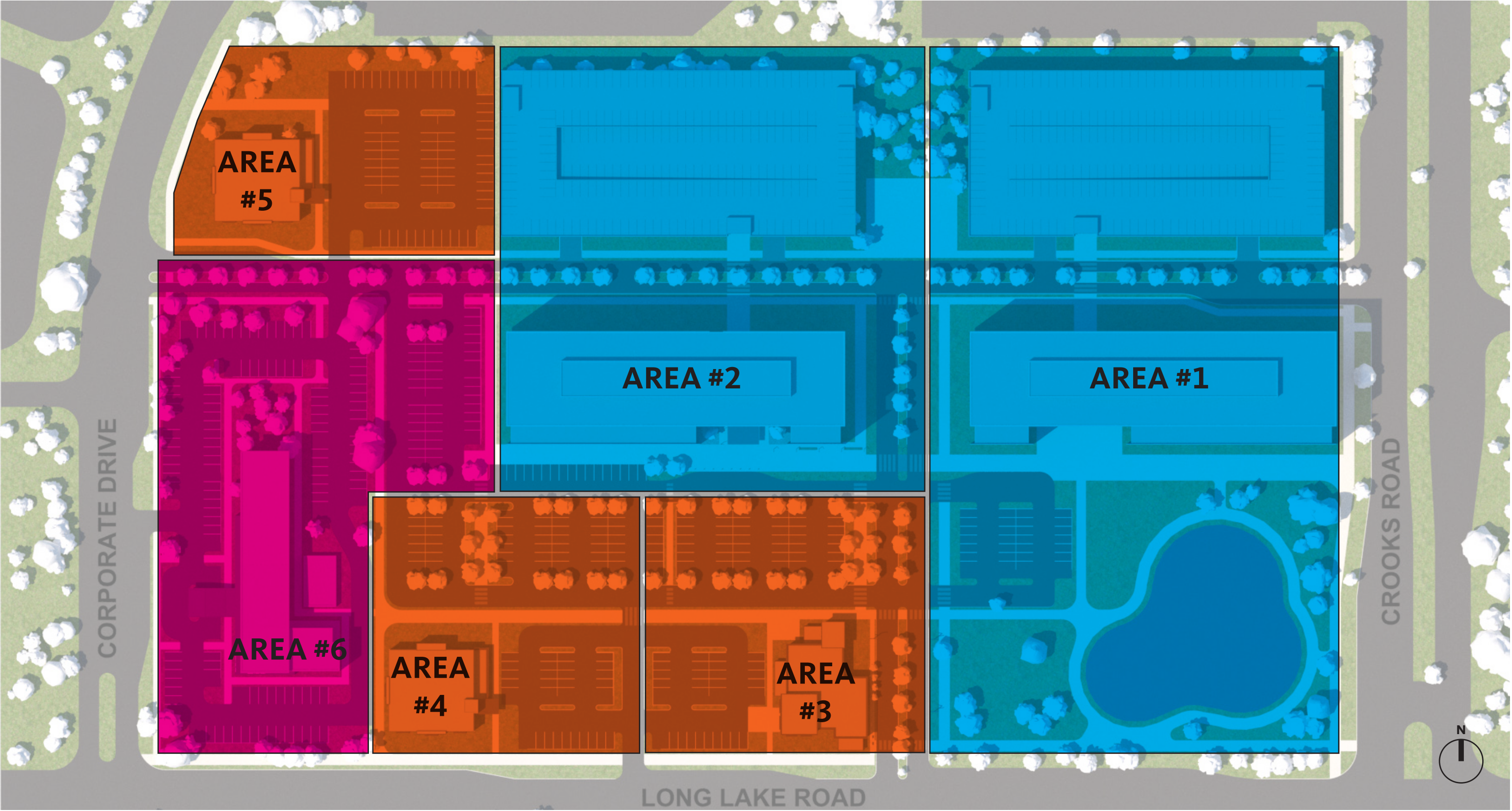


# MASTER PLAN



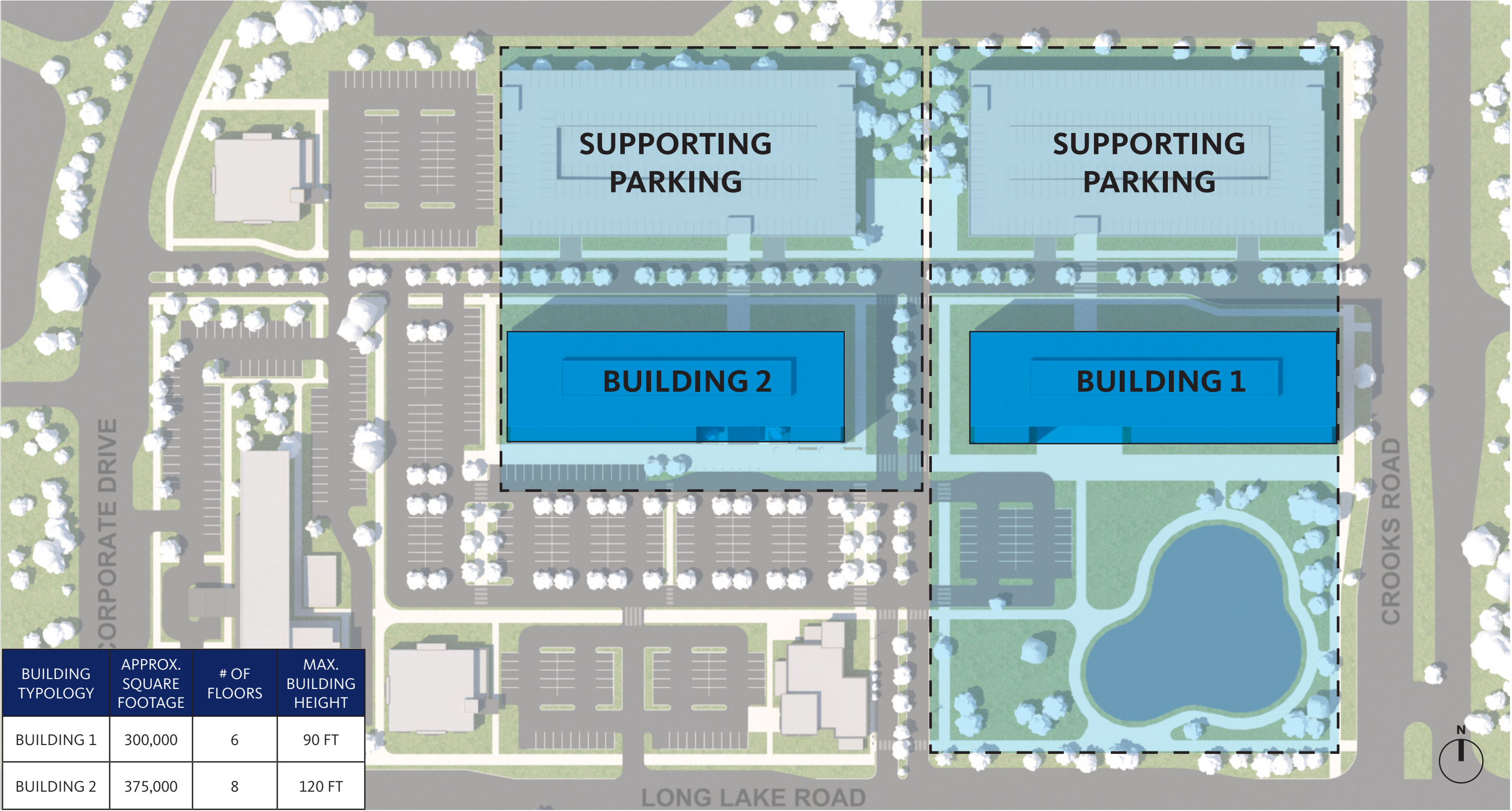


# MASTER PLAN - DEVELOPMENT AREAS



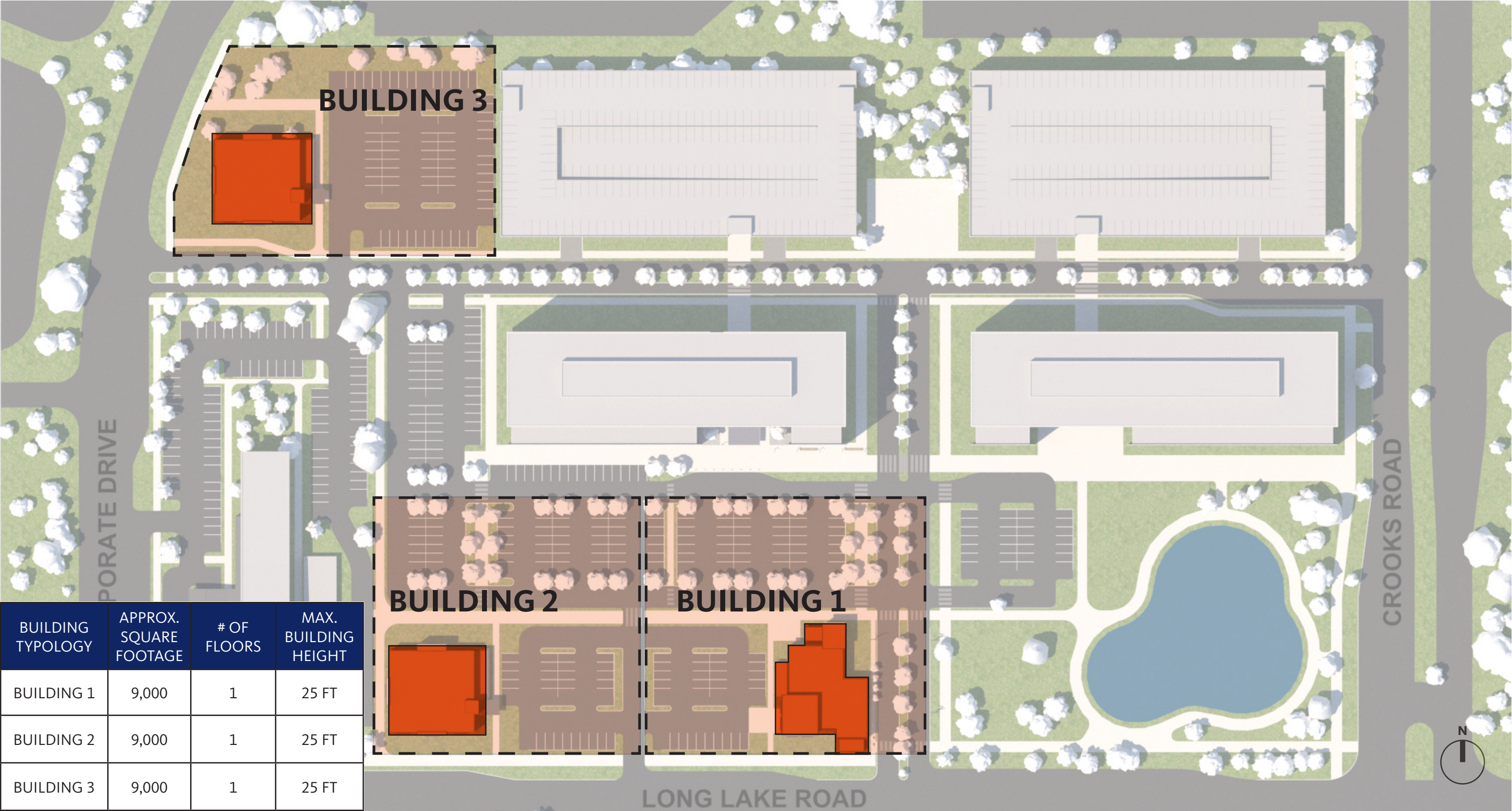


# MASTER PLAN - OFFICE/MEDICAL/RESIDENTIAL



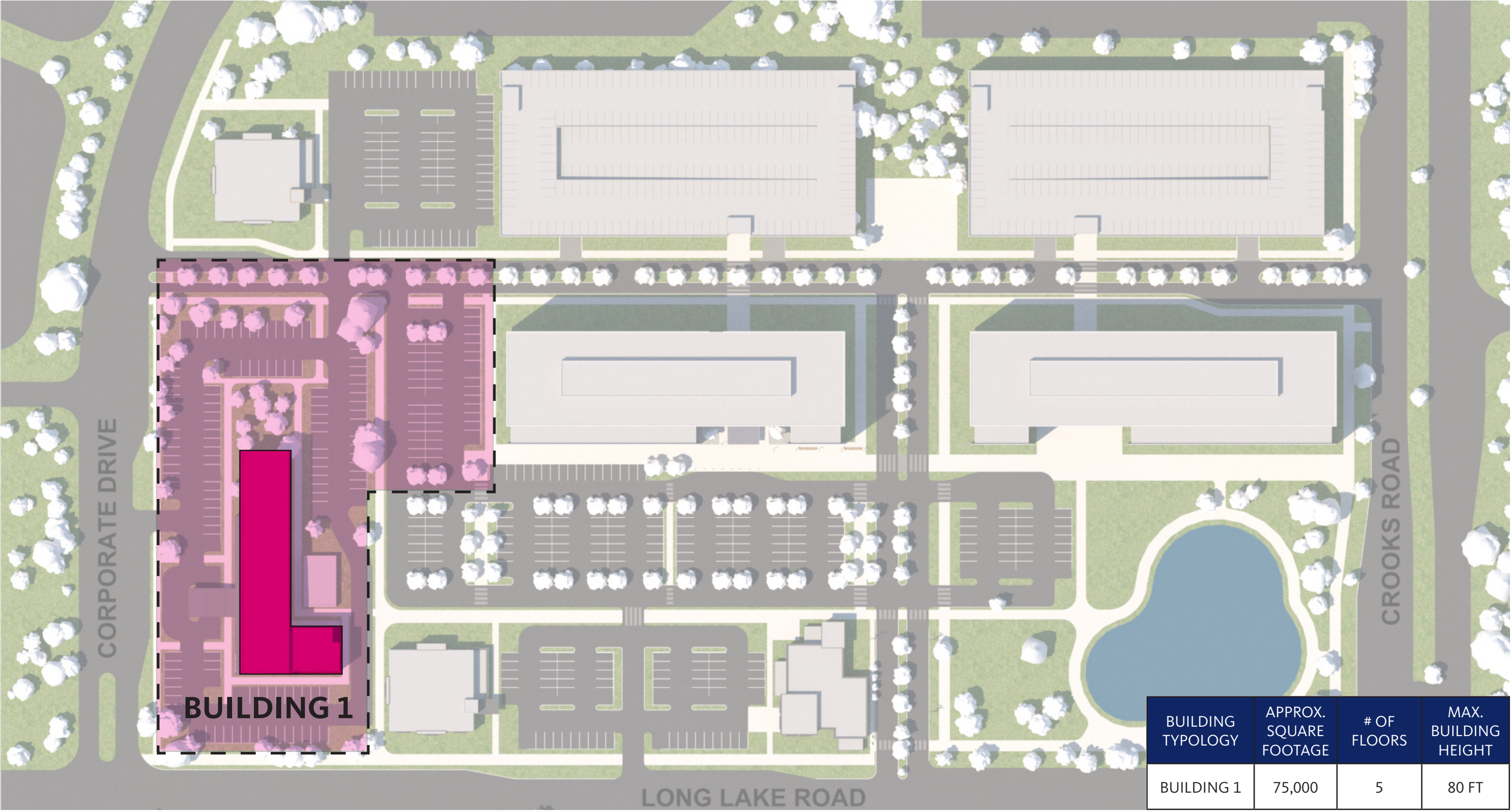


# MASTER PLAN - RETAIL/ENTERTAINMENT/MEDICAL/OFFICE



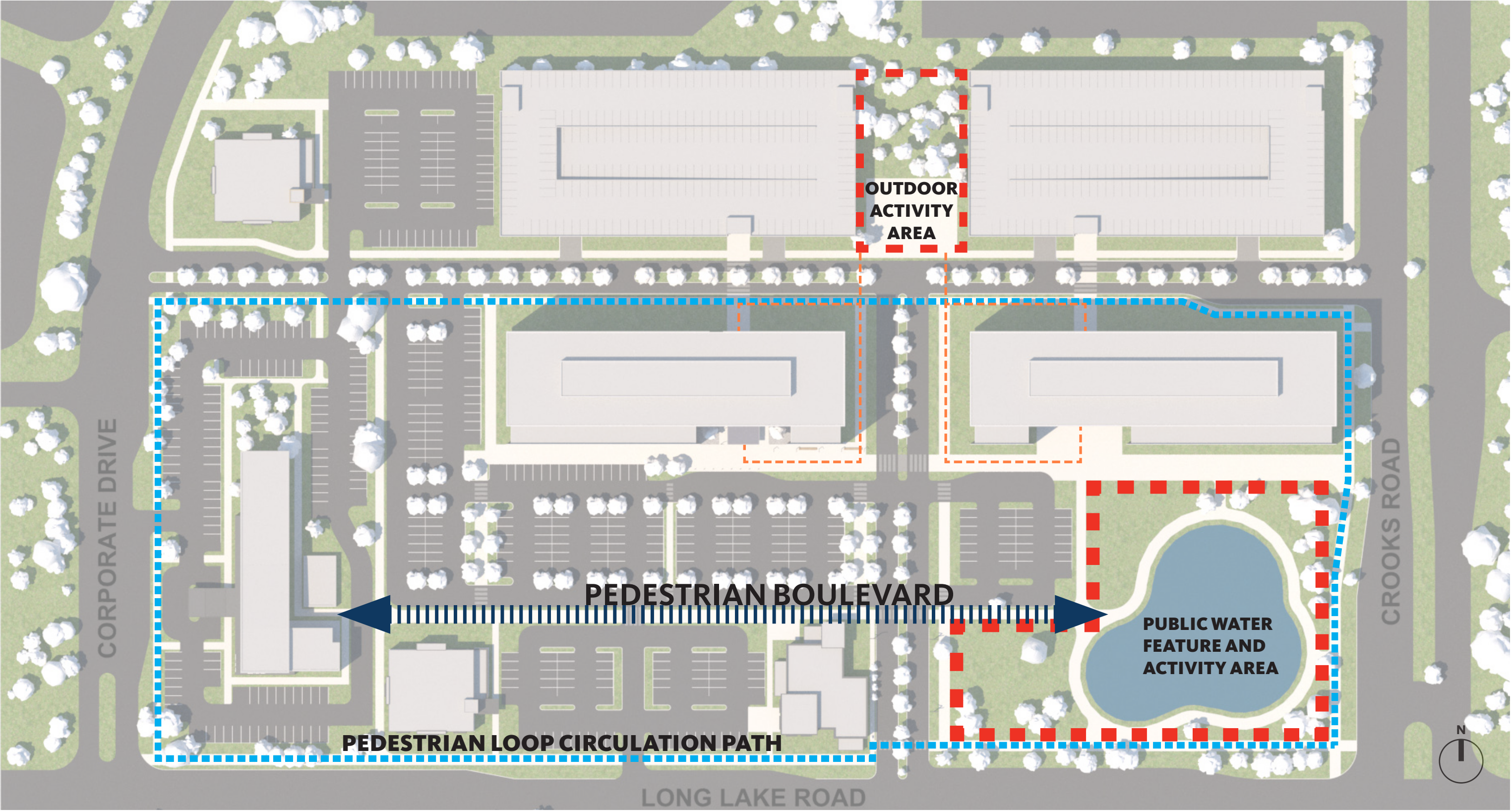


# MASTER PLAN - LODGING





# MASTER PLAN - SITE AMENITIES





# PUBLIC WATER FEATURE



IMAGERY REPRESENTS GENERAL SITE CHARACTERISTICS ONLY, NOT SPECIFIC ARCHITECTURAL SOLUTIONS



# MAIN ENTRY



IMAGERY REPRESENTS GENERAL SITE CHARACTERISTICS ONLY, NOT SPECIFIC ARCHITECTURAL SOLUTIONS



# THE BOULEVARD



IMAGERY REPRESENTS GENERAL SITE CHARACTERISTICS ONLY, NOT SPECIFIC ARCHITECTURAL SOLUTIONS



# **LONG LAKE & CROOKS MASTERPLAN DEVELOPMENT**

## **TRAFFIC IMPACT STUDY AND SHARED PARKING STUDY**

**TROY, MICHIGAN  
NOVEMBER 2, 2020**



**PREPARED BY:**



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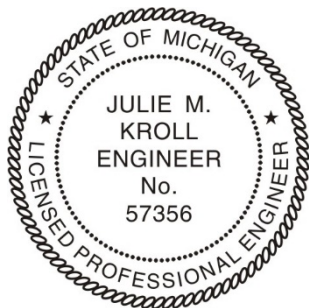
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I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Michigan.

Agency Review	Date	Comments

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## REFERENCES

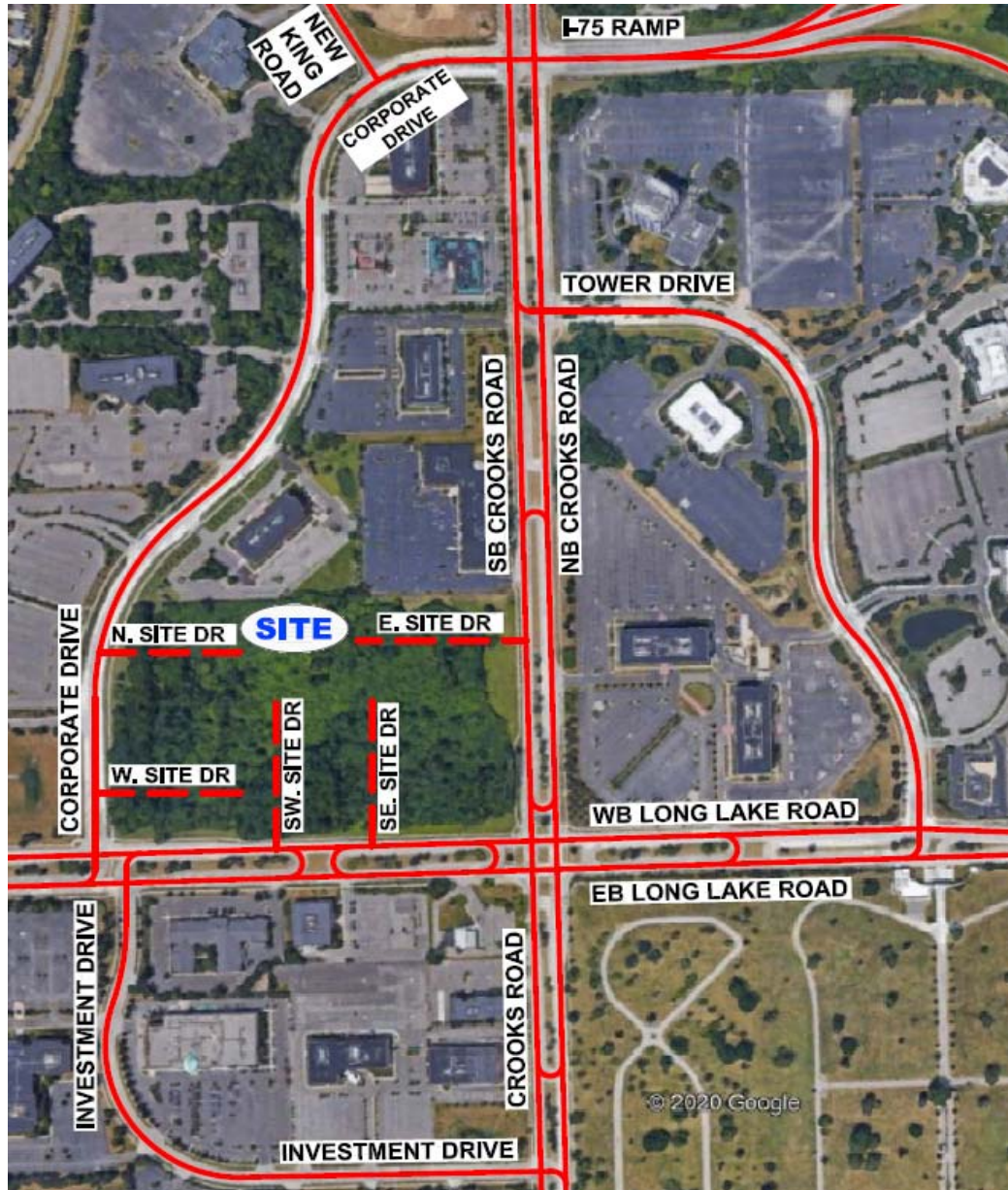
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## EXECUTIVE SUMMARY

This report presents the results of a Traffic Impact Study (TIS) for the proposed master plan development located generally in the northeast quadrant of the Long Lake Road and Corporate Drive intersection adjacent to the west side of Crooks Road in Troy, Michigan, as shown in **Figure E1**.

**FIGURE E1: SITE LOCATION**



This analysis is based on the conceptual development plan included with the application. This study includes an evaluation of the highest trip generation for the potential uses of the site, thereby providing a conservative analysis. The land uses included herein were assumed for analysis purposes and do not necessarily reflect the actual proposed land uses on this site.

The proposed conceptual plan evaluated in this study includes the development of the approximately 23-acre parcel with office, hotel, and retail/restaurant land uses. Parking for the site was assumed to be provided through a combination of parking structures and surface parking. The site access will be finalized at the site plan phase of the project, however for this analysis access was assumed via five (5) site driveways; one (1) on SB Crooks Road, two (2) on Long Lake Road, and two (2) on Corporate Drive. Long Lake Road and Crooks Road are

under the jurisdiction of the Road Commission of Oakland County (RCOC), whereas Corporate Drive is under the jurisdiction of the City of Troy.

The scope of this study was developed based on Fleis & VandenBrink's (F&V) knowledge of the study area, understanding of the development program, accepted traffic engineering practice and information published by the Institute of Transportation Engineers (ITE), and pursuant to the requirements of the City of Troy and the RCOC. Additionally, F&V solicited input regarding the scope of work from the City of Troy's engineering consultant (OHM Advisors).

## BACKGROUND DATA

Due to the impacts of COVID-19 and the subsequent closures of businesses and schools, current traffic volume data is not representative of "typical" operations. In addition, the on-going construction on I-75 has significant impacts on the traffic volumes throughout the study network. Therefore, the traffic volume data necessary for this study were obtained from multiple sources:

- SCATS volume data was obtained from RCOC at the signalized study intersections within the network for use in this study. The SCATS data utilized for this study was obtained for September 13, 2018, prior to COVID-19 and the I-75 construction impacts.
- F&V subconsultant Traffic Data Collection, Inc. (TDC) performed weekday AM (7:00 AM to 9:00 AM) and PM (4:00 PM to 6:00 PM) peak hour turning movement counts on Wednesday, October 6, 2020 at the unsignalized intersections.

A 0.5% annual background growth rate was applied to the 2018 signalized traffic volumes to calculate the baseline 'existing' 2020 traffic volumes. COVID-19 adjustment factors were applied at the unsignalized intersections to calculate the baseline 'existing' 2020 traffic volumes. The traffic volumes were then balanced upwards through the study network. 'Dummy nodes' were added at locations to account for sink and source volumes between intersections.

## TRIP GENERATION

The number of weekday peak hour (AM and PM) and daily vehicle trips that would be generated by the proposed development was forecast based on data published by ITE in the *Trip Generation Manual, 10<sup>th</sup> Edition*. The site trip generation forecast is summarized in **Table 1**. The proposed trip generation included in this analysis was reviewed with the City Traffic Consultant (OHM) prior to use in the study. *Note: Internal trip capture and pass-by trip reductions were not included in this study to provide a conservative analysis.*

**Table E1: Trip Generation Summary**

Land Use	ITE Code	Amount	Units	Average Daily Traffic (vpd)	AM Peak Hour (vph)			PM Peak Hour (vph)		
					In	Out	Total	In	Out	Total
Quality Restaurant	931	24,600	GFA SF	2,062	14	4	18	129	63	192
Hotel	310	220	Rooms	2,057	62	43	105	71	68	139
Medical-Dental Office Building	720	540,000	GFA SF	20,659	782	220	1,002	513	1,320	1,833
Total Trips				24,778	858	267	1,125	713	1,451	2,164

## SITE TRIP DISTRIBUTION

The site access for this analysis was assumed via five (5) driveways: two (2) on Corporate Drive, two (2) on Long Lake Road, and one (1) on SB Crooks Road. The vehicular trips that would be generated by the proposed development were assigned to the study roads based on the proposed site access plan, the existing peak hour traffic patterns on the adjacent roadway network, and the methodologies published by ITE. The adjacent street traffic volumes were used to develop the trip distribution. In order to determine the projected site traffic distribution, it was assumed that the existing adjacent street traffic volumes in the AM are home-to-work based trips, and in the PM are work-to-home based trips. Therefore, the trip distribution assumes trips are coming into the study network and entering the development for work in the AM peak hour, then leaving work and exiting the network towards home in the PM peak hour. The ITE trip distribution methodology assumes that new trips will return to their direction of origin. The site trip distribution used in the analysis is summarized in **Table E2**.



**Table E2: Site Trip Distribution**

From/To	Via	AM	PM
North	Crooks Road	28%	30%
South	Crooks Road	14%	19%
East	Long Lake Road	18%	17%
East	I-75 Ramp	28%	18%
West	Long Lake Road	12%	16%
<b>Total</b>		<b>100%</b>	<b>100%</b>

## CONCLUSIONS

*The conclusions of this TIS are as follows:*

### 1. Masterplan Development Assumptions

- This analysis is based on the conceptual development plan included with the application. This study includes an evaluation of the highest trip generation for the potential uses of the site, thereby providing a conservative analysis. The land uses included herein were assumed for analysis purposes and do not necessarily reflect the actual proposed land uses on this site.
  - The proposed conceptual plan evaluated in this study includes the development of the approximately 23-acre parcel with office, hotel, and retail/restaurant land uses.
  - Parking for the site was assumed to be provided through a combination of parking structures and surface parking.
  - The site access will be finalized at the site plan phase of the project, however for this analysis access was assumed via five (5) site driveways; one (1) on SB Crooks Road, two (2) on Long Lake Road, and two (2) on Corporate Drive.

### 2. Trip Generation Comparison:

- A trip generation comparison analysis was performed for the proposed development to demonstrate the possible impact from another potential development that is currently permitted under the existing Office (O) zoning. The results of the analysis indicate that the proposed development will generate significantly less trips throughout the day and during both peak hours, as compared to a potential development currently permitted by right under the existing zoning.

### 3. Existing Conditions:

- All approaches and movements at the study intersections currently operate acceptably, at LOS D or better during both peak periods, with the exception of the following:
  - The overall intersection of Crooks Road & Corporate Drive/I-75 Ramp is currently operating at LOS E during the AM peak period with multiple approaches and movements operating at LOS E and LOS F during both AM and PM peak periods.
  - The southbound left-turn movement at the intersection of Corporate Drive & New King Drive is currently operating at LOS E during the AM peak period.
  - The southbound approach at the intersection of EB Long Lake Road and Investment Drive is currently operating at LOS E during the AM peak hour and LOS F during the PM peak hour.
  - The westbound right turn movement at the intersection of WB Long Lake Road & Corporate Drive is currently operating at LOS E during the AM peak hour.
- Review of SimTraffic network simulations indicates long vehicles queues at the signalized intersection of Crooks Road & Corporate Drive/I-75 Ramp during both peak periods. Microsimulations indicate acceptable operations at all other study intersections.

### 4. Background Conditions (*without the proposed development*):

- A conservative annual growth rate of 0.5% per year was applied to the 2020 traffic volumes in order to determine the background 2025 traffic volumes.

- The results of the background conditions analysis show that the study intersections will continue to operate in a similar manner to existing conditions, with some increases in the delay.

#### **5. Future Conditions (*with the proposed development*):**

- The results of the future conditions analysis show that, with the addition of the site-generated traffic, all study intersection approaches and movements will operate in a manner similar to existing and background conditions, with the exception of the following:
  - The intersection of Crooks Road & Corporate Drive/I-75 Ramp is expected to operate at LOS F during both AM and PM peak periods with significant increases in delay for the eastbound approach during the PM peak hour and the westbound approach during the AM peak hour.
  - The southbound left-turn traffic at the SB Crooks Road crossover to the intersection of NB Crooks Road & Tower Drive exceeds the available storage length on SB Crooks Road and impacts the upstream operation at the intersection of Crooks Road & Corporate Drive/I-75 Ramp, as well as creating potential safety concerns for through traffic along SB Crooks Road.
  - The eastbound left turn movement at the SB-to-NB Crooks Road Crossover (N. of Long Lake Road) is expected to operate at LOS F during PM peak hour.
  - The westbound right turn movement at the WB Long Lake Road & Corporate Drive intersection is expected to operate at LOS F during the AM peak hour.
  - The eastbound right turn movement at the SB Crooks Road & E. Site Drive intersection is expected to operate at LOS F during the PM peak hour.
  - The westbound left turn movement at the Corporate Drive & N. Site Drive intersection is expected to operate at LOS F during the PM peak hour.
- Review of SimTraffic network simulations indicates long vehicles queues at the signalized intersection of Crooks Road & Corporate Drive/I-75 Ramp during both peak periods. Additionally, long vehicle queues exceeding the available storage length were observed at the Tower Drive Crossover and the SB-to-NB Crossover located north of Long Lake Road. Microsimulations indicate acceptable operations at all other study intersections.

#### **6. Access Management**

- The results of the analysis indicate that right-turn deceleration tapers are warranted at the proposed site driveways located on Corporate Drive and full-width right-turn deceleration lanes are warranted at the proposed site driveways located on Crooks Road and Long Lake Road.
- There are no site access driveways proposed at this time with this PUD. Therefore, the site access driveways will be further reviewed for access management and auxiliary lanes during the development of site plan(s) for this PUD.

#### **7. Parking Study**

- A minimum of 3,192 parking spaces is recommended for this site.
- The proposed PUD includes the addition both surface parking spaces and one or more parking structures.

#### **8. Project Phasing**

- There is no identifiable phasing plan at this juncture of the proposed development. The overall development is assumed to be phased over time, based on tenant opportunities and economic viability. As various areas are developed, a phasing plan will be formulated in a manner where all parking and building requirements are met throughout each phase.



## RECOMMENDATIONS

The recommendations of this TIS are as follows:

Recommended Intersection Improvement		Existing (2020)	Background (2025)	Future (2025)
<b># 10</b>	<b>Crooks Road &amp; Corporate Drive / I-75 Ramp</b>			
Eliminate the EB left-turn movement and the split phasing. <ul style="list-style-type: none"> <li>EB left-turns will be re-routed as EB right-turns and will utilize the SB-to-NB X/O at Tower Drive to continue NB on Crooks.</li> </ul>		X		
Construct an additional westbound left-turn lane. <ul style="list-style-type: none"> <li>Reconfigure WB approach to provide dual (2) LT lanes, one (1) through lane, one (1) shared through/right lane, and one (1) RT lane.</li> </ul>		X		
Construct an additional eastbound right-turn lane. <ul style="list-style-type: none"> <li>Reconfigure EB approach to provide two (2) through lanes and dual (2) right-turn lanes.</li> </ul>				X
Construct an additional northbound right-turn lane. <ul style="list-style-type: none"> <li>Reconfigure NB approach to provide three (4) through lanes and dual (2) right-turn lanes.</li> </ul>				X
Extend the southbound left-turn storage length (~200 feet).				X
<b># 30</b>	<b>NB Crooks Road &amp; Tower Drive</b>			
Construct an additional southbound left-turn lane.				X
<b># 50</b>	<b>SB-to-NB Crooks Road X/O N. of Long Lake Road</b>			
Construct an additional southbound left-turn lane.				X
<b># 120</b>	<b>WB Long Lake Road &amp; Corporate Drive</b>			
Construct an additional eastbound left-turn lane.				X
<b># 160</b>	<b>SB Crooks Road &amp; E. Site Drive</b>			
Construct dual (2) eastbound right-turn egress lanes.				X
Construct a southbound right-turn deceleration lane on Crooks Road.				X
<b># 170</b>	<b>Corporate Drive &amp; N. Site Drive</b>			
Construct exclusive westbound left- and right-turn egress lanes.				X
<b># 180</b>	<b>Corporate Drive &amp; W. Site Drive</b>			
Construct a northbound right-turn deceleration lane on Corporate Drive.				X
<b># 190</b>	<b>WB Long Lake Road &amp; SW. Site Drive</b>			
Construct a westbound right-turn deceleration lane on Long Lake Road.				X
<b># 200</b>	<b>WB Long Lake Road &amp; SE. Site Drive</b>			
Construct dual (2) southbound right-turn egress lanes.				X
Construct a westbound right-turn deceleration lane on Long Lake Road.				X

## 1 INTRODUCTION

This report presents the results of a Traffic Impact Study (TIS) for the proposed development located generally in the northeast quadrant of the Long Lake Road and Corporate Drive intersection adjacent to the west side of Crooks Road in Troy, Michigan, as shown in **Figure 1**. The proposed project includes the development of an approximately 23-acre parcel with office, hotel, and retail/restaurant land uses. The site access will be finalized at the site plan phase of the project, however for this analysis access was assumed via five (5) site driveways; one (1) on SB Crooks Road, two (2) on Long Lake Road, and two (2) on Corporate Drive.. Long Lake Road and Crooks Road are under the jurisdiction of the Road Commission of Oakland County (RCOC), whereas Corporate Drive is under the jurisdiction of the City of Troy.

F&V proposes to complete a Traffic Impact Study (TIS) for this project consistent with accepted traffic engineering practice and pursuant to the City of Troy and RCOC requirements. Specific tasks undertaken for this study include the following:

### 1. Study Area

- a. Provide a description of the study area including: surrounding land uses, intersection and roadway geometries, speed limits, functional classifications, and traffic volume data (where available). In addition, a study area site map showing the site location and the study intersections will also be provided.

### 2. Proposed Land Use

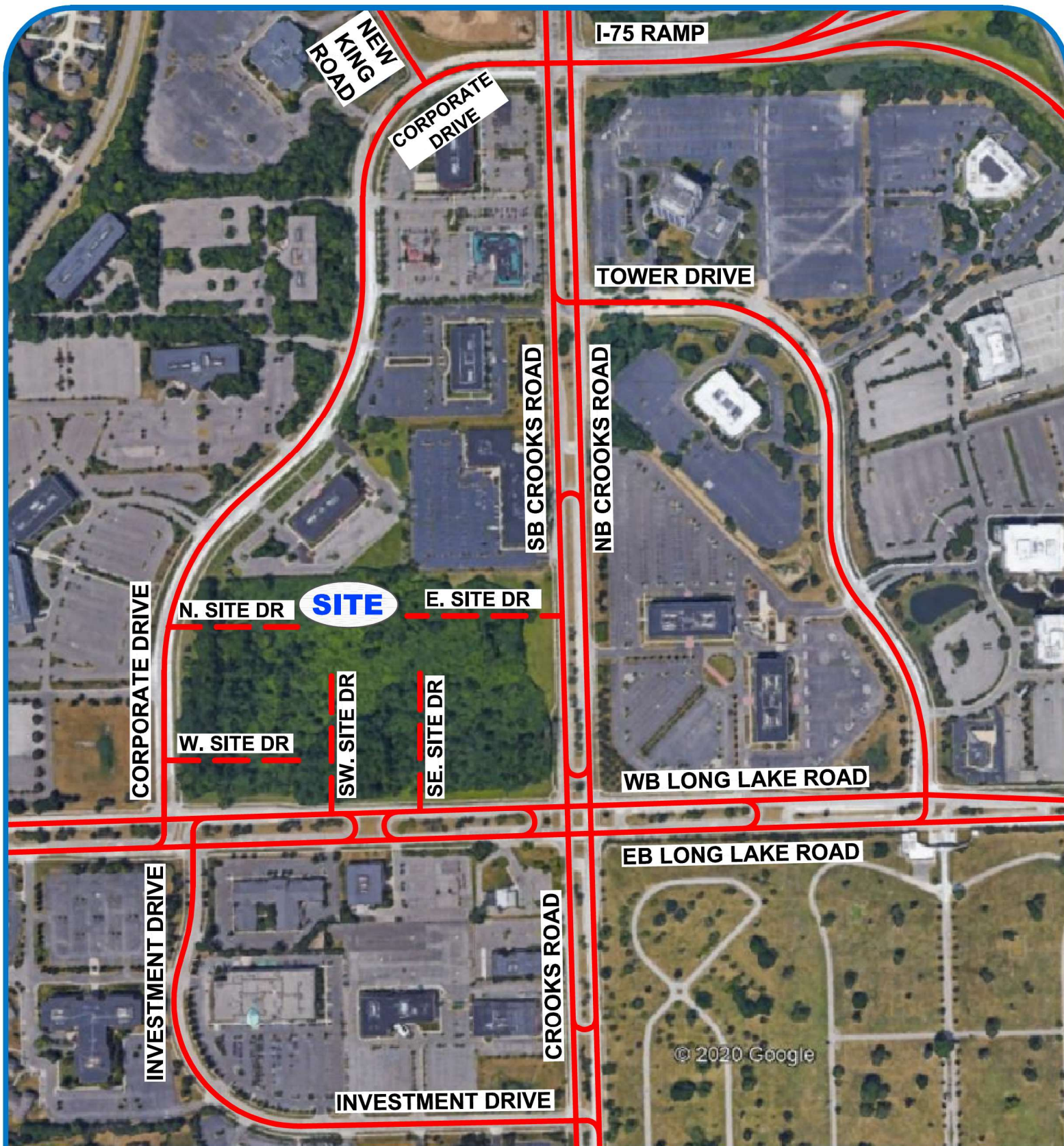
- a. Obtain and review the proposed site plan which includes the proposed land uses, densities, and desired site access locations. A description of the current and proposed land use, including the number and type of dwelling units, will be accompanied with a complete project site plan.

### 3. Existing Conditions

- a. Provide an analysis of the traffic-related impacts of the proposed development at the following study intersections:

Signalized Intersections	Unsignalized Intersections
1. Crooks Road & Corporate Drive / I-75 Ramp	8. Corporate Drive & New King Drive
2. Crooks Road & Tower Drive	9. SB Crooks & NB-to-SB X/O N. of Long Lake
3. WB Long Lake & EB-to-WB X/O E. of Crooks	10. NB Crooks & SB-to-NB X/O N. of Long Lake
4. Crooks Road & Long Lake Road	11. WB Long Lake & EB-to-WB X/O W. of Crooks
5. EB Long Lake & WB-to-EB X/O W. of Crooks	12. WB Long Lake & EB-to-WB X/O E. of Corporate Dr
6. Long Lake Road & Investment Drive	13. EB Long Lake & WB-to-EB X/O W. of Investment
7. Long Lake Road & Corporate Drive	14. NB Crooks & SB-to-NB X/O S. of Long Lake
	15. SB Crooks Road & Investment Drive
	16. SB Crooks Road & E. Site Drive (proposed)
	17. Corporate Drive & N. Site Drive (proposed)
	18. Corporate Drive & W. Site Drive (proposed)
	19. Long Lake Road & SE. Site Drive (proposed)
	20. Long Lake Road & SW. Site Drive (proposed)





**FIGURE 1**

## **SITE LOCATION MAP**

**LONG LAKE & CROOKS MASTERPLAN DEVELOPMENT  
- TROY, MI**

### LEGEND



SITE LOCATION



NORTH  
SCALE: NOT TO SCALE



- b. Due to the impact of COVID-19 and the subsequent closures of businesses and schools, current traffic volume data is not representative of “typical” operations. Therefore, the data collection necessary for this study is proposed as follows:
  - i. Obtain existing SCATS count data from RCOC at the signalized study intersections for use in this study. The SCATS data will be requested for a Tuesday, Wednesday, and Thursday (typical weekdays) in 2018 (prior to the commencement of I-75 construction) to obtain an average weekday. A typical weekday will include fair weather conditions when school is in session and typical traffic operations (no crash impacts or construction).
  - ii. Apply a growth factor (if necessary) to the historical 24-hour traffic volumes to determine the baseline 2020 turning movement counts at the study intersection.
  - iii. Collect existing 4-hour (i.e. peak-hour) traffic volumes on unsignalized study intersections, crossovers, and driveways.
  - iv. Obtain existing SCATS count data at the signalized study intersections on the day that the data collection was performed at the unsignalized intersections.
  - v. Compare the existing traffic volumes collected with the historical traffic volumes at the study intersections to determine a COVID adjustment factor for the existing traffic volume data.
  - vi. Apply the adjustment factor to the existing traffic volume data collected and balance the traffic volumes along the study network to determine the baseline existing 2020 traffic volumes for use in the study.
  - vii. Provide the baseline “existing 2020” traffic volume to the City of Troy and RCOC for review and approval for use in the analysis.
- c. Obtain signal timing permits at the signalized study intersections from RCOC for use in the study.
- d. Calculate the Existing vehicle delays, LOS, and vehicle queues at the existing study intersection during the weekday AM and PM peak hours. Intersection analysis shall include LOS determination for all approaches and movements. The LOS will be based on the procedures outlined in the HCM 6th Edition, the latest edition of Transportation Research Board’s Highway Capacity Manual.

#### 4. Future Background Growth

- a. Calculate the future background traffic volumes based on an appropriate traffic growth determined from local or statewide traffic volume data, or from the Southeast Michigan Council of Governments (SEMCOG). In addition, any applicable background developments in the vicinity of this project as identified by RCOC and/or the City of Troy.
- b. Provide the proposed growth rate to RCOC and the City of Troy for review and approval prior to use in the analysis.

#### 5. Background Conditions (No Build)

- a. Calculate the **Background (without the proposed development)** vehicle delays, LOS, and vehicle queues at the study intersections during the AM and PM peak periods. Intersection analysis shall include LOS determination for all approaches and movements. The LOS will be based on the procedures outlined in the HCM 6<sup>th</sup> Edition, the latest edition of Transportation Research Board’s Highway Capacity Manual.
- b. Any state, local, or private transportation improvement projects in the project study area that will be underway in the build-out year and traffic that is generated by other proposed developments in the study area will be included as background conditions.

#### 6. Trip Generation

- a. Forecast the number of AM and PM peak hour trips that would be generated by the proposed development based on data published by the Institute of Transportation Engineers (ITE) in *Trip Generation, 10<sup>th</sup> Edition* and/or local development data as approved for use in the study by the City of Troy and RCOC.
- b. Forecast and compare the number of Weekday AM and PM peak hour trips that would be generated by the potential land uses and densities permitted under existing and proposed zoning. The forecasts shall be based on the data and procedures outlined in the most recent edition of Trip Generation



published by the Institute of Transportation Engineering (ITE) *Trip Generation, 10<sup>th</sup> Edition*. The data will be summarized in a table that shows the use, ITE code number, trip rate, and trips in and out.

- c. A table will be provided in the report outlining the categories and quantities of land uses, with the corresponding trip generation rates or equations, and the resulting number of trips.
- d. Provide the proposed generation to RCOC and the City of Troy for review and approval prior to use in the analysis.

## 7. Trip Distribution and Traffic Assignment

- a. Assign the trips that would be generated by the proposed development to the adjacent road network based on existing traffic patterns. The distribution of the estimated trip generation to the adjacent street network and nearby intersections shall be included in the report and the basis will be explained. The distribution percentages with the corresponding volumes will be provided in a graphical format.
- b. Combine the site-generated traffic assignments with the background traffic forecasts to establish the Future AM and PM peak hour traffic volumes.
- c. Provide the proposed distribution assumptions to RCOC and the City of Troy for review and approval prior to use in the analysis.

## 8. Future Conditions (Buildout):

- a. Calculate the **Future (with the proposed development)** vehicle delays, LOS, and vehicle queues at the study intersections. Intersection analysis shall include LOS determination for all approaches and movements. The LOS will be based on the procedures outlined in the HCM 6<sup>th</sup> Edition, the latest edition of Transportation Research Board's Highway Capacity Manual.
- b. Identify improvements (if any) for the study road network that would be required to accommodate the site-generated traffic volumes.

## 9. Access Management

- a. Evaluate the City of Troy and RCOC auxiliary lane standards for the determination of need for right-turn lanes at the proposed site driveways.
- b. Evaluate the driveway spacing criteria at the proposed site driveway locations on Corporate Drive and Long Lake Road.

## 10. Parking Study

In accordance with City Zoning Ordinance for PUD developments parking shall be provided in order to properly serve the total range of uses within the PUD. Shared parking in the PUD may be permitted, provided justification to the satisfaction of the City that the shared parking proposed is sufficient for the development and will not impair the functioning of the development, and will not have a negative effect on traffic flow within the development and/or on properties adjacent to the development. Therefore, F&V proposes the following scope of work for the shared parking for this site.

- a. Calculate the parking requirements for the proposed PUD based on the City of Troy zoning ordinance for each land use.
- b. Apply the seasonal, daily, and hourly parking demand variations for each land based on data published in the Urban Land Institute (ULI) in Shared Parking, 3rd Edition to determine the reduction in overall site parking demand that would be attributed to the synergy of the land uses.
- c. Evaluate the adequacy of overall site parking based on the proposed number of on-site parking spaces and the projected shared parking demand. Designated, reserved or by permit parking spaces will not be considered available for shared parking.
- d. Provide interim parking calculations for each project phases to evaluate the adequacy of the parking supply for each project phase.

The scope of this study was developed based on Fleis & VandenBrink's (F&V) knowledge of the study area, understanding of the development program, accepted traffic engineering practice, and information published by the Institute of Transportation Engineers (ITE). The study analyses were completed using Synchro/SimTraffic (Version 10). Sources of data for this study include F&V subconsultant Traffic Data Collection, Inc. (TDC), information provided by the City of Troy, RCOC, ITE, and the Southeast Michigan Council of Governments (SEMCOG). All background information is provided in **Appendix A**.

## 2 BACKGROUND DATA

### 2.1 EXISTING ROAD NETWORK

Vehicle transportation for the project site is proposed via access on Corporate Drive, Long Lake Road, and Crooks Road. The lane use and traffic control at the study intersections are shown on **Figure 2** and the study roadways are further described below. For the purposes of this study, all minor streets and driveways are assumed to have an operating speed of 25 miles per hour (mph), unless otherwise noted.

**Long Lake Road** runs in the east and west directions with a posted speed limit of 45 mph. Long Lake Road is under the jurisdiction of RCOC and the study section of the road is classified as *Principal Arterial* with an Average Annual Daily Traffic (AADT) volume of approximately 17,250 vehicles per day (RCOC 2018) in the vicinity of the project area. The roadway, in the vicinity of the development, has a six-lane, median divided, cross-section, with three lanes of travel in each direction. Long Lake Road widens at signalized intersections and crossover locations to provide exclusive right- and left-turn lanes.

**Corporate Drive** provides access to/from I-75 via Long Lake Road, with a posted speed limit of 35 mph. Corporate Drive is under the jurisdiction of the City of Troy and the study section is classified as a *Major Collector*, with an AADT volume of approximately 8,100 vehicles per day (MDOT 2019). Corporate Drive has a typical five-lane cross-section, with two lanes in each direction and a center two-way left-turn lane.

**Crooks Road** The study section of Crooks Road has a six-lane, median divided cross-section, with three lanes in each direction. Crooks Road generally runs in the north and south directions with a posted speed limit of 45 mph. Crooks Road is under the jurisdiction of RCOC and the study section is classified as *Principal Arterial*, with an AADT volume of approximately 22,600 vehicles per day (RCOC 2018). Crooks Road widens at signalized intersections and crossover locations to provide exclusive right- and left-turn lanes.

### 2.2 EXISTING TRAFFIC VOLUMES

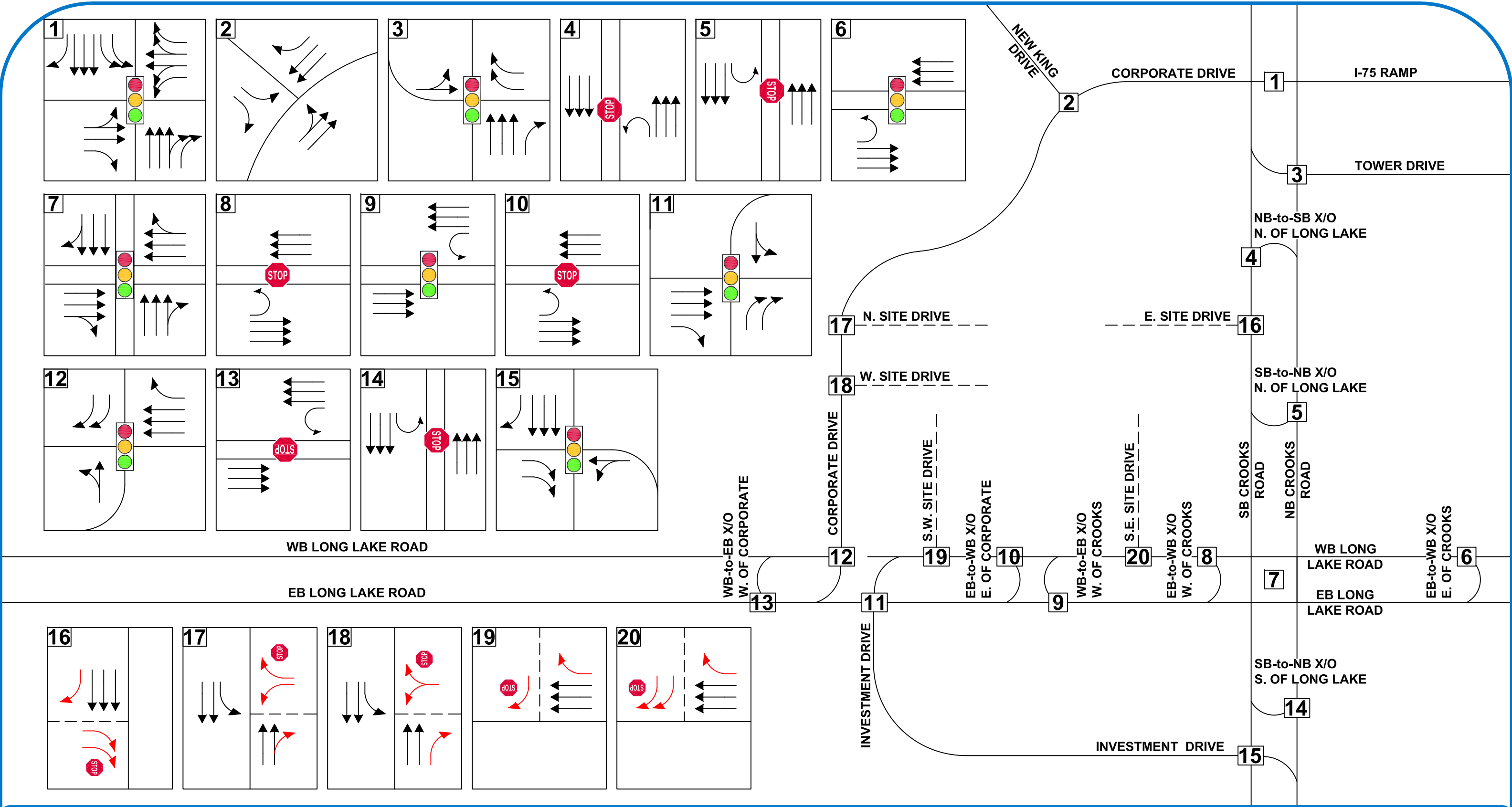
Due to the impacts of COVID-19 and the subsequent closures of businesses and schools, current traffic volume data is not representative of “typical” operations. In addition, the on-going construction on I-75 has significant impacts on the traffic volumes throughout the study network. Therefore, the traffic volume data necessary for this study were obtained from multiple sources:

- SCATS volume data was obtained from RCOC at the signalized study intersections within the network for use in this study. The SCATS data utilized for this study was obtained for September 13, 2018, prior to COVID-19 and the I-75 construction impacts.
- F&V subconsultant Traffic Data Collection, Inc. (TDC) performed weekday AM (7:00 AM to 9:00 AM) and PM (4:00 PM to 6:00 PM) peak hour turning movement counts on Wednesday, October 6, 2020 at the unsignalized intersections.

A **0.5%** annual background growth rate was applied to the 2018 signalized traffic volumes to calculate the baseline ‘existing’ 2020 traffic volumes. COVID-19 adjustment factors were applied at the unsignalized intersections to calculate the baseline ‘existing’ 2020 traffic volumes, as shown in **Figure 3**. The traffic volumes were then balanced upwards through the network. ‘Dummy nodes’ were added at locations to account for sink and source volumes between intersections. The AM and PM peak hours of existing network traffic were identified to generally occur between 8:00 AM to 9:00 AM and 5:00 PM to 6:00 PM, respectively, for a typical weekday. The traffic volume data are included in **Appendix A**.

Existing weekday turning movement traffic volume data at the signalized study intersections were obtained from the RCOC SCATS database for Thursday, September 13, 2018. Additionally, F&V subconsultant Traffic Data Collection, Inc. (TDC) performed AM (7:00 AM to 9:00 AM) and PM (4:00 PM to 6:00 PM) peak hour turning movement counts on Wednesday, October 6, 2020 at the unsignalized study intersection. The mainline traffic volumes at the unsignalized crossover intersections were compared with the SCATS mainline volumes at the signalized intersections; then a COVID-19 adjustment factor was determined for each unsignalized intersection based on the percent increase in traffic for the unsignalized mainline volumes to match the signalized mainline volumes. After applying the 0.5% annual growth rate to the 2018 signalized volumes and the COVID-19 adjustment factors to each of the unsignalized study intersection, the through movements were then balanced upward throughout the study network.



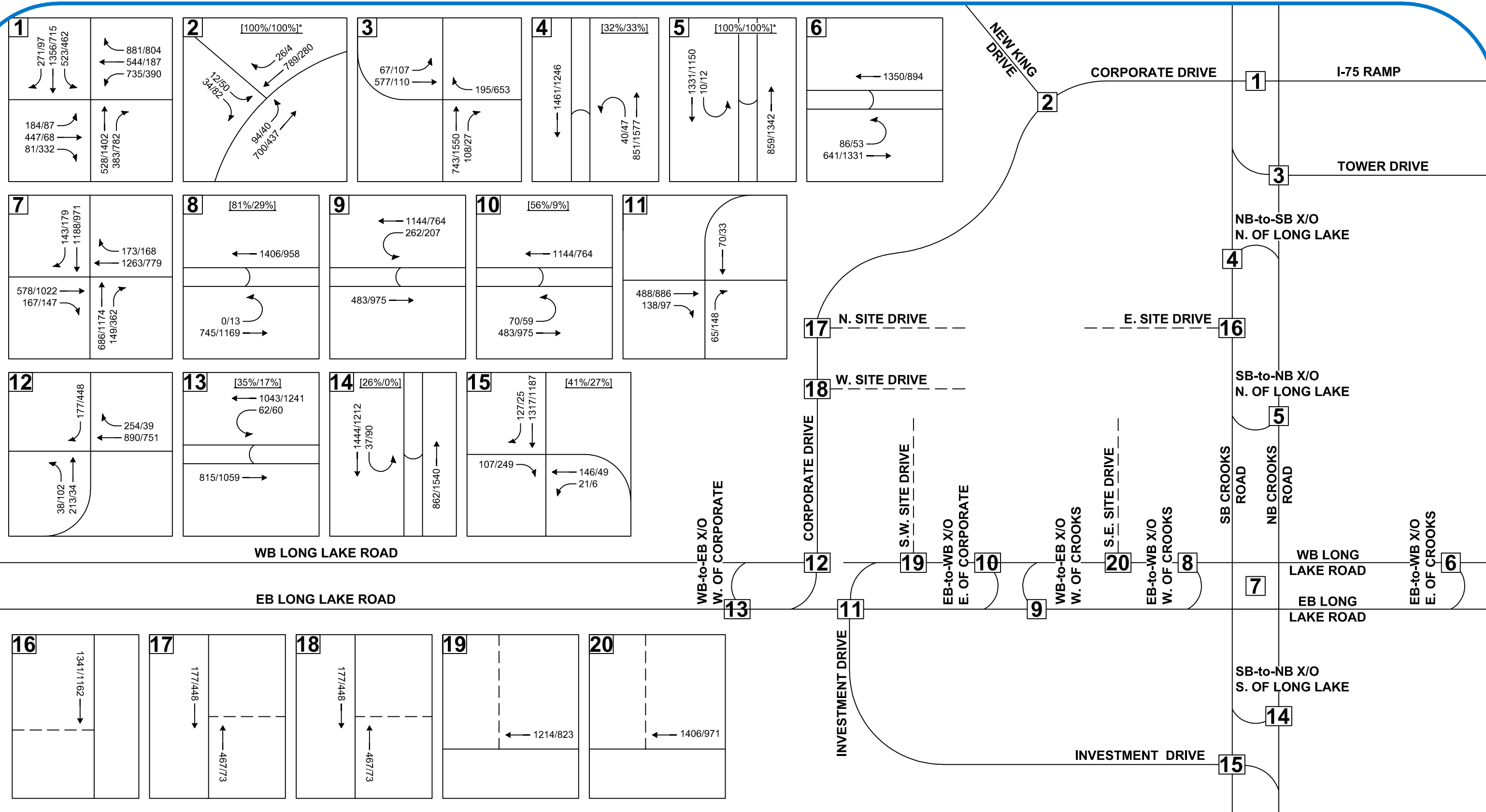


**FIGURE 2**  
**LANE USE AND TRAFFIC CONTROL**  
 LONG LAKE & CROOKS MASTERPLAN DEVELOPMENT  
 - TROY, MI

LEGEND			
	ROADS		PROPOSED ROADS
	LANE USE		PROPOSED LANE USE
	SIGNALIZED INTERSECTION		
	UNSIGNALIZED INTERSECTION		
	ROUNDBOUT INTERSECTION		

NORTH  
 SCALE: NOT TO SCALE








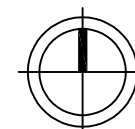


### FIGURE 3 EXISTING TRAFFIC VOLUMES

**LONG LAKE & CROOKS MASTERPLAN DEVELOPMENT  
- TROY, MI**

### LEGEND

- |   |   |
|---|---|
|  | ROADS   |
|  | PROPOSED ROADS  |
|  | TRAFFIC VOLUMES (AM/PM)                                     |
|  | UN-SIGNALIZED CROSSOVERS COVID-19 ADJUSTMENT FACTOR (AM/PM) |
|  | MAXIMUM COVID-19 ADJUSTMENT FACTOR [100%/100%]              |



NORTH  
SCALE: NOT TO SCALE





At the unsignalized intersection of Corporate Drive & New King Drive, it was assumed that construction on I-75 significantly impacted the volume of traffic; therefore, a maximum COVID-19 adjustment factor of 100% (double) was applied to the turning movements to provide a conservative approach. The through volumes at Corporate Drive & New King Drive were balanced upwards from the signalized intersection of Crooks Road & Corporate Drive/I-75 Ramps. Additionally, at the unsignalized intersection of NB Crooks Road & SB-to-NB Crossover N. of Long Lake Road, the crossover movement volumes were determined through review of the data collection videos at an adjacent intersection; therefore, the through volumes were unknown for comparison and the maximum 100% COVID-19 adjustment factor was applied to provide a conservative approach. The COVID-19 adjustment factors are shown in **Figure 3** and were applied to the current 2020 traffic volumes at each unsignalized crossover within the study network to establish the baseline traffic volumes, as show in **Figure 3**.

### 3 TRIP GENERATION COMPARISON

A trip generation comparison was completed for the proposed development, in an effort to demonstrate the possible impact from another potential development that is currently permitted under existing zoning at the proposed site. The number of peak hour (AM and PM) and weekday vehicle trips were calculated based on the rates and equations published by ITE in *Trip Generation, 10<sup>th</sup> Edition*. The proposed site location is currently zoned Office (O) and the proposed development is a Planned Unit Development (PUD). An analysis was performed in order to determine the maximum site trip generation potential under the existing Office zoning. Review of the ITE land use descriptions indicates that the Medical-Dental Office Building (720) and General Office Building (710) represent the highest trip generation for this site that is currently permitted under the existing zoning. The trip generation potential for this site was compared to the projected trips generated by the proposed development. The results of the trip generation analysis comparison are summarized in **Table 1**.

**Table 1: Trip Generation Comparison**

Zoning	Land Use	ITE Code	Size	Unit	Average Daily Traffic (vpd)	AM Peak Hour (vph)			PM Peak Hour (vph)		
						In	Out	Total	In	Out	Total
Existing Zoning (O)	Medical- Dental Office Building	720	947,007	SF	36,296	1,289	363	1,652	899	2,313	3,212
	General Office Building	710	947,007	SF	9,393	789	128	917	154	810	964
<i>Max Trips for Existing Zoning</i>					<i>36,296</i>	<i>1,289</i>	<i>363</i>	<i>1,652</i>	<i>899</i>	<i>2,313</i>	<i>3,212</i>
Proposed PUD	Quality Restaurant	931	24,600	GFA SF	2,062	14	4	18	129	63	192
	Hotel	310	220	Rooms	2,057	62	43	105	71	68	139
	Medical-Dental Office Building	720	540,000	GFA SF	20,659	782	220	1,002	513	1,320	1,833
<i>Total Trips (Proposed PUD)</i>					<i>24,778</i>	<i>858</i>	<i>267</i>	<i>1,125</i>	<i>713</i>	<i>1,451</i>	<i>2,164</i>
Difference					-11,518	-431	-96	-527	-186	-862	-1,048

The results of the analysis show that the proposed PUD will generate significantly less trips throughout the day and during both the peak hours. Therefore, the proposed development will have less of an impact to the existing road network than another potential development that is currently permitted by right.

## 4 EXISTING CONDITIONS

### 4.1 EXISTING OPERATIONS

The existing AM and PM peak hour vehicle delays and Levels of Service (LOS) were calculated at the study intersection using Synchro traffic analysis software. The results of the analysis of existing conditions were based on the existing lane use and traffic control shown on **Figure 2**, the existing traffic volumes shown on **Figure 4**, and the methodologies presented in the Highway Capacity Manual 6<sup>th</sup> Edition (HCM6).

The lane use and traffic control used at several of the study intersections includes non-NEMA phasing and clustered intersections, which are not supported by the HCM 6<sup>th</sup> Edition (HCM6) analysis methodology; therefore, HCM 2000 was determined to be more appropriate for use at these intersections. Additionally, the intersections of SB Crooks Road with Investment Drive & with the proposed E. Site Drive have two (2) exclusive right-turn lanes, which is not supported by either HCM analyses; therefore, SimTraffic delays were determined to be most appropriate for these intersections. The intersections that use HCM6 methodology, the intersections that use HCM 2000 methodology, and the intersections that use SimTraffic delays are summarized below.

HCM6 Methodology	HCM 2000 Methodology	SimTraffic Delays
Crooks & Corporate / I-75 Ramp	NB Crooks Rd & Tower Dr	SB Crooks & Investment Dr
Corporate Dr. & New King Dr.	Crooks Road & Long Lake	SB Crooks & E. Site Drive
SB Crooks Road & NB to SB X/O N. of Long Lake Road	WB Long Lake Road & EB to WB X/O E. of Crooks Road	
NB Crooks Road & SB to NB X/O N. of Long Lake Road	EB Long Lake Road & WB to EB X/O W. of Crooks Road	
WB Long Lake Road & EB to WB X/O W. of Crooks Road	EB Long Lake Road & Investment Drive	
WB Long Lake Road & EB to WB X/O E. of Corporate Drive	WB Long Lake Road & Corporate Drive	
EB Long Lake Road & WB to EB X/O W. of Investment Drive		
NB Crooks Road & SB to NB X/O S. of Long Lake Road		
Corporate Drive & N. Site Dr.		
Corporate Drive & W. Site Dr.		
Long Lake Road & SW. Site Dr.		
Long Lake Road & SE. Site Dr.		

The signalized intersections within the study network operate on Sydney Coordinated Automated Traffic System (SCATS); therefore, the signal will perform real time optimizations to accommodate the traffic volume observed by the approach lane detectors. The signal timing permits for these intersections were provided by RCOC for use in this study. The back-up timings for each intersection were utilized as a baseline for each peak period and the signal splits were optimized for each scenario studied.

Descriptions of LOS "A" through "F" as defined in the HCM, are provided in **Appendix B** for signalized and unsignalized intersections. Typically, LOS D is considered acceptable, with LOS A representing minimal delay, and LOS F indicating failing conditions. Microsimulations were also conducted at the study intersections using SimTraffic to further evaluate the network performance. The results of the analysis of existing conditions are presented in **Appendix B** and are summarized in **Table 2**.



**Table 2: Existing Intersection Operations**

Intersection		Control	Approach	Existing Conditions			
				AM Peak		PM Peak	
				Delay (s/veh)	LOS	Delay (s/veh)	LOS
10	Crooks Road & I-75 Ramp / Corporate Drive	Signalized	EBL	117.8	F	57.9	E
			EBT	90.7	F	56.3	E
			EBR	41.9	D	93.6	F
			WBL	69.4	E	63.7	E
			WBT	104.6	F	75.0	E
			WBR	24.3	C	35.9	D
			NBT	64.1	E	41.1	D
			NBR	24.1	C	23.5	C
			SBL	60.1	E	65.2	E
			SBT	36.0	D	15.3	B
			SBR	29.4	C	13.7	B
			Overall	65.1	E	42.2	D
20	Corporate Drive & New King Drive	Stop (New King Drive)	EBL	10.4	B	8.0	A
			WB	Free		Free	
			SBL	49.8	E	16.0	C
			SBR	11.9	B	9.8	A
30	NB Crooks Road & Tower Drive	Signalized	EBTL	27.1	C	38.7	D
			WBR	18.4	B	43.8	D
			NBT	23.4	C	19.0	B
			NBR	48.4	D	12.7	B
			Overall	25.6	C	28.2	C
40	NB to SB Crooks Road XO N. of Long Lake Rd.	Stop (NB to SB Crossover)	WBL	13.7	B	13.1	B
			SB	Free		Free	
50	SB to NB Crooks Road XO N. of Long Lake Rd.	Stop (SB to NB Crossover)	EBL	10.8	B	12.4	B
			NB	Free		Free	
60	EB to WB Long Lake Rd. XO E. of Crooks Road	Signalized	WB	3.0	A	1.9	A
			NBL	46.2	D	33.6	C
			Overall	6.0	A	3.8	A
70	Crooks Road & Long Lake Road	Signalized	EBT	39.2	D	38.5	D
			EBR	47.2	D	34.7	C
			WBT	33.7	C	30.1	C
			WBR	27.5	C	29.0	C
			NBT	21.3	C	24.7	C
			NBR	19.1	B	25.1	C
			SBT	24.7	C	22.9	C
			SBR	19.8	B	20.2	C
			Overall	29.1	C	28.2	C
80	EB to WB Long Lake Road XO W. of Crooks	Stop (EB to WB Crossover)	WB	Free		Free	
			NBL	0.0*	A	11.2	B
90	WB to EB Long Lake Road XO W. of Crooks	Signalized	EB	3.1	A	6.8	A
			SBL	46.1	D	52.7	D
			Overall	18.2	B	16.2	B

Intersection		Control	Approach	Existing Conditions			
				AM Peak		PM Peak	
				Delay (s/veh)	LOS	Delay (s/veh)	LOS
100	EB to WB Long Lake Rd. XO E. of Corporate	Stop (EB to WB Crossover)	WB	Free		Free	
			NBL	12.6	B	11.4	B
110	EB Long Lake Road & Investment Drive	Signalized	EBT	2.4	A	2.3	A
			EBR	2.4	A	1.9	A
			NBR	49.8	D	54.2	D
			SBTL	78.7	E	77.7	E
			Overall	14.9	B	12.4	B
120	WB Long Lake Road & Corporate Drive	Signalized	WBT	17.4	B	19.8	B
			WBR	72.3	E	36.1	D
			NBTL	54.3	D	38.5	D
			SBR	28.7	C	48.3	D
			Overall	33.6	C	32.7	C
130	WB to EB Long Lake Rd. XO W. of Investment	Stop (WB to EB Crossover)	EB	Free		Free	
			SBL	11.6	B	12.7	B
140	SB to NB Crooks Road XO S. of Long Lake Rd.	Stop (SB to NB Crossover)	EBL	11.2	B	16.5	C
			NB	Free		Free	
150	SB Crooks Rd. & Investment Dr.	Stop (Invest. Drive)	EBR	17.9	C	17.8	C
			WBTL	14.3	B	11.8	B
			SB	Free		Free	

\* Indicates no vehicle volume present

All approaches and movements at the study intersections currently operate acceptably at LOS D or better with the exception of the following:

#### Crooks Road & Corporate Drive/ I-75 Ramp (INT #10)

- The overall intersection is currently operating at LOS E during the AM peak period, with multiple approaches and movements operating at LOS E and LOS F during both AM and PM peak periods.

Review of SimTraffic network simulations indicates long vehicle queues for the southbound left-turn movement during both the peak periods; however, these vehicle queues were observed to dissipate and were not present throughout the peak periods. Additionally, microsimulations indicate long vehicle queues for the eastbound approach during the AM peak period, as a result of the split phasing (EB/WB) at this intersection.

#### Corporate Drive & New King Drive (INT #20)

- The southbound left-turn movement is currently operating at LOS E during the AM peak period.

The review of SimTraffic network simulations indicates that the 95<sup>th</sup> percentile queue length reported for the southbound left-turn movement was 184 feet (approximately 7-8 vehicles) during the AM peak hour. However, this queue length is due to the eastbound through traffic backing up and forming queues from the Crooks Road & Corporate Drive/I-75 Ramp intersection and impacting the intersection of Corporate Drive & New King Drive. Moreover, when traffic from the intersection of Crooks Road & Corporate Drive/I-75 Ramp was not blocking this intersection, vehicles were able to find gaps within the through traffic along Corporate Drive; additionally, these queues were observed to dissipate and were not present throughout the peak hour.

#### EB Long Lake Road and Investment Drive (INT #110)

- The southbound approach is currently operating at LOS E during the AM peak hour and LOS F during the PM peak hour.



However, review of SimTraffic microsimulations indicates that the 95<sup>th</sup> percentile queue length reported for the southbound approach was 85 feet (approximately 3-4 vehicles) or less during both peak periods, which is not significant. Additionally, all vehicles were observed to be serviced within each cycle length, leaving no residual queues.

#### **WB Long Lake Road & Corporate Drive (INT #120)**

- The westbound right turn movement is currently operating at LOS E during the AM peak hour.

However, review of SimTraffic microsimulations indicates that the 95<sup>th</sup> percentile queue length reported for the westbound right-turn movement was 58 feet (approximately 2-3 vehicles), which is not significant. Additionally, all vehicles were observed to be serviced within each cycle length.

## **4.2 EXISTING OPERATIONS WITH IMPROVEMENTS**

### **Crooks Road & Corporate Drive/ I-75 Ramp (INT #10)**

Improvements were investigated at the intersection of Crooks Road & Corporate Drive/I-75 Ramp. The following mitigation measures were identified for consideration to improve existing operations:

- Eliminate the eastbound left-turn movement; thereby, removing the split phasing at this intersection. Additionally, reconfigure the lane usage to provide one (1) through lane, one (1) shared through/right lane, and one (1) right-turn lane.
  - Eastbound left-turns will be re-routed as eastbound right-turns and will utilize the SB-to-NB crossover at Tower Drive to continue northbound on Crooks Road.
- Construct an additional westbound left-turn lane and reconfigure the lanes to provide the following:
  - Dual (2) left-turn lanes, one (1) through lane, one (1) shared through/right, and one (1) exclusive right-turn lane.

The results of the analysis of existing conditions with improvements are presented in **Appendix B** and are summarized in **Table 3**.

The result of the analysis shows that the recommended mitigation measures improve the overall intersection operations to LOS D and LOS C during the AM and PM peak periods, respectively. Additionally, SimTraffic microsimulations at the intersection of Crooks Road & Corporate Drive/I-75 Ramp and the nearby study intersections also indicate improved operations.

The intersection of Crooks Road & Tower Drive is expected to operate acceptably with the additional eastbound left-turn traffic that was re-routed from the Crooks Road & Corporate Drive/I-75 Ramp intersection. Although, the intersection LOS analysis indicates that the northbound right turn approach at the intersection of NB Crooks Road & Tower Drive is expected to operate at LOS F during AM peak, a review of the SimTraffic network simulations indicate a 95<sup>th</sup> percentile queue length of 87 feet (approximately 3-4 vehicles), which is not significant. Additionally, all northbound right-turn vehicles were observed to be serviced within each cycle length, leaving no residual queues.

**Table 3: Existing Intersection Operations with Improvements**

Intersection	Control	Approach	Existing Conditions				Existing Improvements				Difference			
			AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak	
			Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS
10	Crooks Road & I-75 Ramp / Corporate Drive	Signalized	EBL	117.8	F	57.9	E	N/A				N/A		
			EBT	90.7	F	56.3	E	54.9	D	61.2	E	-35.8	F→D	4.9 -
			EBR	41.9	D	93.6	F	53.6	D	66.2	E	11.7	-	-27.4 F→E
			WBL	69.4	E	63.7	E	60.8	E	63.3	E	-8.6	-	-0.4 -
			WBT	104.6	F	75.0	E	27.7	C	40.3	D	-76.9	F→C	-34.7 E→D
			WBR	24.3	C	35.9	D	11.9	B	27.6	C	-12.4	C→B	-8.3 D→C
			NBT	64.1	E	41.1	D	43.8	D	31.0	C	-20.3	E→D	-10.1 D→C
			NBR	24.1	C	23.5	C	22.9	C	21.3	C	-1.2	-	-2.2 -
			SBL	60.1	E	65.2	E	60.1	E	65.2	E	0.0	-	0.0 -
			SBT	36.0	D	15.3	B	25.5	C	10.3	B	-10.5	D→C	-5.0 -
			SBR	29.4	C	13.7	B	21.3	C	9.2	A	-8.1	-	-4.5 B→A
			Overall	65.1	E	42.2	D	37.5	D	34.3	C	-27.6	E→D	-7.9 D→C
30	NB Crooks Road & Tower Drive	Signalized	EBTL	27.1	C	38.7	D	22.8	C	42.9	D	-4.3	-	4.2 -
			WBR	18.4	B	43.8	D	12.4	B	43.8	D	-6.0	-	0.0 -
			NBT	23.4	C	19.0	B	37.2	D	19.0	B	13.8	C→D	0.0 -
			NBR	48.4	D	12.7	B	85.2	F	12.7	B	36.8	D→F	0.0 -
			Overall	25.6	C	28.2	C	30.3	C	29.2	C	4.7	-	1.0 -

## 5 BACKGROUND (NO BUILD) CONDITIONS

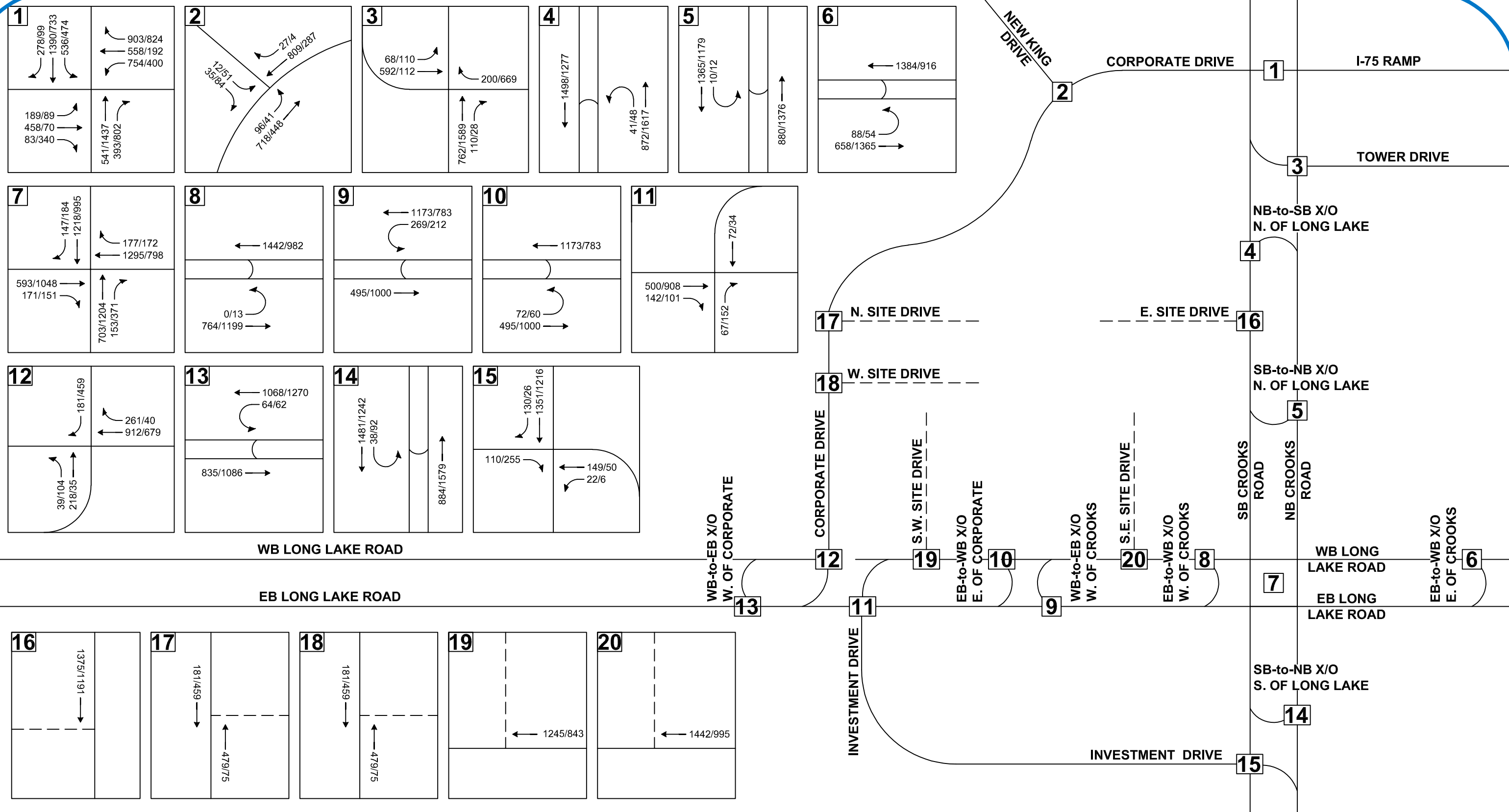
### 5.1 BACKGROUND OPERATIONS

The proposed development is anticipated to be constructed in 2025; therefore, the Southeast Michigan Council of Governments (SEMCOG) community profiles were reviewed for the City of Troy, in order to determine an applicable traffic growth for the background 2025 conditions. The SEMCOG population and employment forecasts (2015 – 2045) were reviewed and the forecasts showed a 0.10% and 0.30% annual growth for the City of Troy's population and employment, respectively. Therefore, conservative annual growth rate of **0.5%** was applied to the existing 2020 traffic volumes to calculate the 2025 buildout year traffic volume **without the proposed development**. The background traffic volumes are shown on **Figure 4**.

Background peak hour vehicle delays and LOS were calculated based on the existing lane use and traffic control shown on **Figure 2**, the background traffic volumes shown on **Figure 4**, and the methodologies presented in the HCM6. The results of the analysis of background conditions are presented in **Appendix C** and are summarized in **Table 4**.

The results of the background conditions analysis show that all of the intersection approaches and movements will continue to operate in a similar manner to existing conditions with some increases in the delay. Review of SimTraffic microsimulations also indicates similar observations to those identified under existing conditions.





**Table 4: Background Intersection Operations**

Intersection		Control	Approach	Existing Conditions				Background Conditions				Difference			
				AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak	
				Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS
10	Crooks Road & I-75 Ramp / Corporate Drive	Signalized	EBL	117.8	F	57.9	E	126.0	F	58.2	E	8.2	-	0.3	-
			EBT	90.7	F	56.3	E	97.2	F	56.4	E	6.5	-	0.1	-
			EBR	41.9	D	93.6	F	42.0	D	106.4	F	0.1	-	12.8	-
			WBL	69.4	E	63.7	E	75.8	E	64.5	E	6.4	-	0.8	-
			WBT	104.6	F	75.0	E	117.3	F	77.6	E	12.7	-	2.6	-
			WBR	24.3	C	35.9	D	24.5	C	35.6	D	0.2	-	-0.3	-
			NBT	64.1	E	41.1	D	70.0	E	43.0	D	5.9	-	1.9	-
			NBR	24.1	C	23.5	C	24.5	C	24.3	C	0.4	-	0.8	-
			SBL	60.1	E	65.2	E	60.6	E	65.7	E	0.5	-	0.5	-
			SBT	36.0	D	15.3	B	36.6	D	15.5	B	0.6	-	0.2	-
			SBR	29.4	C	13.7	B	29.7	C	13.9	B	0.3	-	0.2	-
Overall	65.1	E	42.2	D	70.0	E	43.6	D	4.9	-	1.4	-			
20	Corporate Drive & New King Drive	Stop (New King Drive)	EBL	10.4	B	8.0	A	10.5	B	8.0	A	0.1	-	0.0	-
			WB	Free		Free		Free		Free		Free		Free	
			SBL	49.8	E	16.0	C	54.0	F	16.5	C	4.2	E→F	0.5	-
			SBR	11.9	B	9.8	A	12.0	B	9.8	A	0.1	-	0.0	-
30	NB Crooks Road & Tower Drive	Signalized	EBTL	27.1	C	38.7	D	27.2	C	37.6	D	0.1	-	-1.1	-
			WBR	18.4	B	43.8	D	17.7	B	43.2	D	-0.7	-	-0.6	-
			NBT	23.4	C	19.0	B	23.6	C	19.9	B	0.2	-	0.9	-
			NBR	48.4	D	12.7	B	49.0	D	13.1	B	0.6	-	0.4	-
			Overall	25.6	C	28.2	C	25.7	C	28.5	C	0.1	-	0.3	-
40	NB>SB Crooks Road XO N. of Long Lake Rd.	Stop (NB to SB Crossover)	WBL	13.7	B	13.1	B	13.9	B	13.3	B	0.2	-	0.2	-
			SB	Free		Free		Free		Free		Free		Free	
50	SB>NB Crooks Road XO N. of Long Lake Rd.	Stop (SB to NB Crossover)	EBL	10.8	B	12.4	B	10.8	B	12.5	B	0.0	-	0.1	-
			NB	Free		Free		Free		Free		Free		Free	
60	EB>WB Long Lake Road XO E. of Crooks Road	Signalized	WB	3.0	A	1.9	A	3.2	A	1.9	A	0.2	-	0.0	-
			NBL	46.2	D	33.6	C	43.8	D	32.3	C	-2.4	-	-1.3	-
			Overall	6.0	A	3.8	A	5.9	A	3.7	A	-0.1	-	-0.1	-
70	Crooks Road & Long Lake Road	Signalized	EBT	39.2	D	38.5	D	38.7	D	37.2	D	-0.5	-	-1.3	-
			EBR	47.2	D	34.7	C	46.1	D	32.1	C	-1.1	-	-2.6	-
			WBT	33.7	C	30.1	C	32.4	C	29.8	C	-1.3	-	-0.3	-
			WBR	27.5	C	29.0	C	26.3	C	29.2	C	-1.2	-	0.2	-
			NBT	21.3	C	24.7	C	21.9	C	25.3	C	0.6	-	0.6	-
			NBR	19.1	B	25.1	C	19.7	B	25.8	C	0.6	-	0.7	-
			SBT	24.7	C	22.9	C	25.7	C	23.4	C	1.0	-	0.5	-
			SBR	19.8	B	20.2	C	20.4	B	20.7	C	0.6	-	0.5	-
Overall	29.1	C	28.2	C	28.9	C	27.9	C	-0.2	-	-0.2	-			
80	EB>WB Long Lake Road XO W. of Crooks	Stop (EB to WB Crossover)	WB	Free		Free		Free		Free		Free		Free	
			NBL	0.0*	A	11.2	B	0.0*	A	11.3	B	0.0*	-	0.1	-



Intersection		Control	Approach	Existing Conditions				Background Conditions				Difference			
				AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak	
				Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS
90	WB>EB Long Lake Road XO W. of Crooks	Signalized	EB	3.1	A	6.8	A	3.3	A	7.0	A	0.2	-	0.2	-
			SBL	46.1	D	52.7	D	40.9	D	51.7	D	-5.2	-	-1.0	-
			Overall	18.2	B	16.2	B	16.6	B	16.2	B	-1.6	-	0.0	-
100	EB>WB Long Lake Road XO E. of Corporate	Stop (EB to WB Crossover)	WB	Free		Free		Free		Free		Free		Free	
			NBL	12.6	B	11.4	B	12.8	B	11.5	B	0.2	-	0.1	-
110	EB Long Lake Road & Investment Drive	Signalized	EBT	2.4	A	2.3	A	2.4	A	2.1	A	0.0	-	-0.2	-
			EBR	2.4	A	1.9	A	2.4	A	1.8	A	0.0	-	-0.1	-
			NBR	49.8	D	54.2	D	49.7	D	53.5	D	-0.1	-	-0.7	-
			SBTL	78.7	E	77.7	E	77.6	E	79.2	E	-1.1	-	1.5	-
			Overall	14.9	B	12.4	B	14.8	B	12.2	B	-0.1	-	-0.2	-
120	WB Long Lake Road & Corporate Drive	Signalized	WBT	17.4	B	19.8	B	18.0	B	21.9	C	0.6	-	2.1	B→C
			WBR	72.3	E	36.1	D	75.1	E	38.1	D	2.8	-	2.0	-
			NBTL	54.3	D	38.5	D	54.5	D	37.8	D	0.2	-	-0.7	-
			SBR	28.7	C	48.3	D	29.2	C	47.6	D	0.5	-	-0.7	-
			Overall	33.6	C	32.7	C	34.5	C	33.1	C	0.9	-	0.4	-
130	WB>EB Long Lake Road XO W. of Investment	Stop (WB to EB Crossover)	EB	Free		Free		Free		Free		Free		Free	
			SBL	11.6	B	12.7	B	11.7	B	12.9	B	0.1	-	0.2	-
140	SB>NB Crooks Road XO S. of Long Lake Road	Stop (SB to NB Crossover)	EBL	11.2	B	16.5	C	11.2	B	16.9	C	0.0	-	0.4	-
			NB	Free		Free		Free		Free		Free		Free	
150	SB Crooks Rd. & Investment Dr.	Stop (Invest. Drive)	EBR	17.9	C	17.8	C	19.8	C	18.7	C	1.9	-	0.9	-
			WBTL	14.3	B	11.8	B	15.5	C	11.7	B	1.2	B→C	-0.1	-
			SB	Free		Free		Free		Free		Free		Free	

\* Indicates no vehicle volume present

## 5.2 BACKGROUND OPERATIONS WITH IMPROVEMENTS

### Crooks Road & Corporate Drive/ I-75 Ramp (INT #10)

The mitigation measures that were identified under the existing conditions analysis were applied to the background (2025) conditions, in order to determine if these measures would improve background delays and vehicle queueing at this intersection. The results of the improvement analysis indicates improved operations at the study intersections, similar to that observed under the existing improvements analysis. The results of the analysis of background conditions with improvements analysis are presented in **Appendix C** and are summarized in **Table 5**.

**Table 5: Background Intersection Operations with Improvements**

Intersection		Control	Approach	Background Conditions				Background Improvements				Difference			
				AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak	
				Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS
10	Crooks Road & I-75 Ramp / Corporate Drive	Signalized	EBL	126.0	F	58.2	E	N/A				N/A			
			EBT	97.2	F	56.4	E	61.2	E	60.9	E	-36.0	F→E	4.5	-
			EBR	42.0	D	106.4	F	60.7	E	70.7	E	18.7	D→E	-35.7	F→E
			WBL	75.8	E	64.5	E	62.1	E	71.8	E	-13.7	-	7.3	-
			WBT	117.3	F	77.6	E	28.5	C	40.4	D	-88.8	F→C	-37.2	E→D
			WBR	24.5	C	35.6	D	12.3	B	28.3	C	-12.2	C→B	-7.3	D→C
			NBT	70.0	E	43.0	D	43.6	D	30.8	C	-26.4	E→D	-12.2	D→C
			NBR	24.5	C	24.3	C	22.4	C	21.4	C	-2.1	-	-2.9	-
			SBL	60.6	E	65.7	E	68.8	E	77.7	E	8.2	-	12.0	-
			SBT	36.6	D	15.5	B	25.8	C	10.3	B	-10.8	D→C	-5.2	-
			SBR	29.7	C	13.9	B	21.5	C	9.2	A	-8.2	-	-4.7	B→A
			Overall	70.0	E	43.6	D	39.3	D	36.4	D	-30.7	E→D	-7.2	-
30	NB Crooks Road & Tower Drive	Signalized	EBTL	27.2	C	37.6	D	22.9	C	42.3	D	-4.3	-	4.7	-
			WBR	17.7	B	43.2	D	11.7	B	43.5	D	-6.0	-	0.3	-
			NBT	23.6	C	19.9	B	37.6	D	19.8	B	14.0	C→D	-0.1	-
			NBR	49.0	D	13.1	B	83.8	F	13.1	B	34.8	D→F	0.0	-
			Overall	25.7	C	28.5	C	30.2	C	29.5	C	4.5	-	1.0	-

The result of the analysis shows that the recommended mitigation measures improve the overall intersection operations to LOS D and LOS C during the AM and PM peak periods, respectively. Additionally, SimTraffic microsimulations at the intersection of Crooks Road & Corporate Drive/I-75 Ramp and the nearby study intersections also indicate improved operations.

The intersection of Crooks Road & Tower Drive is expected to operate acceptably with the additional eastbound left-turn traffic that was re-routed from the Crooks Road & Corporate Drive/I-75 Ramp intersection. Although, the intersection LOS analysis indicates that the northbound right turn approach at the intersection of NB Crooks Road & Tower Drive is expected to operate at LOS F during AM peak, a review of the SimTraffic network simulations indicate a 95<sup>th</sup> percentile queue length of 78 feet (approximately 3-4 vehicles), which is not significant. Additionally, all northbound right-turn vehicles were observed to be serviced within each cycle length, leaving no residual queues.



## 6 SITE TRIP GENERATION

The number of peak hour (AM and PM) and daily vehicle trips that would be generated by the proposed development was forecast based on data published by ITE in the *Trip Generation Manual, 10<sup>th</sup> Edition*. The site trip generation forecast is summarized in **Table 6**. The proposed trip generation included in this analysis was reviewed with the City Traffic Consultant (OHM) prior to use in the study. *Note: Internal trip capture and pass-by trip reductions were not included in this study to provide a conservative analysis.*

**Table 6: Site Trip Generation**

Land Use	ITE Code	Amount	Units	Average Daily Traffic (vpd)	AM Peak Hour (vph)			PM Peak Hour (vph)		
					In	Out	Total	In	Out	Total
Quality Restaurant	931	24,600	GFA SF	2,062	14	4	18	129	63	192
Hotel	310	220	Rooms	2,057	62	43	105	71	68	139
Medical-Dental Office Building	720	540,000	GFA SF	20,659	782	220	1,002	513	1,320	1,833
Total Trips				24,778	858	267	1,125	713	1,451	2,164

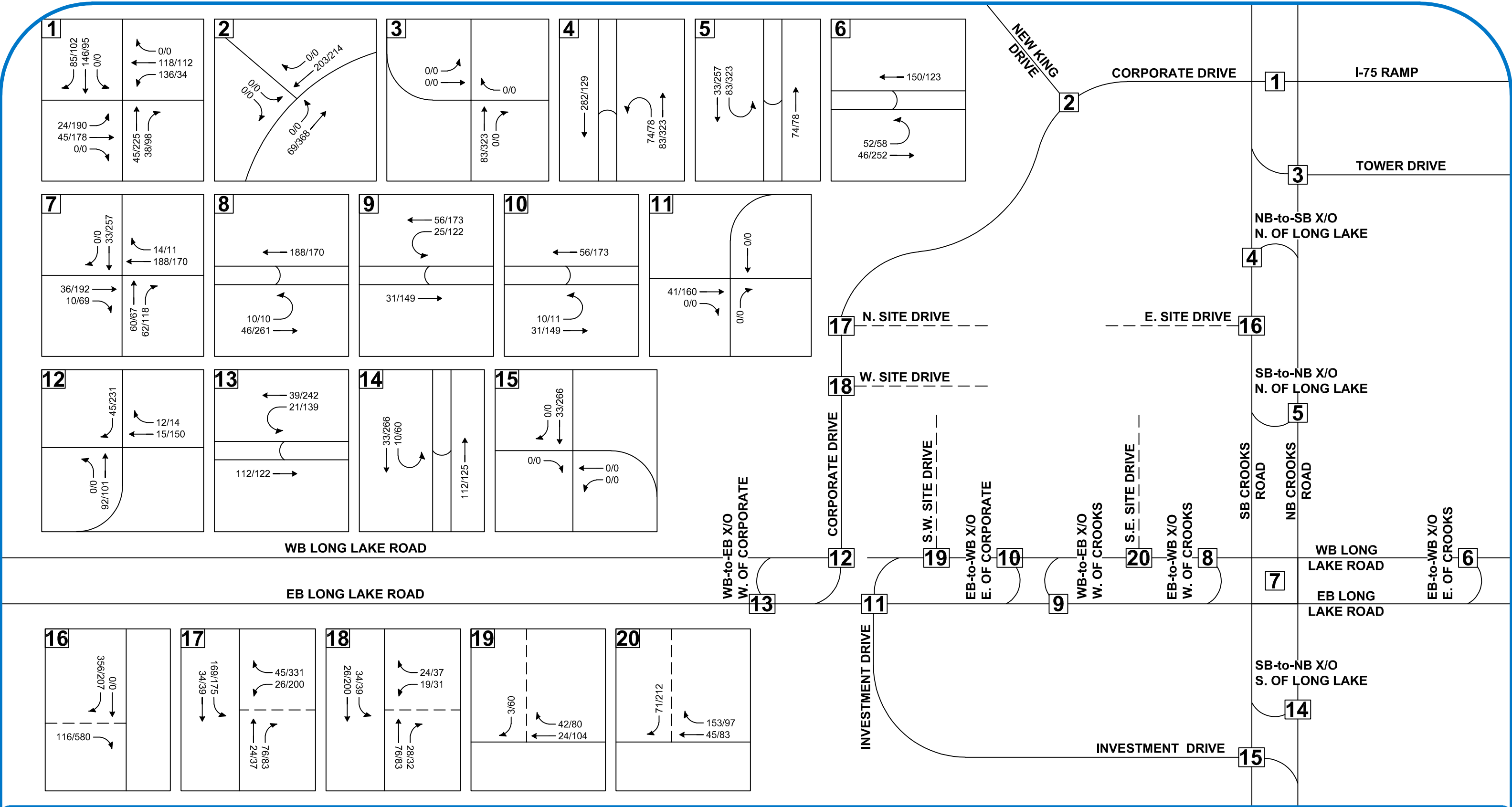
## 7 SITE TRAFFIC ASSIGNMENT

The site access for this analysis was assumed via five (5) driveways: two (2) on Corporate Drive, two (2) on Long Lake Road, and one (1) on SB Crooks Road. The vehicular trips that would be generated by the proposed development were assigned to the study roads based on the proposed site access plan, the existing peak hour traffic patterns on the adjacent roadway network, and the methodologies published by ITE. The adjacent street traffic volumes were used to develop the trip distribution. In order to determine the projected site traffic distribution, it was assumed that the existing adjacent street traffic volumes in the AM are home-to-work based trips, and in the PM are work-to-home based trips. Therefore, the trip distribution assumes trips are coming into the study network and entering the development for work in the AM peak hour, then leaving work and exiting the network towards home in the PM peak hour. The ITE trip distribution methodology assumes that new trips will return to their direction of origin. The site trip distribution used in the analysis is summarized in **Table 7**.

**Table 7: Site Trip Distribution**

New Trips Distribution			
From/To	Via	AM	PM
North	Crooks Road	28%	30%
South	Crooks Road	14%	19%
East	Long Lake Road	18%	17%
East	I-75 Ramp	28%	18%
West	Long Lake Road	12%	16%
Total		100%	100%

The vehicular traffic volumes shown in **Table 6** were distributed to the roadway network according to the distribution shown in **Table 7**. The site generated trips are shown on **Figure 5** and were added to the future background traffic volumes shown on **Figure 4** to calculate the future peak hour traffic volumes with the proposed development. Future traffic volumes are shown on **Figure 6**.



**FIGURE 5**

**SITE-GENERATED TRAFFIC VOLUMES**

LONG LAKE & CROOKS MASTERPLAN DEVELOPMENT  
- TROY, MI

**LEGEND**

ROADS

PROPOSED ROADS

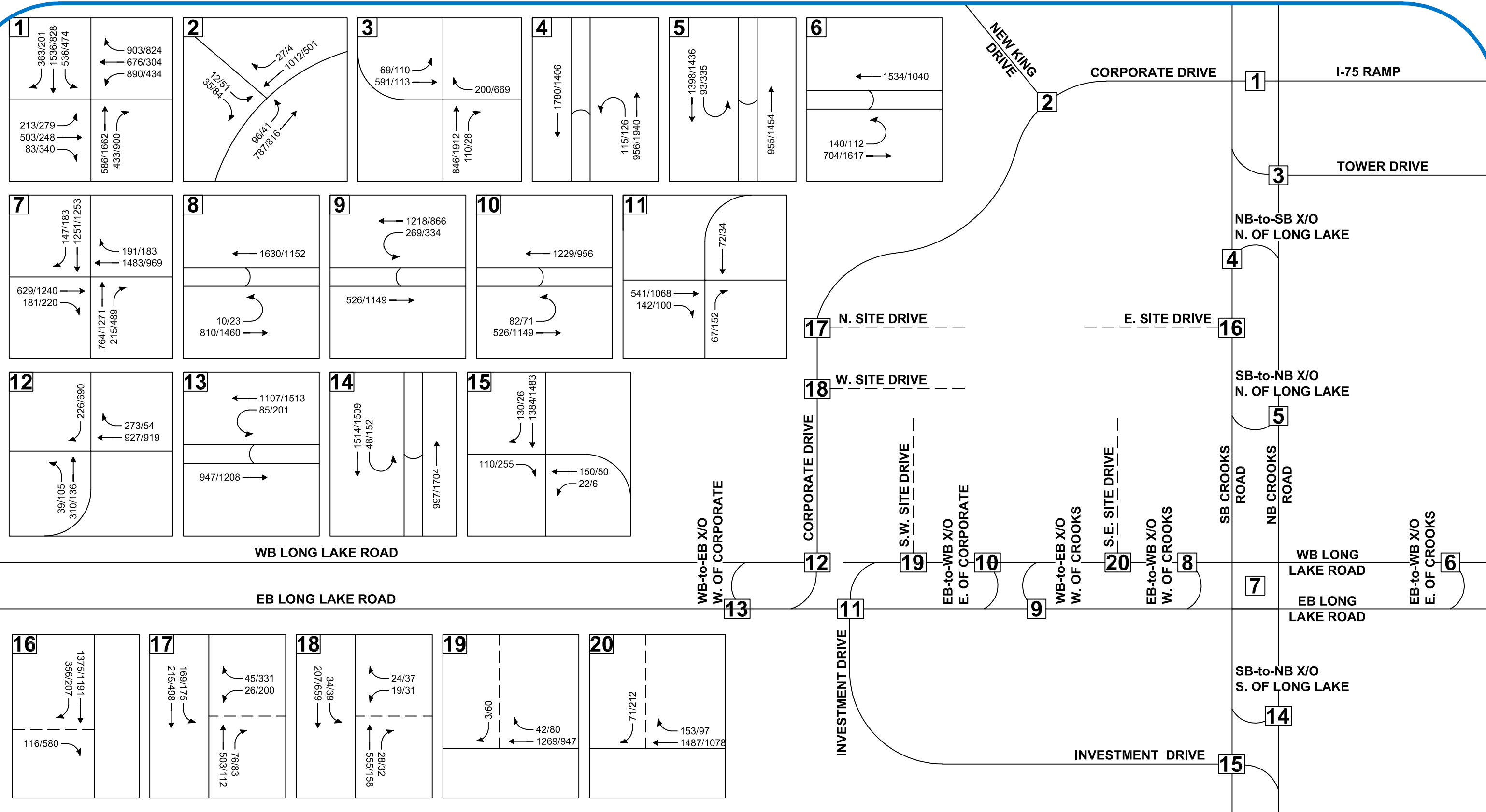
TRAFFIC VOLUMES (AM/PM)

**NORTH**

SCALE: NOT TO SCALE







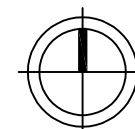


## FIGURE 6 FUTURE TRAFFIC VOLUMES

**LONG LAKE & CROOKS MASTERPLAN DEVELOPMENT  
- TROY, MI**

### LEGEND

-  ROADS  
 PROPOSED ROADS  
 TRAFFIC VOLUMES (AM/PM)



NORTH  
SCALE: NOT TO SCALE



## 8 FUTURE CONDITIONS

### 8.1 FUTURE OPERATIONS

The future peak hour vehicle delays and LOS **with the proposed development** were calculated based on the future lane use and traffic control shown on **Figure 2**, the proposed site access plan, the future traffic volumes shown on **Figure 6**, and the methodologies presented in the HCM. The results of the future conditions analysis are presented in **Appendix D** and are summarized in **Table 8**.

**Table 8: Future Intersection Operations**

Intersection		Control	Approach	Background Conditions				Future Conditions				Difference			
				AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak	
				Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS
10	Crooks Road & I-75 Ramp / Corporate Drive	Signalized	EBL	126.0	F	58.2	E	168.8	F	364.5	F	42.8	-	306.3	E→F
			EBT	97.2	F	56.4	E	129.1	F	290.6	F	31.9	-	234.2	E→F
			EBR	42.0	D	106.4	F	42.0	D	106.4	F	0.0	-	0.0	-
			WBL	75.8	E	64.5	E	132.4	F	72.0	E	56.6	E→F	7.5	-
			WBT	117.3	F	77.6	E	188.7	F	132.8	F	71.4	-	55.2	E→F
			WBR	24.5	C	35.6	D	24.5	C	40.9	D	0.0	-	5.3	-
			NBT	70.0	E	43.0	D	90.9	F	55.1	E	20.9	E→F	12.1	D→E
			NBR	24.5	C	24.3	C	25.1	C	27.8	C	0.6	-	3.5	-
			SBL	60.6	E	65.7	E	60.6	E	65.7	E	0.0	-	0.0	-
			SBT	36.6	D	15.5	B	39.6	D	16.1	B	3.0	-	0.6	-
			SBR	29.7	C	13.9	B	32.8	C	15.4	B	3.1	-	1.5	-
Overall	70.0	E	43.6	D	98.6	F	82.9	F	28.6	E→F	39.3	D→F			
20	Corporate Drive & New King Drive	Stop (New King Drive)	EBL	10.5	B	8.0	A	11.9	B	8.7	A	1.4	-	0.7	-
			WB	Free		Free		Free		Free		Free		Free	
			SBL	54.0	F	16.5	C	96.7	F	33.9	D	42.7	-	17.4	C→D
			SBR	12.0	B	9.8	A	13.4	B	10.9	B	1.4	-	1.1	A→B
30	NB Crooks Road & Tower Drive	Signalized	EBTL	27.2	C	37.6	D	26.0	C	38.0	D	-1.2	-	0.4	-
			WBR	17.7	B	43.2	D	17.7	B	43.2	D	0.0	-	0.0	-
			NBT	23.6	C	19.9	B	22.2	C	22.5	C	-1.4	-	2.6	B→C
			NBR	49.0	D	13.1	B	40.5	D	13.2	B	-8.5	-	0.1	-
			Overall	25.7	C	28.5	C	24.0	C	29.2	C	-1.7	-	0.7	-
40	NB to SB Crooks Road XO N. of Long Lake Rd.	Stop (NB to SB Crossover)	WBL	13.9	B	13.3	B	19.5	C	18.1	C	5.6	B→C	4.8	B→C
			SB	Free		Free		Free		Free		Free		Free	
50	SB to NB Crooks Road XO N. of Long Lake Rd.	Stop (SB to NB Crossover)	EBL	10.8	B	12.5	B	12.4	B	56.9	F	1.6	-	44.4	B→F
			NB	Free		Free		Free		Free		Free		Free	
60	EB to WB Long Lake Road XO E. of Crooks Road	Signalized	WB	3.2	A	1.9	A	4.8	A	3.3	A	1.6	-	1.4	-
			NBL	43.8	D	32.3	C	49.4	D	36.1	D	5.6	-	3.8	C→D
			Overall	5.9	A	3.7	A	9.1	A	6.8	A	3.2	-	3.1	-



Intersection		Control	Approach	Background Conditions				Future Conditions				Difference			
				AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak	
				Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS
70	Crooks Road & Long Lake Road	Signalized	EBT	38.7	D	37.2	D	35.9	D	32.7	D	-2.8	-	-4.5	-
			EBR	46.1	D	32.1	C	41.4	D	22.1	C	-4.7	-	-10.0	-
			WBT	32.4	C	29.8	C	32.2	C	29.9	C	-0.2	-	0.1	-
			WBR	26.3	C	29.2	C	21.8	C	29.6	C	-4.5	-	0.4	-
			NBT	21.9	C	25.3	C	24.6	C	28.5	C	2.7	-	3.2	-
			NBR	19.7	B	25.8	C	23.1	C	34.5	C	3.4	B→C	8.7	-
			SBT	25.7	C	23.4	C	28.8	C	27.9	C	3.1	-	4.5	-
			SBR	20.4	B	20.7	C	22.4	C	22.6	C	2.0	B→C	1.9	-
Overall			28.9	C	27.9	C	28.8	C	28.5	C	-0.1	-	0.5	-	
80	EB to WB Long Lake Road XO W. of Crooks	Stop (EB to WB Crossover)	WB	Free		Free		Free		Free		Free		Free	
			NBL	0.0*	A	11.3	B	13.3	B	12.1	B	13.3	A→B	0.8	-
90	WB to EB Long Lake Road XO W. of Crooks	Signalized	EB	3.3	A	7.0	A	4.7	A	15.8	B	1.4	-	8.8	A→B
			SBL	40.9	D	51.7	D	28.9	D	50.7	D	-12.0	-	-1.0	-
			Overall	16.6	B	16.2	B	13.4	B	24.9	C	-3.2	-	8.7	B→C
100	EB to WB Long Lake Road XO E. of Corporate	Stop (EB to WB Crossover)	WB	Free		Free		Free		Free		Free		Free	
			NBL	12.8	B	11.5	B	13.3	B	12.5	B	0.5	-	1.0	-
110	EB Long Lake Road & Investment Drive	Signalized	EBT	2.4	A	2.1	A	2.4	A	2.6	A	0.0	-	0.5	-
			EBR	2.4	A	1.8	A	2.4	A	2.1	A	0.0	-	0.3	-
			NBR	49.7	D	53.5	D	49.7	D	54.1	D	0.0	-	0.6	-
			SBTL	77.6	E	79.2	E	74.3	E	68.9	E	-3.3	-	-10.3	-
			Overall	14.8	B	12.2	B	13.9	B	11.3	B	-0.9	-	-0.9	-
120	WB Long Lake Road & Corporate Drive	Signalized	WBT	18.0	B	21.9	C	23.1	B	32.2	C	5.1	-	10.3	-
			WBR	75.1	E	38.1	D	90.4	F	50.8	D	15.3	E→F	12.7	-
			NBTL	54.5	D	37.8	D	51.3	D	28.0	C	-3.2	-	-9.8	D→C
			SBR	29.2	C	47.6	D	27.5	C	38.0	D	-1.7	-	-9.6	-
			Overall	34.5	C	33.1	C	39.4	D	34.4	C	4.9	C→D	1.3	-
130	WB to EB Long Lake Road XO W. of Investment	Stop (WB to EB Crossover)	EB	Free		Free		Free		Free		Free		Free	
			SBL	11.7	B	12.9	B	12.6	B	19.8	C	0.9	-	6.9	B→C
140	SB to NB Crooks Road XO S. of Long Lake Road	Stop (SB to NB Crossover)	EBL	11.2	B	16.9	C	11.8	B	23.6	C	0.6	-	6.7	-
			NB	Free		Free		Free		Free		Free		Free	
150	SB Crooks Rd. & Investment Dr.	Stop (Invest. Drive)	EBR	19.8	C	18.7	C	18.5	C	25.0	D	-1.3	-	6.3	C→D
			WBTL	15.5	C	11.7	B	14.8	C	18.9	C	-0.7	-	7.2	B→C
			SB	Free		Free		Free		Free		Free		Free	
160	SB Crooks Rd. & E. Site Drive	Stop (Site Dr.)	EBR	N/A				15.7	C	69.2	F	N/A			
			SB					Free		Free					
170	Corporate Drive & N. Site Drive	Stop (N. Site Drive)	WBL	N/A				19.3	C	54.4	F	N/A			
			WBR					10.7	B	11.3	B				
			NB					Free		Free					
			SBL					9.9	A	8.2	A				

Intersection		Control	Approach	Background Conditions				Future Conditions				Difference			
				AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak	
				Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS
180	Corporate Drive & W. Site Drive	Stop (N. Site Drive)	WB	N/A				12.5	B	11.7	B	N/A			
			NB					Free		Free					
			SBL					9.0	A	7.8	A				
190	WB Long Lake & S.W. Site Dr.	Stop (Site Dr.)	WB	N/A				Free		Free		N/A			
			SBR					15.6	C	15.0	B				
200	WB Long Lake & S.E. Site Dr.	Stop (Site Dr.)	WB	N/A				Free		Free		N/A			
			SBR					16.3	C	20.4	C				

\* Indicates no vehicle volume present

The results of the future conditions analysis show that with the addition of the site generated traffic, all study intersection approaches and movements will operate in a manner similar to existing and background conditions with the exception of the following:

#### Crooks Road & Corporate Drive/ I-75 Ramp (INT #10)

- The intersection of Crooks Road & Corporate Drive/I-75 Ramp is expected to operate at LOS F during both AM and PM peak periods with significant increases in delay for the eastbound approach during the PM peak hour and the westbound approach during the AM peak hour.

Review of SimTraffic network simulations during the AM peak hour indicate long vehicle queues for the eastbound and westbound approaches and the southbound left-turn movement; these queues were not observed to dissipate and were present throughout the peak hour. During the PM peak hour, microsimulation observations indicate long vehicle queues along the eastbound and northbound approaches that do not dissipate and are present throughout the PM peak hour. Additionally, occasional periods of long vehicle queues were observed for the southbound left-turn movement; however, these queues were observed to dissipate and were not present throughout the peak period.

#### NB Crooks Road & Tower Drive (INT #30)

Although the intersection LOS analyses indicates acceptable conditions for all approaches and movements at the intersection of NB Crooks Road & Tower Drive, the eastbound left-turn and through movements for crossover traffic traveling from southbound Crooks Road occasionally exceed the available left-turn storage length along SB Crooks Road during the AM peak hour. These vehicles exceeding the available left-turn storage area impacts the operation at the intersection of Crooks Road & Corporate Drive/I-75 Ramp, as well as creating potential safety concerns for through vehicles along SB Crooks Road.

#### SB to NB Crooks Road XO N. of Long Lake Road (INT #50)

- The eastbound left turn movement is expected to operate at LOS F during the PM peak hour.

Review of SimTraffic microsimulations indicate vehicles are processed quickly through this intersection, with many available gaps within the NB Crooks Road through traffic; however, the high volume (335 vehicles) utilizing this movement results in the failing LOS. The 95<sup>th</sup> percentile queue length reported for this movement during the PM peak hour is 277 feet (approximately 11-12 vehicles), which exceeds the available storage area and creates potential safety concerns.

#### WB Long Lake Road & Corporate Drive (INT #120)

- The westbound right turn movement is expected to operate at LOS F during the AM peak hour.

The failing LOS for this movement is likely due to the high volume (310 vehicles) of northbound through traffic traveling from the crossover. Although the intersection LOS analysis indicates poor operations, review of SimTraffic network simulations indicate acceptable operations, with a 95<sup>th</sup> percentile queue length of 54 feet (approximately 2-3 vehicles), which is not significant.



### **SB Crooks Rd. & E. Site Drive (INT #160)**

- The eastbound right turn movement is expected to operate at LOS F during the PM peak hour.

Review of microsimulations indicate occasional periods of vehicle queueing, as a result of the large volume (580 vehicles) of traffic utilizing this site drive. However, microsimulation observations indicate that egress vehicles are able to find adequate gaps within through traffic along SB Crooks Road. Additionally, during the peak periods of traffic, vehicles can utilize any of the other site driveways in an effort to avoid any excessive delays.

### **Corporate Drive & N. Site Drive (INT #170)**

- The westbound left turn movement is expected to operate at LOS F during the PM peak hour.

Although the intersection LOS analysis indicates poor operations, review of SimTraffic network simulations indicates acceptable operations, with a 95<sup>th</sup> percentile queue length of 120 feet (approximately 4-5 vehicles), which is not significant. Additionally, if vehicles experience significant delays using this movement, they can access any of the other site driveways.

## **8.2 FUTURE IMPROVEMENTS**

In order to improve traffic operations at the study intersections under future conditions **with the proposed development**, the mitigation measures that were identified under existing conditions were again applied. The results of the analysis indicate that with the implementation of the mitigation measures identified under existing conditions, several study intersections will still operate poorly. Therefore, the proposed improvements (including those previously identified) and their impact to the intersection operations are discussed below.

### **Crooks Road & Corporate Drive/I-75 Ramp (INT #10)**

- Eliminate the eastbound left-turn movement; therefore, removing the split phasing at this intersection.
  - *Eastbound left-turns will be re-routed as eastbound right-turns and will utilize the SB-to-NB crossover at Tower Drive to continue northbound on Crooks Road.*
- Construct an additional eastbound right-turn lane.
  - *Reconfigure the lane usage to provide two (2) through lane and dual (2) right-turn lanes.*
- Construct an additional westbound left-turn lane and reconfigure the lanes to provide the following:
  - *Dual (2) left-turn lanes, one (1) through lane, one (1) shared through/right, and one (1) exclusive right-turn lane.*
- Construct an additional northbound right-turn lane and reconfigure the lanes to provide the following:
  - *Three (3) through lanes and dual (2) right-turn lanes.*
- Extend the southbound left-turn storage lanes length by 200-feet

### **NB Crooks Road & Tower Drive (INT #10)**

- Construct an additional southbound left-turn lane.

### **SB to NB Crooks Road XO N. of Long Lake Road (INT #50)**

- Construct an additional southbound left-turn lane.

### **WB Long Lake Road & Corporate Drive (INT #120)**

- Construct an additional eastbound left-turn lane.

### **WB Long Lake Road & SE. Site Drive (INT #200)**

- Construct an additional southbound right-turn egress lane.

Although the recommended capacity improvements alone will not improve the intersection operations for all approaches and movements at the Crooks Road & Corporate Drive/I-75 Ramp intersection to a LOS D or better, the SimTraffic simulations show significant operational improvements at the study intersections and throughout the network. The results of the analysis of future conditions with improvements are presented in **Appendix D** and are summarized in **Table 9**.

**Table 9: Future Intersection Operations with Improvements**

Intersection		Control	Approach	Future Conditions				Future Improvements				Difference			
				AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak	
				Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS
10	Crooks Road & I-75 Ramp / Corporate Drive	Signalized	EBL	168.8	F	364.5	F	N/A				N/A			
			EBT	129.1	F	290.6	F	71.5	E	56.0	E	-57.6	F→E	-234.6	F→E
			EBR	42.0	D	106.4	F	49.0	D	139.9	F	7.0	-	33.5	-
			WBL	132.4	F	72.0	E	58.3	E	88.9	F	-74.1	F→E	16.9	E→F
			WBT	188.7	F	132.8	F	22.2	C	38.5	D	-166.5	F→C	-94.3	F→D
			WBR	24.5	C	40.9	D	10.0	A	23.4	C	-14.5	C→A	-17.5	D→C
			NBT	90.9	F	55.1	E	66.6	E	65.8	F	-24.3	F→E	10.7	E→F
			NBR	25.1	C	27.8	C	21.9	C	21.7	C	-3.2	-	-6.1	-
			SBL	60.6	E	65.7	E	60.6	E	69.7	E	0.0	-	4.0	-
			SBT	39.6	D	16.1	B	33.1	D	13.5	B	-6.5	-	-2.6	-
			SBR	32.8	C	15.4	B	28.2	C	12.9	B	-4.6	-	-2.5	-
			Overall	98.6	F	82.9	F	42.5	D	53.1	D	-56.1	F→D	-29.8	F→D
30	NB Crooks Road & Tower Drive	Signalized	EBTL	26.0	C	38.0	D	22.8	C	42.9	D	-3.2	-	4.9	-
			WBR	17.7	B	43.2	D	18.1	B	40.0	D	0.4	-	-3.2	-
			NBT	22.2	C	22.5	C	22.0	C	24.2	C	-0.2	-	1.7	-
			NBR	40.5	D	13.2	B	40.8	D	14.1	B	0.3	-	0.9	-
			Overall	24.0	C	29.2	C	22.8	C	31.3	C	-1.2	-	2.1	-
50	SB to NB Crooks Road XO N. of Long Lake Rd.	Stop (SB to NB Crossover)	EBL	12.4	B	56.9	F	5.3	A	10.3	C	-7.1	B→A	-46.6	F→C
			NB	Free		Free		Free		Free		Free		Free	
120	WB Long Lake Road & Corporate Drive	Signalized	WBT	23.1	B	32.2	C	1.5	A	31.7	C	-21.6	B→A	-0.5	-
			WBR	90.4	F	50.8	D	0.3	A	49.5	D	-90.1	F→A	-1.3	-
			NBTL	51.3	D	28.0	C	52.4	D	25.2	C	1.1	-	-2.8	-
			SBR	27.5	C	38.0	D	45.9	D	38.0	D	18.4	C→D	0.0	-
			Overall	39.4	D	34.4	C	18.1	B	33.7	C	-21.3	D→B	-0.7	-
200	WB Long Lake & S.E. Site Dr.	Stop (Site Dr.)	WB	Free		Free		Free		Free		Free		Free	
			SBR	16.3	C	20.4	C	15.4	C	16.3	C	-0.9	-	-4.1	-



## 9 ACCESS MANAGEMENT

### 9.1 AUXILIARY TURN LANE

Corporate Drive currently has a center two-way left-turn lane and Long Lake Road and Crooks Road are both median divided; therefore, only the right-turn treatment warrants were evaluated at the proposed site driveways. The City of Troy does not maintain auxiliary turn lane warrants; therefore, the RCOC right-turn warrants were utilized for this analysis and were based on the future traffic volumes as shown in **Figure 6**. The results of the analysis indicate that right-turn deceleration tapers are recommended at the site driveways on Corporate Drive and full-width right-turn lanes are recommended at the proposed site driveway locations on Crooks Road and Long Lake Road. The RCOC turn lane warrant chart is attached in **Appendix E**.

Major Road	Site Driveway	Right-Turn Treatment
Corporate Drive	N. Site Drive	Deceleration Taper
Corporate Drive	W. Site Drive	Deceleration Taper
Long Lake Road	SW. Site Drive	Right-Turn Lane
Long Lake Road	SE. Site Drive	Right-Turn Lane
SB Crooks Road	E. Site Drive	Right-Turn Lane

### 9.2 DRIVEWAY SPACING

According to the City of Troy, the minimum separation between driveways shall be based upon the posted speed limit of the street. However, there is no specific spacing requirement provided. Therefore, MDOT Guideline for unsignalized driveway spacing was reviewed. The required and proposed spacing between driveways are presented in **Table 10**, which indicates that the proposed driveways on Corporate Drive and Long Lake Road meet the required driveway spacing requirement.

**Table 10: Driveway Spacing**

Major Road	Adjacent Driveways	Spacing Requirement	Spacing Proposed
Corporate Drive	N. and W. Site Drives	245 feet	275 feet (approximately)
Long Lake Road	SW. and SE. Site Drives	350 feet	300 feet (approximately)

According to the City of Troy, access points shall be placed as far from intersections as practical, but no closer than one hundred twenty-five (125) feet as measured from centerline to centerline. Therefore, the spacing between the SE. Drive & Long Lake Road intersection should be at least 125 feet apart from the EB Long Lake Road & WB-to-EB X/O (W. of Crooks). Similarly, the spacing between the SW. Drive & Long Lake Road intersection should be at least 125 feet apart from the WB Long Lake Rd & EB-to-WB X/O (E. of Corporate Drive).

There are no site access driveways proposed at this time with this PUD. Therefore, the site access driveways will be further reviewed for access management during the development of site plan(s) for this PUD.

## 10 PARKING STUDY

A parking analysis was performed for this site to calculate the recommended parking supply. The parking demand for the PUD was calculated to determine how much parking will be generated by the proposed development. This data was then used to determine the recommended parking supply to accommodate the projected parking demand.

### 10.1 PARKING DEMAND

The parking demand for the site was calculated by matching the potential land uses and sizes included in the PUD plan for this site to the City of Troy Zoning Ordinance land uses. The zoning ordinance was used to determine the baseline parking requirements for this site with land use anticipated within the PUD. These baseline calculations were further evaluated based on the shared parking methodology as outlined in Urban Land Institute (ULI) in Shared Parking, 3rd Edition. This methodology assumes that a single parking space may be utilized by two or more individual land uses without conflict based on the hourly, daily, and seasonal variations in parking demand. In accordance with the City ordinance, the parking demand was calculated according to the ordinance rates and was distributed according to the ULI distributions by month, day, and hour to determine the projected shared parking demand for this PUD.

For purposes of this analysis, it was assumed the PUD would include the highest and best use of the property. Therefore, a hotel, with a total of 220 hotel rooms, two office buildings, and three fine dining restaurants were included in the analysis. The proposed land uses and sizes included in this study are as follows:

Land Use	Size
Office Space (Medical/Dental Office)	540,000 SF (Gross Floor Area)
Hotel	220 hotel rooms
Hotel (Employees)	12
Hotel (Restaurant)	100 Seats
Retail (Fine Dining Restaurants)	735 Seats

These land uses were developed for use in this study based on the following assumptions:

- The City of Troy Zoning Ordinance has two parking requirements for office uses, medical office building (MOB) and general office building. The MOB parking calculations are more conservative; therefore, it was assumed that 100% of the office space would be MOB.
- A maximum seating capacity of 245 per restaurant was assumed for each of the three (3) proposed fine/casual dining restaurants.
- The hotel is anticipated to be a business type hotel with 220 keys and based on similar size hotels, 12 employees are assumed. The hotel was also assumed to include a 100 seat fine dining restaurant.

The parking demand calculations for this PUD are summarized in **Table 11** which show the Ordinance requirements and the shared parking reduction in parking demand.

**Table 11: Parking Demand Summary**

Land Use	Size	City Ordinance Rates	City Ordinance Parking Demand (no shared)	Shared Parking Peak Demand (2:00 PM)
Office Space (MOB)	540,000 SF (GFA)	1 space per 200 GFA	2,700	2,700
Hotel	220 rooms	1 space per room	220	73
Hotel Employees	12	1 space per emp	12	11
Hotel Restaurant (Fine Dining)	100 Seats	1 space per 2 seats	50	1
Restaurant (Fine Dining)	735 Seats	1 space per 2 seats	368	223
<b>Total Parking (spaces)</b>			<b>3,350</b>	<b>3,008</b>



## 10.2 PARKING SUPPLY

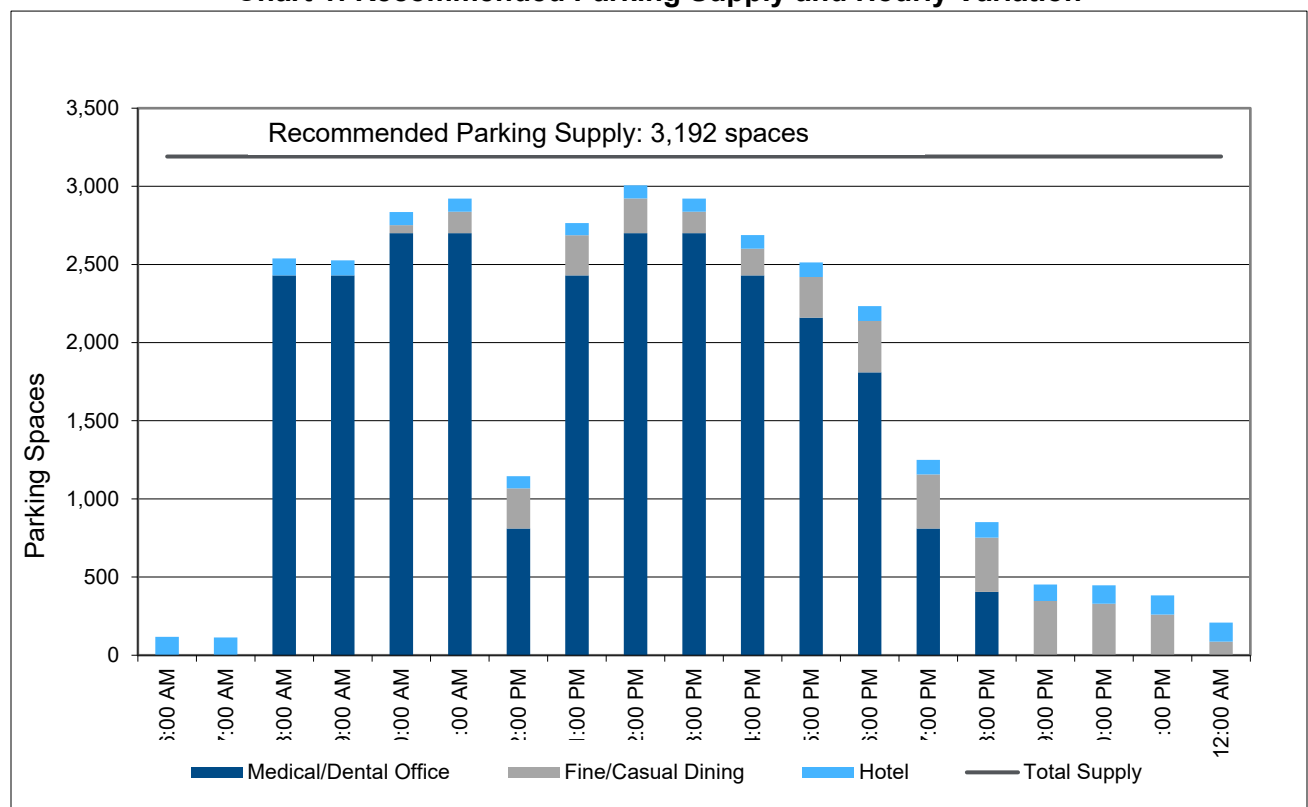
A parking lot is typically designed to accommodate 85-95% occupancy, depending on the proposed land use(s), layout, and parking management (self-parking, valet, active parking management, etc.). As vehicles traversing through the parking lot search for the open spaces or wait for vehicles to exit providing a buffer between supply and demand allows for easier turnover in the parking lot and less congestion. The proposed PUD includes the addition of 496 surface parking spaces and the remaining parking to be provided in one or more parking structures. For purposes of this analysis it was assumed that the surface parking would accommodate a 90% occupancy and the parking structures will have active parking management (*Active parking management is the dynamic management of parking to optimize performance and utilization of those facilities*), therefore could accommodate a 95% occupancy.

F&V used the peak shared parking demand to calculate the recommended parking for this PUD. The results of the analysis are summarized in **Table 12** and the resulting hourly variations in parking demand are shown on **Chart 1**.

**Table 12: Parking Supply Summary**

Parking Spaces	Utilization Rate	Effective Parking Supply	Recommended Parking Supply
Surface Parking	90%	446	496
Parking Garage	95%	2,562	2,696
<b>Total</b>		<b>3,008</b>	<b>3,192</b>

**Chart 1: Recommended Parking Supply and Hourly Variation**



Note: ULI assumes medical offices are closed during lunch hour (12:00 PM – 1:00 PM)

## 10.3 PROJECT PHASING

There is no identifiable phasing plan at this juncture of the proposed development. The overall development is assumed to be phased over time, based on tenant opportunities and economic viability. As various areas are developed, a phasing plan will be formulated in a manner where all parking and building requirements are met throughout each phase.

## 10 CONCLUSIONS

### 1. Masterplan Development Assumptions

- This analysis is based on the conceptual development plan included with the application. This study includes an evaluation of the highest trip generation for the potential uses of the site, thereby providing a conservative analysis. The land uses included herein were assumed for analysis purposes and do not necessarily reflect the actual proposed land uses on this site.
  - The proposed conceptual plan evaluated in this study includes the development of the approximately 23-acre parcel with office, hotel, and retail/restaurant land uses.
  - Parking for the site was assumed to be provided through a combination of parking structures and surface parking.
  - The site access will be finalized at the site plan phase of the project, however for this analysis access was assumed via five (5) site driveways; one (1) on SB Crooks Road, two (2) on Long Lake Road, and two (2) on Corporate Drive.

### 2. Trip Generation Comparison:

- A trip generation comparison analysis was performed for the proposed development to demonstrate the possible impact from another potential development that is currently permitted under the existing Office (O) zoning. The results of the analysis indicate that the proposed development will generate significantly less trips throughout the day and during both peak hours, as compared to a potential development currently permitted by right under the existing zoning.

### 3. Existing Conditions:

- All approaches and movements at the study intersections currently operate acceptably, at LOS D or better during both peak periods, with the exception of the following:
  - The overall intersection of Crooks Road & Corporate Drive/I-75 Ramp is currently operating at LOS E during the AM peak period with multiple approaches and movements operating at LOS E and LOS F during both AM and PM peak periods.
  - The southbound left-turn movement at the intersection of Corporate Drive & New King Drive is currently operating at LOS E during the AM peak period.
  - The southbound approach at the intersection of EB Long Lake Road and Investment Drive is currently operating at LOS E during the AM peak hour and LOS F during the PM peak hour.
  - The westbound right turn movement at the intersection of WB Long Lake Road & Corporate Drive is currently operating at LOS E during the AM peak hour.
- Review of SimTraffic network simulations indicates long vehicles queues at the signalized intersection of Crooks Road & Corporate Drive/I-75 Ramp during both peak periods. Microsimulations indicate acceptable operations at all other study intersections.

### 4. Background Conditions (*without the proposed development*):

- A conservative annual growth rate of 0.5% per year was applied to the 2020 traffic volumes in order to determine the background 2025 traffic volumes.
- The results of the background conditions analysis show that the study intersections will continue to operate in a similar manner to existing conditions, with some increases in the delay.

### 5. Future Conditions (*with the proposed development*):

- The results of the future conditions analysis show that, with the addition of the site-generated traffic, all study intersection approaches and movements will operate in manner similar to existing and background conditions, with the exception of the following:
  - The intersection of Crooks Road & Corporate Drive/I-75 Ramp is expected to operate at LOS F during both AM and PM peak periods with significant increases in delay for the eastbound approach during the PM peak hour and the westbound approach during the AM peak hour.



- The southbound left-turn traffic at the SB Crooks Road crossover to the intersection of NB Crooks Road & Tower Drive exceeds the available storage length on SB Crooks Road and impacts the upstream operation at the intersection of Crooks Road & Corporate Drive/I-75 Ramp, as well as creating potential safety concerns for through traffic along SB Crooks Road.
- The eastbound left turn movement at the SB-to-NB Crooks Road Crossover (N. of Long Lake Road) is expected to operate at LOS F during PM peak hour.
- The westbound right turn movement at the WB Long Lake Road & Corporate Drive intersection is expected to operate at LOS F during the AM peak hour.
- The eastbound right turn movement at the SB Crooks Road & E. Site Drive intersection is expected to operate at LOS F during the PM peak hour.
- The westbound left turn movement at the Corporate Drive & N. Site Drive intersection is expected to operate at LOS F during the PM peak hour.
- Review of SimTraffic network simulations indicates long vehicles queues at the signalized intersection of Crooks Road & Corporate Drive/I-75 Ramp during both peak periods. Additionally, long vehicle queues exceeding the available storage length were observed at the Tower Drive Crossover and the SB-to-NB Crossover located north of Long Lake Road. Microsimulations indicate acceptable operations at all other study intersections.

## **6. Access Management**

- The results of the analysis indicate that right-turn deceleration tapers are warranted at the proposed site driveways located on Corporate Drive and full-width right-turn deceleration lanes are warranted at the proposed site driveways located on Crooks Road and Long Lake Road.
- There are no site access driveways proposed at this time with this PUD. Therefore, the site access driveways will be further reviewed for access management and auxiliary lanes during the development of site plan(s) for this PUD.

## **7. Parking Study**

- A minimum of 3,192 parking spaces is recommended for this site,.
- The proposed PUD includes the addition both surface parking spaces and one or more parking structures.

## **8. Project Phasing**

- There is no identifiable phasing plan at this juncture of the proposed development. The overall development is assumed to be phased over time, based on tenant opportunities and economic viability. As various areas are developed, a phasing plan will be formulated in a manner where all parking and building requirements are met throughout each phase.

## 11 RECOMMENDATIONS

The recommendations of this TIS are as follows:

Recommended Intersection Improvement		Existing (2020)	Background (2025)	Future (2025)
<b># 10</b>	<b>Crooks Road &amp; Corporate Drive / I-75 Ramp</b>			
Eliminate the EB left-turn movement and the split phasing. <ul style="list-style-type: none"> <li>EB left-turns will be re-routed as EB right-turns and will utilize the SB-to-NB X/O at Tower Drive to continue NB on Crooks.</li> </ul>		X		
Construct an additional westbound left-turn lane. <ul style="list-style-type: none"> <li>Reconfigure WB approach to provide dual (2) LT lanes, one (1) through lane, one (1) shared through/right lane, and one (1) RT lane.</li> </ul>		X		
Construct an additional eastbound right-turn lane. <ul style="list-style-type: none"> <li>Reconfigure EB approach to provide two (2) through lanes and dual (2) right-turn lanes.</li> </ul>				X
Construct an additional northbound right-turn lane. <ul style="list-style-type: none"> <li>Reconfigure NB approach to provide three (4) through lanes and dual (2) right-turn lanes.</li> </ul>				X
Extend the southbound left-turn storage length (~200 feet).				X
<b># 30</b>	<b>NB Crooks Road &amp; Tower Drive</b>			
Construct an additional southbound left-turn lane.				X
<b># 50</b>	<b>SB-to-NB Crooks Road X/O N. of Long Lake Road</b>			
Construct an additional southbound left-turn lane.				X
<b># 120</b>	<b>WB Long Lake Road &amp; Corporate Drive</b>			
Construct an additional eastbound left-turn lane.				X
<b># 160</b>	<b>SB Crooks Road &amp; E. Site Drive</b>			
Construct dual (2) eastbound right-turn egress lanes.				X
Construct a southbound right-turn deceleration lane on Crooks Road.				X
<b># 170</b>	<b>Corporate Drive &amp; N. Site Drive</b>			
Construct exclusive westbound left- and right-turn egress lanes.				X
<b># 180</b>	<b>Corporate Drive &amp; W. Site Drive</b>			
Construct a northbound right-turn deceleration lane on Corporate Drive.				X
<b># 190</b>	<b>WB Long Lake Road &amp; SW. Site Drive</b>			
Construct a westbound right-turn deceleration lane on Long Lake Road.				X
<b># 200</b>	<b>WB Long Lake Road &amp; SE. Site Drive</b>			
Construct dual (2) southbound right-turn egress lanes.				X
Construct a westbound right-turn deceleration lane on Long Lake Road.				X



## **Appendix A**

# **BACKGROUND INFORMATION**

# Traffic Data Collection, LLC

www.tdccounts.com

Phone: 586.786-5407

Traffic Study Performed For:

**FLEIS & VANDENBRINK**



**Project: Troy Long Lk. PUD Traffic Study**  
**Study: 4 Hr. Video Turning Movement Count**  
**Weather: Pt. Sunny, Dry Deg's 60s**  
**Count By Miovision Video VCU 24L SW**

**File Name : TMC\_1 Corporate & New King\_10-7-20**  
**Site Code : TMC\_1**  
**Start Date : 10/7/2020**  
**Page No : 1**

4 Hour video traffic study was conducted during typical weekday (Wednesday) from 7:00 AM - 9:00 AM morning & 4:00 PM - 6:00 PM afternoon peak hours, while school was in session during COVID 19.

Groups Printed- Pass Cars - Single Units - Heavy Trucks - Peds

	New King Drive Southbound					Corporate Drive Westbound					New King Drive Northbound					Corporate Drive Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	UTurns	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	0	0	0	0	0	2	27	0	0	29	0	0	0	0	0	0	7	3	0	10	39
07:15 AM	1	0	1	0	2	3	24	1	0	28	0	0	0	0	0	0	5	7	0	12	42
07:30 AM	4	0	2	0	6	1	25	0	0	26	0	0	0	0	0	0	10	9	0	19	51
07:45 AM	3	0	1	0	4	3	43	0	0	46	0	0	0	0	0	0	13	18	0	31	81
Total	8	0	4	0	12	9	119	1	0	129	0	0	0	0	0	0	35	37	0	72	213
08:00 AM	7	0	4	0	11	4	40	0	0	44	0	0	0	0	0	0	9	15	0	24	79
08:15 AM	3	0	1	0	4	6	58	0	0	64	0	0	0	0	0	0	17	8	0	25	93
08:30 AM	4	0	0	0	4	0	30	0	0	30	0	0	0	0	0	0	14	6	0	20	54
08:45 AM	2	0	3	0	5	6	44	0	0	50	0	0	0	0	0	0	9	13	0	22	77
Total	16	0	8	0	24	16	172	0	0	188	0	0	0	0	0	0	49	42	0	91	303
*** BREAK ***																					
04:00 PM	6	0	5	1	12	0	29	0	0	29	0	0	0	0	0	0	44	3	0	47	88
04:15 PM	5	0	5	0	10	1	25	0	0	26	0	0	0	0	0	0	39	5	0	44	80
04:30 PM	10	0	6	0	16	0	18	0	0	18	0	0	0	0	0	0	41	4	0	45	79
04:45 PM	8	0	7	0	15	0	23	2	0	25	0	0	0	0	0	0	41	7	0	48	88
Total	29	0	23	1	53	1	95	2	0	98	0	0	0	0	0	0	165	19	0	184	335
05:00 PM	11	0	6	1	18	1	21	0	0	22	0	0	0	0	0	0	60	3	0	63	103
05:15 PM	14	0	9	0	23	1	36	1	0	38	0	0	0	0	0	0	45	3	0	48	109
05:30 PM	8	0	3	0	11	0	25	0	0	25	0	0	0	0	0	0	53	7	0	60	96
05:45 PM	5	0	2	0	7	0	28	1	0	29	0	0	0	0	0	0	39	1	0	40	76
Total	38	0	20	1	59	2	110	2	0	114	0	0	0	0	0	0	197	14	0	211	384
Grand Total	91	0	55	2	148	28	496	5	0	529	0	0	0	0	0	0	446	112	0	558	1235
Apprch %	61.5	0	37.2	1.4		5.3	93.8	0.9	0		0	0	0	0		0	79.9	20.1	0		
Total %	7.4	0	4.5	0.2	12	2.3	40.2	0.4	0	42.8	0	0	0	0	0	0	36.1	9.1	0	45.2	
Pass Cars	90	0	52	0	142	25	486	5	0	516	0	0	0	0	0	0	440	111	0	551	1209
% Pass Cars	98.9	0	94.5	0	95.9	89.3	98	100	0	97.5	0	0	0	0	0	0	98.7	99.1	0	98.7	97.9
Single Units	1	0	3	0	4	2	7	0	0	9	0	0	0	0	0	0	4	1	0	5	18
% Single Units	1.1	0	5.5	0	2.7	7.1	1.4	0	0	1.7	0	0	0	0	0	0	0.9	0.9	0	0.9	1.5
Heavy Trucks	0	0	0	0	0	1	3	0	0	4	0	0	0	0	0	0	2	0	0	2	6
% Heavy Trucks	0	0	0	0	0	3.6	0.6	0	0	0.8	0	0	0	0	0	0	0.4	0	0	0.4	0.5
Peds	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
% Peds	0	0	0	100	1.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2

TDC Traffic Comments: Non-signalized "T" intersection. Corporate Drive is divided blvd.. Video VCU camera was located within SW intersection quadrant. Corporate Drive & I-75 was under road construction during study (SB I-75 Ramps were closed to traffic). Note: Peds. are excluded from peak hour reports. Traffic study was performed for Troy Long Lake PUD Traffic Impact Study for Fleis & Vandenbrink.



# Traffic Data Collection, LLC

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Phone: 586.786-5407

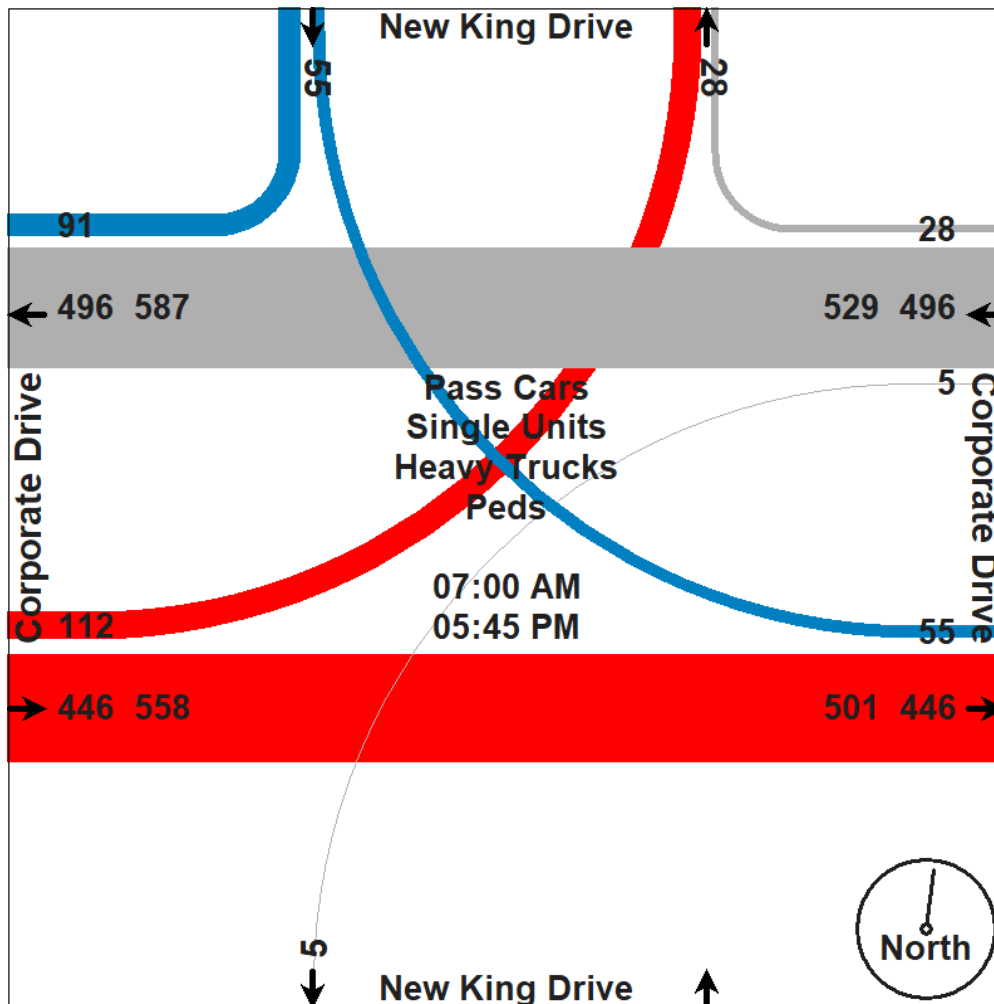
Traffic Study Performed For:

**FLEIS & VANDENBRINK**



Project: Troy Long Lk. PUD Traffic Study  
Study: 4 Hr. Video Turning Movement Count  
Weather: Pt. Sunny, Dry Deg's 60s  
Count By: Miovision Video VCU 24L SW

File Name : TMC\_1 Corporate & New King\_10-7-20  
Site Code : TMC\_1  
Start Date : 10/7/2020  
Page No : 2



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Traffic Study Performed For:

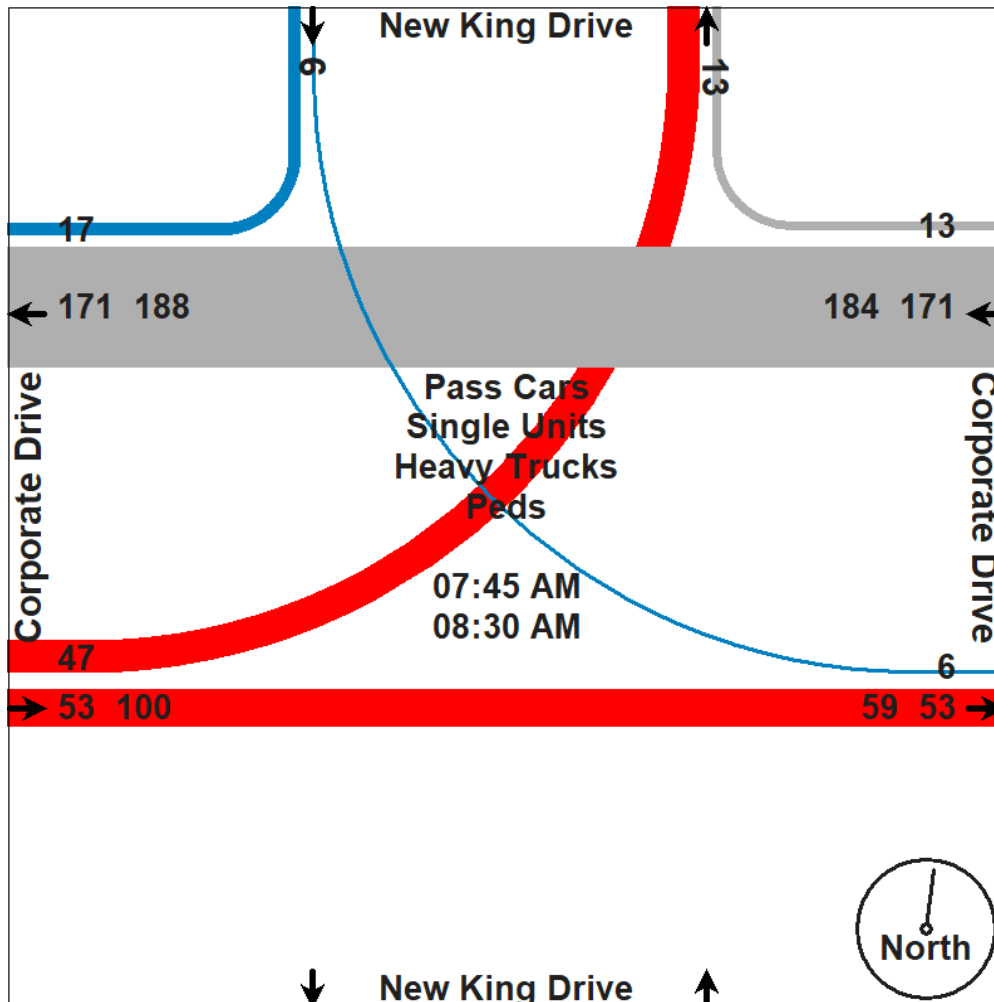
**FLEIS & VANDENBRINK**



Project: Troy Long Lk. PUD Traffic Study  
Study: 4 Hr. Video Turning Movement Count  
Weather: Pt. Sunny, Dry Deg's 60s  
Count By Miovision Video VCU 24L SW

File Name : TMC\_1 Corporate & New King\_10-7-20  
Site Code : TMC\_1  
Start Date : 10/7/2020  
Page No : 3

	New King Drive Southbound				Corporate Drive Westbound				New King Drive Northbound				Corporate Drive Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	UTurns	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 11:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:45 AM																	
07:45 AM	3	0	1	4	3	43	0	46	0	0	0	0	0	13	18	31	81
08:00 AM	7	0	4	11	4	40	0	44	0	0	0	0	0	9	15	24	79
08:15 AM	3	0	1	4	6	58	0	64	0	0	0	0	0	17	8	25	93
08:30 AM	4	0	0	4	0	30	0	30	0	0	0	0	0	14	6	20	54
Total Volume	17	0	6	23	13	171	0	184	0	0	0	0	0	53	47	100	307
% App. Total	73.9	0	26.1		7.1	92.9	0		0	0	0	0	0	53	47		
PHF	.607	.000	.375	.523	.542	.737	.000	.719	.000	.000	.000	.000	.000	.779	.653	.806	.825
Pass Cars	17	0	6	23	11	167	0	178	0	0	0	0	0	52	47	99	300
% Pass Cars	100	0	100	100	84.6	97.7	0	96.7	0	0	0	0	0	98.1	100	99.0	97.7
Single Units	0	0	0	0	1	3	0	4	0	0	0	0	0	0	0	0	4
% Single Units	0	0	0	0	7.7	1.8	0	2.2	0	0	0	0	0	0	0	0	1.3
Heavy Trucks	0	0	0	0	1	1	0	2	0	0	0	0	0	1	0	1	3
% Heavy Trucks	0	0	0	0	7.7	0.6	0	1.1	0	0	0	0	0	1.9	0	1.0	1.0
Peds	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Peds	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0





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Traffic Study Performed For:

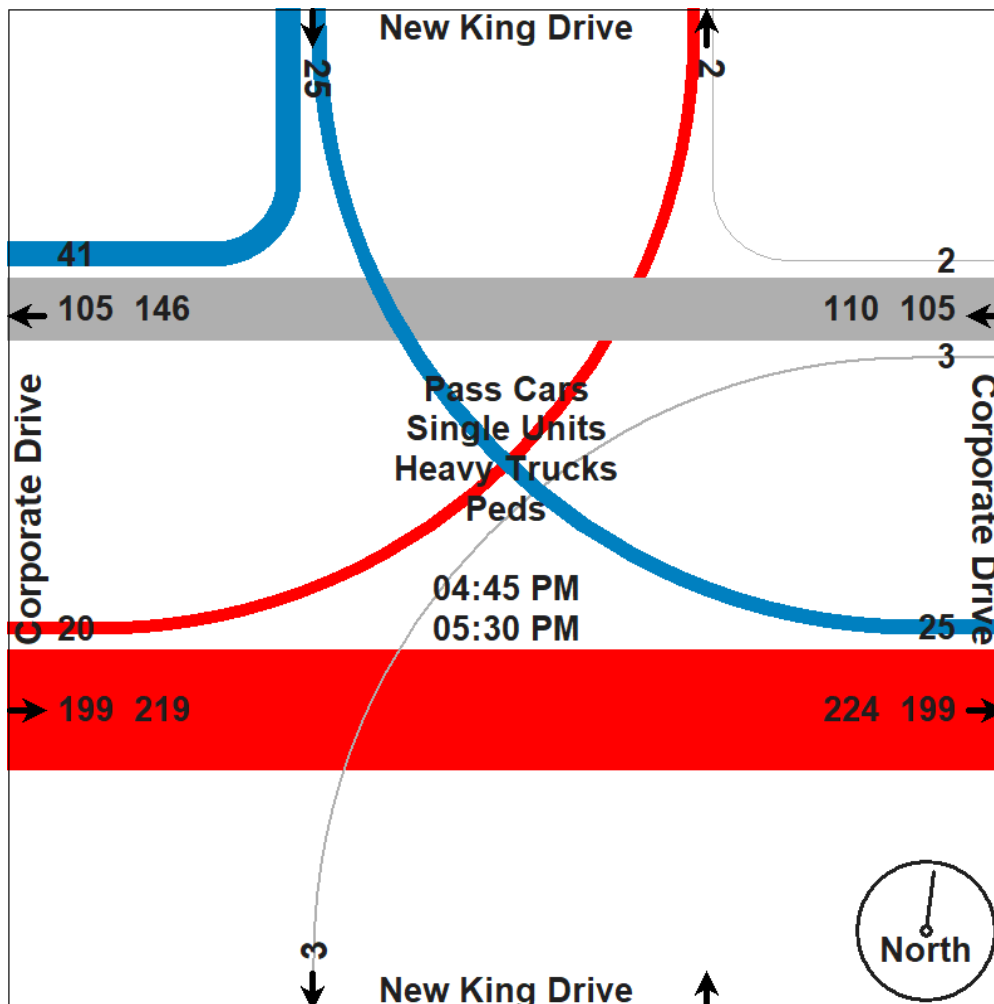
**FLEIS & VANDENBRINK**



**Project:** Troy Long Lk. PUD Traffic Study  
**Study:** 4 Hr. Video Turning Movement Count  
**Weather:** Pt. Sunny, Dry Deg's 60s  
**Count By:** Miovision Video VCU 24L SW

**File Name :** TMC\_1 Corporate & New King\_10-7-20  
**Site Code :** TMC\_1  
**Start Date :** 10/7/2020  
**Page No :** 4

	New King Drive Southbound				Corporate Drive Westbound				New King Drive Northbound				Corporate Drive Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	UTurns	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:45 PM																	
04:45 PM	8	0	7	15	0	23	2	25	0	0	0	0	0	41	7	48	88
05:00 PM	11	0	6	17	1	21	0	22	0	0	0	0	0	60	3	63	102
05:15 PM	14	0	9	23	1	36	1	38	0	0	0	0	0	45	3	48	109
05:30 PM	8	0	3	11	0	25	0	25	0	0	0	0	0	53	7	60	96
Total Volume	41	0	25	66	2	105	3	110	0	0	0	0	0	199	20	219	395
% App. Total	62.1	0	37.9		1.8	95.5	2.7		0	0	0		0	90.9	9.1		
PHF	.732	.000	.694	.717	.500	.729	.375	.724	.000	.000	.000	.000	.000	.829	.714	.869	.906
Pass Cars	40	0	24	64	2	103	3	108	0	0	0	0	0	197	20	217	389
% Pass Cars	97.6	0	96.0	97.0	100	98.1	100	98.2	0	0	0	0	0	99.0	100	99.1	98.5
Single Units	1	0	1	2	0	2	0	2	0	0	0	0	0	1	0	1	5
% Single Units	2.4	0	4.0	3.0	0	1.9	0	1.8	0	0	0	0	0	0.5	0	0.5	1.3
Heavy Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1
% Heavy Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0	0.5	0.3
Peds	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Peds	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



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Traffic Study Performed For:

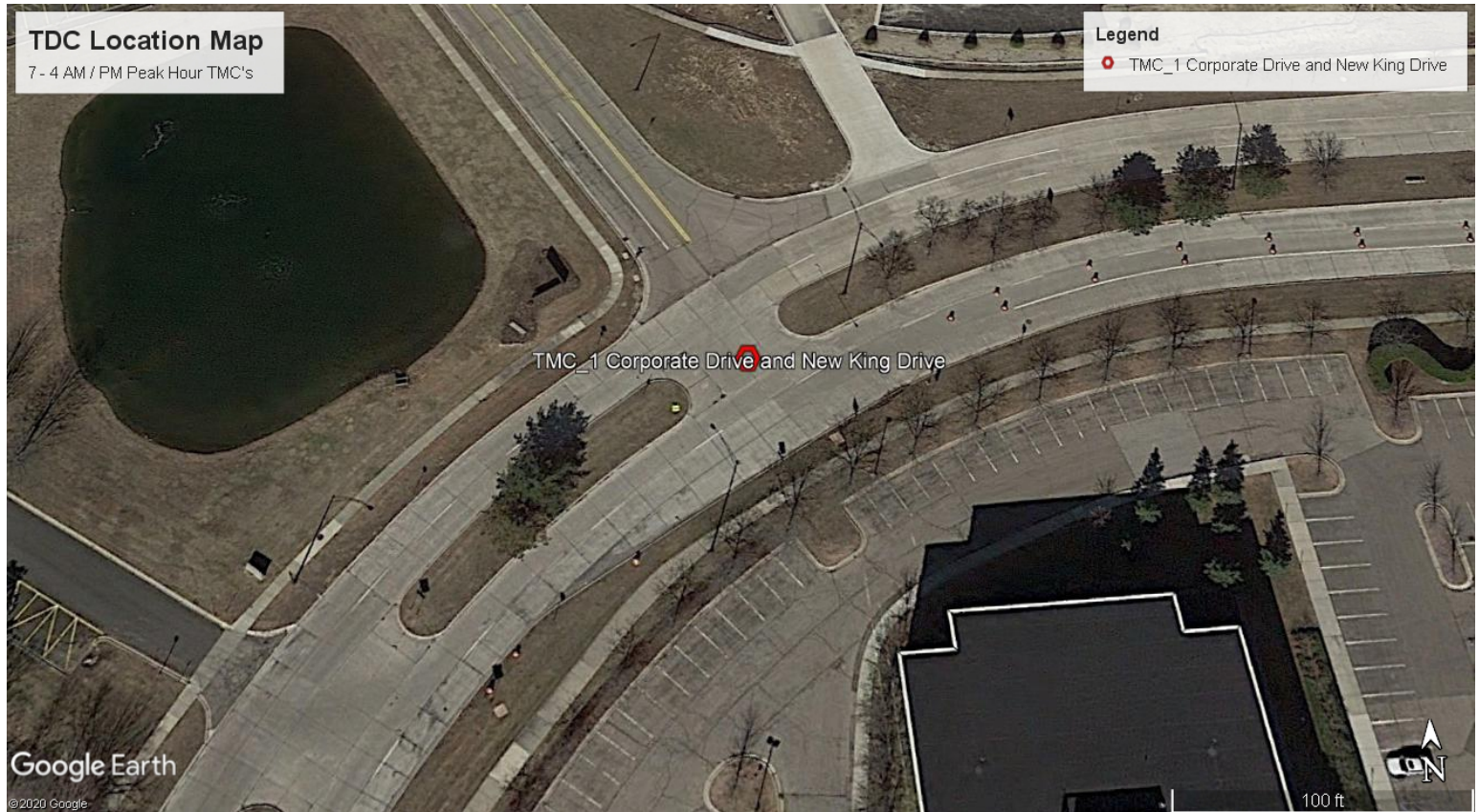
**FLEIS & VANDENBRINK**



**Project:** Troy Long Lk. PUD Traffic Study  
**Study:** 4 Hr. Video Turning Movement Count  
**Weather:** Pt. Sunny, Dry Deg's 60s  
**Count By:** Miovision Video VCU 24L SW

**File Name :** TMC\_1 Corporate & New King\_10-7-20  
**Site Code :** TMC\_1  
**Start Date :** 10/7/2020  
**Page No :** 5

## Aerial Photo





# Traffic Data Collection, LLC

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Traffic Study Performed For:

**Fleis & Vandenbrink**



**Project: Troy Traffic Impact Study**  
**Study: 4 Hr. Video Turning Movement Count**  
**Weather: Sunny/Cldy. Dry Deg's 80's**  
**Count By Miovision Video VCU 4BT NE**

**File Name : TMC\_1 Tower & NB Crooks\_9-13-18**  
**Site Code : TMC\_1**  
**Start Date : 9/13/2018**  
**Page No : 1**

4 Hour traffic study was conducted during typical weekday (Tuesday-Thursday) from 7:00 AM - 9:00 AM morning & 4:00 PM - 6:00 PM afternoon peak hours, while school was in session.

Groups Printed- Pass Cars - Single Units - Heavy Trucks - Peds

	NB Crooks Road Southbound					Tower Drive Westbound					NB Crooks Road Northbound					SB>NB Cross Over Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	0	0	0	0	0	24	0	0	0	24	7	117	0	0	124	0	87	13	0	100	248
07:15 AM	0	0	0	0	0	33	0	0	0	33	19	166	0	0	185	0	132	21	0	153	371
07:30 AM	0	0	0	0	0	44	0	0	0	44	16	162	0	0	178	0	132	18	0	150	372
07:45 AM	0	0	0	0	0	41	0	0	0	41	30	190	0	0	220	0	163	16	0	179	440
Total	0	0	0	0	0	142	0	0	0	142	72	635	0	0	707	0	514	68	0	582	1431
08:00 AM	0	0	0	0	0	66	0	0	3	69	35	170	0	3	208	0	136	16	0	152	429
08:15 AM	0	0	0	0	0	37	0	0	0	37	27	190	0	0	217	0	150	13	0	163	417
08:30 AM	0	0	0	0	0	49	0	0	0	49	15	186	0	0	201	0	122	21	0	143	393
08:45 AM	0	0	0	0	0	42	0	0	0	42	18	167	0	0	185	0	126	22	0	148	375
Total	0	0	0	0	0	194	0	0	3	197	95	713	0	3	811	0	534	72	0	606	1614
*** BREAK ***																					
04:00 PM	0	0	0	0	0	173	0	0	0	173	5	358	0	0	363	0	13	27	0	40	576
04:15 PM	0	0	0	0	0	162	0	0	0	162	6	355	0	0	361	0	19	9	0	28	551
04:30 PM	0	0	0	0	0	174	0	0	0	174	4	382	0	0	386	0	24	23	0	47	607
04:45 PM	0	0	0	0	0	136	0	0	0	136	6	349	0	0	355	0	22	21	0	43	534
Total	0	0	0	0	0	645	0	0	0	645	21	1444	0	0	1465	0	78	80	0	158	2268
05:00 PM	0	0	0	0	0	206	0	0	0	206	3	396	0	0	399	0	35	36	0	71	676
05:15 PM	0	0	0	0	0	131	0	0	0	131	14	408	0	0	422	0	28	26	0	54	607
05:30 PM	0	0	0	0	0	125	0	0	0	125	5	391	0	0	396	0	30	22	0	52	573
05:45 PM	0	0	0	0	0	90	0	0	0	90	8	352	0	0	360	0	25	23	0	48	498
Total	0	0	0	0	0	552	0	0	0	552	30	1547	0	0	1577	0	118	107	0	225	2354
Grand Total	0	0	0	0	0	1533	0	0	3	1536	218	4339	0	3	4560	0	1244	327	0	1571	7667
Apprch %	0	0	0	0		99.8	0	0	0.2		4.8	95.2	0	0.1		0	79.2	20.8	0		
Total %	0	0	0	0	0	20	0	0	0	20	2.8	56.6	0	0	59.5	0	16.2	4.3	0	20.5	
Pass Cars	0	0	0	0	0	1531	0	0	0	1531	218	4285	0	0	4503	0	1243	327	0	1570	7604
% Pass Cars	0	0	0	0	0	99.9	0	0	0	99.7	100	98.8	0	0	98.8	0	99.9	100	0	99.9	99.2
Single Units	0	0	0	0	0	2	0	0	0	2	0	35	0	0	35	0	0	0	0	0	37
% Single Units	0	0	0	0	0	0.1	0	0	0	0.1	0	0.8	0	0	0.8	0	0	0	0	0	0.5
Heavy Trucks	0	0	0	0	0	0	0	0	0	0	0	19	0	0	19	0	1	0	0	1	20
% Heavy Trucks	0	0	0	0	0	0	0	0	0	0	0	0.4	0	0	0.4	0	0.1	0	0	0.1	0.3
Peds	0	0	0	0	0	0	0	0	3	3	0	0	0	3	3	0	0	0	0	0	6
% Peds	0	0	0	0	0	0	0	0	100	0.2	0	0	0	100	0.1	0	0	0	0	0	0.1

TDC Traffic Comments: Signalized ntersection. Video VCU camera was located within NE intersection quadrant. Note: Peds. are excluded from peak hour reports.

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Phone: 586.786-5407

Traffic Study Performed For:

**Fleis & Vandenbrink**



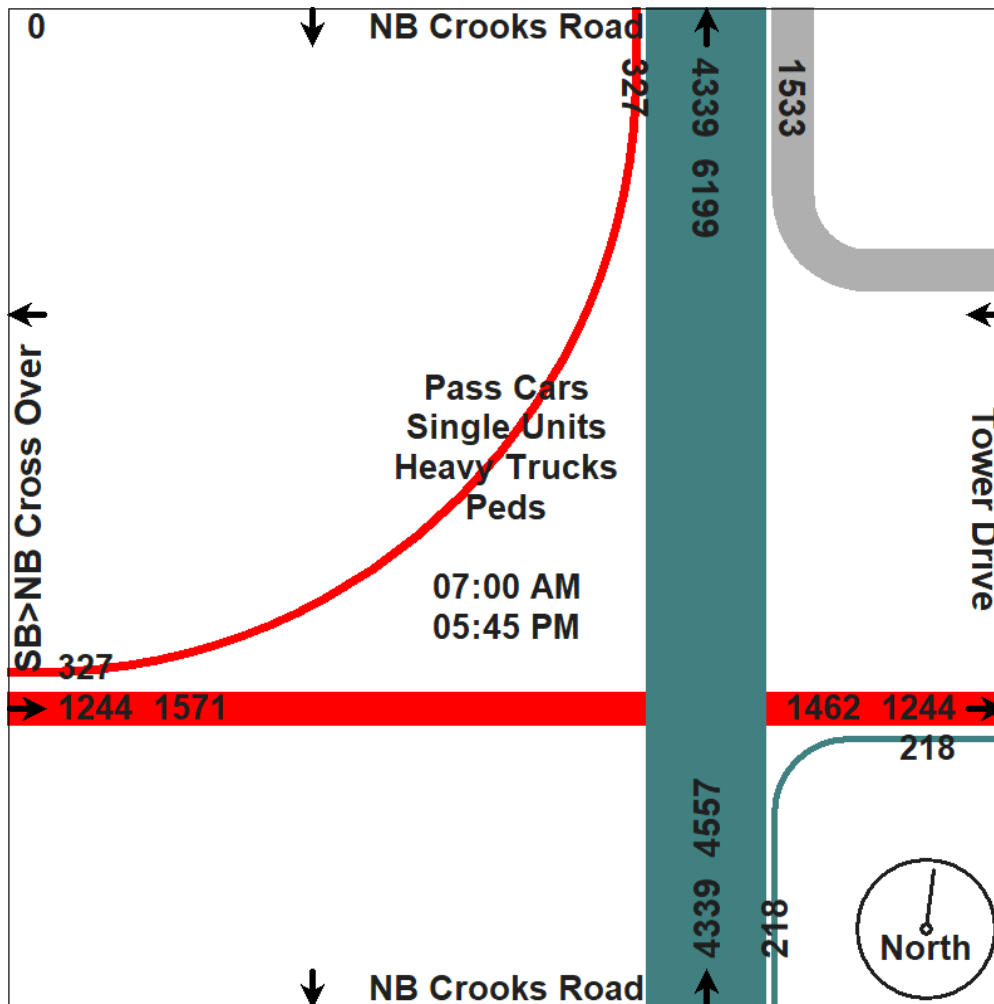
Project: Troy Traffic Impact Study  
Study: 4 Hr. Video Turning Movement Count  
Weather: Sunny/Cldy. Dry Deg's 80's  
Count By: Miovision Video VCU 4BT NE

File Name : TMC\_1 Tower & NB Crooks\_9-13-18

Site Code : TMC\_1

Start Date : 9/13/2018

Page No : 2





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Traffic Study Performed For:

**Fleis & Vandenbrink**



Project: Troy Traffic Impact Study

Study: 4 Hr. Video Turning Movement Count

Weather: Sunny/Cldy. Dry Deg's 80's

Count By Miovision Video VCU 4BT NE

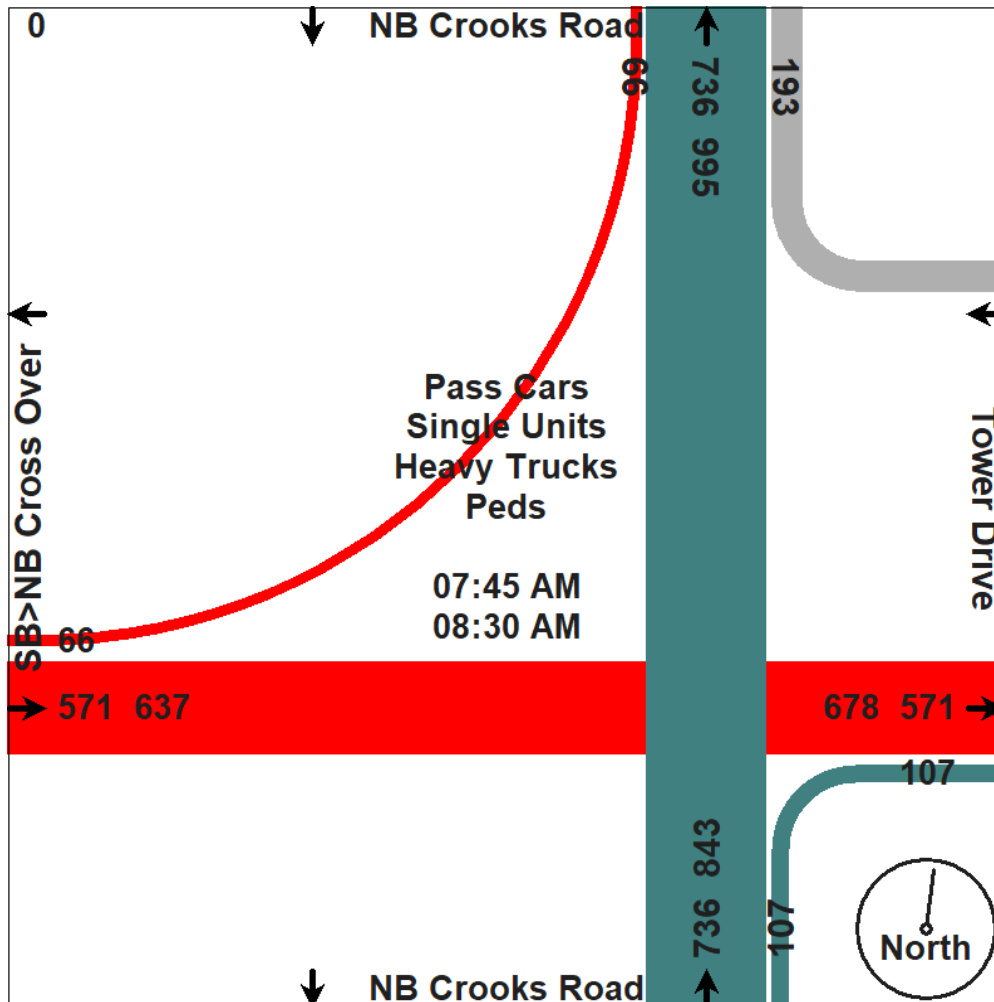
File Name : TMC\_1 Tower & NB Crooks\_9-13-18

Site Code : TMC\_1

Start Date : 9/13/2018

Page No : 3

	NB Crooks Road Southbound				Tower Drive Westbound				NB Crooks Road Northbound				SB>NB Cross Over Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 11:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:45 AM																	
07:45 AM	0	0	0	0	41	0	0	41	30	190	0	220	0	163	16	179	440
08:00 AM	0	0	0	0	66	0	0	66	35	170	0	205	0	136	16	152	423
08:15 AM	0	0	0	0	37	0	0	37	27	190	0	217	0	150	13	163	417
08:30 AM	0	0	0	0	49	0	0	49	15	186	0	201	0	122	21	143	393
Total Volume	0	0	0	0	193	0	0	193	107	736	0	843	0	571	66	637	1673
% App. Total	0	0	0	0	100	0	0	100	12.7	87.3	0	100	0	89.6	10.4	100	100
PHF	.000	.000	.000	.000	.731	.000	.000	.731	.764	.968	.000	.958	.000	.876	.786	.890	.951
Pass Cars	0	0	0	0	192	0	0	192	107	717	0	824	0	570	66	636	1652
% Pass Cars	0	0	0	0	99.5	0	0	99.5	100	97.4	0	97.7	0	99.8	100	99.8	98.7
Single Units	0	0	0	0	1	0	0	1	0	10	0	10	0	0	0	0	11
% Single Units	0	0	0	0	0.5	0	0	0.5	0	1.4	0	1.2	0	0	0	0	0.7
Heavy Trucks	0	0	0	0	0	0	0	0	0	9	0	9	0	1	0	1	10
% Heavy Trucks	0	0	0	0	0	0	0	0	0	1.2	0	1.1	0	0.2	0	0.2	0.6
Peds	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Peds	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



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Traffic Study Performed For:

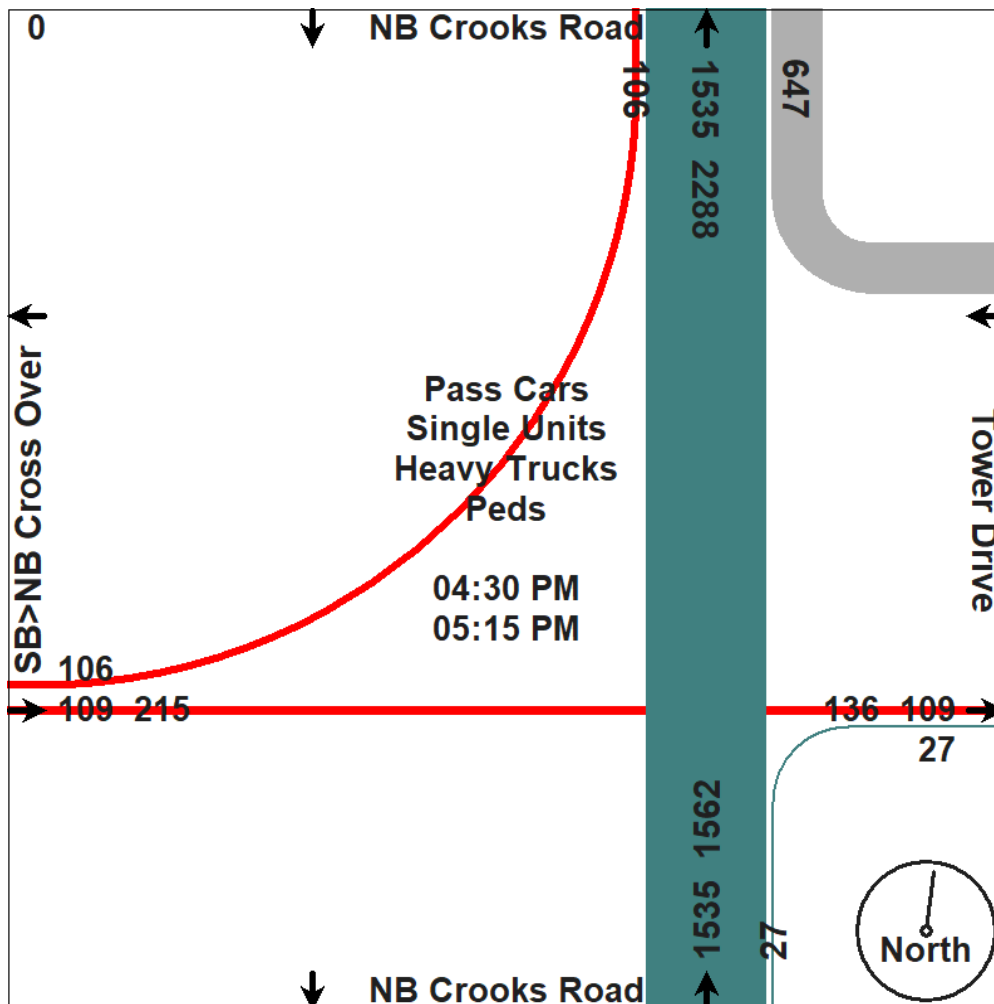
**Fleis & Vandenbrink**



**Project:** Troy Traffic Impact Study  
**Study:** 4 Hr. Video Turning Movement Count  
**Weather:** Sunny/Cldy. Dry Deg's 80's  
**Count By:** Miovision Video VCU 4BT NE

**File Name :** TMC\_1 Tower & NB Crooks\_9-13-18  
**Site Code :** TMC\_1  
**Start Date :** 9/13/2018  
**Page No :** 4

	NB Crooks Road Southbound				Tower Drive Westbound				NB Crooks Road Northbound				SB>NB Cross Over Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:30 PM																	
04:30 PM	0	0	0	0	174	0	0	174	4	382	0	386	0	24	23	47	607
04:45 PM	0	0	0	0	136	0	0	136	6	349	0	355	0	22	21	43	534
05:00 PM	0	0	0	0	<b>206</b>	0	0	<b>206</b>	3	396	0	399	0	<b>35</b>	<b>36</b>	<b>71</b>	<b>676</b>
05:15 PM	0	0	0	0	131	0	0	131	<b>14</b>	<b>408</b>	0	<b>422</b>	0	28	26	54	607
Total Volume	0	0	0	0	647	0	0	647	27	1535	0	1562	0	109	106	215	2424
% App. Total	0	0	0	0	100	0	0	100	1.7	98.3	0	100	0	50.7	49.3	100	100
PHF	.000	.000	.000	.000	.785	.000	.000	.785	.482	.941	.000	.925	.000	.779	.736	.757	.896
Pass Cars	0	0	0	0	647	0	0	647	27	1525	0	1552	0	109	106	215	2414
% Pass Cars	0	0	0	0	100	0	0	100	100	99.3	0	99.4	0	100	100	100	99.6
Single Units	0	0	0	0	0	0	0	0	0	7	0	7	0	0	0	0	7
% Single Units	0	0	0	0	0	0	0	0	0	0.5	0	0.4	0	0	0	0	0.3
Heavy Trucks	0	0	0	0	0	0	0	0	0	3	0	3	0	0	0	0	3
% Heavy Trucks	0	0	0	0	0	0	0	0	0	0.2	0	0.2	0	0	0	0	0.1
Peds	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Peds	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0





# Traffic Data Collection, LLC

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Phone: 586.786-5407

Traffic Study Performed For:

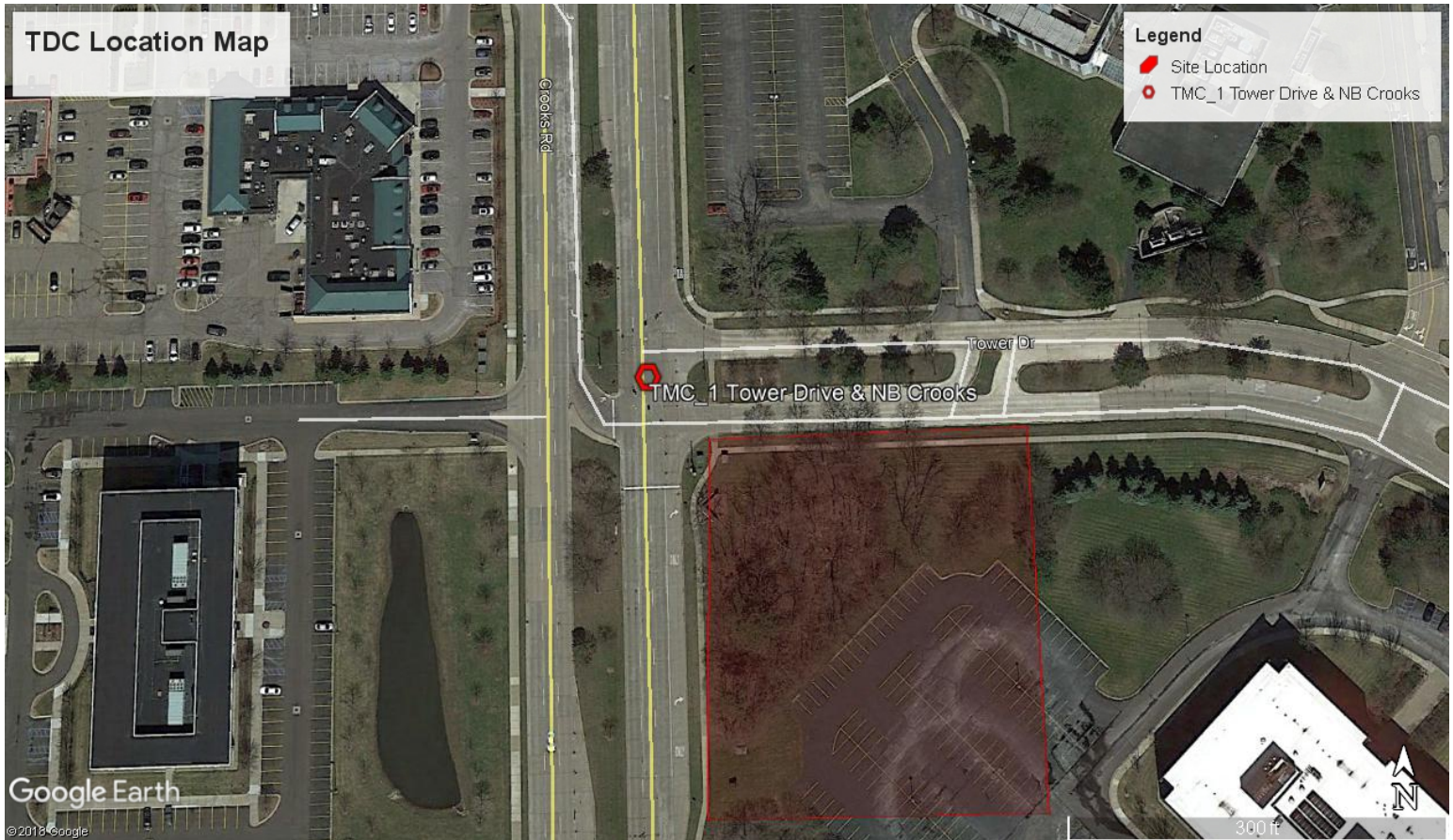
**Fleis & Vandenbrink**



Project: Troy Traffic Impact Study  
Study: 4 Hr. Video Turning Movement Count  
Weather: Sunny/Cldy. Dry Deg's 80's  
Count By Miovision Video VCU 4BT NE

File Name : TMC\_1 Tower & NB Crooks\_9-13-18  
Site Code : TMC\_1  
Start Date : 9/13/2018  
Page No : 5

## Aerial Photo



# Traffic Data Collection, LLC

www.tdccounts.com

Phone: 586.786-5407

Traffic Study Performed For:

**FLEIS & VANDENBRINK**



**Project: Troy Long Lk. PUD Traffic Study**  
**Study: 4 Hr. Video Turning Movement Count**  
**Weather: Pt. Sunny, Dry Deg's 60s**  
**Count By Miovision Video VCU 3DQ SE**

**File Name : TMC\_2 SB Crooks & NB\_SB XO\_N Long Lk\_10-7-20**  
**Site Code : TMC\_2**  
**Start Date : 10/7/2020**  
**Page No : 1**

4 Hour video traffic study was conducted during typical weekday (Wednesday) from 7:00 AM - 9:00 AM morning & 4:00 PM - 6:00 PM afternoon peak hours, while school was in session during COVID 19.

Groups Printed- Pass Cars - Single Units - Heavy Trucks - Peds

SB Crooks Road Southbound					NB>SB X/O_N Long Lk Westbound				SB Crooks Road Northbound				Int. Total
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	
07:00 AM	170	0	0	170	0	3	0	3	0	0	0	0	173
07:15 AM	194	0	0	194	0	3	0	3	0	0	0	0	197
07:30 AM	233	0	0	233	0	5	0	5	0	0	0	0	238
07:45 AM	285	0	0	285	0	7	0	7	0	0	0	0	292
Total	882	0	0	882	0	18	0	18	0	0	0	0	900
08:00 AM	234	0	0	234	0	8	0	8	0	0	0	0	242
08:15 AM	241	0	0	241	0	10	0	10	0	0	0	0	251
08:30 AM	278	0	0	278	0	5	0	5	0	0	0	0	283
08:45 AM	266	0	0	266	0	5	0	5	0	0	0	0	271
Total	1019	0	0	1019	0	28	0	28	0	0	0	0	1047
*** BREAK ***													
04:00 PM	154	0	0	154	0	6	0	6	0	0	0	0	160
04:15 PM	204	0	0	204	0	9	0	9	0	0	0	0	213
04:30 PM	176	0	0	176	0	6	0	6	0	0	0	0	182
04:45 PM	181	0	0	181	0	4	0	4	0	0	0	0	185
Total	715	0	0	715	0	25	0	25	0	0	0	0	740
05:00 PM	208	0	0	208	0	9	0	9	0	0	0	0	217
05:15 PM	225	0	0	225	0	7	0	7	0	0	0	0	232
05:30 PM	185	0	0	185	0	15	0	15	0	0	0	0	200
05:45 PM	165	0	0	165	0	4	0	4	0	0	0	0	169
Total	783	0	0	783	0	35	0	35	0	0	0	0	818
Grand Total	3399	0	0	3399	0	106	0	106	0	0	0	0	3505
Apprch %	100	0	0		0	100	0		0	0	0		
Total %	97	0	0	97	0	3	0	3	0	0	0	0	
Pass Cars	3320	0	0	3320	0	103	0	103	0	0	0	0	3423
% Pass Cars	97.7	0	0	97.7	0	97.2	0	97.2	0	0	0	0	97.7
Single Units	57	0	0	57	0	3	0	3	0	0	0	0	60
% Single Units	1.7	0	0	1.7	0	2.8	0	2.8	0	0	0	0	1.7
Heavy Trucks	22	0	0	22	0	0	0	0	0	0	0	0	22
% Heavy Trucks	0.6	0	0	0.6	0	0	0	0	0	0	0	0	0.6
Peds	0	0	0	0	0	0	0	0	0	0	0	0	0
% Peds	0	0	0	0	0	0	0	0	0	0	0	0	0

TDC Traffic Comments: Non-signalized intersection. Video VCU camera was located within SE intersection quadrant. I-75 was under reconstruction during study. Note: Peds. are excluded from peak hour reports. Traffic study was performed for Troy Long Lake PUD Traffic Impact Study for Fleis & Vandenbrink.



# Traffic Data Collection, LLC

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Phone: 586.786-5407

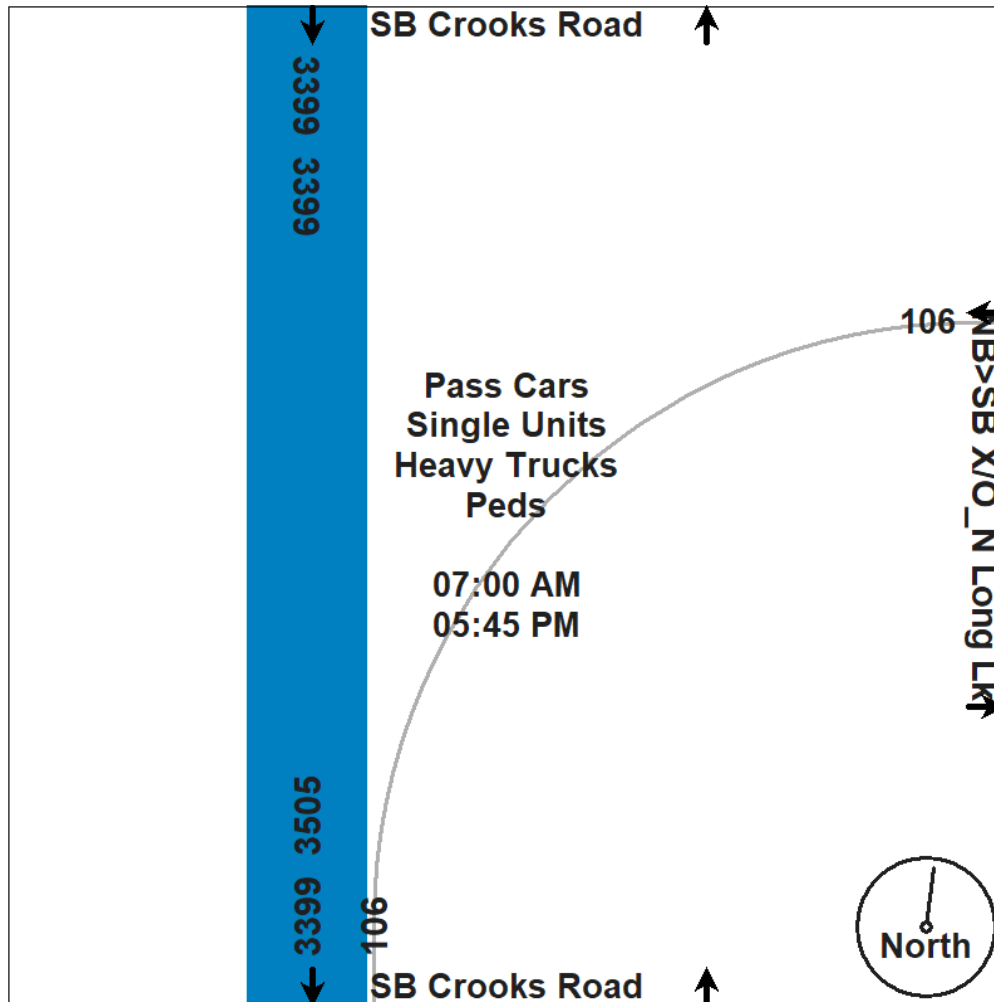
Traffic Study Performed For:

**FLEIS & VANDENBRINK**



Project: Troy Long Lk. PUD Traffic Study  
Study: 4 Hr. Video Turning Movement Count  
Weather: Pt. Sunny, Dry Deg's 60s  
Count By Mivision Video VCU 3DQ SE

File Name : TMC\_2 SB Crooks & NB\_SB XO\_N Long Lk\_10-7-20  
Site Code : TMC\_2  
Start Date : 10/7/2020  
Page No : 2



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Phone: 586.786-5407

Traffic Study Performed For:

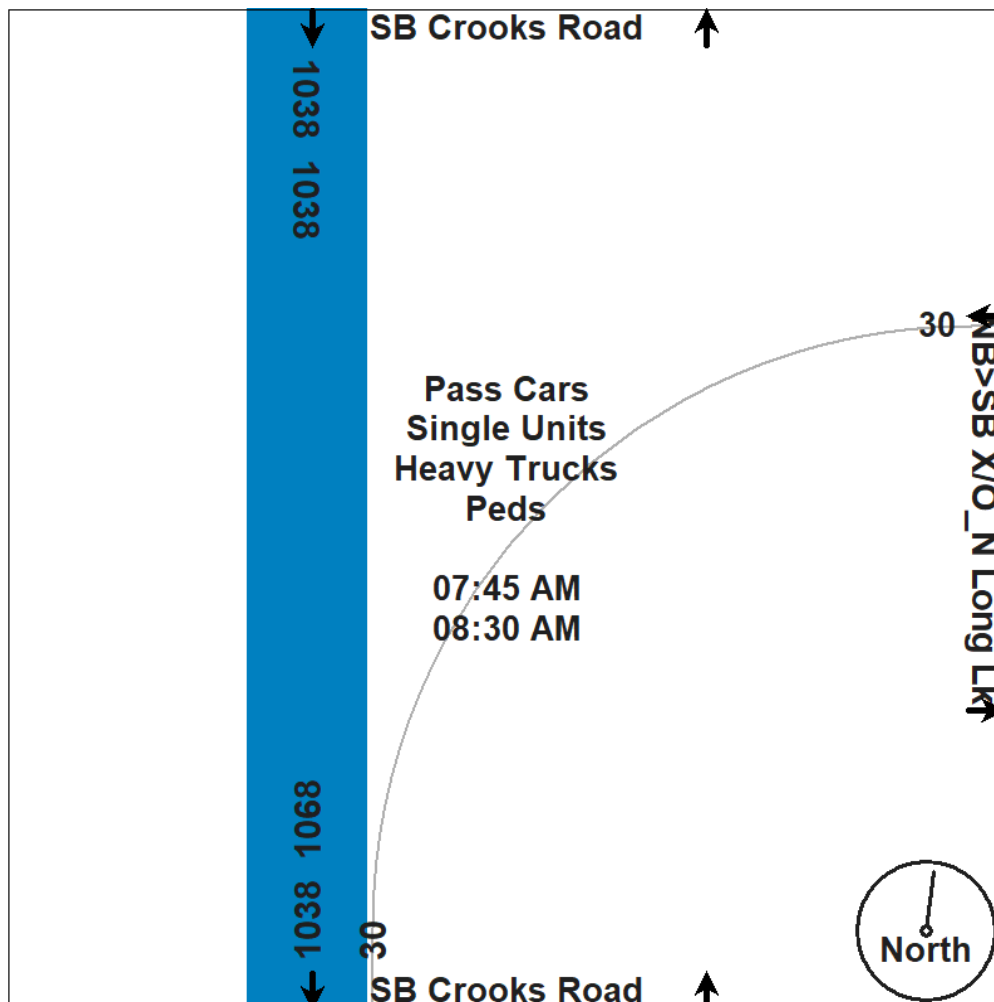
**FLEIS & VANDENBRINK**



Project: Troy Long Lk. PUD Traffic Study  
Study: 4 Hr. Video Turning Movement Count  
Weather: Pt. Sunny, Dry Deg's 60s  
Count By Miovision Video VCU 3DQ SE

File Name : TMC\_2 SB Crooks & NB\_SB XO\_N Long Lk\_10-7-20  
Site Code : TMC\_2  
Start Date : 10/7/2020  
Page No : 3

	SB Crooks Road Southbound			NB>SB X/O_N Long Lk Westbound			SB Crooks Road Northbound			
Start Time	Thru	Left	App. Total	Right	Left	App. Total	Right	Thru	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 11:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:45 AM										
07:45 AM	285	0	285	0	7	7	0	0	0	292
08:00 AM	234	0	234	0	8	8	0	0	0	242
08:15 AM	241	0	241	0	10	10	0	0	0	251
08:30 AM	278	0	278	0	5	5	0	0	0	283
Total Volume	1038	0	1038	0	30	30	0	0	0	1068
% App. Total	100	0		0	100		0	0		
PHF	.911	.000	.911	.000	.750	.750	.000	.000	.000	.914
Pass Cars	1012	0	1012	0	30	30	0	0	0	1042
% Pass Cars	97.5	0	97.5	0	100	100	0	0	0	97.6
Single Units	19	0	19	0	0	0	0	0	0	19
% Single Units	1.8	0	1.8	0	0	0	0	0	0	1.8
Heavy Trucks	7	0	7	0	0	0	0	0	0	7
% Heavy Trucks	0.7	0	0.7	0	0	0	0	0	0	0.7
Peds	0	0	0	0	0	0	0	0	0	0
% Peds	0	0	0	0	0	0	0	0	0	0





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Traffic Study Performed For:

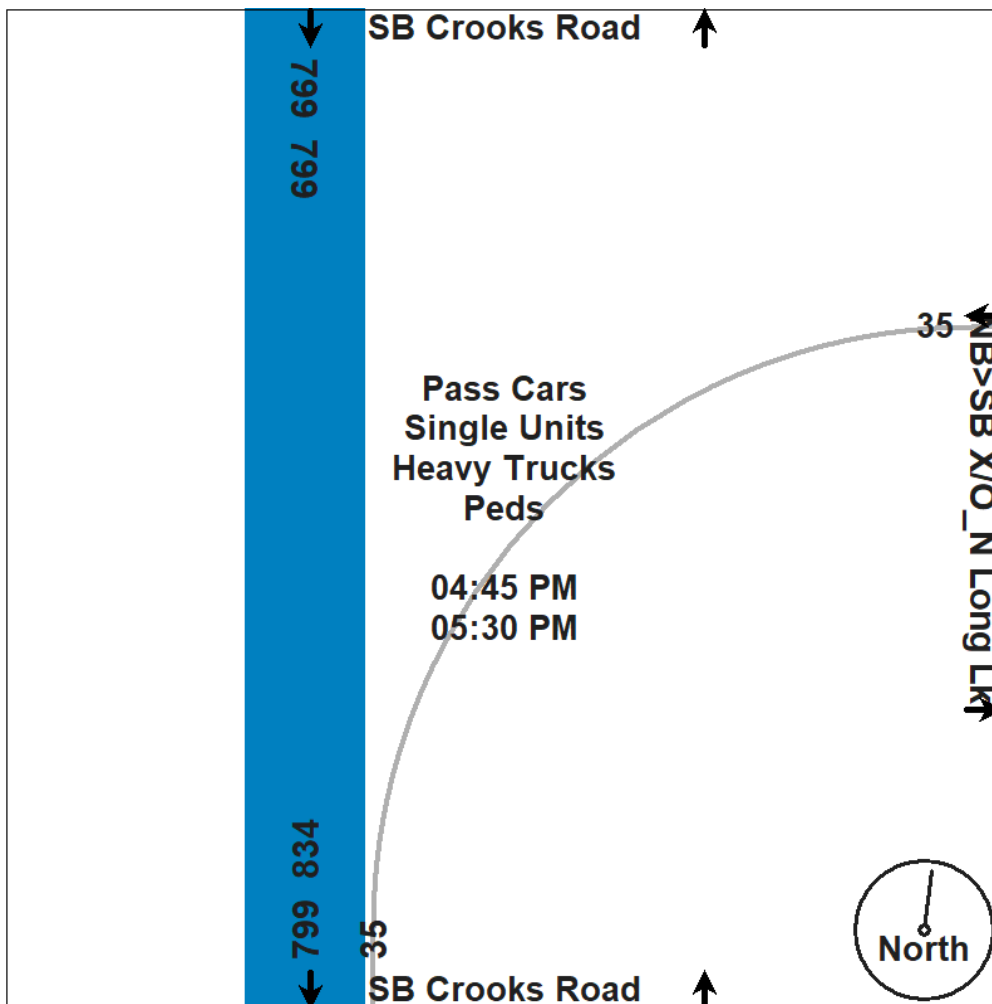
**FLEIS & VANDENBRINK**



Project: Troy Long Lk. PUD Traffic Study  
Study: 4 Hr. Video Turning Movement Count  
Weather: Pt. Sunny, Dry Deg's 60s  
Count By Miovision Video VCU 3DQ SE

File Name : TMC\_2 SB Crooks & NB\_SB XO\_N Long Lk\_10-7-20  
Site Code : TMC\_2  
Start Date : 10/7/2020  
Page No : 4

	SB Crooks Road Southbound			NB>SB X/O_N Long Lk Westbound			SB Crooks Road Northbound			
Start Time	Thru	Left	App. Total	Right	Left	App. Total	Right	Thru	App. Total	Int. Total
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 04:45 PM										
04:45 PM	181	0	181	0	4	4	0	0	0	185
05:00 PM	208	0	208	0	9	9	0	0	0	217
05:15 PM	<b>225</b>	0	<b>225</b>	0	7	7	0	0	0	<b>232</b>
05:30 PM	185	0	185	0	<b>15</b>	<b>15</b>	0	0	0	200
Total Volume	799	0	799	0	35	35	0	0	0	834
% App. Total	100	0		0	100		0	0		
PHF	.888	.000	.888	.000	.583	.583	.000	.000	.000	.899
Pass Cars	792	0	792	0	35	35	0	0	0	827
% Pass Cars	99.1	0	99.1	0	100	100	0	0	0	99.2
Single Units	4	0	4	0	0	0	0	0	0	4
% Single Units	0.5	0	0.5	0	0	0	0	0	0	0.5
Heavy Trucks	3	0	3	0	0	0	0	0	0	3
% Heavy Trucks	0.4	0	0.4	0	0	0	0	0	0	0.4
Peds	0	0	0	0	0	0	0	0	0	0
% Peds	0	0	0	0	0	0	0	0	0	0



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Traffic Study Performed For:

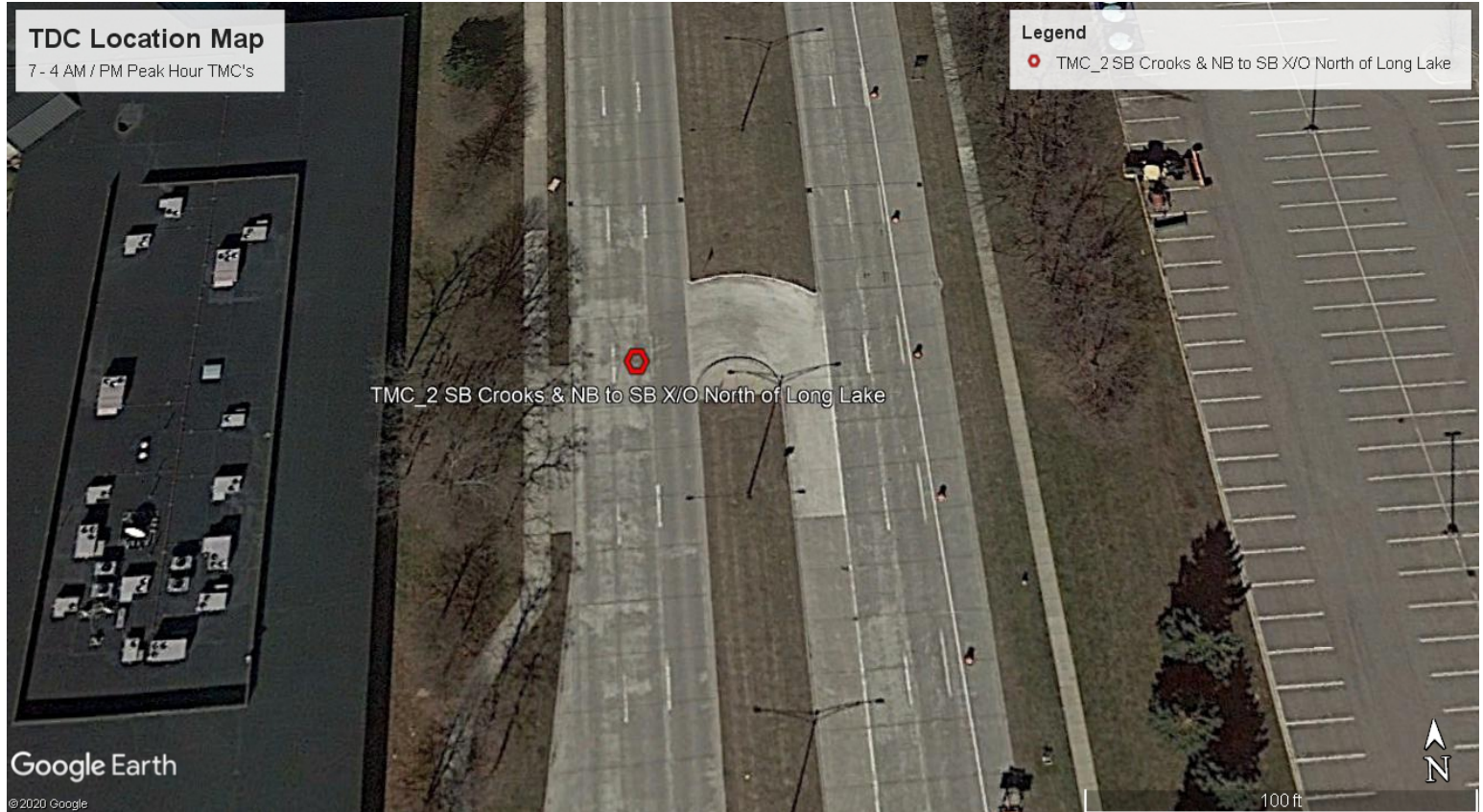
**FLEIS & VANDENBRINK**



Project: Troy Long Lk. PUD Traffic Study  
Study: 4 Hr. Video Turning Movement Count  
Weather: Pt. Sunny, Dry Deg's 60s  
Count By Miovision Video VCU 3DQ SE

File Name : TMC\_2 SB Crooks & NB\_SB XO\_N Long Lk\_10-7-20  
Site Code : TMC\_2  
Start Date : 10/7/2020  
Page No : 5

## Aerial Photo





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Traffic Study Performed For:

**FLEIS & VANDENBRINK**



**Project: Troy Long Lk. PUD Traffic Study**  
**Study: 4 Hr. Video Turning Movement Count**  
**Weather: Pt. Sunny, Dry Deg's 60s**  
**Count By Miovision Video VCU 61E NE**

**File Name : TMC\_3 EB Crooks & WB\_EB XO\_W Corporate\_10-7-20**  
**Site Code : TMC\_3**  
**Start Date : 10/7/2020**  
**Page No : 1**

4 Hour video traffic study was conducted during typical weekday (Wednesday) from 7:00 AM - 9:00 AM morning & 4:00 PM - 6:00 PM afternoon peak hours, while school was in session during COVID 19.

Groups Printed- Pass Cars - Single Units - Heavy Trucks - Peds

Start Time	WB>EB X/O_W Corporate Southbound				EB Long Lake Road Westbound				EB Long Lake Road Eastbound				Int. Total
	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	
07:00 AM	0	4	0	4	0	0	0	0	87	0	0	87	91
07:15 AM	0	11	0	11	0	0	0	0	111	0	0	111	122
07:30 AM	0	5	0	5	0	0	0	0	124	0	0	124	129
07:45 AM	0	12	0	12	0	0	0	0	155	0	0	155	167
Total	0	32	0	32	0	0	0	0	477	0	0	477	509
08:00 AM	0	18	0	18	0	0	0	0	171	0	0	171	189
08:15 AM	0	9	0	9	0	0	0	0	167	0	0	167	176
08:30 AM	0	10	0	10	0	0	0	0	160	0	0	160	170
08:45 AM	0	9	0	9	0	0	0	0	172	0	0	172	181
Total	0	46	0	46	0	0	0	0	670	0	0	670	716
*** BREAK ***													
04:00 PM	0	10	0	10	0	0	0	0	183	0	0	183	193
04:15 PM	0	10	0	10	0	0	0	0	210	0	0	210	220
04:30 PM	0	3	0	3	0	0	0	0	230	0	0	230	233
04:45 PM	0	10	0	10	0	0	0	0	193	0	0	193	203
Total	0	33	0	33	0	0	0	0	816	0	0	816	849
05:00 PM	0	16	0	16	0	0	0	0	204	0	0	204	220
05:15 PM	0	17	0	17	0	0	0	0	210	0	0	210	227
05:30 PM	0	9	0	9	0	0	0	0	259	0	0	259	268
05:45 PM	0	9	0	9	0	0	0	0	203	0	0	203	212
Total	0	51	0	51	0	0	0	0	876	0	0	876	927
Grand Total	0	162	0	162	0	0	0	0	2839	0	0	2839	3001
Apprch %	0	100	0		0	0	0		100	0	0		
Total %	0	5.4	0	5.4	0	0	0	0	94.6	0	0	94.6	
Pass Cars	0	159	0	159	0	0	0	0	2790	0	0	2790	2949
% Pass Cars	0	98.1	0	98.1	0	0	0	0	98.3	0	0	98.3	98.3
Single Units	0	2	0	2	0	0	0	0	37	0	0	37	39
% Single Units	0	1.2	0	1.2	0	0	0	0	1.3	0	0	1.3	1.3
Heavy Trucks	0	1	0	1	0	0	0	0	12	0	0	12	13
% Heavy Trucks	0	0.6	0	0.6	0	0	0	0	0.4	0	0	0.4	0.4
Peds	0	0	0	0	0	0	0	0	0	0	0	0	0
% Peds	0	0	0	0	0	0	0	0	0	0	0	0	0

TDC Traffic Comments: Non-signalized intersection. Video VCU camera was located within NE intersection quadrant. Corporate Drive, Investment Drive & I-75 was under construction during study. Note: Peds. are excluded from peak hour reports. Traffic study was performed for Troy Long Lake PUD Traffic Impact Study for Fleis & Vandenbrink.

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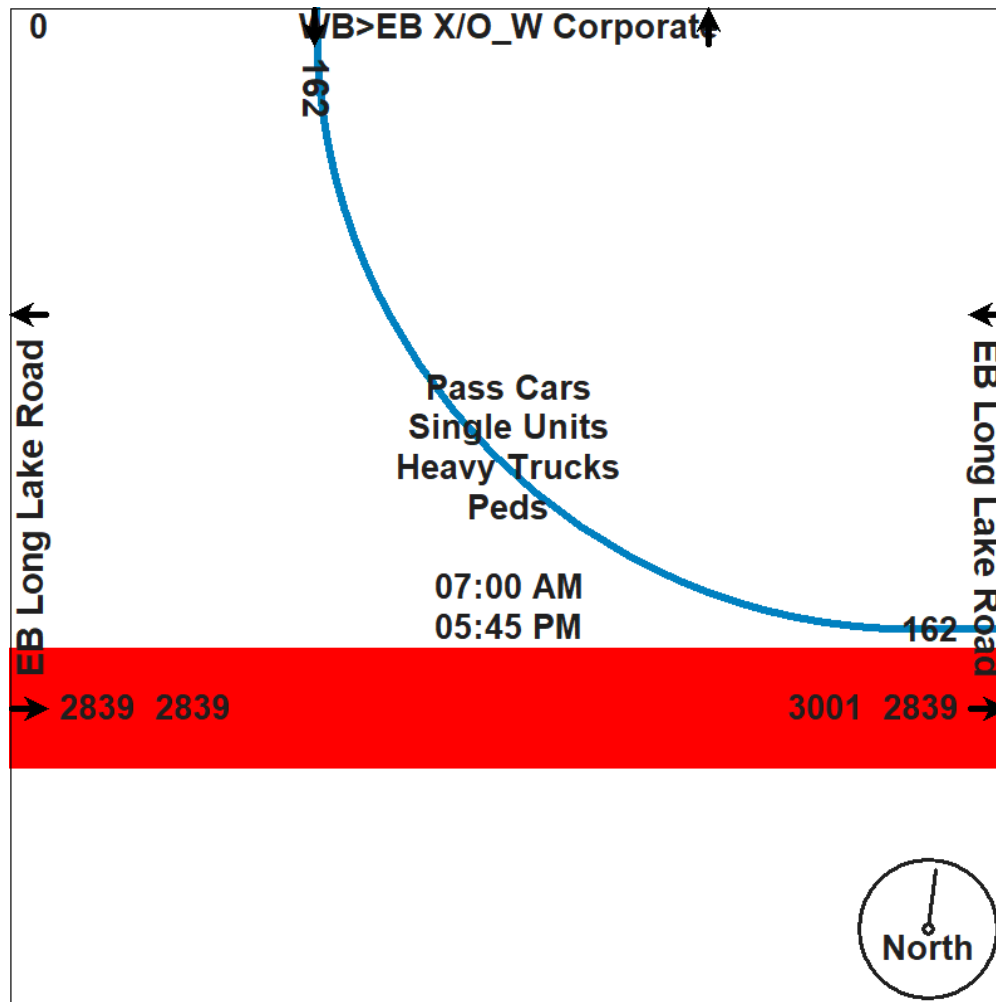
Traffic Study Performed For:

**FLEIS & VANDENBRINK**



Project: Troy Long Lk. PUD Traffic Study  
Study: 4 Hr. Video Turning Movement Count  
Weather: Pt. Sunny, Dry Deg's 60s  
Count By: Miovision Video VCU 61E NE

File Name : TMC\_3 EB Crooks & WB\_EB XO\_W Corporate\_10-7-20  
Site Code : TMC\_3  
Start Date : 10/7/2020  
Page No : 2





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Traffic Study Performed For:

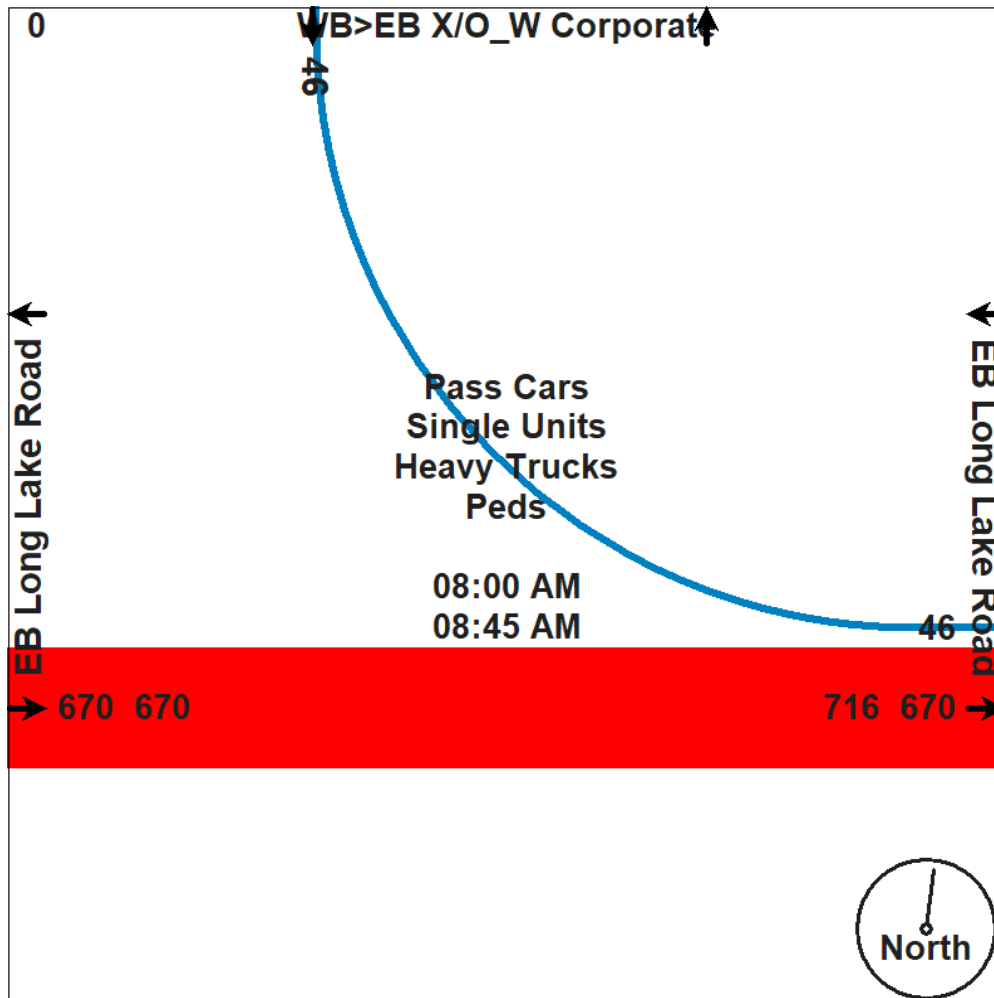
**FLEIS & VANDENBRINK**



Project: Troy Long Lk. PUD Traffic Study  
Study: 4 Hr. Video Turning Movement Count  
Weather: Pt. Sunny, Dry Deg's 60s  
Count By Miovision Video VCU 61E NE

File Name : TMC\_3 EB Crooks & WB\_EB XO\_W Corporate\_10-7-20  
Site Code : TMC\_3  
Start Date : 10/7/2020  
Page No : 3

	WB>EB X/O_W Corporate Southbound			EB Long Lake Road Westbound			EB Long Lake Road Eastbound			
Start Time	Right	Left	App. Total	Right	Thru	App. Total	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 11:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 08:00 AM										
08:00 AM	0	18	18	0	0	0	171	0	171	189
08:15 AM	0	9	9	0	0	0	167	0	167	176
08:30 AM	0	10	10	0	0	0	160	0	160	170
08:45 AM	0	9	9	0	0	0	172	0	172	181
Total Volume	0	46	46	0	0	0	670	0	670	716
% App. Total	0	100		0	0		100	0		
PHF	.000	.639	.639	.000	.000	.000	.974	.000	.974	.947
Pass Cars	0	46	46	0	0	0	645	0	645	691
% Pass Cars	0	100	100	0	0	0	96.3	0	96.3	96.5
Single Units	0	0	0	0	0	0	19	0	19	19
% Single Units	0	0	0	0	0	0	2.8	0	2.8	2.7
Heavy Trucks	0	0	0	0	0	0	6	0	6	6
% Heavy Trucks	0	0	0	0	0	0	0.9	0	0.9	0.8
Peds	0	0	0	0	0	0	0	0	0	0
% Peds	0	0	0	0	0	0	0	0	0	0



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Traffic Study Performed For:

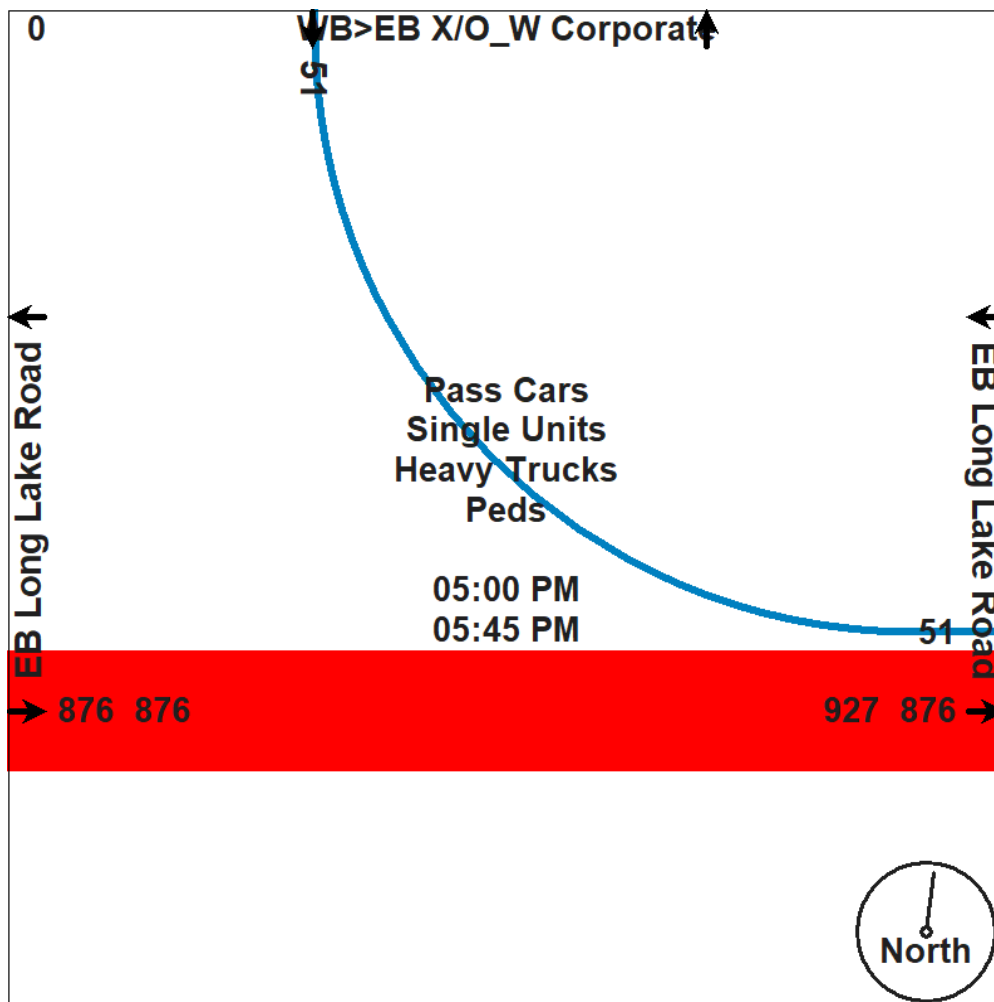
**FLEIS & VANDENBRINK**



Project: Troy Long Lk. PUD Traffic Study  
Study: 4 Hr. Video Turning Movement Count  
Weather: Pt. Sunny, Dry Deg's 60s  
Count By Miovision Video VCU 61E NE

File Name : TMC\_3 EB Crooks & WB\_EB XO\_W Corporate\_10-7-20  
Site Code : TMC\_3  
Start Date : 10/7/2020  
Page No : 4

	WB>EB X/O_W Corporate Southbound			EB Long Lake Road Westbound			EB Long Lake Road Eastbound			
Start Time	Right	Left	App. Total	Right	Thru	App. Total	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 05:00 PM										
05:00 PM	0	16	16	0	0	0	204	0	204	220
05:15 PM	0	17	17	0	0	0	210	0	210	227
05:30 PM	0	9	9	0	0	0	259	0	259	268
05:45 PM	0	9	9	0	0	0	203	0	203	212
Total Volume	0	51	51	0	0	0	876	0	876	927
% App. Total	0	100		0	0		100	0		
PHF	.000	.750	.750	.000	.000	.000	.846	.000	.846	.865
Pass Cars	0	50	50	0	0	0	874	0	874	924
% Pass Cars	0	98.0	98.0	0	0	0	99.8	0	99.8	99.7
Single Units	0	1	1	0	0	0	1	0	1	2
% Single Units	0	2.0	2.0	0	0	0	0.1	0	0.1	0.2
Heavy Trucks	0	0	0	0	0	0	1	0	1	1
% Heavy Trucks	0	0	0	0	0	0	0.1	0	0.1	0.1
Peds	0	0	0	0	0	0	0	0	0	0
% Peds	0	0	0	0	0	0	0	0	0	0





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Traffic Study Performed For:

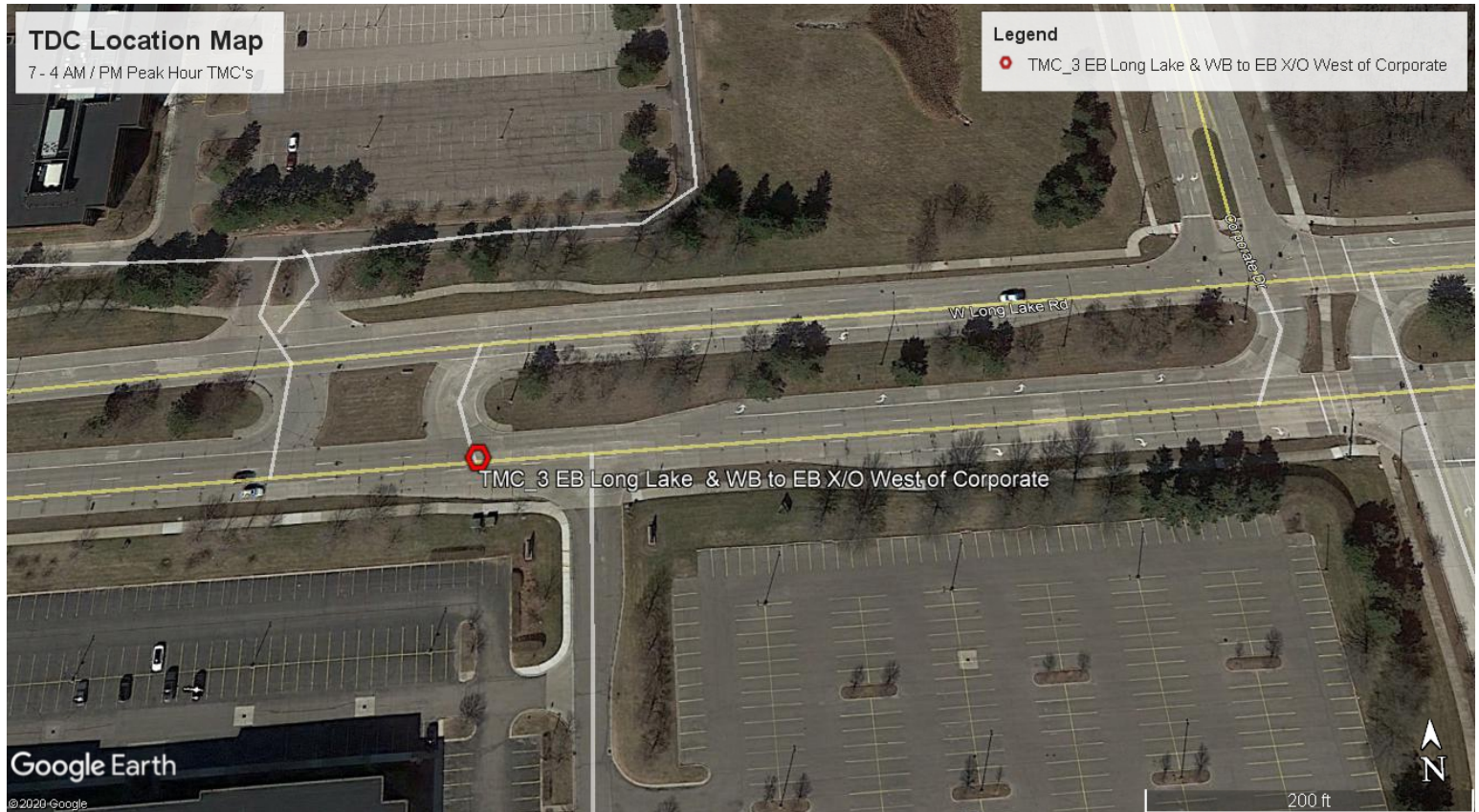
**FLEIS & VANDENBRINK**



Project: Troy Long Lk. PUD Traffic Study  
Study: 4 Hr. Video Turning Movement Count  
Weather: Pt. Sunny, Dry Deg's 60s  
Count By: Miovision Video VCU 61E NE

File Name : TMC\_3 EB Crooks & WB\_EB XO\_W Corporate\_10-7-20  
Site Code : TMC\_3  
Start Date : 10/7/2020  
Page No : 5

## Aerial Photo



# Traffic Data Collection, LLC

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Phone: 586.786-5407

Traffic Study Performed For:

**FLEIS & VANDENBRINK**



**Project: Troy Long Lk. PUD Traffic Study**  
**Study: 4 Hr. Video Turning Movement Count**  
**Weather: Pt. Sunny, Dry Deg's 60s**  
**Count By Miovision Video VCU 1TM SW**

**File Name : TMC\_4 WB Crooks & EB\_WB XO\_E Investment\_10-7-20**  
**Site Code : TMC\_4**  
**Start Date : 10/7/2020**  
**Page No : 1**

4 Hour video traffic study was conducted during typical weekday (Wednesday) from 7:00 AM - 9:00 AM morning & 4:00 PM - 6:00 PM afternoon peak hours, while school was in session during COVID 19.

Groups Printed- Pass Cars - Single Units - Heavy Trucks - Peds

WB Long Lake Road Westbound					EB X/O East of Investment Dr Northbound				WB Long Lake Road Eastbound				Int. Total
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	
07:00 AM	88	0	0	88	0	3	0	3	0	0	0	0	91
07:15 AM	99	0	0	99	0	3	0	3	0	0	0	0	102
07:30 AM	131	0	0	131	0	8	0	8	0	0	0	0	139
07:45 AM	166	0	0	166	0	13	0	13	0	0	0	0	179
Total	484	0	0	484	0	27	0	27	0	0	0	0	511
08:00 AM	162	0	0	162	0	8	0	8	0	0	0	0	170
08:15 AM	167	0	0	167	0	10	0	10	0	0	0	0	177
08:30 AM	158	0	0	158	0	14	0	14	0	0	0	0	172
08:45 AM	153	0	0	153	0	9	0	9	0	0	0	0	162
Total	640	0	0	640	0	41	0	41	0	0	0	0	681
*** BREAK ***													
04:00 PM	152	0	0	152	0	11	0	11	0	0	0	0	163
04:15 PM	145	0	0	145	0	17	0	17	0	0	0	0	162
04:30 PM	141	0	0	141	0	24	0	24	0	0	0	0	165
04:45 PM	158	0	0	158	0	13	0	13	0	0	0	0	171
Total	596	0	0	596	0	65	0	65	0	0	0	0	661
05:00 PM	159	0	0	159	0	27	0	27	0	0	0	0	186
05:15 PM	168	0	0	168	0	13	0	13	0	0	0	0	181
05:30 PM	176	0	0	176	0	5	0	5	0	0	0	0	181
05:45 PM	169	0	0	169	0	9	0	9	0	0	0	0	178
Total	672	0	0	672	0	54	0	54	0	0	0	0	726
Grand Total	2392	0	0	2392	0	187	0	187	0	0	0	0	2579
Apprch %	100	0	0		0	100	0		0	0	0		
Total %	92.7	0	0	92.7	0	7.3	0	7.3	0	0	0	0	
Pass Cars	2340	0	0	2340	0	187	0	187	0	0	0	0	2527
% Pass Cars	97.8	0	0	97.8	0	100	0	100	0	0	0	0	98
Single Units	41	0	0	41	0	0	0	0	0	0	0	0	41
% Single Units	1.7	0	0	1.7	0	0	0	0	0	0	0	0	1.6
Heavy Trucks	11	0	0	11	0	0	0	0	0	0	0	0	11
% Heavy Trucks	0.5	0	0	0.5	0	0	0	0	0	0	0	0	0.4
Peds	0	0	0	0	0	0	0	0	0	0	0	0	0
% Peds	0	0	0	0	0	0	0	0	0	0	0	0	0

TDC Traffic Comments: Non-signalized intersection. Video VCU camera was located within SW intersection quadrant. Corporate Drive, Investment Drive & I-75 were under road construction during study. Note: Peds. are excluded from peak hour reports. Traffic study was performed for Troy Long Lake PUD Traffic Impact Study for Fleis & Vandenbrink.



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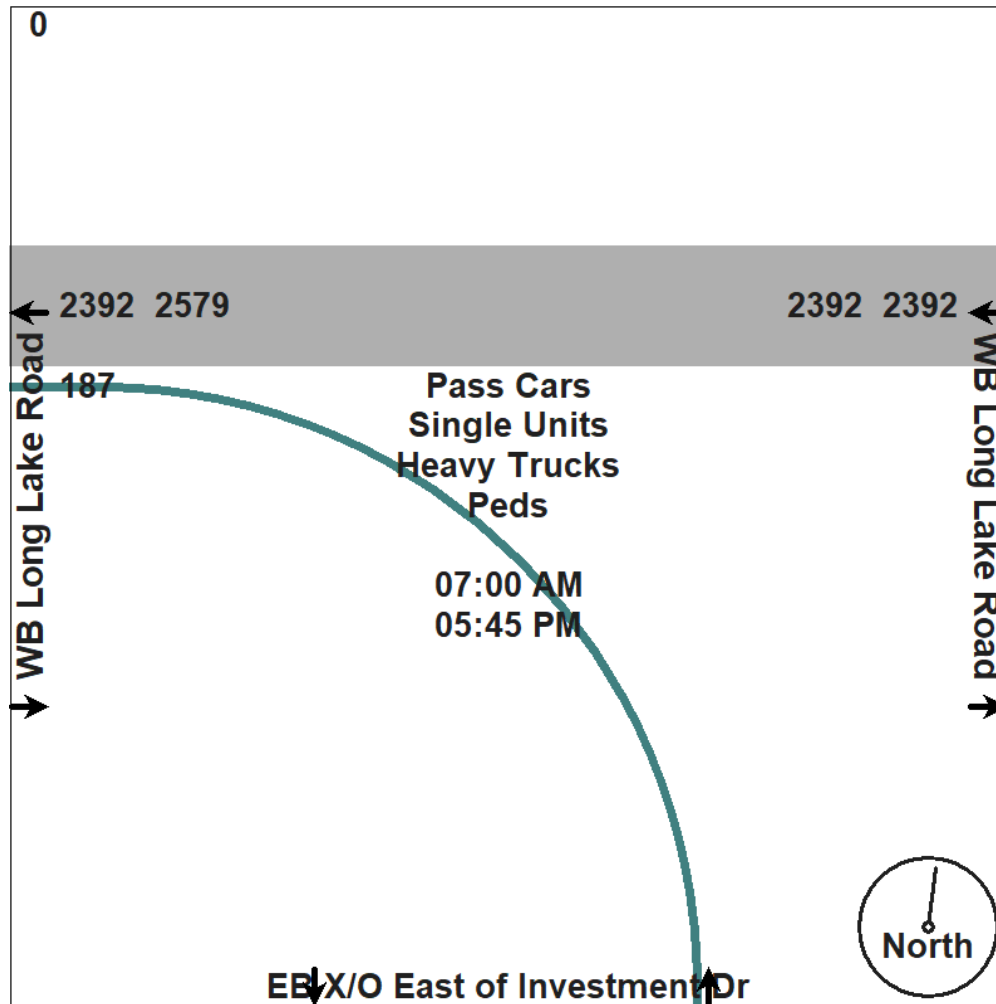
Traffic Study Performed For:

**FLEIS & VANDENBRINK**



Project: Troy Long Lk. PUD Traffic Study  
Study: 4 Hr. Video Turning Movement Count  
Weather: Pt. Sunny, Dry Deg's 60s  
Count By: Miovision Video VCU 1TM SW

File Name : TMC\_4 WB Crooks & EB\_WB XO\_E Investment\_10-7-20  
Site Code : TMC\_4  
Start Date : 10/7/2020  
Page No : 2



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Traffic Study Performed For:

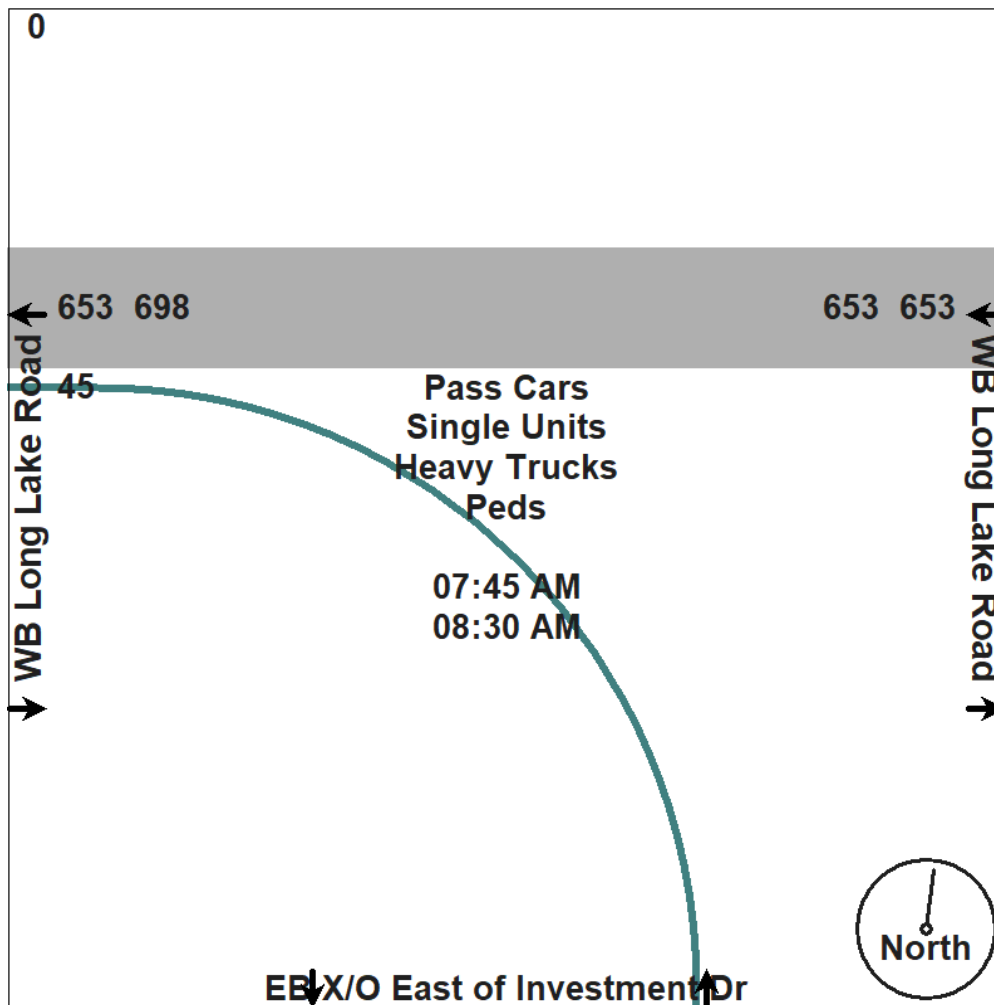
**FLEIS & VANDENBRINK**



Project: Troy Long Lk. PUD Traffic Study  
Study: 4 Hr. Video Turning Movement Count  
Weather: Pt. Sunny, Dry Deg's 60s  
Count By Miovision Video VCU 1TM SW

File Name : TMC\_4 WB Crooks & EB\_WB XO\_E Investment\_10-7-20  
Site Code : TMC\_4  
Start Date : 10/7/2020  
Page No : 3

	WB Long Lake Road Westbound			EB X/O East of Investment Dr Northbound			WB Long Lake Road Eastbound			
Start Time	Thru	Left	App. Total	Right	Left	App. Total	Right	Thru	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 11:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:45 AM										
07:45 AM	166	0	166	0	13	13	0	0	0	179
08:00 AM	162	0	162	0	8	8	0	0	0	170
08:15 AM	167	0	167	0	10	10	0	0	0	177
08:30 AM	158	0	158	0	14	14	0	0	0	172
Total Volume	653	0	653	0	45	45	0	0	0	698
% App. Total	100	0		0	100		0	0		
PHF	.978	.000	.978	.000	.804	.804	.000	.000	.000	.975
Pass Cars	631	0	631	0	45	45	0	0	0	676
% Pass Cars	96.6	0	96.6	0	100	100	0	0	0	96.8
Single Units	19	0	19	0	0	0	0	0	0	19
% Single Units	2.9	0	2.9	0	0	0	0	0	0	2.7
Heavy Trucks	3	0	3	0	0	0	0	0	0	3
% Heavy Trucks	0.5	0	0.5	0	0	0	0	0	0	0.4
Peds	0	0	0	0	0	0	0	0	0	0
% Peds	0	0	0	0	0	0	0	0	0	0





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Traffic Study Performed For:

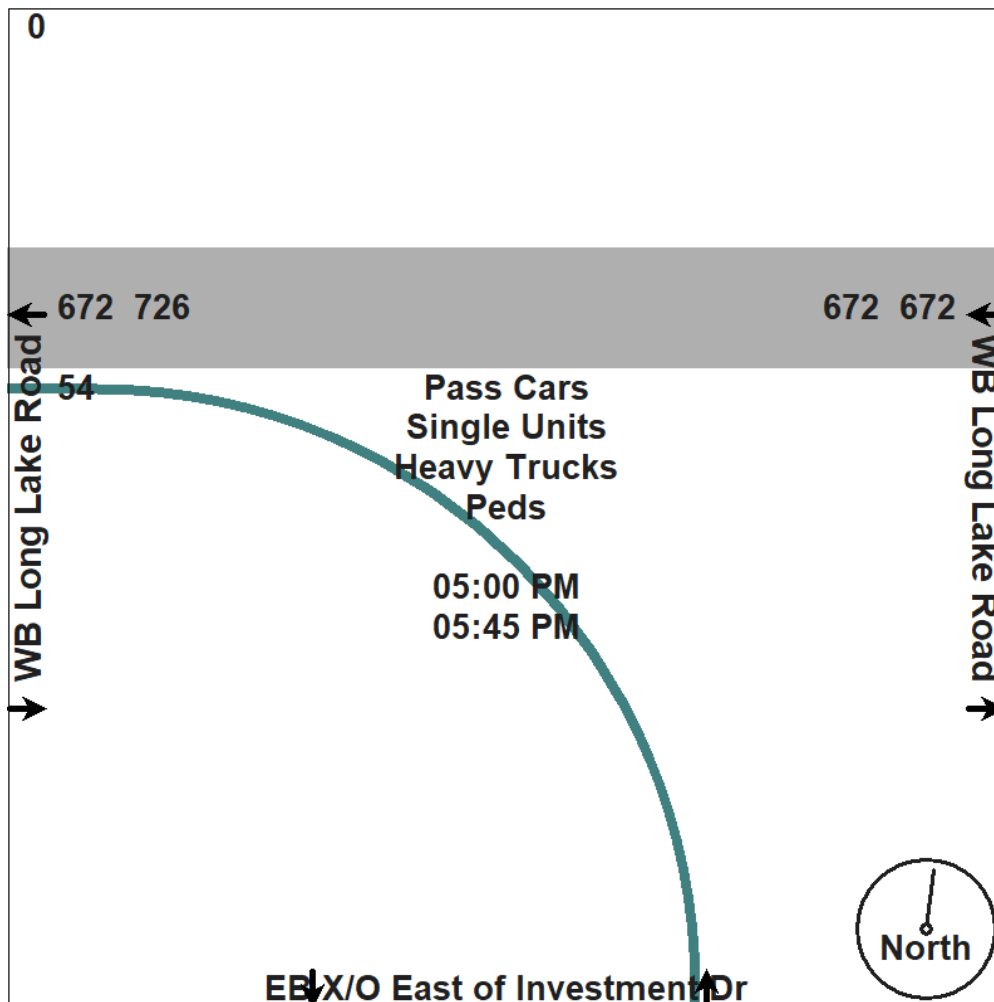
**FLEIS & VANDENBRINK**



Project: Troy Long Lk. PUD Traffic Study  
Study: 4 Hr. Video Turning Movement Count  
Weather: Pt. Sunny, Dry Deg's 60s  
Count By Miovision Video VCU 1TM SW

File Name : TMC\_4 WB Crooks & EB\_WB XO\_E Investment\_10-7-20  
Site Code : TMC\_4  
Start Date : 10/7/2020  
Page No : 4

	WB Long Lake Road Westbound			EB X/O East of Investment Dr Northbound			WB Long Lake Road Eastbound			
Start Time	Thru	Left	App. Total	Right	Left	App. Total	Right	Thru	App. Total	Int. Total
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 05:00 PM										
05:00 PM	159	0	159	0	27	27	0	0	0	186
05:15 PM	168	0	168	0	13	13	0	0	0	181
05:30 PM	176	0	176	0	5	5	0	0	0	181
05:45 PM	169	0	169	0	9	9	0	0	0	178
Total Volume	672	0	672	0	54	54	0	0	0	726
% App. Total	100	0		0	100		0	0		
PHF	.955	.000	.955	.000	.500	.500	.000	.000	.000	.976
Pass Cars	668	0	668	0	54	54	0	0	0	722
% Pass Cars	99.4	0	99.4	0	100	100	0	0	0	99.4
Single Units	2	0	2	0	0	0	0	0	0	2
% Single Units	0.3	0	0.3	0	0	0	0	0	0	0.3
Heavy Trucks	2	0	2	0	0	0	0	0	0	2
% Heavy Trucks	0.3	0	0.3	0	0	0	0	0	0	0.3
Peds	0	0	0	0	0	0	0	0	0	0
% Peds	0	0	0	0	0	0	0	0	0	0



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Traffic Study Performed For:

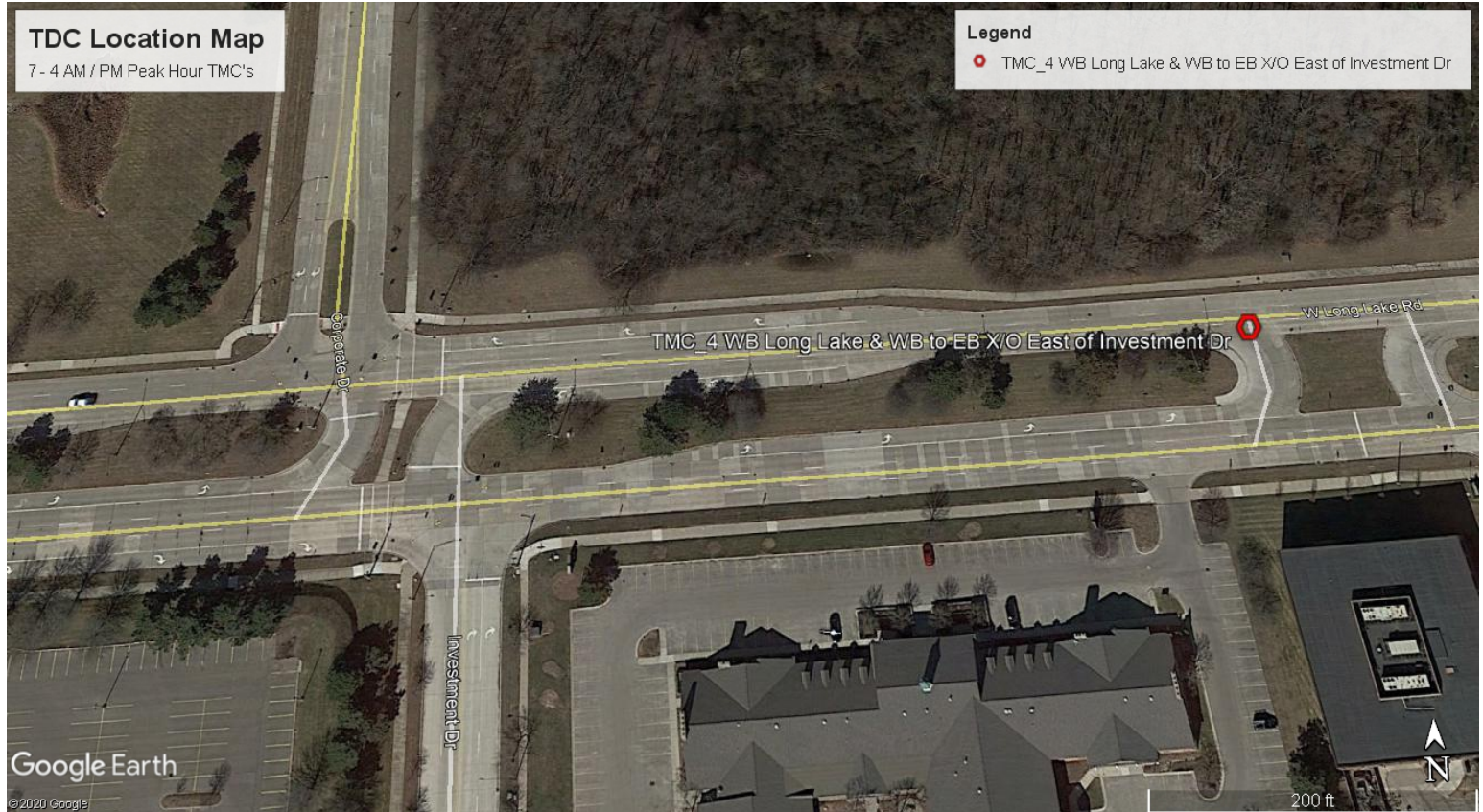
**FLEIS & VANDENBRINK**



Project: Troy Long Lk. PUD Traffic Study  
Study: 4 Hr. Video Turning Movement Count  
Weather: Pt. Sunny, Dry Deg's 60s  
Count By: Miovision Video VCU 1TM SW

File Name : TMC\_4 WB Crooks & EB\_WB XO\_E Investment\_10-7-20  
Site Code : TMC\_4  
Start Date : 10/7/2020  
Page No : 5

## Aerial Photo





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Traffic Study Performed For:

**FLEIS & VANDENBRINK**



**Project: Troy Long Lk. PUD Traffic Study**  
**Study: 4 Hr. Video Turning Movement Count**  
**Weather: Pt. Sunny, Dry Deg's 60s**  
**Count By Miovision Video VCU 340 SW**

**File Name : TMC\_5 WB Crooks & EB\_WB XO\_W Crooks\_10-7-20**  
**Site Code : TMC\_5**  
**Start Date : 10/7/2020**  
**Page No : 1**

4 Hour video traffic study was conducted during typical weekday (Wednesday) from 7:00 AM - 9:00 AM morning & 4:00 PM - 6:00 PM afternoon peak hours, while school was in session during COVID 19.

Groups Printed- Pass Cars - Single Units - Heavy Trucks - Peds

WB Long Lake Road Westbound					EB>WB X/O_W Crooks Northbound				WB Long Lake Road Eastbound				Int. Total
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	
07:00 AM	111	0	0	111	0	1	0	1	0	0	0	0	112
07:15 AM	121	0	0	121	0	0	0	0	0	0	0	0	121
07:30 AM	147	0	0	147	0	0	0	0	0	0	0	0	147
07:45 AM	210	0	0	210	0	0	0	0	0	0	0	0	210
Total	589	0	0	589	0	1	0	1	0	0	0	0	590
08:00 AM	189	0	0	189	0	0	0	0	0	0	0	0	189
08:15 AM	193	0	0	193	0	0	0	0	0	0	0	0	193
08:30 AM	183	0	0	183	0	0	0	0	0	0	0	0	183
08:45 AM	198	0	0	198	0	0	0	0	0	0	0	0	198
Total	763	0	0	763	0	0	0	0	0	0	0	0	763
*** BREAK ***													
04:00 PM	183	0	0	183	0	5	0	5	0	0	0	0	188
04:15 PM	161	0	0	161	0	4	0	4	0	0	0	0	165
04:30 PM	163	0	0	163	0	3	0	3	0	0	0	0	166
04:45 PM	182	0	0	182	0	1	0	1	0	0	0	0	183
Total	689	0	0	689	0	13	0	13	0	0	0	0	702
05:00 PM	175	0	0	175	0	4	0	4	0	0	0	0	179
05:15 PM	183	0	0	183	0	2	0	2	0	0	0	0	185
05:30 PM	184	0	0	184	0	0	0	0	0	0	0	0	184
05:45 PM	181	0	0	181	0	4	0	4	0	0	0	0	185
Total	723	0	0	723	0	10	0	10	0	0	0	0	733
Grand Total	2764	0	0	2764	0	24	0	24	0	0	0	0	2788
Apprch %	100	0	0		0	100	0		0	0	0		
Total %	99.1	0	0	99.1	0	0.9	0	0.9	0	0	0	0	
Pass Cars	2707	0	0	2707	0	22	0	22	0	0	0	0	2729
% Pass Cars	97.9	0	0	97.9	0	91.7	0	91.7	0	0	0	0	97.9
Single Units	45	0	0	45	0	2	0	2	0	0	0	0	47
% Single Units	1.6	0	0	1.6	0	8.3	0	8.3	0	0	0	0	1.7
Heavy Trucks	12	0	0	12	0	0	0	0	0	0	0	0	12
% Heavy Trucks	0.4	0	0	0.4	0	0	0	0	0	0	0	0	0.4
Peds	0	0	0	0	0	0	0	0	0	0	0	0	0
% Peds	0	0	0	0	0	0	0	0	0	0	0	0	0

TDC Traffic Comments: Non-signalized intersection. Video VCU camera was located within SW intersection quadrant. Corporate Drive, Investment Drive & I-75 were under road construction during study. Note: Peds. are excluded from peak hour reports. Traffic study was performed for Troy Long Lake PUD Traffic Impact Study for Fleis & Vandenbrink.

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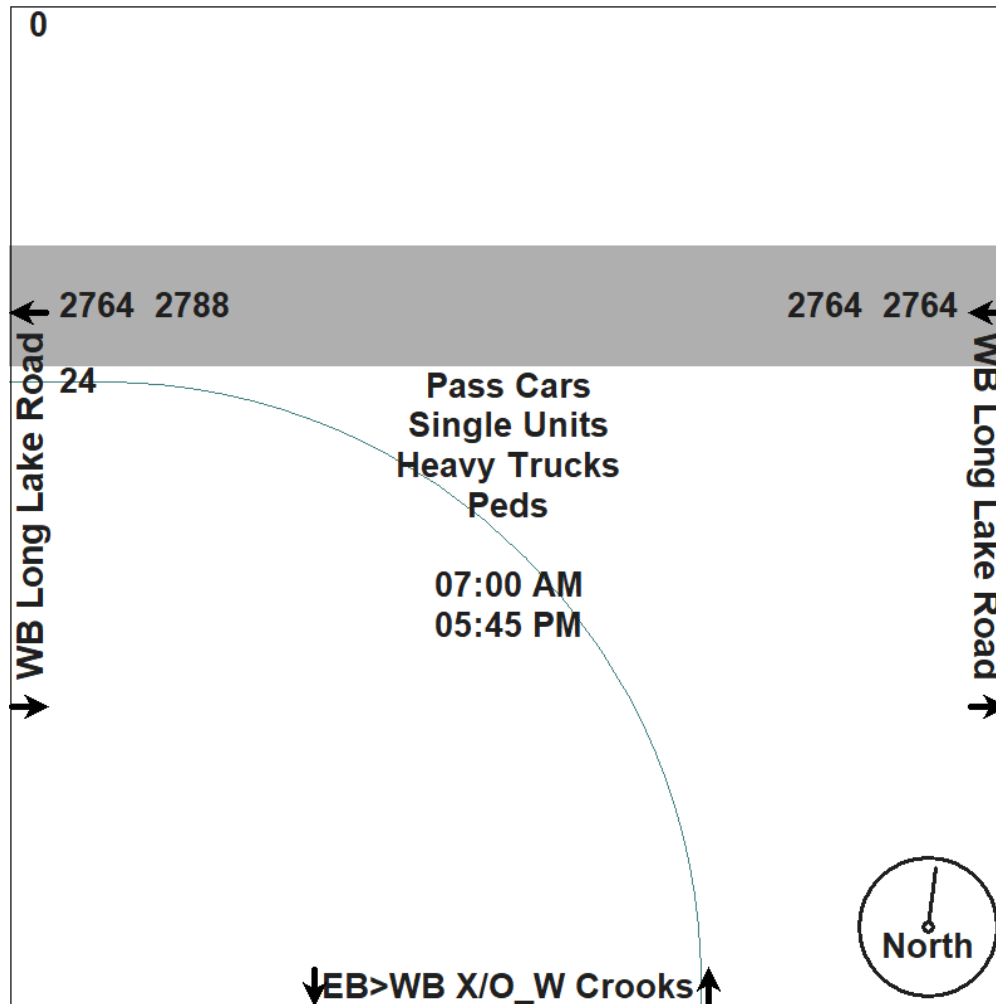
Traffic Study Performed For:

**FLEIS & VANDENBRINK**



Project: Troy Long Lk. PUD Traffic Study  
Study: 4 Hr. Video Turning Movement Count  
Weather: Pt. Sunny, Dry Deg's 60s  
Count By Miovision Video VCU 340 SW

File Name : TMC\_5 WB Crooks & EB\_WB XO\_W Crooks\_10-7-20  
Site Code : TMC\_5  
Start Date : 10/7/2020  
Page No : 2





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Traffic Study Performed For:

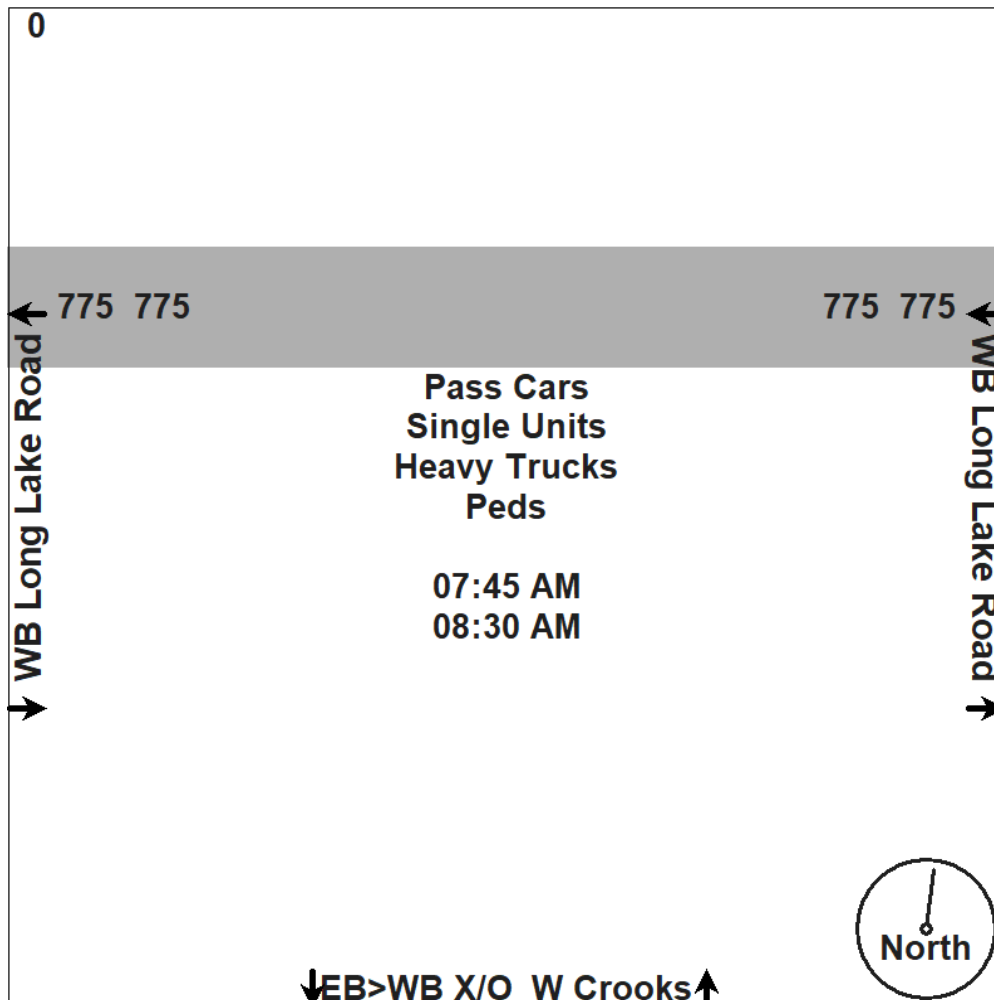
**FLEIS & VANDENBRINK**



Project: Troy Long Lk. PUD Traffic Study  
Study: 4 Hr. Video Turning Movement Count  
Weather: Pt. Sunny, Dry Deg's 60s  
Count By Miovision Video VCU 340 SW

File Name : TMC\_5 WB Crooks & EB\_WB XO\_W Crooks\_10-7-20  
Site Code : TMC\_5  
Start Date : 10/7/2020  
Page No : 3

	WB Long Lake Road Westbound			EB>WB X/O_W Crooks Northbound			WB Long Lake Road Eastbound			
Start Time	Thru	Left	App. Total	Right	Left	App. Total	Right	Thru	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 11:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:45 AM										
07:45 AM	210	0	210	0	0	0	0	0	0	210
08:00 AM	189	0	189	0	0	0	0	0	0	189
08:15 AM	193	0	193	0	0	0	0	0	0	193
08:30 AM	183	0	183	0	0	0	0	0	0	183
Total Volume	775	0	775	0	0	0	0	0	0	775
% App. Total	100	0		0	0		0	0		
PHF	.923	.000	.923	.000	.000	.000	.000	.000	.000	.923
Pass Cars	749	0	749	0	0	0	0	0	0	749
% Pass Cars	96.6	0	96.6	0	0	0	0	0	0	96.6
Single Units	22	0	22	0	0	0	0	0	0	22
% Single Units	2.8	0	2.8	0	0	0	0	0	0	2.8
Heavy Trucks	4	0	4	0	0	0	0	0	0	4
% Heavy Trucks	0.5	0	0.5	0	0	0	0	0	0	0.5
Peds	0	0	0	0	0	0	0	0	0	0
% Peds	0	0	0	0	0	0	0	0	0	0



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Traffic Study Performed For:

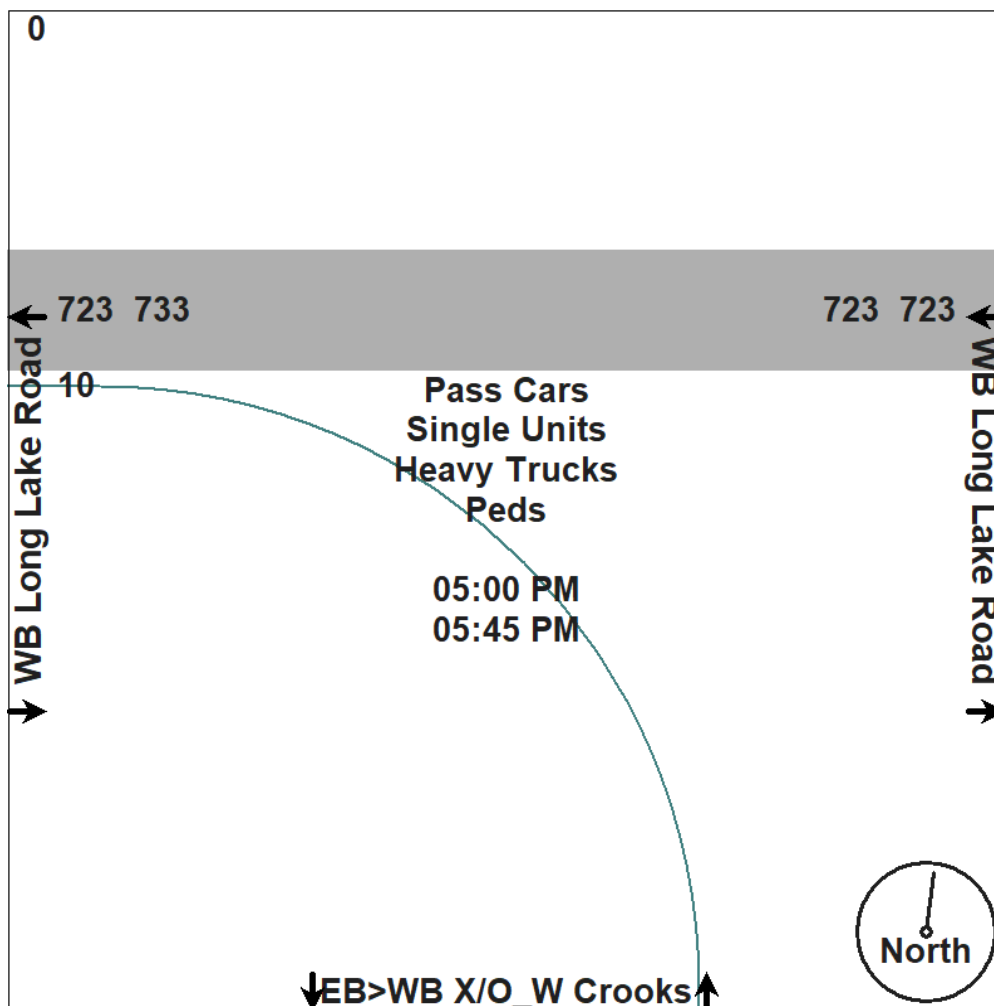
**FLEIS & VANDENBRINK**



Project: Troy Long Lk. PUD Traffic Study  
Study: 4 Hr. Video Turning Movement Count  
Weather: Pt. Sunny, Dry Deg's 60s  
Count By Miovision Video VCU 340 SW

File Name : TMC\_5 WB Crooks & EB\_WB XO\_W Crooks\_10-7-20  
Site Code : TMC\_5  
Start Date : 10/7/2020  
Page No : 4

	WB Long Lake Road Westbound			EB>WB X/O_W Crooks Northbound			WB Long Lake Road Eastbound			
Start Time	Thru	Left	App. Total	Right	Left	App. Total	Right	Thru	App. Total	Int. Total
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 05:00 PM										
05:00 PM	175	0	175	0	4	4	0	0	0	179
05:15 PM	183	0	183	0	2	2	0	0	0	185
05:30 PM	184	0	184	0	0	0	0	0	0	184
05:45 PM	181	0	181	0	4	4	0	0	0	185
Total Volume	723	0	723	0	10	10	0	0	0	733
% App. Total	100	0		0	100		0	0		
PHF	.982	.000	.982	.000	.625	.625	.000	.000	.000	.991
Pass Cars	719	0	719	0	10	10	0	0	0	729
% Pass Cars	99.4	0	99.4	0	100	100	0	0	0	99.5
Single Units	2	0	2	0	0	0	0	0	0	2
% Single Units	0.3	0	0.3	0	0	0	0	0	0	0.3
Heavy Trucks	2	0	2	0	0	0	0	0	0	2
% Heavy Trucks	0.3	0	0.3	0	0	0	0	0	0	0.3
Peds	0	0	0	0	0	0	0	0	0	0
% Peds	0	0	0	0	0	0	0	0	0	0





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Traffic Study Performed For:

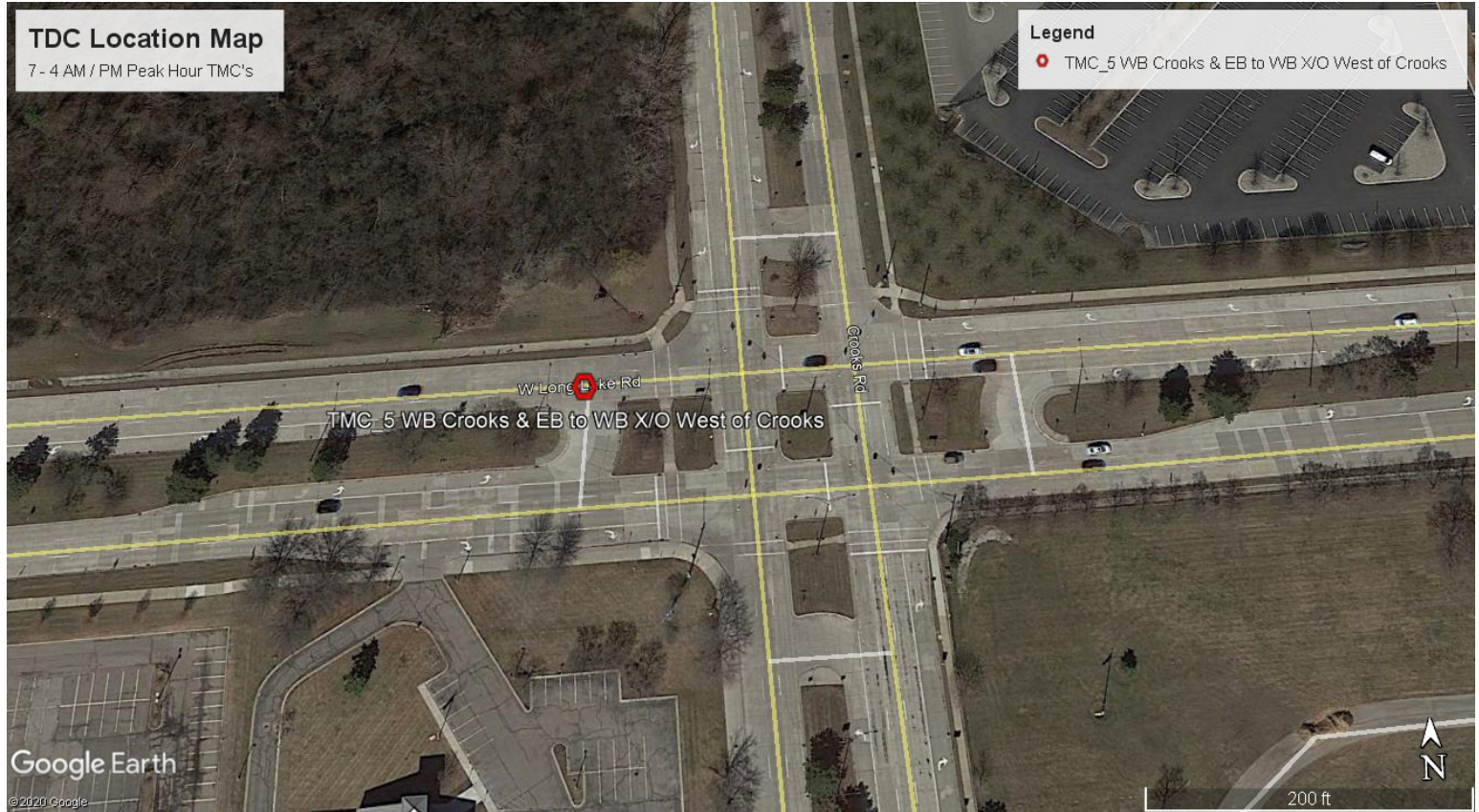
**FLEIS & VANDENBRINK**



**Project:** Troy Long Lk. PUD Traffic Study  
**Study:** 4 Hr. Video Turning Movement Count  
**Weather:** Pt. Sunny, Dry Deg's 60s  
**Count By:** Miovision Video VCU 340 SW

**File Name :** TMC\_5 WB Crooks & EB\_WB XO\_W Crooks\_10-7-20  
**Site Code :** TMC\_5  
**Start Date :** 10/7/2020  
**Page No :** 5

## Aerial Photo



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Traffic Study Performed For:

**FLEIS & VANDENBRINK**



**Project: Troy Long Lk. PUD Traffic Study**  
**Study: 4 Hr. Video Turning Movement Count**  
**Weather: Pt. Sunny, Dry Deg's 60s**  
**Count By Miovision Video VCU 2Z4 NW**

**File Name : TMC\_6 NB Crooks & SB\_NB XO\_S Long Lk\_10-7-20**  
**Site Code : TMC\_6**  
**Start Date : 10/7/2020**  
**Page No : 1**

4 Hour video traffic study was conducted during typical weekday (Wednesday) from 7:00 AM - 9:00 AM morning & 4:00 PM - 6:00 PM afternoon peak hours, while school was in session during COVID 19.

Groups Printed- Pass Cars - Single Units - Heavy Trucks - Peds

Start Time	NB Crooks Road Southbound				NB Crooks Road Northbound				SB>NB X/O_S Long Lk Eastbound				Int. Total
	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	
07:00 AM	0	0	0	0	84	0	0	84	0	2	0	2	86
07:15 AM	0	0	0	0	118	0	0	118	0	4	0	4	122
07:30 AM	0	0	0	0	164	0	0	164	0	2	0	2	166
07:45 AM	0	0	0	0	170	0	0	170	0	9	0	9	179
Total	0	0	0	0	536	0	0	536	0	17	0	17	553
08:00 AM	0	0	0	0	177	0	0	177	0	9	0	9	186
08:15 AM	0	0	0	0	173	0	0	173	0	9	0	9	182
08:30 AM	0	0	0	0	149	0	0	149	0	9	0	9	158
08:45 AM	0	0	0	0	168	0	0	168	0	5	0	5	173
Total	0	0	0	0	667	0	0	667	0	32	0	32	699
*** BREAK ***													
04:00 PM	0	0	0	0	346	0	0	346	0	24	0	24	370
04:15 PM	0	0	0	0	359	0	0	359	0	34	0	34	393
04:30 PM	0	0	0	0	383	0	0	383	0	25	0	25	408
04:45 PM	0	0	0	0	360	0	0	360	0	20	0	20	380
Total	0	0	0	0	1448	0	0	1448	0	103	0	103	1551
05:00 PM	0	0	0	0	406	0	0	406	0	32	0	32	438
05:15 PM	0	0	0	0	391	0	0	391	0	13	0	13	404
05:30 PM	0	0	0	0	363	0	0	363	0	17	0	17	380
05:45 PM	0	0	0	0	298	0	0	298	0	23	0	23	321
Total	0	0	0	0	1458	0	0	1458	0	85	0	85	1543
Grand Total	0	0	0	0	4109	0	0	4109	0	237	0	237	4346
Apprch %	0	0	0		100	0	0		0	100	0		
Total %	0	0	0	0	94.5	0	0	94.5	0	5.5	0	5.5	
Pass Cars	0	0	0	0	4022	0	0	4022	0	234	0	234	4256
% Pass Cars	0	0	0	0	97.9	0	0	97.9	0	98.7	0	98.7	97.9
Single Units	0	0	0	0	58	0	0	58	0	2	0	2	60
% Single Units	0	0	0	0	1.4	0	0	1.4	0	0.8	0	0.8	1.4
Heavy Trucks	0	0	0	0	29	0	0	29	0	1	0	1	30
% Heavy Trucks	0	0	0	0	0.7	0	0	0.7	0	0.4	0	0.4	0.7
Peds	0	0	0	0	0	0	0	0	0	0	0	0	0
% Peds	0	0	0	0	0	0	0	0	0	0	0	0	0

TDC Traffic Comments: Non-signalized intersection. Video VCU camera was located within NW intersection quadrant. Investment Drive & I-75 were under construction during study. Note: Peds. are excluded from peak hour reports. Traffic study was performed for Troy Long Lake PUD Traffic Impact Study for Fleis & Vandenbrink.



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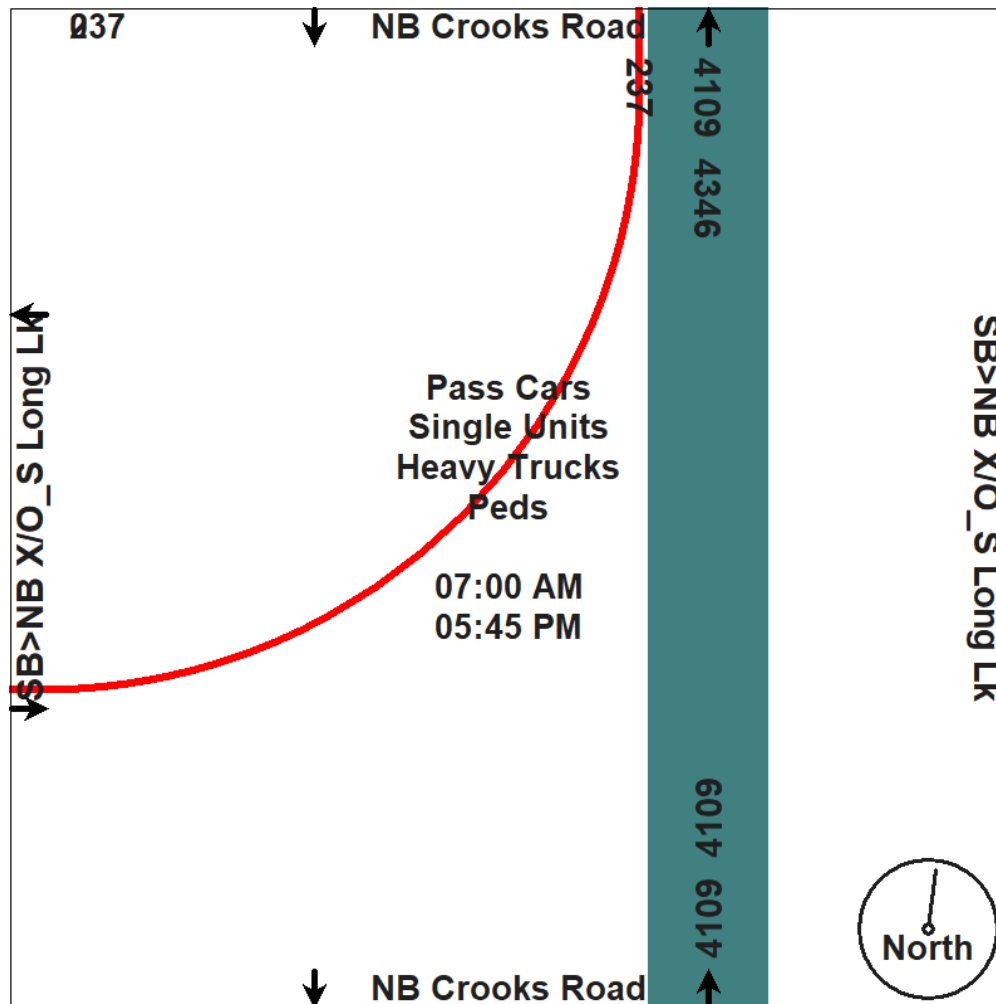
Traffic Study Performed For:

**FLEIS & VANDENBRINK**



Project: Troy Long Lk. PUD Traffic Study  
Study: 4 Hr. Video Turning Movement Count  
Weather: Pt. Sunny, Dry Deg's 60s  
Count By Miovision Video VCU 224 NW

File Name : TMC\_6 NB Crooks & SB\_NB XO\_S Long Lk\_10-7-20  
Site Code : TMC\_6  
Start Date : 10/7/2020  
Page No : 2



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Traffic Study Performed For:

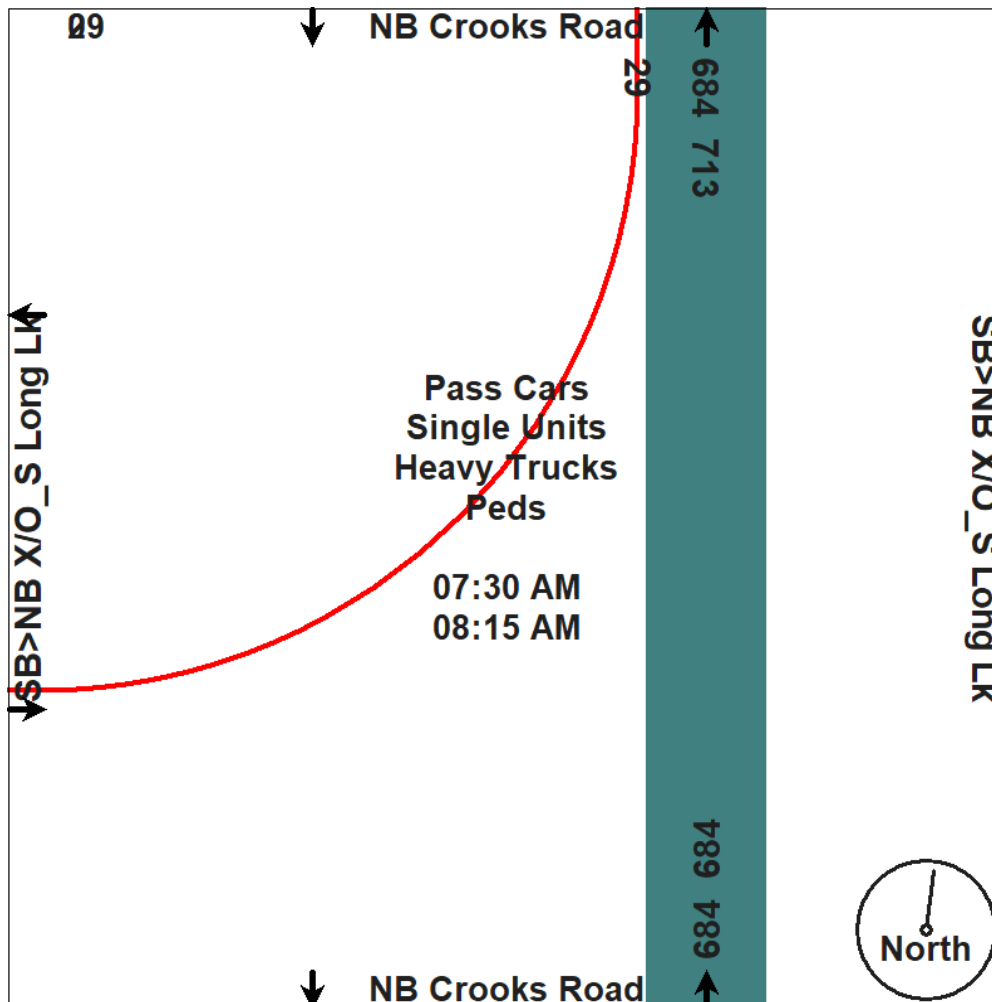
**FLEIS & VANDENBRINK**



Project: Troy Long Lk. PUD Traffic Study  
Study: 4 Hr. Video Turning Movement Count  
Weather: Pt. Sunny, Dry Deg's 60s  
Count By Miovision Video VCU 224 NW

File Name : TMC\_6 NB Crooks & SB\_NB XO\_S Long Lk\_10-7-20  
Site Code : TMC\_6  
Start Date : 10/7/2020  
Page No : 3

	NB Crooks Road Southbound			NB Crooks Road Northbound			SB>NB X/O_S Long Lk Eastbound			
Start Time	Right	Thru	App. Total	Thru	Left	App. Total	Right	Left	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 11:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:30 AM										
07:30 AM	0	0	0	164	0	164	0	2	2	166
07:45 AM	0	0	0	170	0	170	0	9	9	179
08:00 AM	0	0	0	177	0	177	0	9	9	186
08:15 AM	0	0	0	173	0	173	0	9	9	182
Total Volume	0	0	0	684	0	684	0	29	29	713
% App. Total	0	0	0	100	0	100	0	100	100	100
PHF	.000	.000	.000	.966	.000	.966	.000	.806	.806	.958
Pass Cars	0	0	0	657	0	657	0	27	27	684
% Pass Cars	0	0	0	96.1	0	96.1	0	93.1	93.1	95.9
Single Units	0	0	0	17	0	17	0	1	1	18
% Single Units	0	0	0	2.5	0	2.5	0	3.4	3.4	2.5
Heavy Trucks	0	0	0	10	0	10	0	1	1	11
% Heavy Trucks	0	0	0	1.5	0	1.5	0	3.4	3.4	1.5
Peds	0	0	0	0	0	0	0	0	0	0
% Peds	0	0	0	0	0	0	0	0	0	0





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Traffic Study Performed For:

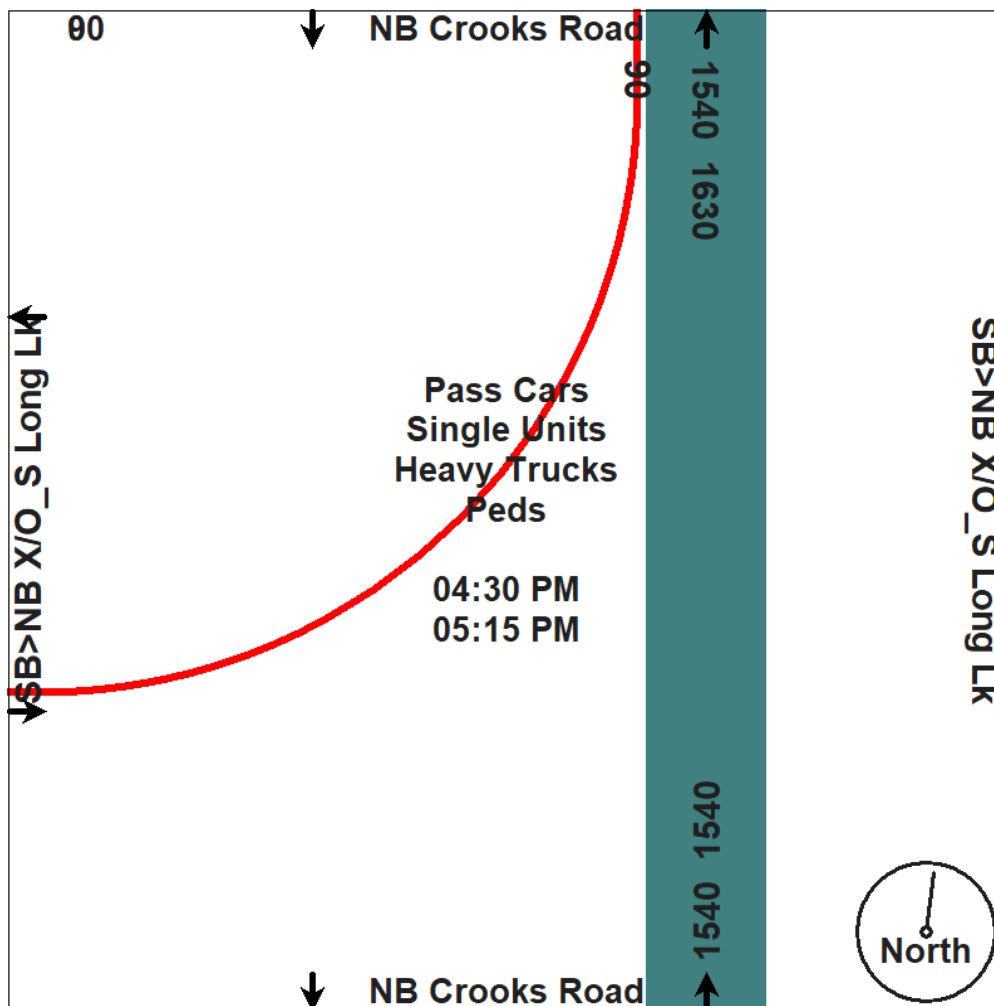
**FLEIS & VANDENBRINK**



Project: Troy Long Lk. PUD Traffic Study  
Study: 4 Hr. Video Turning Movement Count  
Weather: Pt. Sunny, Dry Deg's 60s  
Count By Miovision Video VCU 224 NW

File Name : TMC\_6 NB Crooks & SB\_NB XO\_S Long Lk\_10-7-20  
Site Code : TMC\_6  
Start Date : 10/7/2020  
Page No : 4

	NB Crooks Road Southbound			NB Crooks Road Northbound			SB>NB X/O_S Long Lk Eastbound			
Start Time	Right	Thru	App. Total	Thru	Left	App. Total	Right	Left	App. Total	Int. Total
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 04:30 PM										
04:30 PM	0	0	0	383	0	383	0	25	25	408
04:45 PM	0	0	0	360	0	360	0	20	20	380
05:00 PM	0	0	0	406	0	406	0	32	32	438
05:15 PM	0	0	0	391	0	391	0	13	13	404
Total Volume	0	0	0	1540	0	1540	0	90	90	1630
% App. Total	0	0	0	100	0	100	0	100	100	100
PHF	.000	.000	.000	.948	.000	.948	.000	.703	.703	.930
Pass Cars	0	0	0	1516	0	1516	0	90	90	1606
% Pass Cars	0	0	0	98.4	0	98.4	0	100	100	98.5
Single Units	0	0	0	15	0	15	0	0	0	15
% Single Units	0	0	0	1.0	0	1.0	0	0	0	0.9
Heavy Trucks	0	0	0	9	0	9	0	0	0	9
% Heavy Trucks	0	0	0	0.6	0	0.6	0	0	0	0.6
Peds	0	0	0	0	0	0	0	0	0	0
% Peds	0	0	0	0	0	0	0	0	0	0



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Phone: 586.786-5407

Traffic Study Performed For:

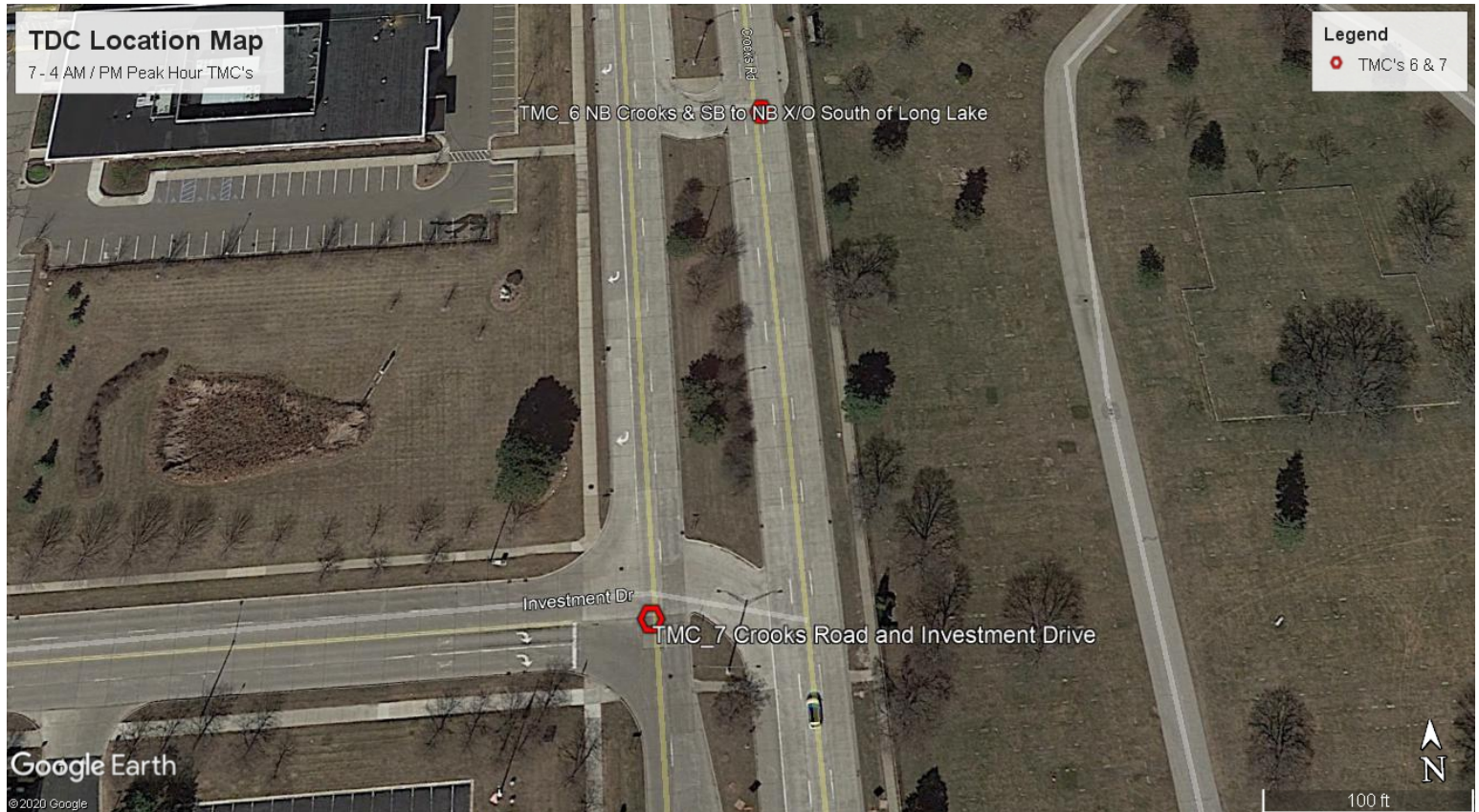
**FLEIS & VANDENBRINK**



**Project:** Troy Long Lk. PUD Traffic Study  
**Study:** 4 Hr. Video Turning Movement Count  
**Weather:** Pt. Sunny, Dry Deg's 60s  
**Count By:** Miovision Video VCU 2Z4 NW

**File Name :** TMC\_6 NB Crooks & SB\_NB XO\_S Long Lk\_10-7-20  
**Site Code :** TMC\_6  
**Start Date :** 10/7/2020  
**Page No :** 5

## Aerial Photo





# Traffic Data Collection, LLC

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Phone: 586.786-5407

Traffic Study Performed For:

**FLEIS & VANDENBRINK**



**Project: Troy Long Lk. PUD Traffic Study**  
**Study: 4 Hr. Video Turning Movement Count**  
**Weather: Pt. Sunny, Dry Deg's 60s**  
**Count By Miovision Video VCU 8EU SE**

**File Name : TMC\_7 SB Crooks & Investment\_10-7-20**  
**Site Code : TMC\_7**  
**Start Date : 10/7/2020**  
**Page No : 1**

4 Hour video traffic study was conducted during typical weekday (Wednesday) from 7:00 AM - 9:00 AM morning & 4:00 PM - 6:00 PM afternoon peak hours, while school was in session during COVID 19.

Groups Printed- Pass Cars - Single Units - Heavy Trucks - Peds

	SB Crooks Road Southbound					NS>SB XO Westbound					SB Crooks Road Northbound					Investment Drive Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	13	149	0	0	162	0	10	0	0	10	0	0	0	0	0	9	0	0	0	9	181
07:15 AM	15	167	0	0	182	0	25	2	0	27	0	0	0	0	0	12	0	0	0	12	221
07:30 AM	18	209	0	0	227	0	17	1	0	18	0	0	0	0	0	9	0	0	0	9	254
07:45 AM	22	266	0	0	288	0	31	3	0	34	0	0	0	0	0	16	0	0	0	16	338
Total	68	791	0	0	859	0	83	6	0	89	0	0	0	0	0	46	0	0	0	46	994
08:00 AM	18	210	0	0	228	0	26	3	0	29	0	0	0	0	0	23	0	0	0	23	280
08:15 AM	22	201	0	0	223	0	27	5	0	32	0	0	0	0	0	20	0	0	1	21	276
08:30 AM	28	258	0	0	286	0	20	4	0	24	0	0	0	0	0	17	0	0	0	17	327
08:45 AM	28	231	0	0	259	0	25	1	0	26	0	0	0	0	0	24	0	0	2	26	311
Total	96	900	0	0	996	0	98	13	0	111	0	0	0	0	0	84	0	0	3	87	1194
*** BREAK ***																					
04:00 PM	4	193	0	0	197	0	13	0	0	13	0	0	0	0	0	38	0	0	0	38	248
04:15 PM	4	185	0	0	189	0	9	1	0	10	0	0	0	0	0	53	0	0	0	53	252
04:30 PM	8	207	0	0	215	0	11	0	0	11	0	0	0	0	0	51	0	0	0	51	277
04:45 PM	5	199	0	0	204	0	9	2	0	11	0	0	0	0	0	44	0	0	0	44	259
Total	21	784	0	0	805	0	42	3	0	45	0	0	0	0	0	186	0	0	0	186	1036
05:00 PM	5	205	0	0	210	0	4	1	0	5	0	0	0	0	0	52	0	0	0	52	267
05:15 PM	2	232	0	0	234	0	11	1	0	12	0	0	0	0	0	30	0	0	0	30	276
05:30 PM	5	200	0	0	205	0	10	0	0	10	0	0	0	0	0	26	0	0	0	26	241
05:45 PM	3	175	0	0	178	0	12	0	0	12	0	0	0	0	0	18	0	0	1	19	209
Total	15	812	0	0	827	0	37	2	0	39	0	0	0	0	0	126	0	0	1	127	993
Grand Total	200	3287	0	0	3487	0	260	24	0	284	0	0	0	0	0	442	0	0	4	446	4217
Apprch %	5.7	94.3	0	0		0	91.5	8.5	0		0	0	0	0		99.1	0	0	0.9		
Total %	4.7	77.9	0	0	82.7	0	6.2	0.6	0	6.7	0	0	0	0	0	10.5	0	0	0.1	10.6	
Pass Cars	200	3227	0	0	3427	0	260	24	0	284	0	0	0	0	0	442	0	0	0	442	4153
% Pass Cars	100	98.2	0	0	98.3	0	100	100	0	100	0	0	0	0	0	100	0	0	0	99.1	98.5
Single Units	0	39	0	0	39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	39
% Single Units	0	1.2	0	0	1.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.9
Heavy Trucks	0	21	0	0	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21
% Heavy Trucks	0	0.6	0	0	0.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5
Peds	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4	4
% Peds	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0.9	0.1

TDC Traffic Comments: Non-signalized intersection. Video VCU camera was located within SE intersection quadrant. Investment Drive & I-75 was under road construction during study. Note: Peds. are excluded from peak hour reports. Traffic study was performed for Troy Long Lake PUD Traffic Impact Study for Fleis & Vandenbrink.

# Traffic Data Collection, LLC

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Phone: 586.786-5407

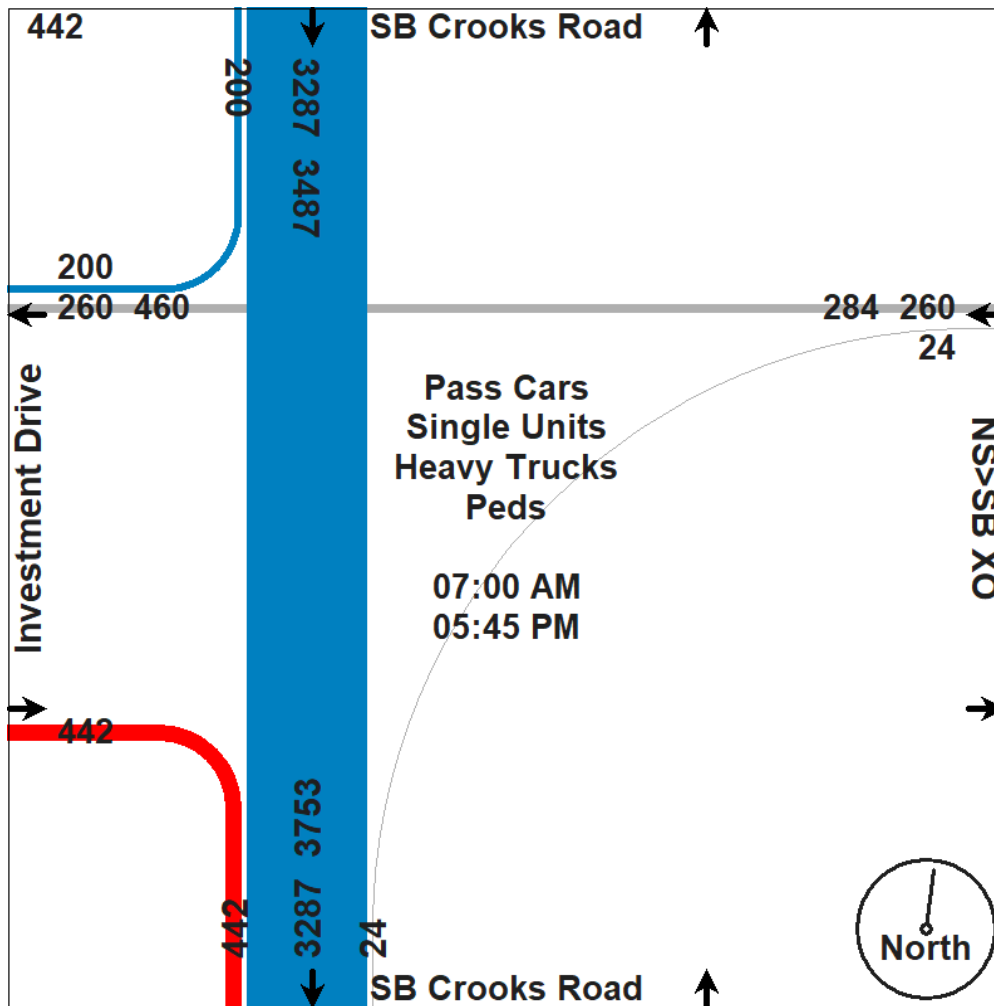
Traffic Study Performed For:

**FLEIS & VANDENBRINK**



Project: Troy Long Lk. PUD Traffic Study  
Study: 4 Hr. Video Turning Movement Count  
Weather: Pt. Sunny, Dry Deg's 60s  
Count By: Miovision Video VCU 8EU SE

File Name : TMC\_7 SB Crooks & Investment\_10-7-20  
Site Code : TMC\_7  
Start Date : 10/7/2020  
Page No : 2





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Phone: 586.786-5407

Traffic Study Performed For:

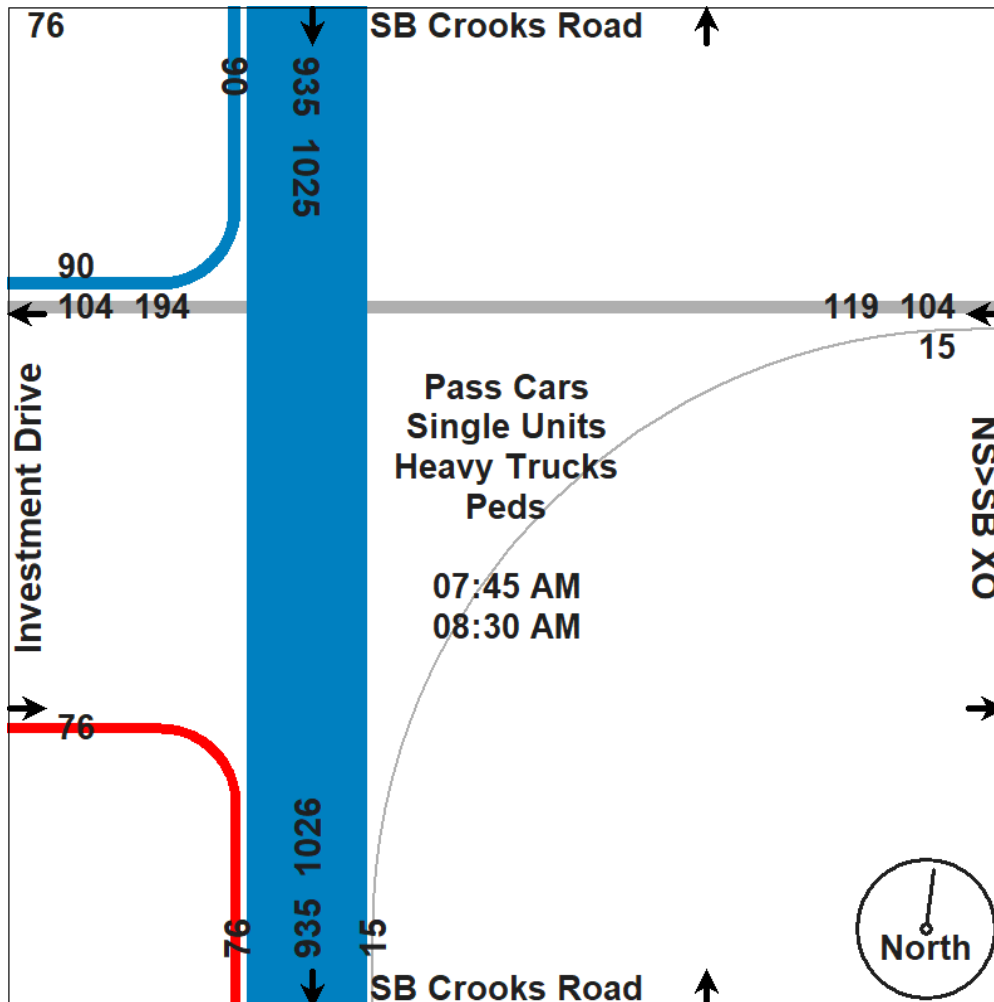
**FLEIS & VANDENBRINK**



Project: Troy Long Lk. PUD Traffic Study  
Study: 4 Hr. Video Turning Movement Count  
Weather: Pt. Sunny, Dry Deg's 60s  
Count By Miovision Video VCU 8EU SE

File Name : TMC\_7 SB Crooks & Investment\_10-7-20  
Site Code : TMC\_7  
Start Date : 10/7/2020  
Page No : 3

	SB Crooks Road Southbound				NS>SB XO Westbound				SB Crooks Road Northbound				Investment Drive Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 11:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:45 AM																	
07:45 AM	22	266	0	288	0	31	3	34	0	0	0	0	16	0	0	16	338
08:00 AM	18	210	0	228	0	26	3	29	0	0	0	0	23	0	0	23	280
08:15 AM	22	201	0	223	0	27	5	32	0	0	0	0	20	0	0	20	275
08:30 AM	28	258	0	286	0	20	4	24	0	0	0	0	17	0	0	17	327
Total Volume	90	935	0	1025	0	104	15	119	0	0	0	0	76	0	0	76	1220
% App. Total	8.8	91.2	0		0	87.4	12.6		0	0	0	0	100	0	0		
PHF	.804	.879	.000	.890	.000	.839	.750	.875	.000	.000	.000	.000	.826	.000	.000	.826	.902
Pass Cars	90	918	0	1008	0	104	15	119	0	0	0	0	76	0	0	76	1203
% Pass Cars	100	98.2	0	98.3	0	100	100	100	0	0	0	0	100	0	0	100	98.6
Single Units	0	10	0	10	0	0	0	0	0	0	0	0	0	0	0	0	10
% Single Units	0	1.1	0	1.0	0	0	0	0	0	0	0	0	0	0	0	0	0.8
Heavy Trucks	0	7	0	7	0	0	0	0	0	0	0	0	0	0	0	0	7
% Heavy Trucks	0	0.7	0	0.7	0	0	0	0	0	0	0	0	0	0	0	0	0.6
Peds	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Peds	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



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Traffic Study Performed For:

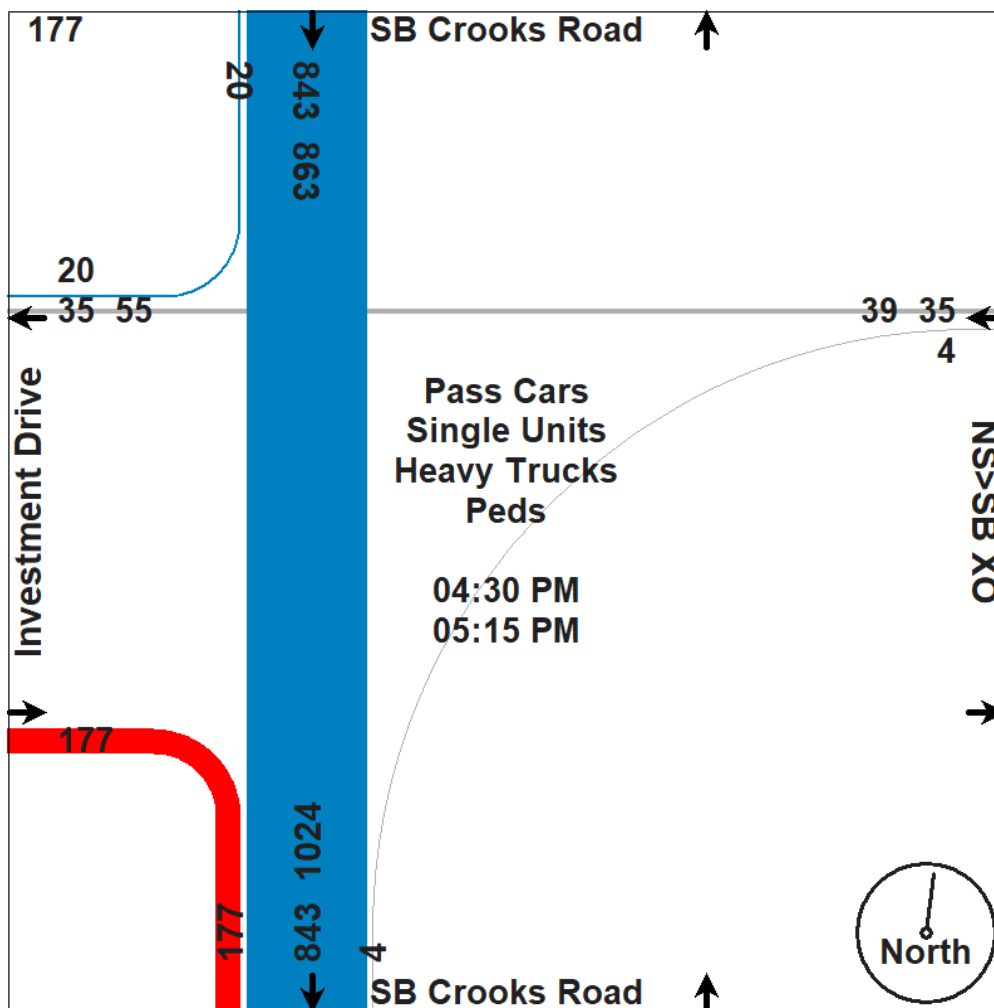
**FLEIS & VANDENBRINK**



**Project:** Troy Long Lk. PUD Traffic Study  
**Study:** 4 Hr. Video Turning Movement Count  
**Weather:** Pt. Sunny, Dry Deg's 60s  
**Count By:** Miovision Video VCU 8EU SE

**File Name :** TMC\_7 SB Crooks & Investment\_10-7-20  
**Site Code :** TMC\_7  
**Start Date :** 10/7/2020  
**Page No :** 4

	SB Crooks Road Southbound				NS>SB XO Westbound				SB Crooks Road Northbound				Investment Drive Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:30 PM																	
04:30 PM	8	207	0	215	0	11	0	11	0	0	0	0	51	0	0	51	277
04:45 PM	5	199	0	204	0	9	2	11	0	0	0	0	44	0	0	44	259
05:00 PM	5	205	0	210	0	4	1	5	0	0	0	0	52	0	0	52	267
05:15 PM	2	232	0	234	0	11	1	12	0	0	0	0	30	0	0	30	276
Total Volume	20	843	0	863	0	35	4	39	0	0	0	0	177	0	0	177	1079
% App. Total	2.3	97.7	0		0	89.7	10.3		0	0	0	0	100	0	0		
PHF	.625	.908	.000	.922	.000	.795	.500	.813	.000	.000	.000	.000	.851	.000	.000	.851	.974
Pass Cars	20	833	0	853	0	35	4	39	0	0	0	0	177	0	0	177	1069
% Pass Cars	100	98.8	0	98.8	0	100	100	100	0	0	0	0	100	0	0	100	99.1
Single Units	0	4	0	4	0	0	0	0	0	0	0	0	0	0	0	0	4
% Single Units	0	0.5	0	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0.4
Heavy Trucks	0	6	0	6	0	0	0	0	0	0	0	0	0	0	0	0	6
% Heavy Trucks	0	0.7	0	0.7	0	0	0	0	0	0	0	0	0	0	0	0	0.6
Peds	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Peds	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0





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Traffic Study Performed For:

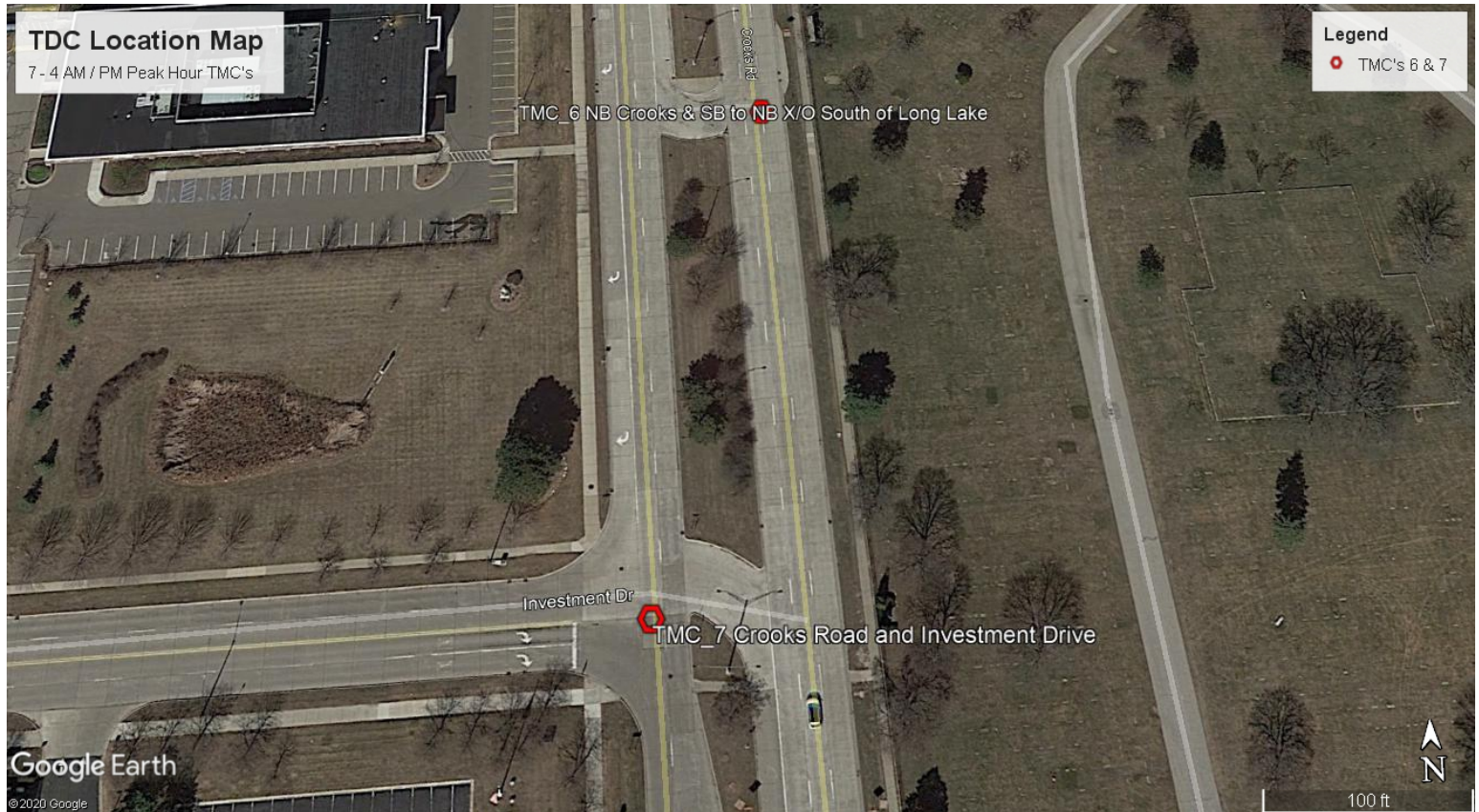
**FLEIS & VANDENBRINK**



**Project:** Troy Long Lk. PUD Traffic Study  
**Study:** 4 Hr. Video Turning Movement Count  
**Weather:** Pt. Sunny, Dry Deg's 60s  
**Count By:** Miovision Video VCU 8EU SE

**File Name :** TMC\_7 SB Crooks & Investment\_10-7-20  
**Site Code :** TMC\_7  
**Start Date :** 10/7/2020  
**Page No :** 5

## Aerial Photo





Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	17401_NB
Type	SPOT
Funct'l Class	-
Located On	CROOKS
SOUTH OF	CORPORATE
Direction	NB
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	NB
Notes	
Station	17401
Study	
Speed Limit	
Description	
Sensor Type	
Source	CombineVolumeCountsIncremental
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	36	16	17	10	79
1:00-2:00	9	5	6	9	29
2:00-3:00	5	8	3	4	20
3:00-4:00	9	7	18	9	43
4:00-5:00	10	7	15	12	44
5:00-6:00	25	28	41	48	142
6:00-7:00	56	84	124	142	406
7:00-8:00	124	191	203	239	757
8:00-9:00	213	215	235	214	877
9:00-10:00	208	158	175	181	722
10:00-11:00	148	149	181	155	633
11:00-12:00	201	199	215	255	870
12:00-13:00	250	219	234	229	932
13:00-14:00	209	214	212	225	860
14:00-15:00	228	229	246	237	940
15:00-16:00	352	327	399	410	1,488
16:00-17:00	479	488	532	501	2,000
17:00-18:00	582	547	510	443	2,082
18:00-19:00	390	308	269	271	1,238
19:00-20:00	209	186	243	181	819
20:00-21:00	180	161	136	157	634
21:00-22:00	160	159	101	81	501
22:00-23:00	95	72	47	32	246
23:00-24:00	43	41	30	22	136
Total					16,498
AADT					
AM Peak	11:45-12:45 958				
PM Peak	16:30-17:30 2,162				





Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	17401_1_NB
Type	SPOT
Funct'l Class	-
Located On	CROOKS
SOUTH OF	CORPORATE
Direction	1
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	17401
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	7	4	3	4	18
1:00-2:00	1	2	2	2	7
2:00-3:00	4	0	1	0	5
3:00-4:00	3	2	4	2	11
4:00-5:00	3	1	1	3	8
5:00-6:00	3	4	15	13	35
6:00-7:00	8	20	26	37	91
7:00-8:00	20	48	41	52	161
8:00-9:00	41	53	59	52	205
9:00-10:00	54	43	45	50	192
10:00-11:00	32	42	46	35	155
11:00-12:00	52	54	50	48	204
12:00-13:00	61	53	54	62	230
13:00-14:00	58	50	53	61	222
14:00-15:00	53	66	70	63	252
15:00-16:00	88	88	105	109	390
16:00-17:00	116	118	126	124	484
17:00-18:00	131	141	147	126	545
18:00-19:00	107	96	88	78	369
19:00-20:00	62	54	67	54	237
20:00-21:00	49	52	38	49	188
21:00-22:00	40	50	28	19	137
22:00-23:00	30	16	13	8	67
23:00-24:00	10	13	4	4	31
Total					4,244
AADT					
AM Peak	08:15-09:15 218				
PM Peak	17:00-18:00 545				



Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	17401_2_NB
Type	SPOT
Funct'l Class	-
Located On	CROOKS
SOUTH OF	CORPORATE
Direction	2
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	17401
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	13	5	5	3	26
1:00-2:00	4	1	1	3	9
2:00-3:00	1	2	0	1	4
3:00-4:00	2	1	6	2	11
4:00-5:00	1	2	4	1	8
5:00-6:00	5	2	8	12	27
6:00-7:00	10	26	31	37	104
7:00-8:00	29	42	37	49	157
8:00-9:00	52	45	47	38	182
9:00-10:00	42	40	45	44	171
10:00-11:00	30	41	49	36	156
11:00-12:00	41	52	53	67	213
12:00-13:00	62	54	51	63	230
13:00-14:00	56	58	60	65	239
14:00-15:00	58	68	66	66	258
15:00-16:00	96	90	105	109	400
16:00-17:00	116	123	135	127	501
17:00-18:00	134	143	152	124	553
18:00-19:00	103	92	75	73	343
19:00-20:00	54	61	67	49	231
20:00-21:00	60	54	43	54	211
21:00-22:00	42	50	27	22	141
22:00-23:00	25	30	15	14	84
23:00-24:00	15	13	9	12	49
Total					4,308
AADT					
AM Peak	11:30-12:30 236				
PM Peak	16:45-17:45 556				





Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	17401_3_NB
Type	SPOT
Funct'l Class	-
Located On	CROOKS
SOUTH OF	CORPORATE
Direction	3
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	17401
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	5	2	2	3	12
1:00-2:00	0	1	0	1	2
2:00-3:00	0	4	1	1	6
3:00-4:00	2	1	1	2	6
4:00-5:00	3	0	3	3	9
5:00-6:00	5	4	4	6	19
6:00-7:00	14	11	26	25	76
7:00-8:00	36	48	60	70	214
8:00-9:00	54	47	47	52	200
9:00-10:00	37	25	25	35	122
10:00-11:00	29	27	33	32	121
11:00-12:00	37	36	47	52	172
12:00-13:00	61	52	55	57	225
13:00-14:00	48	48	46	46	188
14:00-15:00	39	44	56	40	179
15:00-16:00	69	72	79	85	305
16:00-17:00	104	115	121	107	447
17:00-18:00	138	129	110	103	480
18:00-19:00	71	64	58	54	247
19:00-20:00	38	35	47	31	151
20:00-21:00	33	22	32	25	112
21:00-22:00	34	23	21	14	92
22:00-23:00	14	8	7	5	34
23:00-24:00	6	4	8	2	20
Total					3,439
AADT					
AM Peak	07:15-08:15 232				
PM Peak	16:30-17:30 495				



Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	17401_4_NB
Type	SPOT
Funct'l Class	-
Located On	CROOKS
SOUTH OF	CORPORATE
Direction	4
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	17401
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	11	5	7	0	23
1:00-2:00	4	1	3	3	11
2:00-3:00	0	2	1	2	5
3:00-4:00	2	3	7	3	15
4:00-5:00	3	4	7	5	19
5:00-6:00	12	18	14	17	61
6:00-7:00	24	27	41	43	135
7:00-8:00	39	53	65	68	225
8:00-9:00	66	70	82	72	290
9:00-10:00	75	50	60	52	237
10:00-11:00	57	39	53	52	201
11:00-12:00	71	57	65	88	281
12:00-13:00	66	60	74	47	247
13:00-14:00	47	58	53	53	211
14:00-15:00	78	51	54	68	251
15:00-16:00	99	77	110	107	393
16:00-17:00	143	132	150	143	568
17:00-18:00	179	134	101	90	504
18:00-19:00	109	56	48	66	279
19:00-20:00	55	36	62	47	200
20:00-21:00	38	33	23	29	123
21:00-22:00	44	36	25	26	131
22:00-23:00	26	18	12	5	61
23:00-24:00	12	11	9	4	36
Total					4,507
AADT					
AM Peak	08:15-09:15 299				
PM Peak	16:30-17:30 606				





Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	17401_WB
Type	SPOT
Funct'l Class	-
Located On	I-75 RAMP
EAST OF	CROOKS
Direction	WB
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	WB
Notes	
Station	17401
Study	
Speed Limit	
Description	
Sensor Type	
Source	CombineVolumeCountsIncremental
Latitude, Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	38	27	31	28	124
1:00-2:00	27	29	12	15	83
2:00-3:00	11	8	16	12	47
3:00-4:00	8	28	41	34	111
4:00-5:00	17	20	43	50	130
5:00-6:00	52	69	128	192	441
6:00-7:00	158	203	273	316	950
7:00-8:00	373	428	456	566	1,823
8:00-9:00	555	540	478	501	2,074
9:00-10:00	369	316	223	209	1,117
10:00-11:00	195	161	167	170	693
11:00-12:00	162	149	172	182	665
12:00-13:00	171	164	180	215	730
13:00-14:00	185	203	184	195	767
14:00-15:00	167	195	183	210	755
15:00-16:00	222	232	219	250	923
16:00-17:00	262	301	356	314	1,233
17:00-18:00	325	372	330	362	1,389
18:00-19:00	348	282	217	199	1,046
19:00-20:00	177	161	143	120	601
20:00-21:00	136	170	171	160	637
21:00-22:00	144	155	107	120	526
22:00-23:00	95	121	116	74	406
23:00-24:00	70	57	70	50	247
Total					17,518
AADT					
AM Peak	07:45-08:45 2,139				
PM Peak	17:15-18:15 1,412				



Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	17401_1_WB
Type	SPOT
Funct'l Class	-
Located On	I-75 RAMP
EAST OF	CROOKS
Direction	1
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	17401
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	11	4	3	7	25
1:00-2:00	2	2	3	0	7
2:00-3:00	0	1	4	0	5
3:00-4:00	1	2	1	2	6
4:00-5:00	3	2	2	6	13
5:00-6:00	11	14	19	42	86
6:00-7:00	30	31	40	60	161
7:00-8:00	93	101	111	136	441
8:00-9:00	133	142	124	121	520
9:00-10:00	78	72	51	43	244
10:00-11:00	36	37	35	28	136
11:00-12:00	29	29	29	37	124
12:00-13:00	32	36	38	38	144
13:00-14:00	45	36	24	37	142
14:00-15:00	27	30	25	37	119
15:00-16:00	34	33	36	31	134
16:00-17:00	28	40	41	49	158
17:00-18:00	56	68	58	42	224
18:00-19:00	41	32	27	24	124
19:00-20:00	16	20	10	14	60
20:00-21:00	15	23	29	27	94
21:00-22:00	22	22	14	20	78
22:00-23:00	13	16	9	6	44
23:00-24:00	11	4	7	6	28
Total					3,117
AADT					
AM Peak	07:45-08:45 535				
PM Peak	16:45-17:45 231				





Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	17401_2_WB
Type	SPOT
Funct'l Class	-
Located On	I-75 RAMP
EAST OF	CROOKS
Direction	2
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	17401
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	6	4	3	6	19
1:00-2:00	6	5	2	4	17
2:00-3:00	3	3	5	5	16
3:00-4:00	0	3	7	5	15
4:00-5:00	2	5	7	10	24
5:00-6:00	16	9	23	30	78
6:00-7:00	34	29	61	62	186
7:00-8:00	88	104	102	132	426
8:00-9:00	132	130	115	118	495
9:00-10:00	100	84	61	56	301
10:00-11:00	49	39	43	44	175
11:00-12:00	47	36	37	34	154
12:00-13:00	43	33	45	48	169
13:00-14:00	43	36	37	46	162
14:00-15:00	33	37	37	35	142
15:00-16:00	37	47	35	41	160
16:00-17:00	41	49	50	60	200
17:00-18:00	66	70	64	65	265
18:00-19:00	51	51	28	43	173
19:00-20:00	29	28	25	23	105
20:00-21:00	20	20	31	25	96
21:00-22:00	25	29	26	19	99
22:00-23:00	21	27	13	17	78
23:00-24:00	12	9	9	11	41
Total					3,596
AADT					
AM Peak	07:45-08:45 509				
PM Peak	17:00-18:00 265				



Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	17401_3_WB
Type	SPOT
Funct'l Class	-
Located On	I-75 RAMP
EAST OF	CROOKS
Direction	3
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	17401
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	12	10	15	10	47
1:00-2:00	12	13	4	7	36
2:00-3:00	5	2	3	4	14
3:00-4:00	4	13	20	15	52
4:00-5:00	8	7	19	18	52
5:00-6:00	14	25	48	62	149
6:00-7:00	49	65	69	65	248
7:00-8:00	89	100	98	134	421
8:00-9:00	129	143	122	115	509
9:00-10:00	77	64	36	45	222
10:00-11:00	32	25	26	31	114
11:00-12:00	32	32	35	36	135
12:00-13:00	30	30	31	45	136
13:00-14:00	34	38	33	39	144
14:00-15:00	35	32	32	37	136
15:00-16:00	40	38	38	43	159
16:00-17:00	60	76	115	58	309
17:00-18:00	77	78	75	97	327
18:00-19:00	91	65	40	38	234
19:00-20:00	27	29	30	26	112
20:00-21:00	37	59	52	55	203
21:00-22:00	45	61	34	39	179
22:00-23:00	31	39	50	30	150
23:00-24:00	25	24	29	20	98
Total					4,186
AADT					
AM Peak	07:45-08:45 528				
PM Peak	17:15-18:15 341				



Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	17401_4_WB
Type	SPOT
Funct'l Class	-
Located On	I-75 RAMP
EAST OF	CROOKS
Direction	4
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	17401
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	9	9	10	5	33
1:00-2:00	7	9	3	4	23
2:00-3:00	3	2	4	3	12
3:00-4:00	3	10	13	12	38
4:00-5:00	4	6	15	16	41
5:00-6:00	11	21	38	58	128
6:00-7:00	45	78	103	129	355
7:00-8:00	103	123	145	164	535
8:00-9:00	161	125	117	147	550
9:00-10:00	114	96	75	65	350
10:00-11:00	78	60	63	67	268
11:00-12:00	54	52	71	75	252
12:00-13:00	66	65	66	84	281
13:00-14:00	63	93	90	73	319
14:00-15:00	72	96	89	101	358
15:00-16:00	111	114	110	135	470
16:00-17:00	133	136	150	147	566
17:00-18:00	126	156	133	158	573
18:00-19:00	165	134	122	94	515
19:00-20:00	105	84	78	57	324
20:00-21:00	64	68	59	53	244
21:00-22:00	52	43	33	42	170
22:00-23:00	30	39	44	21	134
23:00-24:00	22	20	25	13	80
Total					6,619
AADT					
AM Peak	07:30-08:30				595
PM Peak	17:15-18:15				612





Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	17401_SB
Type	SPOT
Funct'l Class	-
Located On	CROOKS
NORTH OF	CORPORATE
Direction	SB
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	SB
Notes	
Station	17401
Study	
Speed Limit	
Description	
Sensor Type	
Source	CombineVolumeCountsIncremental
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	37	12	29	16	94
1:00-2:00	11	5	10	12	38
2:00-3:00	13	8	12	9	42
3:00-4:00	4	21	19	19	63
4:00-5:00	22	26	46	67	161
5:00-6:00	79	109	160	170	518
6:00-7:00	231	334	359	437	1,361
7:00-8:00	510	543	556	563	2,172
8:00-9:00	494	537	535	593	2,159
9:00-10:00	487	401	319	292	1,499
10:00-11:00	226	246	249	288	1,009
11:00-12:00	222	228	281	265	996
12:00-13:00	272	298	310	266	1,146
13:00-14:00	285	283	220	258	1,046
14:00-15:00	247	276	253	245	1,021
15:00-16:00	303	285	268	312	1,168
16:00-17:00	345	285	319	316	1,265
17:00-18:00	320	306	246	253	1,125
18:00-19:00	222	234	205	187	848
19:00-20:00	235	177	170	174	756
20:00-21:00	170	155	123	117	565
21:00-22:00	113	136	105	70	424
22:00-23:00	85	85	58	44	272
23:00-24:00	76	40	34	40	190
Total					19,938
AADT					
AM Peak	07:00-08:00				2,172
PM Peak	16:00-17:00				1,265



Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	17401_1_SB
Type	SPOT
Funct'l Class	-
Located On	CROOKS
NORTH OF	CORPORATE
Direction	1
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	17401
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	2	0	5	1	8
1:00-2:00	2	0	2	0	4
2:00-3:00	1	1	0	0	2
3:00-4:00	0	3	2	3	8
4:00-5:00	0	2	5	1	8
5:00-6:00	4	3	11	12	30
6:00-7:00	29	20	24	16	89
7:00-8:00	25	29	31	38	123
8:00-9:00	35	30	39	26	130
9:00-10:00	30	35	18	14	97
10:00-11:00	11	9	15	25	60
11:00-12:00	18	27	17	19	81
12:00-13:00	23	18	25	25	91
13:00-14:00	9	28	22	17	76
14:00-15:00	25	31	31	14	101
15:00-16:00	33	26	31	45	135
16:00-17:00	51	30	38	41	160
17:00-18:00	43	43	13	21	120
18:00-19:00	19	16	10	18	63
19:00-20:00	17	20	10	10	57
20:00-21:00	11	9	7	6	33
21:00-22:00	5	9	4	8	26
22:00-23:00	10	4	8	3	25
23:00-24:00	10	9	3	3	25
Total					1,552
AADT					
AM Peak	07:45-08:45 142				
PM Peak	16:30-17:30 165				



Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	17401_2_SB
Type	SPOT
Funct'l Class	-
Located On	CROOKS
NORTH OF	CORPORATE
Direction	2
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	17401
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	18	8	15	8	49
1:00-2:00	4	2	5	2	13
2:00-3:00	9	5	7	4	25
3:00-4:00	1	13	11	12	37
4:00-5:00	9	12	19	21	61
5:00-6:00	32	36	51	48	167
6:00-7:00	75	104	84	101	364
7:00-8:00	123	112	116	103	454
8:00-9:00	95	82	96	102	375
9:00-10:00	96	89	76	73	334
10:00-11:00	54	71	62	86	273
11:00-12:00	57	52	70	66	245
12:00-13:00	54	69	62	60	245
13:00-14:00	67	74	47	72	260
14:00-15:00	73	65	54	65	257
15:00-16:00	85	89	76	95	345
16:00-17:00	88	85	75	78	326
17:00-18:00	73	66	57	57	253
18:00-19:00	53	61	66	49	229
19:00-20:00	83	55	56	42	236
20:00-21:00	46	52	36	34	168
21:00-22:00	39	42	28	26	135
22:00-23:00	28	33	21	16	98
23:00-24:00	38	12	16	17	83
Total					5,032
AADT					
AM Peak	07:00-08:00				454
PM Peak	15:15-16:15				348





Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	17401_3_SB
Type	SPOT
Funct'l Class	-
Located On	CROOKS
NORTH OF	CORPORATE
Direction	3
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	17401
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	9	1	7	2	19
1:00-2:00	1	0	2	2	5
2:00-3:00	1	1	2	4	8
3:00-4:00	2	3	5	3	13
4:00-5:00	5	5	13	18	41
5:00-6:00	19	29	30	34	112
6:00-7:00	40	61	67	78	246
7:00-8:00	83	113	98	106	400
8:00-9:00	86	116	112	120	434
9:00-10:00	87	76	60	56	279
10:00-11:00	46	53	51	46	196
11:00-12:00	44	40	58	57	199
12:00-13:00	58	69	69	54	250
13:00-14:00	65	56	38	48	207
14:00-15:00	41	48	46	52	187
15:00-16:00	49	50	51	53	203
16:00-17:00	66	51	59	57	233
17:00-18:00	53	53	59	49	214
18:00-19:00	36	39	37	38	150
19:00-20:00	37	26	30	36	129
20:00-21:00	28	31	26	29	114
21:00-22:00	21	25	21	14	81
22:00-23:00	18	16	12	7	53
23:00-24:00	11	7	7	9	34
Total					3,807
AADT					
AM Peak	08:15-09:15				435
PM Peak	12:15-13:15				257



Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	17401_4_SB
Type	SPOT
Funct'l Class	-
Located On	CROOKS
NORTH OF	CORPORATE
Direction	4
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	17401
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	5	3	0	2	10
1:00-2:00	2	1	1	4	8
2:00-3:00	2	1	3	0	6
3:00-4:00	1	2	1	1	5
4:00-5:00	4	4	6	19	33
5:00-6:00	11	23	45	41	120
6:00-7:00	46	81	92	102	321
7:00-8:00	116	143	150	144	553
8:00-9:00	124	141	121	157	543
9:00-10:00	115	87	80	69	351
10:00-11:00	57	51	61	61	230
11:00-12:00	58	55	62	61	236
12:00-13:00	67	56	67	51	241
13:00-14:00	67	50	47	45	209
14:00-15:00	43	58	58	60	219
15:00-16:00	67	62	52	60	241
16:00-17:00	64	64	71	75	274
17:00-18:00	70	73	63	62	268
18:00-19:00	49	57	51	35	192
19:00-20:00	51	37	41	41	170
20:00-21:00	45	40	27	30	142
21:00-22:00	29	29	27	18	103
22:00-23:00	20	21	11	8	60
23:00-24:00	14	9	7	9	39
Total					4,574
AADT					
AM Peak	07:15-08:15 561				
PM Peak	16:30-17:30 289				



Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	17401_5_SB
Type	SPOT
Funct'l Class	-
Located On	CROOKS
NORTH OF	CORPORATE
Direction	5
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	17401
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	1	0	2	1	4
1:00-2:00	1	1	0	3	5
2:00-3:00	0	0	0	1	1
3:00-4:00	0	0	0	0	0
4:00-5:00	3	3	2	8	16
5:00-6:00	8	13	18	23	62
6:00-7:00	31	43	55	67	196
7:00-8:00	91	88	94	113	386
8:00-9:00	81	103	96	102	382
9:00-10:00	86	73	55	49	263
10:00-11:00	39	38	40	47	164
11:00-12:00	28	37	54	46	165
12:00-13:00	45	57	63	37	202
13:00-14:00	49	50	40	48	187
14:00-15:00	41	48	45	38	172
15:00-16:00	46	41	36	40	163
16:00-17:00	48	38	50	48	184
17:00-18:00	53	46	32	39	170
18:00-19:00	42	38	27	28	135
19:00-20:00	30	24	23	30	107
20:00-21:00	18	17	14	10	59
21:00-22:00	9	14	14	2	39
22:00-23:00	4	6	3	5	18
23:00-24:00	3	2	0	1	6
Total					3,086
AADT					
AM Peak	07:45-08:45 393				
PM Peak	12:15-13:15 206				





Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	17401_6_SB
Type	SPOT
Funct'l Class	-
Located On	CROOKS
NORTH OF	CORPORATE
Direction	6
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	17401
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	2	0	0	2	4
1:00-2:00	1	1	0	1	3
2:00-3:00	0	0	0	0	0
3:00-4:00	0	0	0	0	0
4:00-5:00	1	0	1	0	2
5:00-6:00	5	5	5	12	27
6:00-7:00	10	25	37	73	145
7:00-8:00	72	58	67	59	256
8:00-9:00	73	65	71	86	295
9:00-10:00	73	41	30	31	175
10:00-11:00	19	24	20	23	86
11:00-12:00	17	17	20	16	70
12:00-13:00	25	29	24	39	117
13:00-14:00	28	25	26	28	107
14:00-15:00	24	26	19	16	85
15:00-16:00	23	17	22	19	81
16:00-17:00	28	17	26	17	88
17:00-18:00	28	25	22	25	100
18:00-19:00	23	23	14	19	79
19:00-20:00	17	15	10	15	57
20:00-21:00	22	6	13	8	49
21:00-22:00	10	17	11	2	40
22:00-23:00	5	5	3	5	18
23:00-24:00	0	1	1	1	3
Total					1,887
AADT					
AM Peak	08:00-09:00				295
PM Peak	12:15-13:15				120



Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	17401_EB
Type	SPOT
Funct'l Class	-
Located On	CORPORATE
WEST OF	CROOKS
Direction	EB
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Tue 4/25/2017
End Date	Wed 4/26/2017
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	EB
Notes	
Station	17401
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	9	9	21	14	53
1:00-2:00	15	15	16	11	57
2:00-3:00	7	10	11	10	38
3:00-4:00	15	12	7	18	52
4:00-5:00	11	9	15	17	52
5:00-6:00	19	26	18	27	90
6:00-7:00	45	68	102	96	311
7:00-8:00	132	145	129	199	605
8:00-9:00	149	180	149	117	595
9:00-10:00	97	80	76	51	304
10:00-11:00	60	63	54	65	242
11:00-12:00	70	59	113	105	347
12:00-13:00	96	83	70	78	327
13:00-14:00	85	76	59	75	295
14:00-15:00	97	94	65	75	331
15:00-16:00	91	79	88	86	344
16:00-17:00	141	76	119	106	442
17:00-18:00	113	101	88	66	368
18:00-19:00	83	71	85	73	312
19:00-20:00	56	50	43	44	193
20:00-21:00	51	52	38	48	189
21:00-22:00	47	37	17	19	120
22:00-23:00	13	8	10	7	38
23:00-24:00	11	6	6	9	32
Total					5,737
AADT					
AM Peak	07:45-08:45 677				
PM Peak	16:00-17:00 442				



Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	17401_1_EB
Type	SPOT
Funct'l Class	-
Located On	CORPORATE
WEST OF	CROOKS
Direction	1
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Tue 4/25/2017
End Date	Wed 4/26/2017
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	17401
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	3	1	6	0	10
1:00-2:00	0	0	1	0	1
2:00-3:00	0	0	0	0	0
3:00-4:00	3	0	0	3	6
4:00-5:00	1	1	1	3	6
5:00-6:00	7	13	7	16	43
6:00-7:00	28	44	75	68	215
7:00-8:00	80	89	91	133	393
8:00-9:00	109	119	103	77	408
9:00-10:00	58	51	47	34	190
10:00-11:00	39	40	36	40	155
11:00-12:00	47	32	57	55	191
12:00-13:00	38	47	40	36	161
13:00-14:00	49	55	32	43	179
14:00-15:00	53	34	24	30	141
15:00-16:00	39	37	32	32	140
16:00-17:00	41	20	40	21	122
17:00-18:00	32	26	33	9	100
18:00-19:00	34	19	37	41	131
19:00-20:00	24	26	22	23	95
20:00-21:00	23	25	19	23	90
21:00-22:00	18	17	8	8	51
22:00-23:00	5	2	3	3	13
23:00-24:00	2	4	2	4	12
Total					2,853
AADT					
AM Peak	07:45-08:45 464				
PM Peak	13:15-14:15 183				





Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	17401_2_EB
Type	SPOT
Funct'l Class	-
Located On	CORPORATE
WEST OF	CROOKS
Direction	2
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Tue 4/25/2017
End Date	Wed 4/26/2017
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	17401
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	0	1	1	0	2
1:00-2:00	0	0	0	0	0
2:00-3:00	0	0	0	0	0
3:00-4:00	0	0	0	4	4
4:00-5:00	0	0	0	0	0
5:00-6:00	1	1	0	2	4
6:00-7:00	4	13	14	14	45
7:00-8:00	27	24	20	50	121
8:00-9:00	21	40	28	22	111
9:00-10:00	24	16	19	6	65
10:00-11:00	3	9	3	6	21
11:00-12:00	6	5	15	11	37
12:00-13:00	14	12	3	12	41
13:00-14:00	13	8	5	10	36
14:00-15:00	9	8	1	9	27
15:00-16:00	5	2	5	9	21
16:00-17:00	4	4	7	13	28
17:00-18:00	2	0	6	0	8
18:00-19:00	3	4	1	1	9
19:00-20:00	4	0	2	3	9
20:00-21:00	3	6	3	4	16
21:00-22:00	5	6	1	3	15
22:00-23:00	1	0	2	0	3
23:00-24:00	1	0	0	2	3
Total					626
AADT					
AM Peak	07:45-08:45				139
PM Peak	12:00-13:00				41



Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	17401_3_EB
Type	SPOT
Funct'l Class	-
Located On	CORPORATE
WEST OF	CROOKS
Direction	3
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Tue 4/25/2017
End Date	Wed 4/26/2017
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	17401
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	6	7	14	14	41
1:00-2:00	15	15	15	11	56
2:00-3:00	7	10	11	10	38
3:00-4:00	12	12	7	11	42
4:00-5:00	10	8	14	14	46
5:00-6:00	11	12	11	9	43
6:00-7:00	13	11	13	14	51
7:00-8:00	25	32	18	16	91
8:00-9:00	19	21	18	18	76
9:00-10:00	15	13	10	11	49
10:00-11:00	18	14	15	19	66
11:00-12:00	17	22	41	39	119
12:00-13:00	44	24	27	30	125
13:00-14:00	23	13	22	22	80
14:00-15:00	35	52	40	36	163
15:00-16:00	47	40	51	45	183
16:00-17:00	96	52	72	72	292
17:00-18:00	79	75	49	57	260
18:00-19:00	46	48	47	31	172
19:00-20:00	28	24	19	18	89
20:00-21:00	25	21	16	21	83
21:00-22:00	24	14	8	8	54
22:00-23:00	7	6	5	4	22
23:00-24:00	8	2	4	3	17
Total					2,258
AADT					
AM Peak	11:30-12:30 148				
PM Peak	16:30-17:30 298				



Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	17401_EB
Type	SPOT
Funct'l Class	-
Located On	CORPORATE
WEST OF	CROOKS
Direction	EB
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Wed 4/26/2017
End Date	Thu 4/27/2017
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	EB
Notes	
Station	17401
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	0	3	6	11	20
1:00-2:00	8	13	19	9	49
2:00-3:00	13	13	11	11	48
3:00-4:00	12	14	12	13	51
4:00-5:00	18	16	15	11	60
5:00-6:00	22	17	33	43	115
6:00-7:00	42	57	67	99	265
7:00-8:00	133	161	141	171	606
8:00-9:00	186	193	161	139	679
9:00-10:00	120	97	97	87	401
10:00-11:00	67	62	65	61	255
11:00-12:00	68	72	73	94	307
12:00-13:00	113	58	103	90	364
13:00-14:00	82	69	71	62	284
14:00-15:00	79	102	85	86	352
15:00-16:00	115	68	90	103	376
16:00-17:00	126	111	135	131	503
17:00-18:00	152	116	92	108	468
18:00-19:00	82	83	73	55	293
19:00-20:00	64	61	63	27	215
20:00-21:00	61	57	62	47	227
21:00-22:00	38	20	31	24	113
22:00-23:00	33	13	9	6	61
23:00-24:00	7	1	2	5	15
Total					6,127
AADT					
AM Peak	07:45-08:45 711				
PM Peak	16:30-17:30 534				





Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	17401_1_EB
Type	SPOT
Funct'l Class	-
Located On	CORPORATE
WEST OF	CROOKS
Direction	1
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Wed 4/26/2017
End Date	Thu 4/27/2017
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	17401
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	0	0	1	0	1
1:00-2:00	1	1	4	1	7
2:00-3:00	0	0	0	0	0
3:00-4:00	0	0	0	1	1
4:00-5:00	6	1	3	3	13
5:00-6:00	8	10	19	25	62
6:00-7:00	23	37	45	74	179
7:00-8:00	88	106	81	118	393
8:00-9:00	96	108	99	79	382
9:00-10:00	70	59	58	59	246
10:00-11:00	39	35	39	40	153
11:00-12:00	40	40	40	55	175
12:00-13:00	58	22	48	44	172
13:00-14:00	33	32	42	38	145
14:00-15:00	46	37	36	46	165
15:00-16:00	44	29	30	49	152
16:00-17:00	40	32	37	49	158
17:00-18:00	42	46	22	40	150
18:00-19:00	28	31	30	30	119
19:00-20:00	28	24	26	14	92
20:00-21:00	22	26	27	16	91
21:00-22:00	20	13	16	9	58
22:00-23:00	15	5	4	3	27
23:00-24:00	3	0	0	2	5
Total					2,946
AADT					
AM Peak	07:45-08:45 421				
PM Peak	16:30-17:30 174				



Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	17401_2_EB
Type	SPOT
Funct'l Class	-
Located On	CORPORATE
WEST OF	CROOKS
Direction	2
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Wed 4/26/2017
End Date	Thu 4/27/2017
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	17401
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	0	0	1	0	1
1:00-2:00	1	0	0	0	1
2:00-3:00	0	0	0	0	0
3:00-4:00	0	0	0	0	0
4:00-5:00	0	0	0	0	0
5:00-6:00	1	1	2	6	10
6:00-7:00	6	9	15	16	46
7:00-8:00	21	32	31	36	120
8:00-9:00	70	62	42	43	217
9:00-10:00	31	28	23	20	102
10:00-11:00	16	13	10	8	47
11:00-12:00	11	11	8	11	41
12:00-13:00	11	8	14	14	47
13:00-14:00	12	8	14	3	37
14:00-15:00	7	5	6	6	24
15:00-16:00	3	4	8	6	21
16:00-17:00	9	10	6	6	31
17:00-18:00	8	7	0	5	20
18:00-19:00	1	0	6	1	8
19:00-20:00	3	7	2	2	14
20:00-21:00	13	8	10	6	37
21:00-22:00	6	3	3	3	15
22:00-23:00	2	1	3	1	7
23:00-24:00	1	0	0	2	3
Total					849
AADT					
AM Peak	08:00-09:00 217				
PM Peak	12:15-13:15 48				



Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	17401_3_EB
Type	SPOT
Funct'l Class	-
Located On	CORPORATE
WEST OF	CROOKS
Direction	3
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Wed 4/26/2017
End Date	Thu 4/27/2017
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	17401
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	0	3	4	11	18
1:00-2:00	6	12	15	8	41
2:00-3:00	13	13	11	11	48
3:00-4:00	12	14	12	12	50
4:00-5:00	12	15	12	8	47
5:00-6:00	13	6	12	12	43
6:00-7:00	13	11	7	9	40
7:00-8:00	24	23	29	17	93
8:00-9:00	20	23	20	17	80
9:00-10:00	19	10	16	8	53
10:00-11:00	12	14	16	13	55
11:00-12:00	17	21	25	28	91
12:00-13:00	44	28	41	32	145
13:00-14:00	37	29	15	21	102
14:00-15:00	26	60	43	34	163
15:00-16:00	68	35	52	48	203
16:00-17:00	77	69	92	76	314
17:00-18:00	102	63	70	63	298
18:00-19:00	53	52	37	24	166
19:00-20:00	33	30	35	11	109
20:00-21:00	26	23	25	25	99
21:00-22:00	12	4	12	12	40
22:00-23:00	16	7	2	2	27
23:00-24:00	3	1	2	1	7
Total					2,332
AADT					
AM Peak	11:45-12:45 141				
PM Peak	16:15-17:15 339				





Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	17401_EB
Type	SPOT
Funct'l Class	-
Located On	CORPORATE
WEST OF	CROOKS
Direction	EB
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 4/27/2017
End Date	Fri 4/28/2017
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	EB
Notes	
Station	17401
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	1	3	2	2	8
1:00-2:00	1	0	1	0	2
2:00-3:00	2	2	0	0	4
3:00-4:00	1	0	3	0	4
4:00-5:00	1	7	6	8	22
5:00-6:00	13	13	30	29	85
6:00-7:00	35	70	74	92	271
7:00-8:00	166	161	133	180	640
8:00-9:00	185	189	169	127	670
9:00-10:00	125	97	78	82	382
10:00-11:00	79	56	67	65	267
11:00-12:00	70	82	102	87	341
12:00-13:00	113	91	80	81	365
13:00-14:00	72	94	86	79	331
14:00-15:00	92	105	76	68	341
15:00-16:00	97	68	104	87	356
16:00-17:00	129	109	108	114	460
17:00-18:00	128	114	98	78	418
18:00-19:00	73	67	63	73	276
19:00-20:00	73	55	39	28	195
20:00-21:00	46	46	55	42	189
21:00-22:00	32	26	13	25	96
22:00-23:00	10	8	10	11	39
23:00-24:00	10	11	12	7	40
Total					5,802
AADT					
AM Peak	07:45-08:45 723				
PM Peak	16:30-17:30 464				



Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	17401_1_EB
Type	SPOT
Funct'l Class	-
Located On	CORPORATE
WEST OF	CROOKS
Direction	1
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 4/27/2017
End Date	Fri 4/28/2017
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	17401
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude, Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	1	0	1	0	2
1:00-2:00	0	0	1	0	1
2:00-3:00	0	2	0	0	2
3:00-4:00	1	0	2	0	3
4:00-5:00	1	6	3	2	12
5:00-6:00	10	7	23	20	60
6:00-7:00	24	53	48	54	179
7:00-8:00	95	88	81	113	377
8:00-9:00	105	106	100	78	389
9:00-10:00	67	57	50	51	225
10:00-11:00	44	38	41	36	159
11:00-12:00	45	48	49	45	187
12:00-13:00	69	50	49	47	215
13:00-14:00	45	54	42	49	190
14:00-15:00	40	29	37	34	140
15:00-16:00	37	29	34	36	136
16:00-17:00	32	38	13	29	112
17:00-18:00	24	29	27	19	99
18:00-19:00	21	24	32	36	113
19:00-20:00	36	25	22	16	99
20:00-21:00	16	16	13	23	68
21:00-22:00	14	13	6	16	49
22:00-23:00	7	5	5	9	26
23:00-24:00	2	5	6	2	15
Total					2,858
AADT					
AM Peak	07:45-08:45 424				
PM Peak	12:00-13:00 215				



Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	17401_2_EB
Type	SPOT
Funct'l Class	-
Located On	CORPORATE
WEST OF	CROOKS
Direction	2
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 4/27/2017
End Date	Fri 4/28/2017
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	17401
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude, Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	0	0	1	0	1
1:00-2:00	0	0	0	0	0
2:00-3:00	0	0	0	0	0
3:00-4:00	0	0	1	0	1
4:00-5:00	0	0	0	0	0
5:00-6:00	2	1	1	3	7
6:00-7:00	7	11	19	28	65
7:00-8:00	54	44	35	51	184
8:00-9:00	57	56	51	34	198
9:00-10:00	48	24	13	11	96
10:00-11:00	14	5	9	5	33
11:00-12:00	12	8	9	4	33
12:00-13:00	10	10	5	5	30
13:00-14:00	4	17	14	9	44
14:00-15:00	10	6	7	5	28
15:00-16:00	9	5	12	3	29
16:00-17:00	6	4	5	3	18
17:00-18:00	5	7	1	7	20
18:00-19:00	2	2	1	5	10
19:00-20:00	1	2	1	0	4
20:00-21:00	4	7	2	1	14
21:00-22:00	3	1	0	3	7
22:00-23:00	1	1	3	0	5
23:00-24:00	1	1	0	1	3
Total					830
AADT					
AM Peak	07:45-08:45 215				
PM Peak	13:15-14:15 50				





Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	17401_3_EB
Type	SPOT
Funct'l Class	-
Located On	CORPORATE
WEST OF	CROOKS
Direction	3
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 4/27/2017
End Date	Fri 4/28/2017
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	17401
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude, Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	0	3	0	2	5
1:00-2:00	1	0	0	0	1
2:00-3:00	2	0	0	0	2
3:00-4:00	0	0	0	0	0
4:00-5:00	0	1	3	6	10
5:00-6:00	1	5	6	6	18
6:00-7:00	4	6	7	10	27
7:00-8:00	17	29	17	16	79
8:00-9:00	23	27	18	15	83
9:00-10:00	10	16	15	20	61
10:00-11:00	21	13	17	24	75
11:00-12:00	13	26	44	38	121
12:00-13:00	34	31	26	29	120
13:00-14:00	23	23	30	21	97
14:00-15:00	42	70	32	29	173
15:00-16:00	51	34	58	48	191
16:00-17:00	91	67	90	82	330
17:00-18:00	99	78	70	52	299
18:00-19:00	50	41	30	32	153
19:00-20:00	36	28	16	12	92
20:00-21:00	26	23	40	18	107
21:00-22:00	15	12	7	6	40
22:00-23:00	2	2	2	2	8
23:00-24:00	7	5	6	4	22
Total					2,114
AADT					
AM Peak	11:30-12:30 147				
PM Peak	16:30-17:30 349				



Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	77_NB
Type	SPOT
Funct'l Class	-
Located On	CROOKS
SOUTH OF	LONG LAKE
Direction	NB
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	NB
Notes	
Station	77
Study	
Speed Limit	
Description	
Sensor Type	
Source	CombineVolumeCountsIncremental
Latitude, Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	28	9	12	12	61
1:00-2:00	8	7	5	8	28
2:00-3:00	7	8	3	3	21
3:00-4:00	10	4	12	5	31
4:00-5:00	6	4	10	4	24
5:00-6:00	10	14	38	44	106
6:00-7:00	41	71	92	131	335
7:00-8:00	126	196	201	227	750
8:00-9:00	214	222	198	193	827
9:00-10:00	185	162	148	160	655
10:00-11:00	137	136	158	142	573
11:00-12:00	182	177	195	198	752
12:00-13:00	220	191	222	194	827
13:00-14:00	221	209	215	200	845
14:00-15:00	198	222	180	224	824
15:00-16:00	261	274	235	262	1,032
16:00-17:00	307	298	338	336	1,279
17:00-18:00	428	376	380	336	1,520
18:00-19:00	307	238	239	226	1,010
19:00-20:00	170	179	203	155	707
20:00-21:00	161	157	141	130	589
21:00-22:00	120	133	91	64	408
22:00-23:00	70	48	47	35	200
23:00-24:00	26	30	19	19	94
Total					13,498
AADT					
AM Peak	07:30-08:30				864
PM Peak	16:45-17:45				1,520



Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	77_2_NB
Type	SPOT
Funct'l Class	-
Located On	CROOKS
SOUTH OF	LONG LAKE
Direction	2
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	77
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	7	3	4	3	17
1:00-2:00	2	4	3	3	12
2:00-3:00	4	2	2	1	9
3:00-4:00	4	2	3	1	10
4:00-5:00	3	2	3	2	10
5:00-6:00	3	4	15	16	38
6:00-7:00	14	27	33	43	117
7:00-8:00	35	62	59	64	220
8:00-9:00	68	71	58	71	268
9:00-10:00	55	49	47	57	208
10:00-11:00	36	41	58	43	178
11:00-12:00	48	59	50	56	213
12:00-13:00	66	53	64	65	248
13:00-14:00	69	58	64	71	262
14:00-15:00	57	71	55	75	258
15:00-16:00	74	92	77	92	335
16:00-17:00	101	110	102	105	418
17:00-18:00	111	115	123	124	473
18:00-19:00	94	74	85	70	323
19:00-20:00	56	58	63	53	230
20:00-21:00	50	53	39	41	183
21:00-22:00	42	44	28	22	136
22:00-23:00	28	10	16	9	63
23:00-24:00	8	9	4	3	24
Total					4,253
AADT					
AM Peak	08:00-09:00 268				
PM Peak	17:00-18:00 473				





Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	77_3_NB
Type	SPOT
Funct'l Class	-
Located On	CROOKS
SOUTH OF	LONG LAKE
Direction	3
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	77
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	11	5	7	3	26
1:00-2:00	2	3	0	3	8
2:00-3:00	3	2	1	0	6
3:00-4:00	4	2	5	2	13
4:00-5:00	1	2	4	1	8
5:00-6:00	4	2	10	11	27
6:00-7:00	13	19	26	43	101
7:00-8:00	38	52	60	53	203
8:00-9:00	63	56	51	51	221
9:00-10:00	53	43	45	44	185
10:00-11:00	46	41	49	30	166
11:00-12:00	54	44	57	56	211
12:00-13:00	58	53	57	61	229
13:00-14:00	62	58	62	55	237
14:00-15:00	66	73	44	59	242
15:00-16:00	73	90	64	74	301
16:00-17:00	89	71	84	89	333
17:00-18:00	124	93	115	105	437
18:00-19:00	104	76	71	80	331
19:00-20:00	52	57	62	48	219
20:00-21:00	57	60	50	47	214
21:00-22:00	43	45	28	23	139
22:00-23:00	22	26	13	16	77
23:00-24:00	13	15	8	11	47
Total					3,981
AADT					
AM Peak	07:30-08:30				232
PM Peak	17:00-18:00				437



Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	77_4_NB
Type	SPOT
Funct'l Class	-
Located On	CROOKS
SOUTH OF	LONG LAKE
Direction	4
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	77
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	6	1	1	1	9
1:00-2:00	0	0	1	1	2
2:00-3:00	0	4	0	0	4
3:00-4:00	0	0	1	1	2
4:00-5:00	2	0	2	1	5
5:00-6:00	2	3	3	6	14
6:00-7:00	8	11	22	22	63
7:00-8:00	28	43	51	66	188
8:00-9:00	50	52	46	42	190
9:00-10:00	39	25	24	29	117
10:00-11:00	33	23	22	25	103
11:00-12:00	38	28	29	37	132
12:00-13:00	40	34	36	33	143
13:00-14:00	35	35	43	29	142
14:00-15:00	37	33	30	38	138
15:00-16:00	61	48	48	39	196
16:00-17:00	55	46	64	54	219
17:00-18:00	89	71	73	51	284
18:00-19:00	65	44	36	30	175
19:00-20:00	34	25	30	26	115
20:00-21:00	18	16	19	14	67
21:00-22:00	15	20	13	5	53
22:00-23:00	9	5	8	3	25
23:00-24:00	4	3	3	1	11
Total					2,397
AADT					
AM Peak	07:30-08:30				219
PM Peak	16:45-17:45				287



Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	77_5_NB
Type	SPOT
Funct'l Class	-
Located On	CROOKS
SOUTH OF	LONG LAKE
Direction	5
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	77
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	4	0	0	5	9
1:00-2:00	4	0	1	1	6
2:00-3:00	0	0	0	2	2
3:00-4:00	2	0	3	1	6
4:00-5:00	0	0	1	0	1
5:00-6:00	1	5	10	11	27
6:00-7:00	6	14	11	23	54
7:00-8:00	25	39	31	44	139
8:00-9:00	33	43	43	29	148
9:00-10:00	38	45	32	30	145
10:00-11:00	22	31	29	44	126
11:00-12:00	42	46	59	49	196
12:00-13:00	56	51	65	35	207
13:00-14:00	55	58	46	45	204
14:00-15:00	38	45	51	52	186
15:00-16:00	53	44	46	57	200
16:00-17:00	62	71	88	88	309
17:00-18:00	104	97	69	56	326
18:00-19:00	44	44	47	46	181
19:00-20:00	28	39	48	28	143
20:00-21:00	36	28	33	28	125
21:00-22:00	20	24	22	14	80
22:00-23:00	11	7	10	7	35
23:00-24:00	1	3	4	4	12
Total					2,867
AADT					
AM Peak	11:45-12:45 221				
PM Peak	16:30-17:30 377				





Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	77_WB
Type	SPOT
Funct'l Class	-
Located On	LONG LAKE
EAST OF	CROOKS
Direction	WB
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	WB
Notes	
Station	77
Study	
Speed Limit	
Description	
Sensor Type	
Source	CombineVolumeCountsIncremental
Latitude, Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	13	19	4	5	41
1:00-2:00	5	4	4	4	17
2:00-3:00	4	2	2	1	9
3:00-4:00	4	2	8	5	19
4:00-5:00	2	2	10	9	23
5:00-6:00	17	26	33	45	121
6:00-7:00	75	99	170	287	631
7:00-8:00	277	234	319	281	1,111
8:00-9:00	356	362	341	362	1,421
9:00-10:00	233	197	165	145	740
10:00-11:00	106	116	118	129	469
11:00-12:00	128	164	148	179	619
12:00-13:00	156	175	212	184	727
13:00-14:00	159	178	179	150	666
14:00-15:00	164	166	182	164	676
15:00-16:00	163	173	195	172	703
16:00-17:00	206	186	229	230	851
17:00-18:00	244	229	234	181	888
18:00-19:00	214	172	147	164	697
19:00-20:00	123	150	162	116	551
20:00-21:00	120	119	97	78	414
21:00-22:00	82	81	70	47	280
22:00-23:00	42	30	29	18	119
23:00-24:00	22	15	16	17	70
Total					11,863
AADT					
AM Peak	08:00-09:00				1,421
PM Peak	16:45-17:45				937



Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	77_2_WB
Type	SPOT
Funct'l Class	-
Located On	LONG LAKE
EAST OF	CROOKS
Direction	2
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	77
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	4	12	3	5	24
1:00-2:00	1	4	3	3	11
2:00-3:00	2	2	1	0	5
3:00-4:00	3	0	2	3	8
4:00-5:00	1	1	6	7	15
5:00-6:00	8	16	22	24	70
6:00-7:00	38	52	93	145	328
7:00-8:00	117	92	142	126	477
8:00-9:00	161	154	171	178	664
9:00-10:00	113	100	77	63	353
10:00-11:00	58	62	61	58	239
11:00-12:00	63	85	70	82	300
12:00-13:00	81	84	99	73	337
13:00-14:00	76	90	85	79	330
14:00-15:00	88	73	82	78	321
15:00-16:00	80	89	90	84	343
16:00-17:00	104	91	99	107	401
17:00-18:00	121	108	105	77	411
18:00-19:00	103	88	81	77	349
19:00-20:00	64	65	72	47	248
20:00-21:00	56	64	45	34	199
21:00-22:00	37	34	30	22	123
22:00-23:00	18	14	13	9	54
23:00-24:00	12	8	9	10	39
Total					5,649
AADT					
AM Peak	08:00-09:00				664
PM Peak	16:45-17:45				441



Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	77_3_WB
Type	SPOT
Funct'l Class	-
Located On	LONG LAKE
EAST OF	CROOKS
Direction	3
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	77
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	5	4	0	0	9
1:00-2:00	1	0	0	0	1
2:00-3:00	2	0	0	1	3
3:00-4:00	0	0	0	0	0
4:00-5:00	1	0	2	0	3
5:00-6:00	1	6	5	8	20
6:00-7:00	15	29	49	88	181
7:00-8:00	87	68	80	71	306
8:00-9:00	88	87	80	88	343
9:00-10:00	62	49	43	34	188
10:00-11:00	23	28	25	32	108
11:00-12:00	40	33	41	48	162
12:00-13:00	33	40	49	44	166
13:00-14:00	36	34	39	35	144
14:00-15:00	35	48	45	48	176
15:00-16:00	38	41	58	38	175
16:00-17:00	49	44	54	47	194
17:00-18:00	62	61	64	52	239
18:00-19:00	55	42	31	44	172
19:00-20:00	28	41	42	35	146
20:00-21:00	30	33	24	21	108
21:00-22:00	17	28	17	14	76
22:00-23:00	11	7	7	3	28
23:00-24:00	6	2	2	3	13
Total					2,961
AADT					
AM Peak	08:00-09:00				343
PM Peak	17:00-18:00				239





Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	77_4_WB
Type	SPOT
Funct'l Class	-
Located On	LONG LAKE
EAST OF	CROOKS
Direction	4
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	77
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	0	2	1	0	3
1:00-2:00	0	0	0	1	1
2:00-3:00	0	0	0	0	0
3:00-4:00	0	1	0	1	2
4:00-5:00	0	0	0	0	0
5:00-6:00	3	1	0	2	6
6:00-7:00	5	4	15	29	53
7:00-8:00	37	38	43	41	159
8:00-9:00	64	76	47	56	243
9:00-10:00	35	28	24	23	110
10:00-11:00	11	13	10	17	51
11:00-12:00	9	20	12	24	65
12:00-13:00	14	25	22	41	102
13:00-14:00	28	29	26	15	98
14:00-15:00	19	16	17	22	74
15:00-16:00	15	18	22	20	75
16:00-17:00	24	18	19	23	84
17:00-18:00	23	22	28	19	92
18:00-19:00	27	17	13	14	71
19:00-20:00	14	22	17	16	69
20:00-21:00	14	7	8	8	37
21:00-22:00	7	9	8	4	28
22:00-23:00	4	4	6	3	17
23:00-24:00	1	2	0	2	5
Total					1,445
AADT					
AM Peak	08:00-09:00				243
PM Peak	12:45-13:45				124



Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	77_5_WB
Type	SPOT
Funct'l Class	-
Located On	LONG LAKE
EAST OF	CROOKS
Direction	5
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	77
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	4	1	0	0	5
1:00-2:00	3	0	1	0	4
2:00-3:00	0	0	1	0	1
3:00-4:00	1	1	6	1	9
4:00-5:00	0	1	2	2	5
5:00-6:00	5	3	6	11	25
6:00-7:00	17	14	13	25	69
7:00-8:00	36	36	54	43	169
8:00-9:00	43	45	43	40	171
9:00-10:00	23	20	21	25	89
10:00-11:00	14	13	22	22	71
11:00-12:00	16	26	25	25	92
12:00-13:00	28	26	42	26	122
13:00-14:00	19	25	29	21	94
14:00-15:00	22	29	38	16	105
15:00-16:00	30	25	25	30	110
16:00-17:00	29	33	57	53	172
17:00-18:00	38	38	37	33	146
18:00-19:00	29	25	22	29	105
19:00-20:00	17	22	31	18	88
20:00-21:00	20	15	20	15	70
21:00-22:00	21	10	15	7	53
22:00-23:00	9	5	3	3	20
23:00-24:00	3	3	5	2	13
Total					1,808
AADT					
AM Peak	07:30-08:30				185
PM Peak	16:30-17:30				186



Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	77_SB
Type	SPOT
Funct'l Class	-
Located On	CROOKS
NORTH OF	LONG LAKE
Direction	SB
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	SB
Notes	
Station	77
Study	
Speed Limit	
Description	
Sensor Type	
Source	CombineVolumeCountsIncremental
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	13	6	4	9	32
1:00-2:00	5	3	3	7	18
2:00-3:00	2	2	9	4	17
3:00-4:00	4	1	6	2	13
4:00-5:00	8	6	17	30	61
5:00-6:00	29	46	76	94	245
6:00-7:00	102	155	179	233	669
7:00-8:00	263	303	322	353	1,241
8:00-9:00	299	346	309	364	1,318
9:00-10:00	288	259	211	189	947
10:00-11:00	168	138	167	195	668
11:00-12:00	168	149	202	182	701
12:00-13:00	218	190	201	196	805
13:00-14:00	209	177	146	196	728
14:00-15:00	171	176	164	195	706
15:00-16:00	211	205	173	218	807
16:00-17:00	224	222	263	269	978
17:00-18:00	309	292	268	234	1,103
18:00-19:00	194	171	173	122	660
19:00-20:00	134	132	117	106	489
20:00-21:00	105	110	101	80	396
21:00-22:00	70	69	71	55	265
22:00-23:00	40	55	27	20	142
23:00-24:00	23	18	16	18	75
Total					13,084
AADT					
AM Peak	07:30-08:30				1,320
PM Peak	16:45-17:45				1,138





Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	77_2_SB
Type	SPOT
Funct'l Class	-
Located On	CROOKS
NORTH OF	LONG LAKE
Direction	2
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	77
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	6	1	2	3	12
1:00-2:00	2	2	1	2	7
2:00-3:00	1	0	0	2	3
3:00-4:00	3	0	2	0	5
4:00-5:00	3	1	6	7	17
5:00-6:00	5	8	26	26	65
6:00-7:00	33	48	53	73	207
7:00-8:00	94	110	107	110	421
8:00-9:00	85	116	103	123	427
9:00-10:00	83	72	61	59	275
10:00-11:00	52	36	61	66	215
11:00-12:00	52	49	64	65	230
12:00-13:00	73	67	61	59	260
13:00-14:00	68	56	47	60	231
14:00-15:00	49	63	59	70	241
15:00-16:00	75	68	59	70	272
16:00-17:00	82	87	93	104	366
17:00-18:00	114	116	107	76	413
18:00-19:00	61	56	56	44	217
19:00-20:00	47	47	48	35	177
20:00-21:00	31	35	36	33	135
21:00-22:00	26	23	23	19	91
22:00-23:00	13	14	9	7	43
23:00-24:00	7	6	4	5	22
Total					4,352
AADT					
AM Peak	08:00-09:00				427
PM Peak	16:45-17:45				441



Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	77_3_SB
Type	SPOT
Funct'l Class	-
Located On	CROOKS
NORTH OF	LONG LAKE
Direction	3
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	77
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	4	5	0	4	13
1:00-2:00	2	1	2	4	9
2:00-3:00	1	0	5	0	6
3:00-4:00	1	1	3	1	6
4:00-5:00	2	2	5	16	25
5:00-6:00	11	18	33	37	99
6:00-7:00	44	65	84	88	281
7:00-8:00	100	121	128	140	489
8:00-9:00	106	124	116	133	479
9:00-10:00	99	79	68	65	311
10:00-11:00	62	46	56	59	223
11:00-12:00	60	52	76	62	250
12:00-13:00	77	75	73	61	286
13:00-14:00	77	58	53	58	246
14:00-15:00	61	62	48	67	238
15:00-16:00	73	78	56	79	286
16:00-17:00	78	89	96	92	355
17:00-18:00	106	91	94	88	379
18:00-19:00	78	64	66	44	252
19:00-20:00	52	46	40	44	182
20:00-21:00	49	49	48	29	175
21:00-22:00	24	32	32	23	111
22:00-23:00	17	25	14	7	63
23:00-24:00	11	8	8	11	38
Total					4,802
AADT					
AM Peak	07:30-08:30				498
PM Peak	16:30-17:30				385



Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	77_4_SB
Type	SPOT
Funct'l Class	-
Located On	CROOKS
NORTH OF	LONG LAKE
Direction	4
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	77
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	0	0	0	2	2
1:00-2:00	0	0	0	1	1
2:00-3:00	0	2	2	0	4
3:00-4:00	0	0	1	1	2
4:00-5:00	1	2	6	6	15
5:00-6:00	8	13	12	20	53
6:00-7:00	18	31	29	47	125
7:00-8:00	42	52	61	64	219
8:00-9:00	74	69	54	73	270
9:00-10:00	75	84	55	45	259
10:00-11:00	26	27	33	48	134
11:00-12:00	37	31	40	36	144
12:00-13:00	38	32	45	52	167
13:00-14:00	37	40	29	46	152
14:00-15:00	37	28	33	32	130
15:00-16:00	32	30	30	36	128
16:00-17:00	33	22	37	42	134
17:00-18:00	26	42	27	36	131
18:00-19:00	25	17	23	23	88
19:00-20:00	16	17	17	17	67
20:00-21:00	7	14	8	9	38
21:00-22:00	6	9	6	7	28
22:00-23:00	4	7	4	4	19
23:00-24:00	2	1	2	0	5
Total					2,315
AADT					
AM Peak	08:45-09:45				287
PM Peak	12:30-13:30				174





Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	77_5_SB
Type	SPOT
Funct'l Class	-
Located On	CROOKS
NORTH OF	LONG LAKE
Direction	5
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	77
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	3	0	2	0	5
1:00-2:00	1	0	0	0	1
2:00-3:00	0	0	2	2	4
3:00-4:00	0	0	0	0	0
4:00-5:00	2	1	0	1	4
5:00-6:00	5	7	5	11	28
6:00-7:00	7	11	13	25	56
7:00-8:00	27	20	26	39	112
8:00-9:00	34	37	36	35	142
9:00-10:00	31	24	27	20	102
10:00-11:00	28	29	17	22	96
11:00-12:00	19	17	22	19	77
12:00-13:00	30	16	22	24	92
13:00-14:00	27	23	17	32	99
14:00-15:00	24	23	24	26	97
15:00-16:00	31	29	28	33	121
16:00-17:00	31	24	37	31	123
17:00-18:00	63	43	40	34	180
18:00-19:00	30	34	28	11	103
19:00-20:00	19	22	12	10	63
20:00-21:00	18	12	9	9	48
21:00-22:00	14	5	10	6	35
22:00-23:00	6	9	0	2	17
23:00-24:00	3	3	2	2	10
Total					1,615
AADT					
AM Peak	07:45-08:45				146
PM Peak	17:00-18:00				180



Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	77_EB
Type	SPOT
Funct'l Class	-
Located On	LONG LAKE
WEST OF	CROOKS
Direction	EB
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	EB
Notes	
Station	77
Study	
Speed Limit	
Description	
Sensor Type	
Source	CombineVolumeCountsIncremental
Latitude, Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	19	8	12	10	49
1:00-2:00	5	10	6	8	29
2:00-3:00	5	7	4	2	18
3:00-4:00	2	1	9	7	19
4:00-5:00	14	9	7	11	41
5:00-6:00	18	11	28	36	93
6:00-7:00	36	66	57	101	260
7:00-8:00	134	145	143	168	590
8:00-9:00	168	158	152	183	661
9:00-10:00	164	134	113	120	531
10:00-11:00	106	134	125	124	489
11:00-12:00	108	161	157	160	586
12:00-13:00	170	153	179	184	686
13:00-14:00	179	171	157	142	649
14:00-15:00	175	252	173	177	777
15:00-16:00	209	200	209	245	863
16:00-17:00	258	246	263	237	1,004
17:00-18:00	370	296	255	258	1,179
18:00-19:00	214	223	166	152	755
19:00-20:00	134	136	144	129	543
20:00-21:00	143	125	131	119	518
21:00-22:00	141	104	62	67	374
22:00-23:00	58	34	47	27	166
23:00-24:00	19	23	18	11	71
Total					10,951
AADT					
AM Peak	11:45-12:45 662				
PM Peak	17:00-18:00 1,179				



Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	77_2_EB
Type	SPOT
Funct'l Class	-
Located On	LONG LAKE
WEST OF	CROOKS
Direction	2
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	77
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	11	4	5	4	24
1:00-2:00	1	4	1	4	10
2:00-3:00	1	1	2	0	4
3:00-4:00	1	0	1	4	6
4:00-5:00	6	4	3	5	18
5:00-6:00	7	7	13	17	44
6:00-7:00	20	35	24	40	119
7:00-8:00	55	59	61	76	251
8:00-9:00	78	70	61	61	270
9:00-10:00	69	57	42	54	222
10:00-11:00	43	54	51	54	202
11:00-12:00	49	69	60	62	240
12:00-13:00	65	56	77	76	274
13:00-14:00	76	75	71	67	289
14:00-15:00	77	107	76	75	335
15:00-16:00	91	91	91	108	381
16:00-17:00	115	106	108	96	425
17:00-18:00	158	129	109	113	509
18:00-19:00	83	95	69	65	312
19:00-20:00	58	62	64	61	245
20:00-21:00	68	48	59	52	227
21:00-22:00	70	49	28	33	180
22:00-23:00	32	15	21	17	85
23:00-24:00	9	13	12	7	41
Total					4,713
AADT					
AM Peak	07:30-08:30				285
PM Peak	17:00-18:00				509





Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	77_3_EB
Type	SPOT
Funct'l Class	-
Located On	LONG LAKE
WEST OF	CROOKS
Direction	3
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	77
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	7	1	5	4	17
1:00-2:00	2	3	2	1	8
2:00-3:00	2	3	0	0	5
3:00-4:00	0	0	2	0	2
4:00-5:00	4	2	2	3	11
5:00-6:00	3	2	10	6	21
6:00-7:00	8	15	21	36	80
7:00-8:00	42	48	40	42	172
8:00-9:00	42	46	48	62	198
9:00-10:00	54	44	41	35	174
10:00-11:00	35	42	47	42	166
11:00-12:00	35	49	54	50	188
12:00-13:00	54	53	60	57	224
13:00-14:00	60	51	51	42	204
14:00-15:00	57	92	61	68	278
15:00-16:00	74	71	74	86	305
16:00-17:00	102	80	95	78	355
17:00-18:00	148	113	100	92	453
18:00-19:00	85	83	52	55	275
19:00-20:00	51	43	48	42	184
20:00-21:00	45	47	49	49	190
21:00-22:00	49	37	25	28	139
22:00-23:00	19	16	19	7	61
23:00-24:00	8	4	4	1	17
Total					3,727
AADT					
AM Peak	11:45-12:45 217				
PM Peak	17:00-18:00 453				



Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	77_4_EB
Type	SPOT
Funct'l Class	-
Located On	LONG LAKE
WEST OF	CROOKS
Direction	4
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	77
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	0	0	2	2	4
1:00-2:00	1	3	2	2	8
2:00-3:00	2	3	2	2	9
3:00-4:00	1	1	5	2	9
4:00-5:00	3	3	2	2	10
5:00-6:00	1	0	0	5	6
6:00-7:00	1	4	3	4	12
7:00-8:00	8	8	3	6	25
8:00-9:00	7	5	5	11	28
9:00-10:00	6	6	3	7	22
10:00-11:00	7	10	4	10	31
11:00-12:00	7	10	7	12	36
12:00-13:00	11	9	10	13	43
13:00-14:00	14	7	7	7	35
14:00-15:00	18	17	13	8	56
15:00-16:00	15	17	14	20	66
16:00-17:00	14	20	20	22	76
17:00-18:00	24	22	13	15	74
18:00-19:00	18	18	13	17	66
19:00-20:00	8	9	8	7	32
20:00-21:00	8	11	7	8	34
21:00-22:00	9	9	1	1	20
22:00-23:00	2	1	2	0	5
23:00-24:00	2	3	1	1	7
Total					714
AADT					
AM Peak	11:45-12:45				42
PM Peak	16:30-17:30				88



Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	77_5_EB
Type	SPOT
Funct'l Class	-
Located On	LONG LAKE
WEST OF	CROOKS
Direction	5
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	77
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	1	3	0	0	4
1:00-2:00	1	0	1	1	3
2:00-3:00	0	0	0	0	0
3:00-4:00	0	0	1	1	2
4:00-5:00	1	0	0	1	2
5:00-6:00	7	2	5	8	22
6:00-7:00	7	12	9	21	49
7:00-8:00	29	30	39	44	142
8:00-9:00	41	37	38	49	165
9:00-10:00	35	27	27	24	113
10:00-11:00	21	28	23	18	90
11:00-12:00	17	33	36	36	122
12:00-13:00	40	35	32	38	145
13:00-14:00	29	38	28	26	121
14:00-15:00	23	36	23	26	108
15:00-16:00	29	21	30	31	111
16:00-17:00	27	40	40	41	148
17:00-18:00	40	32	33	38	143
18:00-19:00	28	27	32	15	102
19:00-20:00	17	22	24	19	82
20:00-21:00	22	19	16	10	67
21:00-22:00	13	9	8	5	35
22:00-23:00	5	2	5	3	15
23:00-24:00	0	3	1	2	6
Total					1,797
AADT					
AM Peak	08:00-09:00				165
PM Peak	16:15-17:15				161





Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	738_EB
Type	SPOT
Funct'l Class	-
Located On	X-OVER E OF CROOKS
WEST OF	LONG LAKE
Direction	EB
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	EB
Notes	
Station	738
Study	
Speed Limit	
Description	
Sensor Type	
Source	CombineVolumeCountsIncremental
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	39	19	50	51	159
1:00-2:00	34	38	66	240	378
2:00-3:00	190	319	322	383	1,214
3:00-4:00	406	419	313	326	1,464
4:00-5:00	228	213	247	3	691
5:00-6:00	1	0	0	3	4
6:00-7:00	2	8	3	6	19
7:00-8:00	10	11	17	19	57
8:00-9:00	26	22	18	14	80
9:00-10:00	21	15	14	17	67
10:00-11:00	7	9	7	10	33
11:00-12:00	5	11	12	14	42
12:00-13:00	10	10	17	10	47
13:00-14:00	14	20	18	8	60
14:00-15:00	12	13	14	10	49
15:00-16:00	7	8	4	12	31
16:00-17:00	13	11	15	13	52
17:00-18:00	11	8	11	14	44
18:00-19:00	13	5	7	12	37
19:00-20:00	11	15	7	11	44
20:00-21:00	14	7	9	6	36
21:00-22:00	12	9	4	5	30
22:00-23:00	4	3	2	1	10
23:00-24:00	1	2	3	2	8
Total					4,656
AADT					
AM Peak	02:30-03:30 1,530				
PM Peak	23:45-00:45 110				



Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	739_WB
Type	SPOT
Funct'l Class	-
Located On	X-OVER W.OF CROOKS
EAST OF	LONG LAKE
Direction	WB
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	WB
Notes	
Station	739
Study	
Speed Limit	
Description	
Sensor Type	
Source	CombineVolumeCountsIncremental
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	2	4	1	0	7
1:00-2:00	0	0	1	1	2
2:00-3:00	0	0	2	0	2
3:00-4:00	0	0	1	2	3
4:00-5:00	0	0	0	1	1
5:00-6:00	3	1	10	11	25
6:00-7:00	6	17	10	21	54
7:00-8:00	40	39	55	46	180
8:00-9:00	63	64	61	71	259
9:00-10:00	51	32	29	23	135
10:00-11:00	26	27	26	24	103
11:00-12:00	23	30	37	26	116
12:00-13:00	43	23	31	39	136
13:00-14:00	41	48	36	29	154
14:00-15:00	30	27	21	20	98
15:00-16:00	38	27	34	31	130
16:00-17:00	46	37	38	44	165
17:00-18:00	77	40	44	36	197
18:00-19:00	43	41	32	30	146
19:00-20:00	23	26	26	21	96
20:00-21:00	31	23	11	21	86
21:00-22:00	9	15	14	7	45
22:00-23:00	10	8	3	1	22
23:00-24:00	2	6	2	2	12
Total					2,174
AADT					
AM Peak	08:00-09:00 259				
PM Peak	16:45-17:45 205				



Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	728_NB
Type	SPOT
Funct'l Class	-
Located On	CORPORATE NB
SOUTH OF	LONG LAKE EB
Direction	NB
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	NB
Notes	
Station	728
Study	
Speed Limit	
Description	
Sensor Type	
Source	CombineVolumeCountsIncremental
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	18	1	7	6	32
1:00-2:00	5	14	1	6	26
2:00-3:00	2	6	2	0	10
3:00-4:00	0	0	2	5	7
4:00-5:00	0	2	0	0	2
5:00-6:00	0	6	5	12	23
6:00-7:00	16	20	31	6	73
7:00-8:00	14	14	14	17	59
8:00-9:00	19	16	13	16	64
9:00-10:00	13	25	23	14	75
10:00-11:00	33	24	28	38	123
11:00-12:00	18	27	32	35	112
12:00-13:00	28	29	29	38	124
13:00-14:00	29	28	20	33	110
14:00-15:00	25	13	17	26	81
15:00-16:00	36	28	33	33	130
16:00-17:00	43	25	34	38	140
17:00-18:00	54	29	32	32	147
18:00-19:00	38	21	21	30	110
19:00-20:00	32	27	19	15	93
20:00-21:00	49	43	47	27	166
21:00-22:00	35	25	24	34	118
22:00-23:00	39	17	23	7	86
23:00-24:00	20	11	11	8	50
Total					1,961
AADT					
AM Peak	11:30-12:30				124
PM Peak	20:00-21:00				166





Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	728_1_NB
Type	SPOT
Funct'l Class	-
Located On	CORPORATE NB
SOUTH OF	LONG LAKE EB
Direction	1
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	728
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	9	1	4	2	16
1:00-2:00	2	6	1	2	11
2:00-3:00	1	1	1	0	3
3:00-4:00	0	0	1	2	3
4:00-5:00	0	1	0	0	1
5:00-6:00	0	3	3	7	13
6:00-7:00	6	9	17	3	35
7:00-8:00	8	10	9	7	34
8:00-9:00	11	8	5	12	36
9:00-10:00	8	17	11	10	46
10:00-11:00	20	15	19	22	76
11:00-12:00	11	13	21	28	73
12:00-13:00	16	17	18	26	77
13:00-14:00	22	15	17	14	68
14:00-15:00	14	8	8	16	46
15:00-16:00	21	20	19	23	83
16:00-17:00	25	19	21	25	90
17:00-18:00	28	18	21	19	86
18:00-19:00	26	15	11	16	68
19:00-20:00	24	19	14	8	65
20:00-21:00	19	21	23	13	76
21:00-22:00	16	11	10	13	50
22:00-23:00	18	6	10	5	39
23:00-24:00	9	4	5	5	23
Total					1,118
AADT					
AM Peak	11:30-12:30				82
PM Peak	16:15-17:15				93



Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	728_2_NB
Type	SPOT
Funct'l Class	-
Located On	CORPORATE NB
SOUTH OF	LONG LAKE EB
Direction	2
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	728
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	9	0	3	4	16
1:00-2:00	3	8	0	4	15
2:00-3:00	1	5	1	0	7
3:00-4:00	0	0	1	3	4
4:00-5:00	0	1	0	0	1
5:00-6:00	0	3	2	5	10
6:00-7:00	10	11	14	3	38
7:00-8:00	6	4	5	10	25
8:00-9:00	8	8	8	4	28
9:00-10:00	5	8	12	4	29
10:00-11:00	13	9	9	16	47
11:00-12:00	7	14	11	7	39
12:00-13:00	12	12	11	12	47
13:00-14:00	7	13	3	19	42
14:00-15:00	11	5	9	10	35
15:00-16:00	15	8	14	10	47
16:00-17:00	18	6	13	13	50
17:00-18:00	26	11	11	13	61
18:00-19:00	12	6	10	14	42
19:00-20:00	8	8	5	7	28
20:00-21:00	30	22	24	14	90
21:00-22:00	19	14	14	21	68
22:00-23:00	21	11	13	2	47
23:00-24:00	11	7	6	3	27
Total					843
AADT					
AM Peak	10:45-11:45				48
PM Peak	20:00-21:00				90



Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	728_WB
Type	SPOT
Funct'l Class	-
Located On	LONG LAKE EB
EAST OF	LONG LAKE WB
Direction	WB
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	WB
Notes	
Station	728
Study	
Speed Limit	
Description	
Sensor Type	
Source	CombineVolumeCountsIncremental
Latitude, Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	1	4	0	0	5
1:00-2:00	1	0	0	0	1
2:00-3:00	3	1	0	0	4
3:00-4:00	1	0	2	2	5
4:00-5:00	3	1	2	1	7
5:00-6:00	5	5	7	10	27
6:00-7:00	15	8	13	11	47
7:00-8:00	15	7	4	13	39
8:00-9:00	22	15	14	18	69
9:00-10:00	14	11	13	4	42
10:00-11:00	6	13	4	5	28
11:00-12:00	6	3	5	4	18
12:00-13:00	8	7	6	5	26
13:00-14:00	8	6	6	6	26
14:00-15:00	14	6	10	8	38
15:00-16:00	6	4	6	8	24
16:00-17:00	6	2	6	2	16
17:00-18:00	6	7	10	10	33
18:00-19:00	7	7	9	10	33
19:00-20:00	10	6	6	7	29
20:00-21:00	4	17	10	6	37
21:00-22:00	12	5	7	5	29
22:00-23:00	3	5	2	4	14
23:00-24:00	4	1	3	1	9
Total					606
AADT					
AM Peak	08:00-09:00				69
PM Peak	20:15-21:15				45





Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	728_EB
Type	SPOT
Funct'l Class	-
Located On	LONG LAKE WB
WEST OF	LONG LAKE EB
Direction	EB
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	EB
Notes	
Station	728
Study	
Speed Limit	
Description	
Sensor Type	
Source	CombineVolumeCountsIncremental
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	10	9	9	13	41
1:00-2:00	8	4	2	4	18
2:00-3:00	6	1	2	0	9
3:00-4:00	5	0	6	4	15
4:00-5:00	20	10	22	18	70
5:00-6:00	33	32	54	63	182
6:00-7:00	57	102	114	97	370
7:00-8:00	142	128	139	162	571
8:00-9:00	163	150	140	167	620
9:00-10:00	182	127	118	112	539
10:00-11:00	94	111	120	100	425
11:00-12:00	102	119	137	137	495
12:00-13:00	147	135	148	157	587
13:00-14:00	149	148	136	113	546
14:00-15:00	146	244	166	156	712
15:00-16:00	158	171	165	196	690
16:00-17:00	231	206	214	194	845
17:00-18:00	275	238	219	201	933
18:00-19:00	179	181	148	150	658
19:00-20:00	107	108	117	123	455
20:00-21:00	156	172	190	198	716
21:00-22:00	232	148	74	81	535
22:00-23:00	65	39	67	33	204
23:00-24:00	21	18	22	12	73
Total					10,309
AADT					
AM Peak	08:15-09:15 639				
PM Peak	17:00-18:00 933				



Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	728_1_EB
Type	SPOT
Funct'l Class	-
Located On	LONG LAKE WB
WEST OF	LONG LAKE EB
Direction	1
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	728
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	6	4	4	2	16
1:00-2:00	1	2	0	2	5
2:00-3:00	2	1	0	0	3
3:00-4:00	1	0	1	2	4
4:00-5:00	7	4	6	6	23
5:00-6:00	5	7	15	18	45
6:00-7:00	19	37	27	26	109
7:00-8:00	60	52	52	68	232
8:00-9:00	67	61	51	48	227
9:00-10:00	65	48	37	43	193
10:00-11:00	27	46	45	43	161
11:00-12:00	41	49	52	49	191
12:00-13:00	47	54	62	58	221
13:00-14:00	52	61	56	44	213
14:00-15:00	57	97	61	63	278
15:00-16:00	68	82	73	94	317
16:00-17:00	109	84	95	71	359
17:00-18:00	120	97	90	97	404
18:00-19:00	76	80	67	57	280
19:00-20:00	40	50	58	55	203
20:00-21:00	57	52	58	60	227
21:00-22:00	74	54	33	30	191
22:00-23:00	22	14	23	16	75
23:00-24:00	8	9	9	7	33
Total					4,010
AADT					
AM Peak	07:30-08:30 248				
PM Peak	17:00-18:00 404				



Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	728_2_EB
Type	SPOT
Funct'l Class	-
Located On	LONG LAKE WB
WEST OF	LONG LAKE EB
Direction	2
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	728
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	3	2	3	5	13
1:00-2:00	0	0	1	2	3
2:00-3:00	3	0	0	0	3
3:00-4:00	1	0	1	1	3
4:00-5:00	6	3	4	3	16
5:00-6:00	5	5	15	12	37
6:00-7:00	13	29	41	33	116
7:00-8:00	40	44	40	34	158
8:00-9:00	42	41	41	56	180
9:00-10:00	58	28	36	31	153
10:00-11:00	33	37	41	34	145
11:00-12:00	29	35	41	44	149
12:00-13:00	54	43	45	46	188
13:00-14:00	49	50	45	28	172
14:00-15:00	53	96	56	66	271
15:00-16:00	62	62	56	71	251
16:00-17:00	92	78	73	73	316
17:00-18:00	103	84	87	67	341
18:00-19:00	59	69	47	54	229
19:00-20:00	38	34	35	47	154
20:00-21:00	45	60	61	67	233
21:00-22:00	85	43	22	29	179
22:00-23:00	19	10	24	11	64
23:00-24:00	8	6	8	2	24
Total					3,398
AADT					
AM Peak	08:15-09:15				196
PM Peak	16:45-17:45				347





Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	728_3_EB
Type	SPOT
Funct'l Class	-
Located On	LONG LAKE WB
WEST OF	LONG LAKE EB
Direction	3
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	728
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	1	2	1	5	9
1:00-2:00	5	1	1	0	7
2:00-3:00	1	0	1	0	2
3:00-4:00	1	0	1	0	2
4:00-5:00	5	2	4	4	15
5:00-6:00	9	8	14	17	48
6:00-7:00	14	23	33	25	95
7:00-8:00	15	14	13	25	67
8:00-9:00	19	12	21	24	76
9:00-10:00	15	13	14	11	53
10:00-11:00	13	9	8	6	36
11:00-12:00	8	16	20	16	60
12:00-13:00	23	18	21	16	78
13:00-14:00	20	18	13	12	63
14:00-15:00	17	27	14	8	66
15:00-16:00	17	13	19	16	65
16:00-17:00	14	21	26	21	82
17:00-18:00	25	25	21	21	92
18:00-19:00	23	18	12	12	65
19:00-20:00	8	7	10	9	34
20:00-21:00	32	52	59	59	202
21:00-22:00	64	39	14	19	136
22:00-23:00	17	12	18	5	52
23:00-24:00	5	2	4	1	12
Total					1,417
AADT					
AM Peak	06:15-07:15				96
PM Peak	20:15-21:15				234



Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	728_4_EB
Type	SPOT
Funct'l Class	-
Located On	LONG LAKE WB
WEST OF	LONG LAKE EB
Direction	4
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	728
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	0	1	1	1	3
1:00-2:00	2	1	0	0	3
2:00-3:00	0	0	1	0	1
3:00-4:00	2	0	3	1	6
4:00-5:00	2	1	8	5	16
5:00-6:00	14	12	10	16	52
6:00-7:00	11	13	13	13	50
7:00-8:00	27	18	34	35	114
8:00-9:00	35	36	27	39	137
9:00-10:00	44	38	31	27	140
10:00-11:00	21	19	26	17	83
11:00-12:00	24	19	24	28	95
12:00-13:00	23	20	20	37	100
13:00-14:00	28	19	22	29	98
14:00-15:00	19	24	35	19	97
15:00-16:00	11	14	17	15	57
16:00-17:00	16	23	20	29	88
17:00-18:00	27	32	21	16	96
18:00-19:00	21	14	22	27	84
19:00-20:00	21	17	14	12	64
20:00-21:00	22	8	12	12	54
21:00-22:00	9	12	5	3	29
22:00-23:00	7	3	2	1	13
23:00-24:00	0	1	1	2	4
Total					1,484
AADT					
AM Peak	08:45-09:45				152
PM Peak	16:45-17:45				109



Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	740_EB
Type	SPOT
Funct'l Class	-
Located On	LONG LAKE WB
WEST OF	CORPORATE SB
Direction	EB
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	EB
Notes	
Station	740
Study	
Speed Limit	
Description	
Sensor Type	
Source	CombineVolumeCountsIncremental
Latitude, Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	1	2	2	2	7
1:00-2:00	1	1	0	0	2
2:00-3:00	0	0	0	1	1
3:00-4:00	0	1	0	0	1
4:00-5:00	0	2	3	2	7
5:00-6:00	6	5	14	25	50
6:00-7:00	21	23	31	26	101
7:00-8:00	54	53	47	55	209
8:00-9:00	59	70	68	52	249
9:00-10:00	53	37	23	25	138
10:00-11:00	24	16	21	29	90
11:00-12:00	20	29	32	19	100
12:00-13:00	24	40	26	29	119
13:00-14:00	34	34	16	25	109
14:00-15:00	28	53	34	26	141
15:00-16:00	47	25	39	29	140
16:00-17:00	44	40	46	30	160
17:00-18:00	49	24	27	35	135
18:00-19:00	25	20	21	28	94
19:00-20:00	22	19	22	24	87
20:00-21:00	21	26	24	20	91
21:00-22:00	45	18	8	5	76
22:00-23:00	8	5	2	2	17
23:00-24:00	3	3	0	3	9
Total					2,133
AADT					
AM Peak	07:45-08:45 252				
PM Peak	16:15-17:15 165				





Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	740_WB
Type	SPOT
Funct'l Class	-
Located On	LONG LAKE EB
EAST OF	LONG LAKE WB
Direction	WB
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	WB
Notes	
Station	740
Study	
Speed Limit	
Description	
Sensor Type	
Source	CombineVolumeCountsIncremental
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	24	20	10	10	64
1:00-2:00	7	12	1	4	24
2:00-3:00	3	3	4	9	19
3:00-4:00	6	0	0	3	9
4:00-5:00	4	8	7	11	30
5:00-6:00	14	33	28	40	115
6:00-7:00	61	104	196	146	507
7:00-8:00	216	159	191	187	753
8:00-9:00	254	260	228	258	1,000
9:00-10:00	163	147	152	112	574
10:00-11:00	110	114	94	113	431
11:00-12:00	102	115	111	154	482
12:00-13:00	128	139	156	154	577
13:00-14:00	143	133	130	127	533
14:00-15:00	116	135	116	158	525
15:00-16:00	113	168	167	144	592
16:00-17:00	172	165	180	165	682
17:00-18:00	195	182	220	178	775
18:00-19:00	208	167	153	142	670
19:00-20:00	125	142	126	99	492
20:00-21:00	135	150	149	105	539
21:00-22:00	128	134	93	78	433
22:00-23:00	54	46	53	26	179
23:00-24:00	31	21	17	27	96
Total					10,101
AADT					
AM Peak	08:00-09:00 1,000				
PM Peak	17:15-18:15 788				



Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	740_1_WB
Type	SPOT
Funct'l Class	-
Located On	LONG LAKE EB
EAST OF	LONG LAKE WB
Direction	1
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	740
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	10	8	5	7	30
1:00-2:00	4	5	1	2	12
2:00-3:00	1	1	1	2	5
3:00-4:00	4	0	0	0	4
4:00-5:00	3	4	4	7	18
5:00-6:00	5	23	14	19	61
6:00-7:00	31	58	101	71	261
7:00-8:00	74	53	71	79	277
8:00-9:00	84	85	92	97	358
9:00-10:00	61	56	61	37	215
10:00-11:00	47	41	34	42	164
11:00-12:00	43	52	43	58	196
12:00-13:00	50	59	63	42	214
13:00-14:00	47	44	50	60	201
14:00-15:00	44	54	50	63	211
15:00-16:00	42	84	72	58	256
16:00-17:00	81	71	83	62	297
17:00-18:00	86	79	112	85	362
18:00-19:00	107	81	86	69	343
19:00-20:00	62	67	64	42	235
20:00-21:00	56	66	56	39	217
21:00-22:00	51	51	35	30	167
22:00-23:00	20	15	16	6	57
23:00-24:00	12	9	11	13	45
Total					4,206
AADT					
AM Peak	08:00-09:00				358
PM Peak	17:30-18:30				385



Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	740_2_WB
Type	SPOT
Funct'l Class	-
Located On	LONG LAKE EB
EAST OF	LONG LAKE WB
Direction	2
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	740
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	8	6	3	3	20
1:00-2:00	2	3	0	0	5
2:00-3:00	1	0	1	5	7
3:00-4:00	2	0	0	0	2
4:00-5:00	1	3	2	2	8
5:00-6:00	2	6	9	14	31
6:00-7:00	18	31	53	51	153
7:00-8:00	98	71	74	65	308
8:00-9:00	82	72	76	90	320
9:00-10:00	59	54	56	49	218
10:00-11:00	41	43	41	42	167
11:00-12:00	41	38	44	58	181
12:00-13:00	48	49	52	54	203
13:00-14:00	49	42	46	38	175
14:00-15:00	42	54	43	60	199
15:00-16:00	49	57	62	55	223
16:00-17:00	55	72	65	72	264
17:00-18:00	78	80	77	66	301
18:00-19:00	69	56	45	50	220
19:00-20:00	48	50	37	37	172
20:00-21:00	46	42	43	33	164
21:00-22:00	36	42	26	28	132
22:00-23:00	20	16	15	8	59
23:00-24:00	11	7	5	8	31
Total					3,563
AADT					
AM Peak	08:00-09:00				320
PM Peak	16:45-17:45				307





Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	740_3_WB
Type	SPOT
Funct'l Class	-
Located On	LONG LAKE EB
EAST OF	LONG LAKE WB
Direction	3
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	740
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	6	5	1	0	12
1:00-2:00	1	3	0	1	5
2:00-3:00	1	1	1	2	5
3:00-4:00	0	0	0	1	1
4:00-5:00	0	1	1	1	3
5:00-6:00	3	3	4	6	16
6:00-7:00	8	8	27	11	54
7:00-8:00	17	9	10	7	43
8:00-9:00	19	16	14	22	71
9:00-10:00	13	12	13	14	52
10:00-11:00	16	18	11	18	63
11:00-12:00	13	7	11	21	52
12:00-13:00	9	15	13	20	57
13:00-14:00	11	15	12	11	49
14:00-15:00	11	13	7	25	56
15:00-16:00	11	17	26	20	74
16:00-17:00	25	17	18	16	76
17:00-18:00	16	17	24	16	73
18:00-19:00	25	20	18	19	82
19:00-20:00	10	22	20	18	70
20:00-21:00	28	33	34	22	117
21:00-22:00	29	33	21	16	99
22:00-23:00	10	11	15	8	44
23:00-24:00	6	3	1	5	15
Total					1,189
AADT					
AM Peak	08:00-09:00				71
PM Peak	20:15-21:15				118



Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	740_4_WB
Type	SPOT
Funct'l Class	-
Located On	LONG LAKE EB
EAST OF	LONG LAKE WB
Direction	4
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	740
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	0	1	1	0	2
1:00-2:00	0	1	0	1	2
2:00-3:00	0	1	1	0	2
3:00-4:00	0	0	0	2	2
4:00-5:00	0	0	0	1	1
5:00-6:00	4	1	1	1	7
6:00-7:00	4	7	15	13	39
7:00-8:00	27	26	36	36	125
8:00-9:00	69	87	46	49	251
9:00-10:00	30	25	22	12	89
10:00-11:00	6	12	8	11	37
11:00-12:00	5	18	13	17	53
12:00-13:00	21	16	28	38	103
13:00-14:00	36	32	22	18	108
14:00-15:00	19	14	16	10	59
15:00-16:00	11	10	7	11	39
16:00-17:00	11	5	14	15	45
17:00-18:00	15	6	7	11	39
18:00-19:00	7	10	4	4	25
19:00-20:00	5	3	5	2	15
20:00-21:00	5	9	16	11	41
21:00-22:00	12	8	11	4	35
22:00-23:00	4	4	7	4	19
23:00-24:00	2	2	0	1	5
Total					1,143
AADT					
AM Peak	08:00-09:00				251
PM Peak	12:30-13:30				134



Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	740_SB
Type	SPOT
Funct'l Class	-
Located On	CORPORATE SB
NORTH OF	LONG LAKE WB
Direction	SB
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	SB
Notes	
Station	740
Study	
Speed Limit	
Description	
Sensor Type	
Source	CombineVolumeCountsIncremental
Latitude, Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	9	1	2	7	19
1:00-2:00	4	7	0	0	11
2:00-3:00	3	0	0	0	3
3:00-4:00	1	0	0	0	1
4:00-5:00	2	0	0	2	4
5:00-6:00	6	3	5	14	28
6:00-7:00	31	32	64	31	158
7:00-8:00	57	35	44	39	175
8:00-9:00	40	41	40	54	175
9:00-10:00	49	38	35	32	154
10:00-11:00	28	33	36	21	118
11:00-12:00	31	44	50	55	180
12:00-13:00	82	61	54	61	258
13:00-14:00	73	38	42	54	207
14:00-15:00	51	54	49	41	195
15:00-16:00	55	43	57	59	214
16:00-17:00	87	76	88	95	346
17:00-18:00	154	90	94	106	444
18:00-19:00	98	69	59	66	292
19:00-20:00	50	37	38	34	159
20:00-21:00	67	44	47	44	202
21:00-22:00	55	50	49	32	186
22:00-23:00	22	24	18	20	84
23:00-24:00	6	8	10	0	24
Total					3,637
AADT					
AM Peak	11:45-12:45 252				
PM Peak	17:00-18:00 444				





Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	740_1_SB
Type	SPOT
Funct'l Class	-
Located On	CORPORATE SB
NORTH OF	LONG LAKE WB
Direction	1
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	740
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	3	0	0	2	5
1:00-2:00	2	2	0	0	4
2:00-3:00	1	0	0	0	1
3:00-4:00	0	0	0	0	0
4:00-5:00	0	0	0	1	1
5:00-6:00	2	1	5	11	19
6:00-7:00	19	16	35	14	84
7:00-8:00	30	19	26	23	98
8:00-9:00	21	30	20	25	96
9:00-10:00	25	14	19	13	71
10:00-11:00	15	16	14	11	56
11:00-12:00	16	25	30	29	100
12:00-13:00	43	34	31	34	142
13:00-14:00	48	21	18	25	112
14:00-15:00	26	26	16	16	84
15:00-16:00	24	20	24	25	93
16:00-17:00	47	36	44	55	182
17:00-18:00	79	47	48	55	229
18:00-19:00	58	38	27	36	159
19:00-20:00	22	13	12	13	60
20:00-21:00	30	19	13	19	81
21:00-22:00	23	14	24	16	77
22:00-23:00	10	10	7	5	32
23:00-24:00	2	5	3	0	10
Total					1,796
AADT					
AM Peak	11:45-12:45 137				
PM Peak	16:45-17:45 229				



Transportation Data Management System

# Volume Count Report

LOCATION INFO	
Location ID	740_2_SB
Type	SPOT
Funct'l Class	-
Located On	CORPORATE SB
NORTH OF	LONG LAKE WB
Direction	2
County	Oakland
Community	-
MPO ID	
HPMS ID	
Agency	Oakland County - SCATS

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 9/13/2018
End Date	Fri 9/14/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	740
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN					
Time	15-min Interval				Hourly Count
	1st	2nd	3rd	4th	
0:00-1:00	6	1	2	5	14
1:00-2:00	2	5	0	0	7
2:00-3:00	2	0	0	0	2
3:00-4:00	1	0	0	0	1
4:00-5:00	2	0	0	1	3
5:00-6:00	4	2	0	3	9
6:00-7:00	12	16	29	17	74
7:00-8:00	27	16	18	16	77
8:00-9:00	19	11	20	29	79
9:00-10:00	24	24	16	19	83
10:00-11:00	13	17	22	10	62
11:00-12:00	15	19	20	26	80
12:00-13:00	39	27	23	27	116
13:00-14:00	25	17	24	29	95
14:00-15:00	25	28	33	25	111
15:00-16:00	31	23	33	34	121
16:00-17:00	40	40	44	40	164
17:00-18:00	75	43	46	51	215
18:00-19:00	40	31	32	30	133
19:00-20:00	28	24	26	21	99
20:00-21:00	37	25	34	25	121
21:00-22:00	32	36	25	16	109
22:00-23:00	12	14	11	15	52
23:00-24:00	4	3	7	0	14
Total					1,841
AADT					
AM Peak	11:45-12:45				115
PM Peak	17:00-18:00				215

 = Assumed Shared Lane Distribution

### 2018 Turning Movement Counts

	Crooks Road Northbound		I-75 Ramp Westbound			Crooks Road Southbound			Corporate Drive Eastbound			
Start Time	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Total
7:00 AM	70	54	126	93	154	148	290	72	37	85	22	1151
7:15 AM	118	73	141	106	181	141	344	58	40	87	28	1317
7:30 AM	113	90	150	104	202	147	342	67	35	78	21	1349
7:45 AM	141	98	186	139	241	141	363	59	51	116	16	1551
8:00 AM	124	89	183	136	236	130	291	73	43	109	21	1435
8:15 AM	125	90	191	141	208	112	360	65	47	117	24	1480
8:30 AM	133	102	168	123	187	135	329	71	43	98	19	1408
8:45 AM	120	94	166	122	213	128	379	86	33	78	17	1436

2020 Peak Hour

<b>Total</b>	<b>528</b>	<b>383</b>	<b>735</b>	<b>544</b>	<b>881</b>	<b>523</b>	<b>1356</b>	<b>271</b>	<b>187</b>	<b>447</b>	<b>81</b>
PHF	<b>0.94</b>		<b>0.94</b>			<b>0.95</b>			<b>0.94</b>		

4:00 PM	301	178	57	32	173	139	178	28	25	19	88	1218
4:15 PM	317	171	75	40	186	115	153	17	20	16	63	1173
4:30 PM	341	191	76	54	226	113	180	26	20	16	85	1328
4:45 PM	322	179	91	38	185	119	180	17	22	18	77	1248
5:00 PM	356	226	102	46	177	116	176	28	22	16	93	1358
5:15 PM	369	178	117	47	208	109	172	25	22	17	72	1336
5:30 PM	372	138	103	44	183	70	154	22	18	11	63	1178
5:45 PM	318	125	88	52	222	78	150	25	15	12	57	1142

2020 Peak Hour

<b>Total</b>	<b>1402</b>	<b>782</b>	<b>390</b>	<b>187</b>	<b>804</b>	<b>462</b>	<b>715</b>	<b>97</b>	<b>87</b>	<b>68</b>	<b>332</b>
PHF	<b>0.93</b>		<b>0.92</b>			<b>0.99</b>			<b>0.92</b>		



### *2018 Turning Movement Counts*

	Long Lake Westbound		Crooks Road Southbound		Long Lake Eastbound		Crooks Northbound		
Start Time	Thru	Right	Thru	Right	Thru	Right	Thru	Right	Total
7:00 AM	241	36	236	27	105	29	101	25	<b>800</b>
7:15 AM	198	36	283	20	115	30	157	39	<b>878</b>
7:30 AM	265	54	296	26	104	39	170	31	<b>985</b>
7:45 AM	238	43	314	39	124	44	183	44	<b>1029</b>
8:00 AM	313	43	265	34	127	41	181	33	<b>1037</b>
8:15 AM	317	45	309	37	121	37	179	43	<b>1088</b>
8:30 AM	298	43	273	36	114	38	155	43	<b>1000</b>
8:45 AM	322	40	329	35	134	49	164	29	<b>1102</b>

2020 Peak Hour

<b>Total</b>	<b>1263</b>	<b>173</b>	<b>1188</b>	<b>143</b>	<b>501</b>	<b>167</b>	<b>686</b>	<b>149</b>
PHF	<b>0.98</b>		<b>0.91</b>		<b>0.90</b>		<b>0.93</b>	

4:00 PM	177	29	193	31	231	27	245	62	<b>995</b>
4:15 PM	153	33	198	24	206	40	227	71	<b>952</b>
4:30 PM	172	57	226	37	223	40	250	88	<b>1093</b>
4:45 PM	177	53	238	31	196	41	248	88	<b>1072</b>
5:00 PM	206	38	246	63	330	40	324	104	<b>1351</b>
5:15 PM	191	38	249	43	264	32	279	97	<b>1193</b>
5:30 PM	197	37	228	40	222	33	311	69	<b>1137</b>
5:45 PM	148	33	200	34	220	38	280	56	<b>1009</b>

2020 Peak Hour

<b>Total</b>	<b>779</b>	<b>168</b>	<b>971</b>	<b>179</b>	<b>1022</b>	<b>147</b>	<b>1174</b>	<b>362</b>
PHF	<b>0.96</b>		<b>0.92</b>		<b>0.78</b>		<b>0.89</b>	

### 2018 Turning Movement Counts

	Crooks Road Northbound		Tower Dr Westbound	X/O Eastbound		
Start Time	Thru	Right	Right	Left	Thru	Total
7:00 AM	117	7	24	13	87	248
7:15 AM	166	19	33	21	132	371
7:30 AM	162	16	44	18	132	372
7:45 AM	190	30	41	16	163	440
8:00 AM	170	35	66	16	136	423
8:15 AM	190	27	37	13	150	417
8:30 AM	186	15	49	21	122	393
8:45 AM	167	18	42	22	126	375

Peak hour

<b>Total</b>	<b>743</b>	<b>108</b>	<b>195</b>	<b>67</b>	<b>577</b>	<b>1673</b>
PHF	0.96		0.73	0.89		

4:00 PM	358	5	173	27	13	576
4:15 PM	355	6	162	9	19	551
4:30 PM	382	4	174	23	24	607
4:45 PM	349	6	136	21	22	534
5:00 PM	396	3	206	36	35	676
5:15 PM	408	14	131	26	28	607
5:30 PM	391	5	125	22	30	573
5:45 PM	352	8	90	23	25	498

Peak hour

<b>Total</b>	<b>1550</b>	<b>27</b>	<b>653</b>	<b>107</b>	<b>110</b>	<b>2424</b>
PHF	0.93		0.79	0.76		

### 2018 Turning Movement Counts

	Crossover Southbound	Long Lake Eastbound		Investment Dr. Northbound	
Start Time	Thru	Thru	Right	Right	Total
7:00 AM	15	115	27	14	171
7:15 AM	7	110	18	14	149
7:30 AM	4	105	34	14	157
7:45 AM	13	127	35	17	192
8:00 AM	22	128	35	19	204
8:15 AM	15	114	36	16	181
8:30 AM	14	113	27	13	167
8:45 AM	18	128	39	16	201

2020 Peak Hour

<b>Total</b>	<b>70</b>	<b>488</b>	<b>138</b>	<b>65</b>	<b>753</b>
PHF	0.78	0.93		0.84	

4:00 PM	6	215	16	43	280
4:15 PM	2	183	23	25	233
4:30 PM	6	194	20	34	254
4:45 PM	2	165	29	38	234
5:00 PM	6	248	27	54	335
5:15 PM	7	206	32	29	274
5:30 PM	10	198	21	32	261
5:45 PM	10	185	16	32	243

2020 Peak Hour

<b>Total</b>	<b>33</b>	<b>845</b>	<b>97</b>	<b>148</b>	<b>1113</b>
PHF	0.83	0.85		0.68	



### 2018 Turning Movement Counts

	Crossover Southbound	Long Lake Eastbound		
Start Time	Left	Thru (From Long Lake & Crooks)	Total	
7:00 AM	40		40	
7:15 AM	39		39	
7:30 AM	55		55	
7:45 AM	46		46	180
8:00 AM	63		63	203
8:15 AM	64		64	228
8:30 AM	61		61	234
8:45 AM	71		71	259

2020 Peak Hour

<b>Total</b>	<b>262</b>	<b>0</b>	<b>180</b>
PHF	0.91	#DIV/0!	

4:00 PM	46		46	
4:15 PM	37		37	
4:30 PM	38		38	
4:45 PM	44		44	165
5:00 PM	77		77	196
5:15 PM	40		40	199
5:30 PM	44		44	205
5:45 PM	36		36	197

2020 Peak Hour

<b>Total</b>	<b>207</b>	<b>0</b>	<b>165</b>
PHF	0.67	#DIV/0!	

### 2018 Turning Movement Counts

	Crossover Northbound		Long Lake Westbound		Corporate. Southbound	
Start Time	Left	Thru	Thru	Right	Right	Total
7:00 AM	8	46	189	27	57	327
7:15 AM	8	45	133	26	35	247
7:30 AM	7	40	155	36	44	282
7:45 AM	8	47	151	36	39	281
8:00 AM	9	50	185	69	40	353
8:15 AM	11	59	173	87	41	371
8:30 AM	10	58	182	46	40	336
8:45 AM	8	44	209	49	54	364

2020 Peak Hour

<b>Total</b>	<b>38</b>	<b>213</b>	<b>757</b>	<b>254</b>	<b>177</b>	<b>1424</b>
PHF	0.89		0.96		0.81	

4:00 PM	33	11	161	11	87	303
4:15 PM	30	10	160	5	76	281
4:30 PM	35	11	166	14	88	314
4:45 PM	23	7	150	15	95	290
5:00 PM	37	12	180	15	154	398
5:15 PM	18	6	176	6	90	296
5:30 PM	20	7	213	7	94	341
5:45 PM	26	9	167	11	106	319

2020 Peak Hour

<b>Total</b>	<b>102</b>	<b>34</b>	<b>743</b>	<b>39</b>	<b>448</b>	<b>1354</b>
PHF	0.69		0.88		0.72	

## 2018 Turning Movement Counts

	Crossover Northbound	Long Lake Westbound		
Start Time	Left	Thru (From Long Lake & Crooks)	Total	
7:00 AM	10		10	
7:15 AM	11		11	
7:30 AM	17		17	
7:45 AM	19		19	57
8:00 AM	26		26	73
8:15 AM	22		22	84
8:30 AM	18		18	85
8:45 AM	14		14	80

2020 Peak Hour

<b>Total</b>	<b>86</b>	<b>0</b>	<b>84</b>
PHF	0.82	#DIV/0!	

4:00 PM	13		13	
4:15 PM	11		11	
4:30 PM	15		15	
4:45 PM	13		13	52
5:00 PM	11		11	50
5:15 PM	8		8	47
5:30 PM	11		11	43
5:45 PM	14		14	44

2020 Peak Hour

<b>Total</b>	<b>53</b>	<b>0</b>	<b>52</b>
PHF	0.87	#DIV/0!	



### Turning Movement Counts

	Crooks Road Northbound		I-75 Ramp Westbound			Crooks Road Southbound			Corporate Drive Eastbound			
Start Time	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Total
7:00 AM	70	54	148	71	154	148	290	72	37	85	22	1151
7:15 AM	118	73	165	82	181	141	344	58	40	87	28	1317
7:30 AM	113	90	174	80	202	147	342	67	35	78	21	1349
7:45 AM	141	98	218	107	241	141	363	59	51	116	16	1551
8:00 AM	124	89	215	104	236	130	291	73	43	109	21	1435
8:15 AM	125	90	223	109	208	112	360	65	47	117	24	1480
8:30 AM	133	102	195	96	187	135	329	71	43	98	19	1408
8:45 AM	120	94	194	94	213	128	379	86	33	78	17	1436

### TMC #1 - Corporate & New King (10-7-20)

Total	0	0	0	171	13	6	0	17	47	53	0	5874	Total	#REF!
PHF	0.00			0.72			0.60			0.81				

Adjusted Peak Hour

Total				342	26	12	0	34	94	106	0
PHF				0.72			0.60			0.81	

4:00 PM	301	178	57	32	173	139	178	28	13	31	88	1218
4:15 PM	317	171	75	40	186	115	153	17	10	26	63	1173
4:30 PM	341	191	76	54	226	113	180	26	10	26	85	1328
4:45 PM	322	179	91	38	185	119	180	17	11	29	77	1248
5:00 PM	356	226	102	46	177	116	176	28	11	27	93	1358
5:15 PM	369	178	117	47	208	109	172	25	12	27	72	1336
5:30 PM	372	138	103	44	183	70	154	22	9	20	63	1178
5:45 PM	318	125	88	52	222	78	150	25	8	19	57	1142

### TMC #1 - Corporate & New King (10-7-20)

Total	0	0	0	105	2	25	0	41	20	199	0	5270	Total	#REF!
PHF	0.00			0.72			0.72			0.87				

Adjusted Peak Hour

Total				210	4	50	0	82	40	398	0
PHF				0.72			0.72			0.87	

1  
@ New King

WB

143
140
147
166
177
174
167
180

1  
@ New King

EB

144
155
134
183
173
188
160
128

1294 317

4.08

698 188

3.71

1265 96

13.18

704 59

11.93

2

= Assumed Max 2x, due to closures @ 75

= Balanced Thru Volumes & PHF

60
57
80
55
74
72
66
77

132
99
121
117
131
111
92
84

541 212

2.55

289 114

2.54

887 405

2.19

480 224

2.14

	Crossover Northbound		Long Lake Westbound		Corporate. Southbound	
Start Time	Left	Thru	Thru	Right	Right	Total
7:00 AM	14	40	189	27	57	327
7:15 AM	13	40	133	26	35	247
7:30 AM	12	35	155	36	44	282
7:45 AM	14	41	151	36	39	281
8:00 AM	15	44	185	69	40	353
8:15 AM	18	52	173	87	41	371
8:30 AM	17	51	182	46	40	336
8:45 AM	13	39	209	49	54	364

#### TMC #4 - WB L.L. & E>W XO, E. of Corp (10-7-20)

Total	45	0	653	0
PHF	0.80		0.95	

Adjusted Peak Hour

Total	70	1019	0
PHF	0.80	0.95	

4:00 PM	33	11	161	11	87	303
4:15 PM	30	10	160	5	76	281
4:30 PM	35	11	166	14	88	314
4:45 PM	23	7	150	15	95	290
5:00 PM	37	12	180	15	154	398
5:15 PM	18	6	176	6	90	296
5:30 PM	20	7	213	7	94	341
5:45 PM	26	9	167	11	106	319

#### TMC #4 - WB L.L. & E>W XO, E. of Corp (10-7-20)

Total	54	0	672	0	0	1354
PHF	0.60		0.95		0.00	

Adjusted Peak Hour

Total	59	730	0
PHF	0.60	0.95	

E. of Corp

WB	E-W XO
231	91
166	102
195	139
200	179
276	170
275	177
242	172
276	162

1861	1192
1.56	
1069	698
1.53	

178	163
167	162
186	165
167	171
201	186
189	181
230	181
188	178

8%

1506	1387
1.09	
808	726
1.11	

	Long Lake Westbound		Crooks Road Southbound		Long Lake Eastbound		Crooks Northbound		
Start Time	Thru	Right	Thru	Right	Thru	Right	Thru	Right	Total
7:00 AM	241	36	236	27	105	29	101	25	800
7:15 AM	198	36	283	20	115	30	157	39	878
7:30 AM	265	54	296	26	104	39	170	31	985
7:45 AM	238	43	314	39	124	44	183	44	1029
8:00 AM	313	43	265	34	127	41	181	33	1037
8:15 AM	317	45	309	37	121	37	179	43	1088
8:30 AM	298	43	273	36	114	38	155	43	1000
8:45 AM	322	40	329	35	134	49	164	29	1102

TMC #2			TMC #5			TMC #6		
Peak hour	SBT	WBL	WBT	NBL		NBT	EBL	
Total	1038	30	775	0		684	29	
PHF	0.91	0.75	0.92	0.92		0.95	0.81	

Adjusted Peak Hour

Total	1368	40	1401	0	862	37
PHF	0.91	0.75	0.92	0.92	0.95	0.81

4:00 PM	177	29	193	31	231	27	245	62	995
4:15 PM	153	33	198	24	206	40	227	71	952
4:30 PM	172	57	226	37	223	40	250	88	1093
4:45 PM	177	53	238	31	196	41	248	88	1072
5:00 PM	206	38	246	63	330	40	324	104	1351
5:15 PM	191	38	249	43	264	32	279	97	1193
5:30 PM	197	37	228	40	222	33	311	69	1137
5:45 PM	148	33	200	34	220	38	280	56	1009

TMC #2			TMC #5			TMC #6		
Peak hour	SBT	WBL	WBT	NBL		NBT	EBL	
Total	799	35	723	10		1540	90	
PHF	0.89	0.60	0.95	0.63		0.95	0.70	

Adjusted Peak Hour

Total	1067	47	935	13	1540	90
PHF	0.89	0.60	0.95	0.63	0.95	0.70

N. of L.L.		W. of Crooks		S. of L.L.	
SB	N-S XO	WB	E-W XO	NB	S-N XO
263	173	268	112	126	86
303	197	218	121	196	122
322	238	291	147	201	166
353	292	277	210	227	179
299	242	347	189	214	186
346	251	354	193	222	182
309	283	334	183	198	158
364	266	357	198	193	173

Total	2559	1942	2446	1353	1577	1252
	1.32		1.81		1.26	
Peak Hour	1320	1068	1392	775	864	713
	1.24		1.80		1.21	

224	161	208	188	307	370
222	213	177	165	298	393
263	182	209	166	338	408
269	185	208	183	336	380
309	217	269	179	428	438
292	232	234	185	376	404
268	200	237	184	380	380
234	169	182	185	336	321

Total	2081	1559	1724	1435	2799	3094
	1.33		1.20		0.90	
Peak Hour	1138	834	948	733	1520	1630
	1.36		1.29		0.93	

Use x1.0



	Long Lake Westbound		Crooks Road Southbound		Long Lake Eastbound		Crooks Northbound		
Start Time	Thru	Right	Thru	Right	Thru	Right	Thru	Right	Total
7:00 AM	241	36	236	27	105	29	101	25	800
7:15 AM	198	36	283	20	115	30	157	39	878
7:30 AM	265	54	296	26	104	39	170	31	985
7:45 AM	238	43	314	39	124	44	183	44	1029
8:00 AM	313	43	265	34	127	41	181	33	1037
8:15 AM	317	45	309	37	121	37	179	43	1088
8:30 AM	298	43	273	36	114	38	155	43	1000
8:45 AM	322	40	329	35	134	49	164	29	1102

@ Investment

SSB	SB
265	162
313	182
335	227
358	288
306	228
346	223
311	286
378	259

TMC #2			TMC #5			TMC #6			S>N, N. of LL
Peak hour	SBT	WBL	WBT	NBL	NBT	EBL	NBT	EBL	
Total	1038	30	775	0	684	29	Balance	5	
PHF	0.91	0.75	0.92	0.92	0.95	0.81			

Adjusted Peak Hour

Total	1368	40
PHF	0.91	0.75

1401	0
0.92	0.92

862	37
0.95	0.81

Balance	10	Use x2.0
	0.75	0.75 Based on video

Total	2612	1855
Peak Hour	1345	1025
	1.31	

TMC #7 - SB Crooks & Investment					
Peak hour	SBR	SBT	WBT	WBL	EBR
Total	90	935	104	15	76
PHF	0.89		0.88		0.83

Adjusted Peak Hour

Total	127	1317	146	21	107
PHF	0.89		0.88		0.83

4:00 PM	177	29	193	31	231	27	245	62	995
4:15 PM	153	33	198	24	206	40	227	71	952
4:30 PM	172	57	226	37	223	40	250	88	1093
4:45 PM	177	53	238	31	196	41	248	88	1072
5:00 PM	206	38	246	63	330	40	324	104	1351
5:15 PM	191	38	249	43	264	32	279	97	1193
5:30 PM	197	37	228	40	222	33	311	69	1137
5:45 PM	148	33	200	34	220	38	280	56	1009

TMC #2			TMC #5			TMC #6			TMC #6
Peak hour	SBT	WBL	WBT	NBL	NBT	EBL	NBT	EBL	
Total	799	35	723	10	1540	90	Balance	6	
PHF	0.89	0.60	0.95	0.63	0.95	0.70			

Adjusted Peak Hour

Total	1067	47
PHF	0.89	0.60

935	13
0.95	0.63

1540	90
0.95	0.70

Balance	12	Use x2.0
	0.75	0.75 Based on video

Total	2069	1632
Peak Hour	1112	863
	1.29	

TMC #7 - SB Crooks & Investment					
Peak hour	SBR	SBT	WBT	WBL	EBR
Total	20	843	35	4	177
PHF	0.92		0.81		0.85

Adjusted Peak Hour

Total	25	1187	49	6	249
PHF	0.92		0.81		0.85

	Crossover Southbound	Long Lake Eastbound		Investment Dr. Northbound	
Start Time	Thru	Thru	Right	Right	Total
7:00 AM	15	115	27	14	171
7:15 AM	7	110	18	14	149
7:30 AM	4	105	34	14	157
7:45 AM	13	127	35	17	192
8:00 AM	22	128	35	19	204
8:15 AM	15	114	36	16	181
8:30 AM	14	113	27	13	167
8:45 AM	18	128	39	16	201

W. of Invest

EB	W-E XO
196	91
181	122
186	129
217	167
222	189
220	176
208	170
219	181

### TMC #3 - EB L.L. & W>E XO, W. of Invest (10-7-20)

Total	46	0	670	0
PHF	0.64		0.95	

1649	1225
869	716
1.21	

Adjusted Peak Hour

Total	62	902	#REF!
PHF	0.64	0.95	

4:00 PM	6	215	16	43	280
4:15 PM	2	183	23	25	233
4:30 PM	6	194	20	34	254
4:45 PM	2	165	29	38	234
5:00 PM	6	248	27	54	335
5:15 PM	7	206	32	29	274
5:30 PM	10	198	21	32	261
5:45 PM	10	185	16	32	243

275	193
246	220
260	233
224	203
324	220
262	227
246	268
236	212

### TMC #3 - EB L.L. & W>E XO, W. of Invest (10-7-20)

Total	51	0	876	0
PHF	0.75	0.85	0.00	

2073	1776
1070	927
1.15	

Adjusted Peak Hour

Total	60	1022	#REF!
PHF	0.75	0.85	

LOCATION: CROOKS & I-75 RAMP /CORPORATE DATE: 8/11/17  
CITY/TOWNSHIP: TROY BY: C. MARKEL  
COUNTY#: 17401 STATE#: 63174-01-002 CHARGES: 78009990

\_\_\_\_\_ ELECTRICAL DEVICE: \_\_\_\_\_ INSTALL \_\_\_\_\_ MODERNIZE \_\_\_\_\_ MAINTENANCE

\_\_\_\_\_ UNDERGROUND: \_\_\_\_\_

\_\_\_\_\_ EDISON OK: \_\_\_\_\_ YES \_\_\_\_\_ NO

\_\_\_\_\_ JOB#: \_\_\_\_\_

\_\_\_\_\_ COORDINATE W/DISTRICT 7: \_\_\_\_\_

[illegible]

X CHANGE BREAKOUT OR EPROM: CHANGE PERSONALITY – REV#3  
(FLEXI PLANS & SCHEDULES, DETECTORS RENUMBERED)  
CHANGE HOURS OF OPERATION:

OLD: \_\_\_\_\_

NEW: \_\_\_\_\_

REPROGRAM TBC

INSTALL INTERCONNECT: \_\_\_\_\_ TBC \_\_\_\_\_ MINITROL \_\_\_\_\_ TONE

MBT OK: \_\_\_\_\_ YES \_\_\_\_\_ NO

NO CHANGE - RECORD CORRECTION

X OTHER: REQUIRES A CHECKSUM CHANGE.

APPROVED BY: \_\_\_\_\_ DATE: 8 / 11 / 11

DATE INSTALLED: \_\_\_\_\_

INSTALLED BY: \_\_\_\_\_



INTERSECTION :- 17401 CROOKS & I-75 RAMP / CORPORATE  
CONTROLLER TYPE :- STANDARD PERSONALITY CONTROLLER  
SOFTWARE TYPE :- MOD 52 SCATS S30 TS2

INPUTS :-

1. NB CROOKS L (LK)
2. NB CROOKS C (LK)
3. NB CROOKS R (LK)
4. NB CROOKS RT (LK)
5. WB I-75 RAMP LT (LK)
6. WB I-75 RAMP Thru/LT (LK)
7. WB I-75 RAMP Thru/RT (NL)
8. WB I-75 RAMP RT (NL)
9. SB CROOKS LT L (LK)
10. SB CROOKS LT R (LK)
11. SB CROOKS L (LK)
12. SB CROOKS C (LK)
13. SB CROOKS R (LK)
14. SB CROOKS RT (LK)
15. EB CORPORATE L (LK)
16. EB CORPORATE R (LK)
16. EB CORPORATE RT (LK)

NOTE :- ALL DETECTORS ARE AUTOSCOPE  
(RACKVISION, AIS-IV CAMERAS).

Opticom 1: TB2 PREEMPT INPUT 3 (CALLS NB & SB CROOKS)

PED 2: NB CROOKS PED EAST P.B.  
PED 4: WB I-75 RAMP PED NORTH P.B.  
PED 6: SB CROOKS PED WEST P.B.  
PED 8: EB CORPORATE PED SOUTH P.B.

APPROACHES :-

A APP 1 : NB CROOKS                      APP 2 : SB CROOKS  
B APP 1 : WB I-75 RAMP  
C APP 1 : EB CORPORATE  
D APP 1 : SB CROOKS LT

FLEXIDATA :-

SEQUENCE	A,B,C,D	A,B,C,D
AUTO REL		
R- REL	A	A
R+ REL	B	B
Q- REL	C	C
Q+ REL	D	D

PEDESTRIANS :-

1. No PED 1
2. NB CROOKS PED EAST
3. No PED 3
4. WB I-75 RAMP PED NORTH
5. No PED 5
6. SB CROOKS PED WEST
7. No PED 7
8. EB CORPORATE PED SOUTH

SPECIAL FEATURES :-

Personality revision is 3 (=C).

A STAGE HAS PERMANENT DEMAND.  
DEMAND FOR STAGES B, C, D IN FLEXI & ISOL, SET ZNEG TO DISABLE.

OPTICOM 1 calls NB & SB CROOKS.  
Night Flash code: Set Y+ to activate the night flash in Flexilink.

Pedestrians have automatic introduction using SCATS Y-.  
 NB CROOKS PED EAST introduction is suppressed when OPTICOM is active.  
 WB I-75 RAMP PED NORTH introduction is suppressed when OPTICOM is active.  
 SB CROOKS PED WEST has walk/clearance overlap from AD to AD stages.  
 SB CROOKS PED WEST introduction is suppressed when OPTICOM is active.  
 EB CORPORATE PED SOUTH introduction is suppressed when OPTICOM is active.

BACKPANEL :- SIZE P44-16 **TS2** CABINET

LOAD SWITCH 1 - SB CROOKS LT & WB I-75 RAMP RT	CL & BR	FLR
LOAD SWITCH 2 - NB CROOKS	A	FLR
LOAD SWITCH 4 - WB I-75 RAMPS & NB CROOKS RT	B, BL, & AR	FLR
LOAD SWITCH 6 - SB CROOKS	C	FLR
LOAD SWITCH 8 - EB CORPORATE	D & DL	FLR
LOAD SWITCH 9 - NB CROOKS PED EAST	WA	
LOAD SWITCH 10- WB I-75 RAMP PED NORTH	WB	
LOAD SWITCH 11- SB CROOKS PED WEST	WC	
LOAD SWITCH 12- EB CORPORATE PED SOUTH	WD	

MMU 2 :- (MENU : SET/VIEW CONFIG)

Field Check Enable	Channel 1: G, Y, R Channel 2: G, Y, R Channel 4: G, Y, R Channel 6: G, Y, R Channel 8: G, Y, R
Dual Indication Enable:	R+G: Channel 1,2,4,6,8,9,10,11,12 R+Y: Channel 1,2,4,6,8 G+Y: Channel 1,2,4,6,8,
Red Fail Enable:	Enable: Channel 1,2,4,6,8
Unit Options:	All OFF except: Recurrent pulse Program Memory Card
Y & R Clearance Disable:	Channel 1,2,4,6,8 Enabled
Flashing Yellow Arrow:	None
Program Card:	Compatible Channels: 1-6,1-11,2-6,2-9, 2-11,4-10,6-9,6-11,8-12,9-11 Min Flash Time : 4+2+1 Min Yellow Change Disable: 9,10,11,12 Voltage Monitor Latch: None

Note :- Add Jumper 16 MMU Flash - 116 Monitor ST Out

*****	CHECKSUMS
* CONTROLLER INFORMATION SHEET *	TIMES: EC/354
* FOR SITE NO. 17401 *	PERS: 9A/232
* CARISSA MARKEL *	TOTAL: 76/166
* 11-AUG -2017 *	
*****	

# FLEXILINK PLAN DATA

Intersection # 17401 State # 63174-01-002 Date: 08/11/17 Prepared By: Carissa Markel

Intersection: Crooks & I-75 Ramp / Corporate City: Troy

Hours of Operation: 7 Days: 24 Hours Approved By: Rachel Jones

Hours of Flashing: None

		<b>AM</b>		<b>PM</b>						
		PL0	PL1	PL2	PL3	PL4	PL5	PL6	PL7	PL8
0	CL		120	120	130	80				
1	A		0	0	0	0				
2	B		30	30	44	30				
3	C		70	70	78	50				
4	D		90	90	105	65				
5	E									
6	F									
7	G									
8	R-									
9	R+									
10	Of (Y-)		100	100	100	79				
11	Y+	C								
12	Z-									
13	Z+									
14	Q-									
15	Q+									
16	XH									
17	XL									

**NOTE:** Stages with 1 second of phase time are skipped. Blank entries are default values equal to 0. Except for an AWA controller, entries #8 to #15 (=254) and 'C' entry means continuous (=255).

							Timers		
Phase	Direction	Min	Max	ECO	Amber	All Red	Gap	Hdwy	Waste
A	NB & SB Crooks	10.0	50.0		4.3	2.5	3.0	1.2	10.0
B	WB I-75	5.0	40.0		4.3	2.8	3.0	1.2	10.0
C	EB Corporate	8.0	20.0		3.6	3.5	3.0	1.2	10.0
D	SB Crooks Thru & Left	5.0	20.0		4.3	2.5	4.0	1.2	10.0
E									
F									
G									

TSM15 = Opticom Min Alarm Time = 10  
TSM16 = Opticom Max Alarm Time = 200

	Day	Hours	Plan#
SC1	14	0:00	4
SC2	8	6:00	2
SC3	8	9:00	1
SC4	8	15:00	3
SC5	8	20:00	4
SC6			
SC7			
SC8			
SC9			
SC10			

## Pedestrian Crossing Times

Direction	Walk	CL 1	CL 2
NB Crooks Ped East (Ped 2)	5.0	14.0	3.8
WB I-75 Ramp Ped North (Ped 4)	7.0	18.0	4.1
SB Crooks Ped West (Ped 6)	7.0	14.0	3.8
EB Corporate Ped South (Ped 8)	7.0	14.0	4.1

## Normal Operating Mode

Isolated	Flexilink	Masterlink	Master Isolated	Flexi Isolated
		X		

## DAY OF WEEK CODE NUMBER

0	End of Schedule	4	WED	8	MON-FRI	12	MON,FRI,SAT
1	SUN	5	THUR	9	MON-SAT	13	SAT,SUN
2	MON	6	FRI	10	TUE,WED,THU	14	EVERY DAY
3	TUE	7	SAT	11	MON,FRI	15	NEVER



## TS2 Autoscope AIS-IV Cameras

### CO#17401 - CROOKS & I-75 RAMP/CORPORATE

Camera #	Rack Select Switch Position / Detector BIU	Input/Output LED	Description	Detector Number on Print	Phase
1	1	1	NB Crooks L	1	2
1	1	2	NB Crooks C	2	2
1	1	3	NB Crooks R	3	2
1	1	4	NB Crooks RT	4	2
2	1	5	WB I-75 Ramp LT	5	4
2	1	6	WB I-75 Ramp Thru & LT	6	4
2	1	7	WB I-75 Ramp Thru & RT	7	4
2	1	8	WB I-75 Ramp RT	8	4
3	1	9	SB Crooks LT L	9	1
3	1	10	SB Crooks LT R	10	1
4	1	11	SB Crooks L	11	6
4	1	12	SB Crooks C	12	6
4	1	13	SB Crooks R	13	6
4	1	14	SB Crooks RT	14	6
5	1	15	EB Corporate L	15	8
5	1	16	EB Corporate R	16	8
5	1	16	EB Corporate RT	16	8

#### Input / Output Indicators

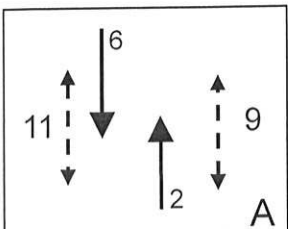
TS2 Rack Select Switch Position 1 - Detectors 1-16  
 TS2 Rack Select Switch Position 2 - Detectors 17-32  
 TS2 Rack Select Switch Position 3 - Detectors 33-48  
 TS2 Rack Select Switch Position 4 - Detectors 49-64  
 TS2 Rack Select Switch Position 5 - Red Phases  
 TS2 Rack Select Switch Position 6 - Green Phases  
 TS2 Rack Select Switch Position 7-10 - All OFF

#### MVP Status LEDs

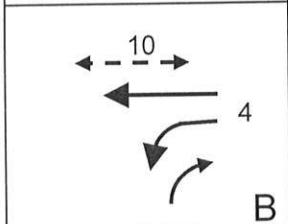
TS2 Rack Select Switch Position 1-7 - Cameras 1-4  
 TS2 Rack Select Switch Position 8 - Cameras 5-8  
 TS2 Rack Select Switch Position 9-10 - NOT USED

**#17401 – CROOKS & I-75 RAMP / CORPORATE**

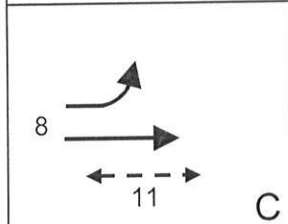
• **Movement Diagram**



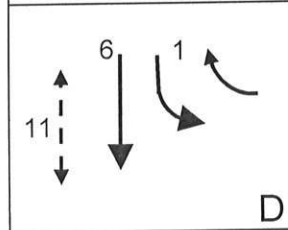
**CROOKS**



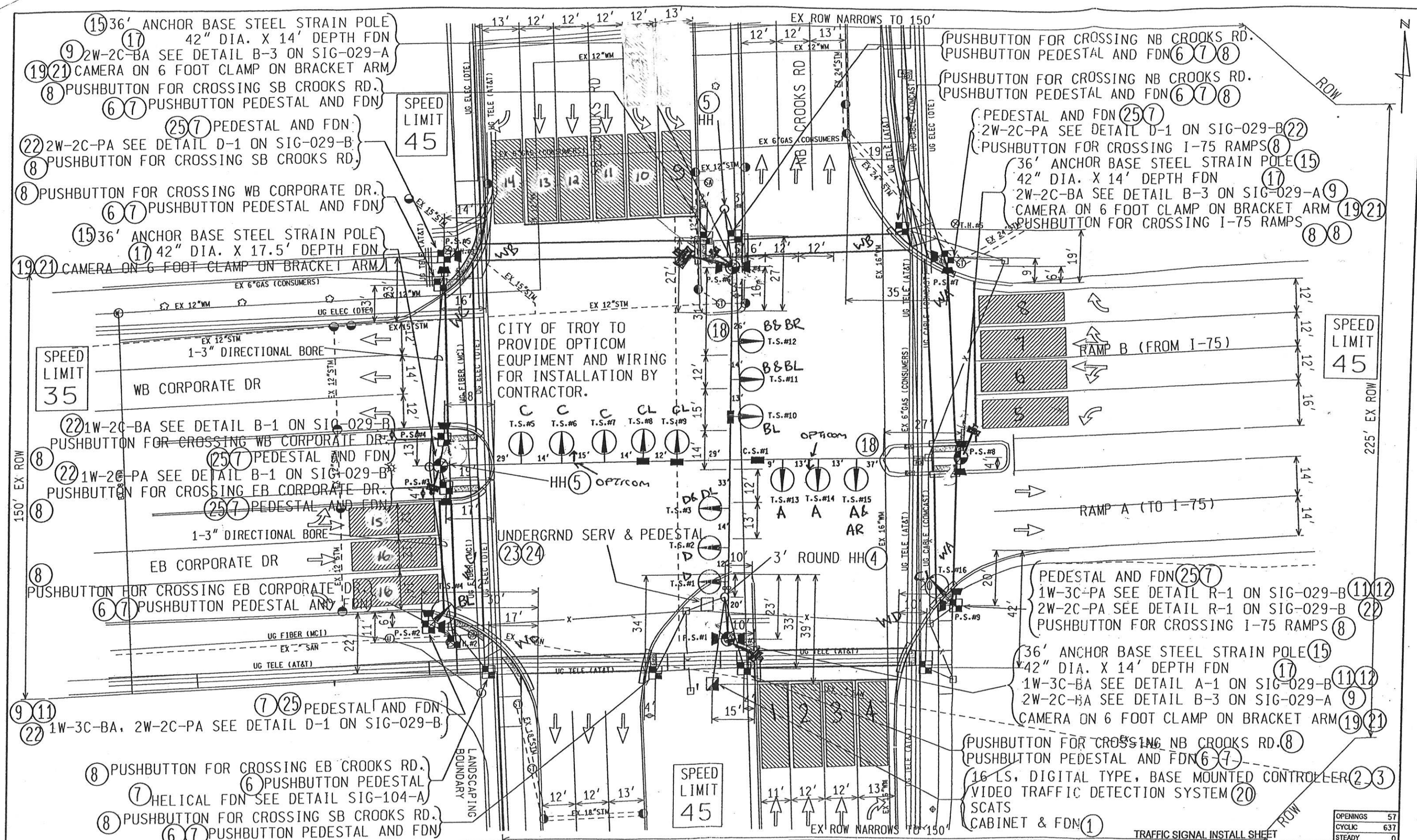
**I-75 RAMPS**



**CORPORATE**



**SB CROOKS THRU & LT**



AS-LET PLAN REVISIONS						APPLIED POWER & CONTROLS, INC.		MDOT		DATE: 9-20-13		CS: 63174		I-75 RAMP		DRAWING SHEET	
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION	DESIGN UNIT: TRAFFIC SIGNALS	JN: 113811	AT CROOKS RD		SIGNAL	
												TSC: OAKLAND		TROY, OAKLAND COUNTY		001	

CO# 17401



OAKLAND COUNTY ROAD COMMISSION  
TRAFFIC - SAFETY DEPARTMENT  
SIGNAL WORK ORDER

LOCATION: Crooks & Long Lake DATE: 11/22/16  
CITY/TOWNSHIP: Troy BY: ELabiano  
COUNTY#: 77 STATE#: \_\_\_\_\_ CHARGES: 000770

PLEASE PERFORM THE FOLLOWING:

\_\_\_\_\_ ELECTRICAL DEVICE: \_\_\_\_\_ INSTALL \_\_\_\_\_ MODERNIZE \_\_\_\_\_ MAINTENANCE

\_\_\_\_\_ UNDERGROUND: \_\_\_\_\_

\_\_\_\_\_ EDISON OK: \_\_\_\_\_ YES \_\_\_\_\_ NO JOB#: \_\_\_\_\_

\_\_\_\_\_ COORDINATE W/DISTRICT 7: \_\_\_\_\_

DIAL..	1	1	1	1		2	2	2	2		3	3	3	3		4	4	4	4
SPLIT.	1	2	3	4		1	2	3	4		1	2	3	4		1	2	3	4
CHANGE TIMING.....																			
CHANGE OFFSET.....																			
CHANGE CYCLE LENGTH.....																			
ADD DIAL/SPLIT.....																			

☒ CHANGE BREAKOUT OR EPROM: CHANGE PERSONALITY - REV 2.

\_\_\_\_\_ CHANGE HOURS OF OPERATION:

OLD: \_\_\_\_\_

NEW: \_\_\_\_\_

\_\_\_\_\_ REPROGRAM TBC

\_\_\_\_\_ INSTALL INTERCONNECT: \_\_\_\_\_ TBC \_\_\_\_\_ MINITROL \_\_\_\_\_ TONE

\_\_\_\_\_ MBT OK: \_\_\_\_\_ YES \_\_\_\_\_ NO

\_\_\_\_\_ NO CHANGE - RECORD CORRECTION

☒ OTHER: Rev 2 - confirm opticon operating (wired per CIS)  
confirm jumper 16MMUFlash - 116 Monitor ST out  
\* Requires a checksum change

APPROVED BY: [Signature] DATE: 4/8/20

DATE INSTALLED: 4/20/20

INSTALLED BY: J-8

INTERSECTION :- 77 Crooks & Long Lake  
DESCRIPTION PROMS :- X00077 / F2404  
SOFTWARE :- Mod 52 SCATS S30

INPUTS :-

1. WB LONG LAKE L (LK)	Note: All detectors are autoscope
2. WB LONG LAKE CL (LK)	(RACKVISION, AIS-IV CAMERAS).
3. WB LONG LAKE CR (LK)	
4. WB LONG LAKE R (LK)	
5. SB CROOKS L (LK)	
6. SB CROOKS CL (LK)	
7. SB CROOKS CR (LK)	
8. SB CROOKS R (LK)	
9. EB LONG LAKE L (LK)	
10. EB LONG LAKE CL (LK)	
11. EB LONG LAKE CR (LK)	
12. EB LONG LAKE R (LK)	
13. NB CROOKS L (LK)	
14. NB CROOKS CL (LK)	
15. NB CROOKS CR (LK)	
16. NB CROOKS R (LK)	

Opticom 1: TB2 PREEMPT INPUT 3 (CALLS NB & SB CROOKS).

Opticom 2: TB2 PREEMPT INPUT 4 (CALLS EB & WB LONG LAKE).

Ped 2. CROOKS PED (EAST & WEST LEGS) P.B.

Ped 4. LONG LAKE PED (NORTH & SOUTH LEGS) P.B.

APPROACHES :-

A APP 1 : NB CROOKS L,CL,CR,R

A APP 2 : SB CROOKS L,CL,CR,R

B APP 1 : WB LONG LAKE L,CL,CR,R

B APP 2 : EB LONG LAKE L,CL,CR,R

FLEXIDATA :-

SEQUENCE	A,B	A,B
AUTO REL		
R- REL	A	A
R+ REL	B	B
Q- REL		
Q+ REL		

PEDESTRIANS :-

1. NO PED1
2. CROOKS PED
3. NO PED3
4. LONG LAKE PED

SPECIAL FEATURES :-

Personality revision is 2 (=B).

Pedestrians have automatic introduction using SCATS Y-.

A stage has a permanent demand.

Demand for B stage in flexi and isol. Set ZNEG to disable.

CROOKS NEAR has early cut-off operation in A stage.

LONG LAKE NEAR has early cut-off operation in B stage.

Opticom 1 calls A stage. Opticom 2 calls B stage.

Ped CROOKS PED introduction is suppressed when OPTICOM is active.

Ped LONG LAKE PED introduction is suppressed when OPTICOM is active.

BACKPANEL FOR TS2 P44-16 CABINET:

LOAD SWITCH 2: CROOKS (NEAR)	A	FLR
LOAD SWITCH 4: LONG LAKE (NEAR)	B	FLR
LOAD SWITCH 6: CROOKS (FAR)	C	FLR
LOAD SWITCH 8: LONG LAKE (FAR)	D	FLR
LOAD SWITCH 9: CROOKS PEDS	P1	
LOAD SWITCH 10: LONG LAKE PEDS	P2	

MMU 2: (MENU : SET/VIEW CONFIG)

Field Check Enable	Channel 2: G, Y, R Channel 4: G, Y, R Channel 6: G, Y, R Channel 8: G, Y, R
Dual Indication Enable:	R+G: Channel 2,4,6,8,9,10 R+Y: Channel 2,4,6,8 G+Y: Channel 2,4,6,8
Red Fail Enable:	Enable: Channel 2,4,6,8
Unit Options:	All OFF except: Recurrent pulse Program Memory Card
Y & R Clearance Disable:	Channel 2,4,6,8 Enabled
Flashing Yellow Arrow:	None
Program Card:	Compatible Channels: 2-6, 4-8, 2-9, 6-9, 4-10, 8-10.  Min Flash Time : 4+2+1 Min Yellow Change Disable: 9, 10 Voltage Monitor Latch: NONE

Note :- Add Jumper 16 MMU Flash - 116 Monitor ST Out

*****	Checksums: Times 5F / 137
* CONTROLLER INFORMATION SHEET *	Pers 11 / 021
* FOR SITE NO. 77 *	Total 4E / 116
* E LABIANO *	
* 23-NOV-2016 *	
*****	



# FLEXILINK PLAN DATA

Intersection # 77 State # \_\_\_\_\_ Date: 06/27/13 Prepared By: T. Creech  
 Intersection: Crooks & Long Lake City: Troy  
 Hours of Operation: 7 Days: 24 Hours Approved By: R. Jones  
 Hours of Flash: None

				AM	PM					
		PL0	PL1	PL2	PL3	PL4	PL5	PL6	PL7	PL8
0	CL		80	120	120					
1	A		0	0	0					
2	B		41	50	65					
3	C									
4	D									
5	E									
6	F									
7	G									
8	R-									
9	R+									
10	Y-		68	12	55					
11	Y+	C								
12	Z-									
13	Z+									
14	Q-									
15	Q+									
16										
17										

**NOTE:** STAGES WITH ONE SECOND PHASE TIMES ARE SKIPPED

BLANK ENTRIES ARE DEFAULT VALUES = 0 FOR ENTRIES #0 - #7, #16 - #17

254 FOR ENTRIES #8 - #15

'C' ENTRY MEANS CONTINUOUS = 255

Phase	Direction	Min	Max	ECO	Amber	All Red	Timers		
							Gap	Hdwy	Waste
A	Crooks	10.0	40.0	3.0	4.3	1.6	3.0	1.2	10.0
B	Long Lake	10.0	40.0	3.0	4.3	1.6	3.0	1.2	10.0
C									
D									
E									
F									
G									

	Day	Hours	Plan#
SC1	8	6:00	2
SC2	8	9:00	1
SC3	8	15:00	3
SC4	8	19:00	1
SC5	14	0:00	1
SC6			
SC7			
SC8			
SC9			
SC10			

TSM16 = Opticom Max Alarm Time = 200

## Pedestrian Crossing Times

Direction	Walk	CL 1	CL 2
Crooks Peds	7.0	12.0	2.9
Long Lake Peds	7.0	12.0	2.9

## Normal Operating Mode

Isolated	Flexilink	Masterlink	Master Isolated	Flexi Isolated
		X		

## DAY OF WEEK CODE NUMBER

0	End of Schedule	4	WED	8	MON-FRI	12	MON,FRI,SAT
1	SUN	5	THUR	9	MON-SAT	13	SAT,SUN
2	MON	6	FRI	10	TUE,WED,THU	14	EVERY DAY
3	TUE	7	SAT	11	MON,FRI	15	NEVER

## TS2 Autoscope AIS-IV Cameras

### CO# 77 - CROOKS & LONG LAKE

Camera #	Rack Select Switch Position / Detector BIU	Input/Output LED	Description	Detector Number on Print	Phase
1	1	1	WB LONG LAKE L	1	4
1	1	2	WB LONG LAKE CL	2	4
1	1	3	WB LONG LAKE CR	3	4
1	1	4	WB LONG LAKE R	4	4
2	1	5	SB CROOKS L	5	2
2	1	6	SB CROOKS CL	6	2
2	1	7	SB CROOKS CR	7	2
2	1	8	SB CROOKS R	8	2
3	1	9	EB LONG LAKE L	9	4
3	1	10	EB LONG LAKE CL	10	4
3	1	11	EB LONG LAKE CR	11	4
3	1	12	EB LONG LAKE R	12	4
4	1	13	NB CROOKS L	13	2
4	1	14	NB CROOKS CL	14	2
4	1	15	NB CROOKS CR	15	2
4	1	16	NB CROOKS R	16	2
	2	17			
	2	18			
	2	19			
	2	20			
	2	21			
	2	22			
	2	23			
	2	24			

#### Input / Output Indicators

TS2 Rack Select Switch Position 1 - Detectors 1-16  
 TS2 Rack Select Switch Position 2 - Detectors 17-32  
 TS2 Rack Select Switch Position 3 - Detectors 33-48  
 TS2 Rack Select Switch Position 4 - Detectors 49-64  
 TS2 Rack Select Switch Position 5 - Red Phases  
 TS2 Rack Select Switch Position 6 - Green Phases  
 TS2 Rack Select Switch Position 7-10 - All OFF

#### MVP Status LEDs

TS2 Rack Select Switch Position 1-7 - Cameras 1-4  
 TS2 Rack Select Switch Position 8 - Cameras 5-8  
 TS2 Rack Select Switch Position 9-10 - NOT USED

# AutoScope Detection Camera - IP Port Worksheet

Site: 77

Crooks & Long Lake

WWAN IP: 10.32.145.119

## AutoScope Property Editor // Communications Tab

	Camera #1	Camera #2	Camera #3	Camera #4
Network Address:	10.32.58.244	10.32.58.245	10.32.58.246	10.32.58.247
Subnet Mask:	255.255.255.240	255.255.255.240	255.255.255.240	255.255.255.240
Default Gateway:	10.32.58.241	10.32.58.241	10.32.58.241	10.32.58.241

## AutoScope Property Editor // Advanced Comm Tab

Supervisor IP Port (54321):	56011	56021	56031	56041
Detector IP Port (54322):	56012	56022	56032	56042
Video Streaming IP Port (554):	56013	56023	56033	56043
Web IP Port (80):	56014	56024	56034	56044
Traffic Data IP Port (54323):	56015	56025	56035	56045

## AutoScope Property Editor // Communications Tab

	Camera #5	Camera #6	Camera #7	Camera #8
Network Address:	10.32.58.248	10.32.58.249	10.32.58.250	10.32.58.251
Subnet Mask:	255.255.255.240	255.255.255.240	255.255.255.240	255.255.255.240
Default Gateway:	10.32.58.241	10.32.58.241	10.32.58.241	10.32.58.241

## AutoScope Property Editor // Advanced Comm Tab

Supervisor IP Port (54321):	56051	56061	56071	56081
Detector IP Port (54322):	56052	56062	56072	56082
Video Streaming IP Port (554):	56053	56063	56073	56083
Web IP Port (80):	56054	56064	56074	56084
Traffic Data IP Port (54323):	56055	56065	56075	56085

# AutoScope Property Editor // Advanced Comm Tab - Camera #1 Example

Autoscope Property Editor

File View Properties Help

Autoscope

Description

2017.06.27 7:58:59 - 10.5.0 - 0A0301FF92CAB035 - S...

Status

General

Communication

Advanced Comm

Regional Settings

Optional Features

Accounts

Detector Port Configuration

☒ Enable Network Address Translation (NAT) settings

Autoscope Ports

Supervisor IP Port:

56011

▲

Detector IP Port:

56012

▲

Video Streaming IP Port:

56013

▲

☒ Enable Web Interface

Web IP Port:

56014

▲

☒ Enable Autoscope Traffic Data Protocol

Traffic Data IP Port:

56015

▲

▲ If shown, field is not the default value.

Restore Defaults

☒ Use Adaptive IP Optimization

For Help, press F1





OAKLAND COUNTY ROAD COMMISSION  
TRAFFIC - SAFETY DEPARTMENT  
SIGNAL WORK ORDER

LOCATION: Crooks & Tower Dr DATE: 6-11-19

CITY/TOWNSHIP: Troy BY: E Labiano

COUNTY#: 934 STATE#: - CHARGES: WO 185372

PLEASE PERFORM THE FOLLOWING:

ELECTRICAL DEVICE: ☐ INSTALL ☐ MODERNIZE ☐ MAINTENANCE

UNDERGROUND: ☐

EDISON OK: ☐ YES ☐ NO

JOB#: JUN 25 2019

COORDINATE W/DISTRICT 7: ☐

DIAL..  
SPLIT.

1	1	1	1		2	2	2	2		3	3	3	3		4	4	4	4
1	2	3	4		1	2	3	4		1	2	3	4		1	2	3	4

CHANGE TIMING.....

CHANGE OFFSET.....

CHANGE CYCLE LENGTH.....

ADD DIAL/SPLIT.....

☒ CHANGE BREAKOUT OR EPROM:

Rev 2 (Flexi)  
(PLAN 2 @ 9A)

CHANGE HOURS OF OPERATION:

OLD: \_\_\_\_\_

NEW: \_\_\_\_\_

REPROGRAM TBC

INSTALL INTERCONNECT: ☐ TBC ☐ MINITROL ☐ TONE

MBT OK: ☐ YES ☐ NO

NO CHANGE - RECORD CORRECTION

☒ OTHER: Requires a checksum change

APPROVED BY: \_\_\_\_\_

DATE: 6 / 11 / 19

DATE INSTALLED: 6/24/19

INSTALLED BY: 5-8

INTERSECTION :- 934 Crooks Road & Tower Drive  
DESCRIPTION PROMS :- X00934D / F2102  
CONTROLLER TYPE :- STANDARD PERSONALITY CONTROLLER  
SOFTWARE TYPE : - MOD 52 SCATS

INPUTS :-

1. TOWER DRIVE L PRES (LK)
2. TOWER DRIVE R PRES (LK)
- 3.
4. X-OVER SOUTH I-75 C PRES (LK)
5. X-OVER SOUTH I-75 R PRES (LK)
6. NB CROOKS L PRES (LK)
7. NB CROOKS LC PRES (LK)
8. NB CROOKS RC PRES (LK)
9. NB CROOKS R PRES (LK)

NOTE: ALL DETECTORS ARE LOOPS.

PED 2. NB CROOKS (EAST LEG) W.F.G.

APPROACHES :-

A APPR 1 : NB CROOKS THRU L,C,R,RT

B APPR 1 : X-OVER SOUTH I-75 LT,LT ADV

B APPR 2 : TOWER DRIVE L,R

FLEXIDATA :-

SEQUENCE A,B

A,B

AUTO REL

R- REL A

A

R+ REL B

B

Q- REL

Q+ REL

LOOKAHEAD

PEDESTRIANS :-

2. CROOKS PED (EAST LEG)

SPECIAL FEATURES :-

The personality revision number is currently 2 (=B).

A STAGE HAS PERMANENT DEMAND.

DEMAND FOR STAGE B FLEXI AND ISOL, SET ZNEG TO DISABLE.

Pedestrians have automatic introduction using SCATS Y-.

Ped CROOKS PED EAST is walk for green in A stage and is secret under masterlink.

Ped CROOKS PED EAST has automatic introduction in A stage.

BACKPANEL :- SIZE M CABINET

LOAD SWITCH 2 - NB CROOKS ROAD

A

FLA

LOAD SWITCH 4 - TOWER DRIVE/X-OVER SOUTH OF I-75

B

FLR

LOAD SWITCH 6 - CROOKS PED (EAST LEG)

W1

JUMPERS:

121-213,151-152,153-154,155-156,173-174,175-176,177-178,179-180,185-186,  
233-PB1,237-PB1,241-PB1,255-256,257-258,259-260,261-262,263-PB1,268-269.

SIGNAL MONITOR: NONE.

ALL SWITCHES OFF EXCEPT: DUAL SELECT A&B; G&Y ENABLE; SSM 2,4.

MINIMUM FLASH = 4+2+1.

\*\*\*\*\*

\* CONTROLLER INFORMATION SHEET \*

\* FOR SITE NO. 934 \*

\* E LABIANO \*

\* DATE :- 11-JUNE-2019 \*

\*\*\*\*\*

TIMES: AD/255

PERS: 61/141

TOTAL: CC/314

# FLEXILINK PLAN DATA

Intersection # 934 State # \_\_\_\_\_ Date: 06/11/19

Prepared By: Ed Labiano

Intersection: Crooks Road and Tower Drive

City: Troy

Hours of Operation: M-F: 7am-9pm

Approved By: Rachel Jones

Hours of Flashing: M-F: 9pm-7am; Sat & Sun: 24 Hours

				AM	PM					
		PL0	PL1	PL2	PL3	PL4	PL5	PL6	PL7	PL8
0	CL		80	120	130					
1	A		0	0	0					
2	B		28	48	48					
3	C									
4	D									
5	E									
6	F									
7	G									
8	R-									
9	R+									
10	Of (Y-)		69	90	90					
11	Y+	C								
12	Z-									
13	Z+									
14	Q-									
15	Q+									
16	XH									
17	XL									

NOTE: STAGES WITH ONE SECOND PHASE TIMES ARE SKIPPED

BLANK ENTRIES ARE DEFAULT VALUES = 0 FOR ENTRIES #0 - #7, #16 - #17

254 FOR ENTRIES #8 - #15

'C' ENTRY MEANS CONTINUOUS = 255

							Timers		
Phase	Direction	Min	Max	ECO	Amber	All Red	Gap	Hdwy	Waste
A	Crooks	10.0	50.0	19.0	4.3	2.1	3.0	1.2	10.0
B	Tower Drive	7.0	20.0		3.5	2.5	4.5	1.4	12.0
C									
D									
E									
F									
G									

	Day	Hours	Plan#
SC1	8	7:00	2
SC2	8	9:00	2
SC3	8	15:00	3
SC4	8	19:00	1
SC5	8	21:00	0
SC6	14	0:00	0
SC7			
SC8			
SC9			
SC10			

## Pedestrian Crossing Times

Direction	Walk	CL 1	CL 2
Crooks Ped East	7.0	19.0	3.4

## Normal Operating Mode

Isolated	Flexilink	Masterlink	Master Isolated	Flexi Isolated
		X		

## DAY OF WEEK CODE NUMBER

0	End of Schedule	4	WED	8	MON-FRI	12	MON,FRI,SAT
1	SUN	5	THUR	9	MON-SAT	13	SAT,SUN
2	MON	6	FRI	10	TUE,WED,THU	14	EVERY DAY
3	TUE	7	SAT	11	MON,FRI	15	NEVER



## D Connector Form for Mod 52 w/Loops

Intersection Name: Crooks & Tower

County No: 934

Date: 5/4/2015

[illegible]

# RCOC MATERIALS:

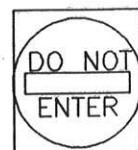
- 1-CONTROLLER & CABINET
- 1-SAFETY SWITCH
- 3-1W3C 12" SIGNALS
- 3-2W3C 12" SIGNALS
- 1-4W CASE SIGN, 24"X30"
- 1-2W CASE SIGN, 24"X30"
- 2-1W PED. SIGNAL
- 1-10' ALUMINUM PEDESTAL & FOUNDATION
- 9-6'X15' LOOPS
- 2-36' STEEL POLE
- #14/20 = 550'
- #14/12 = 550'
- 2-SPAN WIRES
- 3-HANDHOLES



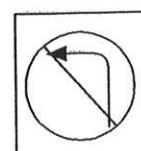
## CROOKS ROAD



FACING WEST



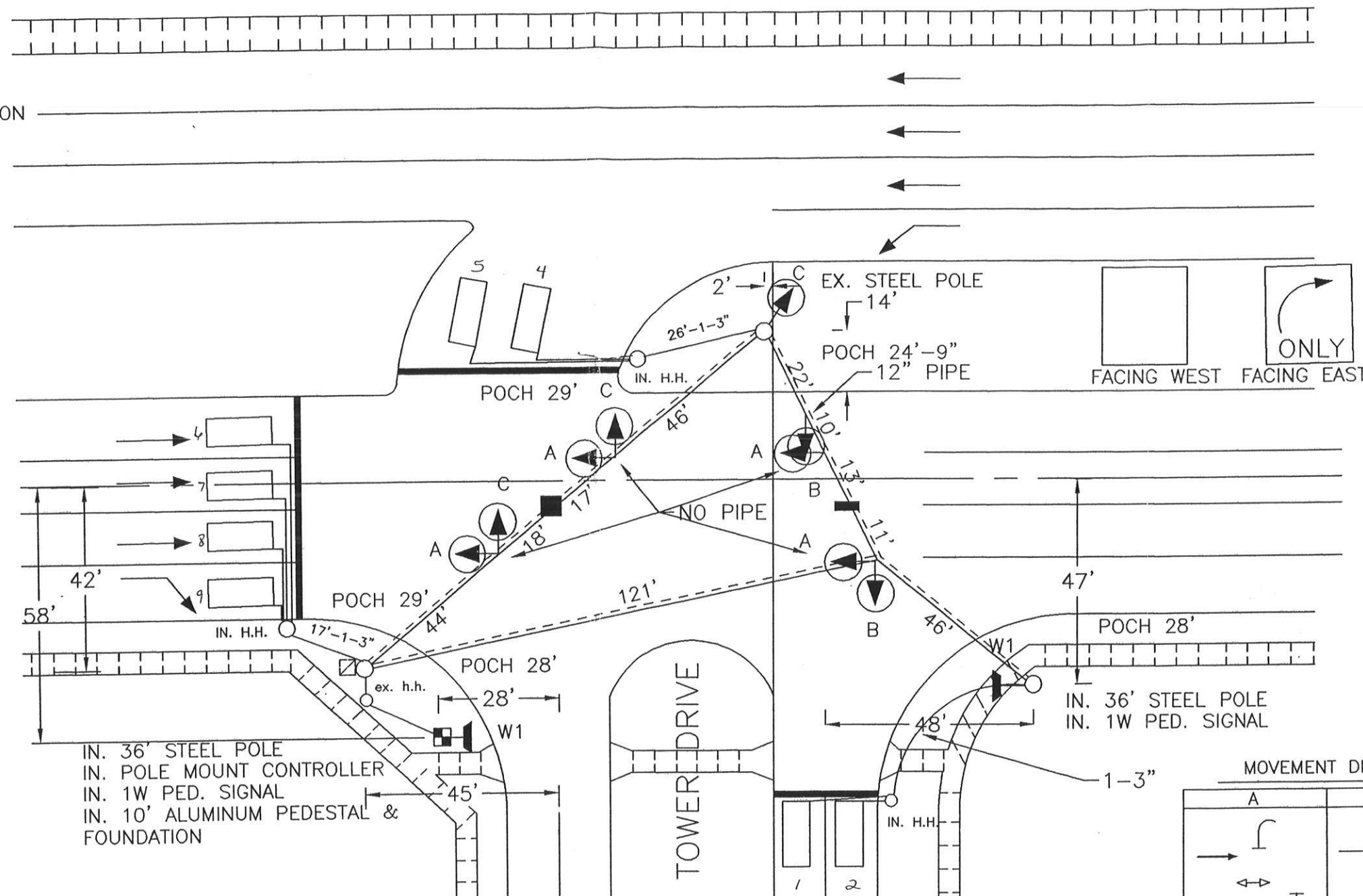
FACING NORTH  
& EAST



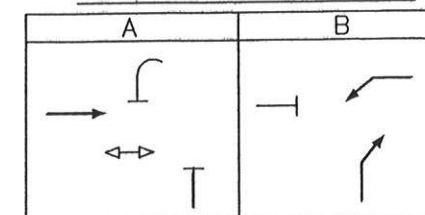
FACING SOUTH

### LEGEND

- NEW SIGNAL 12"
- NEW SIGNAL 8"
- SIGNAL TO REMAIN
- SIGNAL TO BE REMOVED
- PEDESTRIAN SIGNAL (INC.)
- WOOD POLE
- STEEL POLE
- LIGHT STANDARD
- PEDESTAL
- CONTROLLER



### MOVEMENT DIAGRAM



LOAD	AMPS	WATTS	DRAWN	P.A.D.	DATE	REV. 1-15-96	CROOKS ROAD & TOWER DRIVE
SIGNALS			DESIGNED	J.S.H.	SCALE	1" = 30'	TROY
CASE SIGNS			APPROVED		LOCATION NO.	CO. 934	

ROAD COMMISSION FOR OAKLAND COUNTY  
TRAFFIC-SAFETY DEPARTMENT  
WATERFORD, MICHIGAN

OAKLAND COUNTY ROAD COMMISSION  
TRAFFIC - SAFETY DEPARTMENT  
SIGNAL WORK ORDER

TRAFFIC COMMISSION FOR  
OAKLAND COUNTY

AUG 24 2015

TRAFFIC OPERATIONS

LOCATION: Long Lake EB & Corporate / Investment Dr DATE: 8/14/15

CITY/TOWNSHIP: Troy BY: Dawn Bierlein

COUNTY#: 728 STATE#: \_\_\_\_\_ CHARGES: 78 00728 0

PLEASE PERFORM THE FOLLOWING:

\_\_\_\_ ELECTRICAL DEVICE: \_\_\_\_ INSTALL \_\_\_\_ MODERNIZE \_\_\_\_ MAINTENANCE

\_\_\_\_ UNDERGROUND: \_\_\_\_\_

\_\_\_\_ EDISON OK: \_\_\_\_ YES \_\_\_\_ NO JOB#: \_\_\_\_\_

\_\_\_\_ COORDINATE W/DISTRICT 7: \_\_\_\_\_

	DIAL..	1	1	1	1		2	2	2	2		3	3	3	3		4	4	4	4
	SPLIT.	1	2	3	4		1	2	3	4		1	2	3	4		1	2	3	4
____	CHANGE TIMING.....																			
____	CHANGE OFFSET.....																			
____	CHANGE CYCLE LENGTH.....																			
____	ADD DIAL/SPLIT.....																			

X CHANGE BREAKOUT OR EPROM: Change personality (Rev 2)

\_\_\_\_ CHANGE HOURS OF OPERATION:

OLD: \_\_\_\_\_

NEW: \_\_\_\_\_

\_\_\_\_ REPROGRAM TBC

\_\_\_\_ INSTALL INTERCONNECT: \_\_\_\_ TBC \_\_\_\_ MINITROL \_\_\_\_ TONE

\_\_\_\_ MBT OK: \_\_\_\_ YES \_\_\_\_ NO

\_\_\_\_ NO CHANGE - RECORD CORRECTION

X OTHER: Requires a checksum change

APPROVED BY:  DATE: 8/14/15

DATE INSTALLED: 8-21-15

INSTALLED BY: Dave Williams

INTERSECTION :- 728 LONG LAKE EB & CORPORATE/INVESTMENT DR  
DESCRIPTION PROMS :- X00728D / F2202  
CONTROLLER TYPE :- STANDARD PERSONALITY CONTROLLER  
SOFTWARE TYPE : - MOD 52 SCATS

INPUTS :-

1. CROSSOVER (LK)
2. LONG LAKE THRU L (LK)
3. LONG LAKE THRU C (LK)
4. LONG LAKE THRU R (LK)
5. LONG LAKE RT (LK)
6. CORPORATE RT (NL)
7. CORPORATE RT (NL)
8. -
9. -
10. -
11. -
12. -
13. -
14. -
15. -
16. Opticom 1

NOTE: ALL DETECTORS ARE AUTOSCOPE  
(2004 CAMERAS)

PED 2. LONG LAKE (SOUTH LEG) WFG.  
PED 4. CORPORATE (WEST LEG) P.B.

APPROACHES :-

A APPR 1 : LONG LAKE L, LC, RC  
B APPR 1 : CROSSOVER

A APPR 2 : LONG LAKE RT  
B APPR 2 : CORPORATE RT

FLEXIDATA :-

SEQUENCE A,B A,B  
AUTO REL  
R- REL A A  
R+ REL B B  
Q- REL  
Q+ REL  
LOOKAHEAD

PEDESTRIANS :-

2. LONG LAKE PED  
4. CORPORATE PED

SPECIAL FEATURES :-

The personality revision number is currently 2 (=B).

A STAGE HAS PERMANENT DEMAND.

DEMAND FOR STAGE B FLEXI AND ISOL, SET ZNEG TO DISABLE.

Pedestrians have automatic introduction using SCATS Y-.

Ped EB LONG LAKE (SOUTH LEG) is walk for green in A stage and is secret under masterlink.

Ped EB LONG LAKE (SOUTH LEG) has automatic introduction in A stage.

Ped LONG LAKE PED introduction is suppressed when OPTICOM is active.

Ped CORPORATE PED introduction is suppressed when OPTICOM is active.

Opticom 1 calls A stage.



BACKPANEL - M CABINET

LOAD SWITCH 2 - LONG LAKE	A	FLA
LOAD SWITCH 4 - CORPORATE/CROSSOVER	B&C	FLR
LOAD SWITCH 6 - LONG LAKE PED	P1	
LOAD SWITCH 8 - CORPORATE PED	P2	

JUMPERS:

121-213, 151-152, 153-154, 155-156, 173-174, 175-176, 177-178,  
179-180, 185-186, 223-224, 229-230, 233-PB1, 237-PB1, 241-PB1,  
255-256, 257-258, 259-260, 261-262, 263-PB1, 268-269, 273-274.

CONFLICT MONITOR: NONE.

All switches OFF EXCEPT: Dual Select A&B; G&Y Enable; SSM 2,4.  
Minimum Flash = 4 + 2 + 1.

\*\*\*\*\*  
\* CONTROLLER INFORMATION SHEET \*  
\* FOR SITE NO. 728 \*  
\* DAWN BIERLEIN \*  
\* DATE :- 14-AUGUST-2015 \*  
\*\*\*\*\*

CHECKSUM  
TIMES: 9E/236  
PERS: 5C/134  
TOTAL: C2/302

# FLEXILINK PLAN DATA

Intersection # 728 State # - Date: 08/14/15 Prepared By: Dawn Bierlein

Intersection: EB Long Lake & Corporate/Investment City: Troy

Hours of Operation: Mon - Sat: 7am - 9pm Approved By: Dawn Bierlein

Hours of Flash: Mon - Sat: 9pm - 7am, Sun: 24 Hours

				AM	PM					
		PL0	PL1	PL2	PL3	PL4	PL5	PL6	PL7	PL8
0	CL		80	120	120					
1	A		0	0	0					
2	B		47	82	82					
3	C									
4	D									
5	E									
6	F									
7	G									
8	R-									
9	R+									
10	Of (Y-)		12	45	103					
11	Y+	C								
12	Z-									
13	Z+									
14	Q-									
15	Q+									
16	XH									
17	XL									

**NOTE:** STAGES WITH ONE SECOND PHASE TIMES ARE SKIPPED

BLANK ENTRIES ARE DEFAULT VALUES = 0 FOR ENTRIES #0 - #7, #16 - #17

254 FOR ENTRIES #8 - #15

'C' ENTRY MEANS CONTINUOUS = 255

							Timers		
Phase	Direction	Min	Max	ECO	Amber	All Red	Gap	Hdwy	Waste
A	EB Long Lake Thru	10.0	60.0	8.0	4.3	1.7	4.0	1.2	10.0
B	Corp RT, WB Long Lk LT	5.0	20.0		3.6	1.9	3.0	1.2	10.0
C									
D									
E									
F									
G									

	Day	Hours	Plan#
SC1	8	7:00	2
SC2	8	9:00	1
SC3	8	15:00	3
SC4	9	21:00	0
SC5	7	7:00	1
SC6	14	0:00	0
SC7			
SC8			
SC9			
SC10			

## Pedestrian Crossing Times

Direction	Walk	CL 1	CL 2
Long Lake Ped	7.0	8.0	3.0
Corporate Ped	7.0	10.0	2.5

TSM16 = Opticom alarm time (200 seconds)

## Normal Operating Mode

Isolated	Flexilink	Masterlink	Master Isolated	Flexi Isolated
		X		

## DAY OF WEEK CODE NUMBER

0	End of Schedule	4	WED	8	MON-FRI	12	MON,FRI,SAT
1	SUN	5	THUR	9	MON-SAT	13	SAT,SUN
2	MON	6	FRI	10	TUE,WED,THU	14	EVERY DAY
3	TUE	7	SAT	11	MON,FRI	15	NEVER

## Autoscope 37-Pin Male Output Harness (33457G2) Wiring

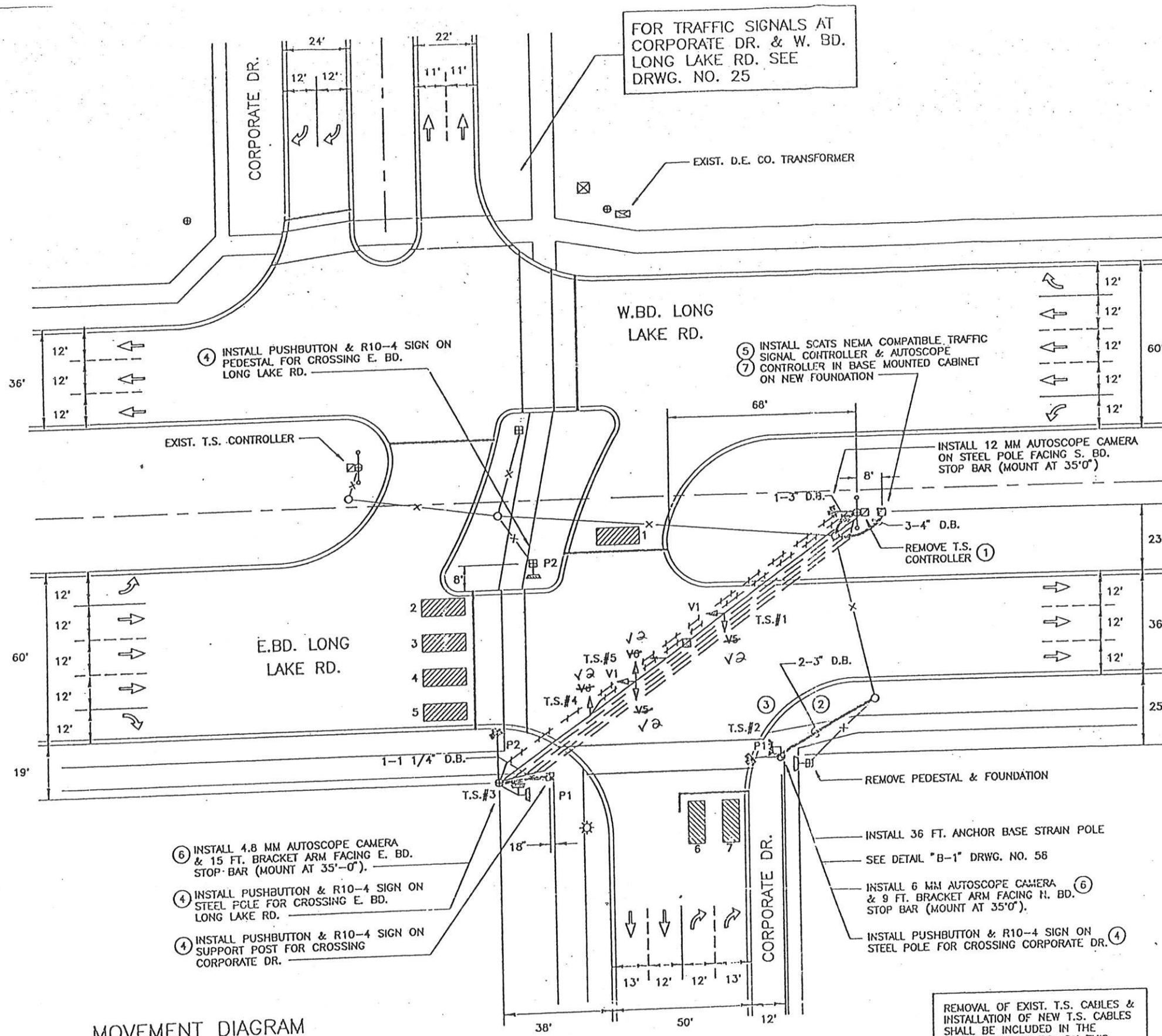
Co#128

Autoscope Output Harness Pins #1 &amp; #20 to Logic Common &amp; Pins #18 &amp; #37 to +24 VDC

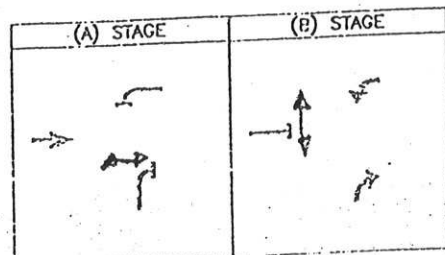
Camera Number	EIM Switch Position	EIM LED#	Output Harness Pin#	SCATS D-Conn. Term#	SCATS Detector Description
1	1	1	29	1	Crossover
	1	2	30		
	1	3	31		
	1	4	32		
	1	5	33		
	1	6	34		
	1	7	35		
	1	8	36		
2	2	1	10	2	Long Lake L
	2	2	11	3	Long Lake LC
	2	3	12	4	Long Lake RC
	2	4	13	5	Long Lake RT
	2	5	14		
	2	6	15		
	2	7	16		
	2	8	17		
3	3	1	21	6	Corporate
	3	2	22	7	Corporate RT
	3	3	23		
	3	4	24		
	3	5	25		
	3	6	26		
	3	7	27		
	3	8	28		
	4	1	2		
	4	2	3		
	4	3	4		
	4	4	5		
	4	5	6		
	4	6	7		
	4	7	8		
	4	8	9		

## Autoscope 37-Pin Female Input Harness (33457G3) Wiring

EIM Switch Position	EIM LED#	Input Harness Pin#	Phase Status Input From +24 VDC	Backpanel Terminal Position
5	1	29	Phase 8 Green	
5	1	30	Phase 7 Green	
5	1	31	Phase 6 Green	
5	1	32	Phase 5 Green	
5	1	33	Phase 4 Green	LOAD SWITCH 4 GREEN (177)
5	1	34	Phase 3 Green	
5	1	35	Phase 2 Green	LOAD SWITCH 2 GREEN (155)
5	1	36	Phase 1 Green	
6	2	10	Phase 8 Red	
6	2	11	Phase 7 Red	
6	2	12	Phase 6 Red	
6	2	13	Phase 5 Red	
6	2	14	Phase 4 Red	LOAD SWITCH 4 RED (173)
6	2	15	Phase 3 Red	
6	2	16	Phase 2 Red	LOAD SWITCH 2 RED (151)
6	2	17	Phase 1 Red	



MOVEMENT DIAGRAM

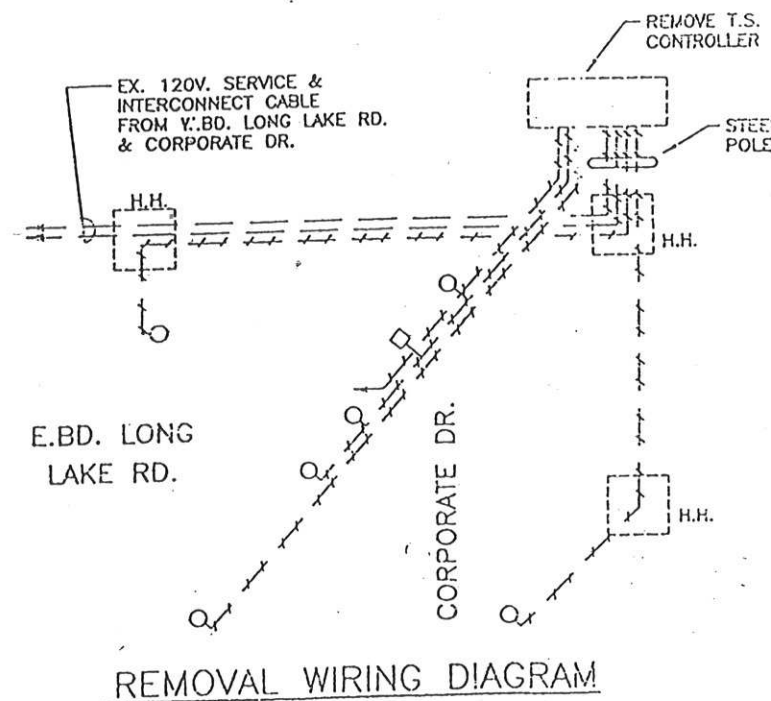


PLAN  
SCALE: 1"=20'

LOAD	AMPS	WATTS
SIGNALS	0	0

TRAFFIC SAFETY DEPARTMENT

LIST OF MATERIALS		
NO.	ITEM	QUANTITIES
(1)	REMOVE T.S. CONTROLLER & CABINET	1 EACH
(2)	REMOVE PEDESTAL MOUNTED PEDESTRIAN T.S.	1 EACH
(3)	1-WAY BRACKET ARM MOUNTED PEDESTRIAN T.S.	1 EACH
(4)	PUSHBUTTON & SIGN	4 EACH
(5)	SOLID STATE ACTUATED CONTROLLER & CABINET	1 EACH
(6)	AUTOSCOPE CAMERA	3 EACH
(7)	AUTOSCOPE CONTROLLER	1 EACH
	DIRECT BURIAL CONDUIT, 1-1 1/4"	20 UN. FT.
	DIRECT BURIAL CONDUIT, 2-3"	40 UN. FT.
	DIRECT BURIAL CONDUIT, 3-4"	20 UN. FT.
	BASE MOUNT CONTROLLER FOUNDATION	1 EACH
	600V., 1-2/C#4 SECONDARY CABLE	40 UN. FT.
	600V., 1-12/C#14 P.J. CABLE (INTERCONNECT)	40 UN. FT.
	REMOVE FOUNDATION	1 EACH
	REMOVE PEDESTAL	1 EACH
	CLAMP-ON BRACKET ARM, 9 FT.	1 EACH
	CLAMP-ON BRACKET ARM, 15 FT.	1 EACH
	DIRECT BURIAL CONDUIT, 1-3"	15 UN. FT.



CORPORATE DR. & E.B.D. LONG LAKE RD.  
CO. 728

MANCILL ASSOCIATES INC. ENGINEERING CONSULTANTS 32500 Grand River Farmington, ME 04834 (207) 453-7070		PROJECT NAME SIGNALS INSTALLATION
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OAKLAND COUNTY ROAD COMMISSION  
TRAFFIC - SAFETY DEPARTMENT  
SIGNAL WORK ORDER

TRAFFIC - SAFETY DEPARTMENT FOR  
OAKLAND COUNTY

AUG 24 2015

LOCATION: Long Lake X/O & W/O Crooks DATE: 8/14/15

CITY/TOWNSHIP: Troy BY: Dawn Bierlein

TRAFFIC OPERATIONS

COUNTY#: 739 STATE#: \_\_\_\_\_ CHARGES: 78 00739 0

PLEASE PERFORM THE FOLLOWING:

\_\_\_\_\_ ELECTRICAL DEVICE: \_\_\_\_\_ INSTALL \_\_\_\_\_ MODERNIZE \_\_\_\_\_ MAINTENANCE

\_\_\_\_\_ UNDERGROUND: \_\_\_\_\_

\_\_\_\_\_ EDISON OK: \_\_\_\_\_ YES \_\_\_\_\_ NO JOB#: \_\_\_\_\_

\_\_\_\_\_ COORDINATE W/DISTRICT 7: \_\_\_\_\_

DIAL..	1	1	1	1		2	2	2	2		3	3	3	3		4	4	4	4
SPLIT.	1	2	3	4		1	2	3	4		1	2	3	4		1	2	3	4
_____ CHANGE TIMING.....																			
_____ CHANGE OFFSET.....																			
_____ CHANGE CYCLE LENGTH.....																			
_____ ADD DIAL/SPLIT.....																			

☒ CHANGE BREAKOUT OR EPROM: Change personality (Rev 2)

\_\_\_\_\_ CHANGE HOURS OF OPERATION:

OLD: \_\_\_\_\_

NEW: \_\_\_\_\_

\_\_\_\_\_ REPROGRAM TBC

\_\_\_\_\_ INSTALL INTERCONNECT: \_\_\_\_\_ TBC \_\_\_\_\_ MINITROL \_\_\_\_\_ TONE

\_\_\_\_\_ MBT OK: \_\_\_\_\_ YES \_\_\_\_\_ NO

\_\_\_\_\_ NO CHANGE - RECORD CORRECTION

☒ OTHER: Requires a checksum change

APPROVED BY:  DATE: 8/14/15

DATE INSTALLED: 8-21-15

INSTALLED BY: Dave Williams

INTERSECTION :- 739 LONG LAKE CROSSOVER W CROOKS  
DESCRIPTION PROMS :- X00739D / F2002  
CONTROLLER TYPE :- STANDARD PERSONALITY CONTROLLER  
SOFTWARE TYPE : - MOD 52 SCATS

INPUTS :-

1. CROSSOVER TIMED (5 SEC)	12.
2. Long Lake (Dummy)	13. -
3. -	14. -
4. -	15. -
5. -	16. Opticom 1
6. -	
7. -	
8. -	
9. -	
10. -	
11. -	

Note: Detector 1 is Autoscope (2004 camera)  
Detector 2 is a Dummy detector - Hook up  
Det 2 to logic common on the D-Connector

APPROACHES :-

A APPR 1 : LONG LAKE  
B APPR 1 : CROSSOVER

FLEXIDATA :-

SEQUENCE	A,B	A,B
AUTO REL		
R- REL	A	A
R+ REL	B	B
Q- REL		
Q+ REL		
LOOKAHEAD		

SPECIAL FEATURES :-

The personality revision number is currently 2 (=B).  
A STAGE HAS PERMANENT DEMAND.  
DEMAND FOR STAGE B FLEXI AND ISOL, SET ZNEG TO DISABLE.  
Opticom 1 calls A stage.

BACKPANEL - SIZE M CABINET

LOAD SWITCH 2 - LONG LAKE	A	FLA
LOAD SWITCH 4 - CROSSOVER	B	FLR

JUMPERS:

121-213, 151-152, 153-154, 155-156, 173-174, 175-176, 177-178,  
233-PB1, 241-PB1, 255-256, 257-258, 259-260, 261-262, 263-PB1.

SIGNAL MONITOR: NONE

All switches OFF EXCEPT: Dual Select A&B; G&Y Enable; SSM 2,4.  
Minimum Flash = 4 + 2 + 1.

\*\*\*\*\*  
\* CONTROLLER INFORMATION SHEET \*  
\* FOR SITE NO. 739 \*  
\* DAWN BIERLEIN \*  
\* DATE :- 14-AUGUST-2015 \*  
\*\*\*\*\*

CHECKSUMS  
TIMES: 2A/052  
PERS: F2/352  
TOTAL: C0/300

# FLEXILINK PLAN DATA

Intersection # 739 State # \_\_\_\_\_ Date: 08/14/15 Prepared By: Dawn Bierlein

Intersection: Long Lake & X/O West of Crooks City: Troy

Hours of Operation: 7 Days: 7am-10pm Approved By: Rachel Jones

Hours of Flashing: 7 Days: 10pm-7am

			AM	PM						
		PL0	PL1	PL2	PL3	PL4	PL5	PL6	PL7	PL8
0	CL		80	120	120					
1	A		0	0	0					
2	B		40	70	55					
3	C									
4	D									
5	E									
6	F									
7	G									
8	R-									
9	R+									
10	Of (Y-)		21	54	112					
11	Y+	C								
12	Z-									
13	Z+									
14	Q-									
15	Q+									
16	XH									
17	XL									

**NOTE:** STAGES WITH ONE SECOND PHASE TIMES ARE SKIPPED

BLANK ENTRIES ARE DEFAULT VALUES = 0 FOR ENTRIES #0 - #7, #16 - #17

254 FOR ENTRIES #8 - #15

'C' ENTRY MEANS CONTINUOUS = 255

							Timers		
Phase	Direction	Min	Max	ECO	Amber	All Red	Gap	Hdwy	Waste
A	Long Lake	10.0	60.0		4.3	1.7	3.0	1.2	10.0
B	Crossover	5.0	20.0		3.5	1.9	3.0	1.2	10.0
C									
D									
E									
F									
G									

	Day	Hours	Plan#
SC1	8	7:00	2
SC2	8	9:00	1
SC3	8	15:00	3
SC4	8	19:00	1
SC5	14	22:00	0
SC6	14	0:00	0
SC7	13	7:00	1
SC8			
SC9			
SC10			

## Pedestrian Crossing Times

Direction	Walk	CL 1	CL 2

TSM16 = Opticom alarm time (200 seconds)

## Normal Operating Mode

Isolated	Flexilink	Masterlink	Master Isolated	Flexi Isolated
		X		

## DAY OF WEEK CODE NUMBER

0	End of Schedule	4	WED	8	MON-FRI	12	MON,FRI,SAT
1	SUN	5	THUR	9	MON-SAT	13	SAT,SUN
2	MON	6	FRI	10	TUE,WED,THU	14	EVERY DAY
3	TUE	7	SAT	11	MON,FRI	15	NEVER

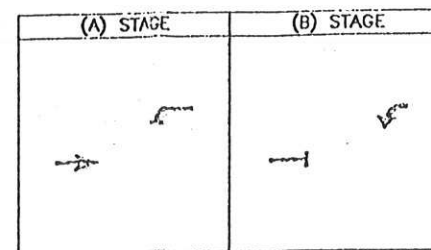
Autoscope 37-Pin Male Output Harness (33457G2) Wiring

Camera Number	EIM Switch Position	EIM LED#	Output Harness Pin#	SCATS D-Conn. Term#	SCATS Detector Description
1	1	1	29	1	Crossover
	1	2	30		
	1	3	31		
	1	4	32		
	1	5	33		
	1	6	34		
	1	7	35		
	1	8	36		
	2	1	10		
	2	2	11		
	2	3	12		
	2	4	13		
	2	5	14		
	2	6	15		
	2	7	16		
	2	8	17		
	3	1	21		
	3	2	22		
	3	3	23		
	3	4	24		
	3	5	25		
	3	6	26		
	3	7	27		
	3	8	28		
	4	1	2		
	4	2	3		
	4	3	4		
	4	4	5		
	4	5	6		
	4	6	7		
	4	7	8		
	4	8	9		

Autoscope 37-Pin Female Input Harness (33457G3) Wiring

EIM Switch Position	EIM LED#	Input Harness Pin#	Phase Status Input From +24 VDC	Backpanel Terminal Position
5	1	29	Phase 8 Green	
5	1	30	Phase 7 Green	
5	1	31	Phase 6 Green	
5	1	32	Phase 5 Green	
5	1	33	Phase 4 Green	177
5	1	34	Phase 3 Green	
5	1	35	Phase 2 Green	155
5	1	36	Phase 1 Green	
6	2	10	Phase 8 Red	
6	2	11	Phase 7 Red	
6	2	12	Phase 6 Red	
6	2	13	Phase 5 Red	
6	2	14	Phase 4 Red	173
6	2	15	Phase 3 Red	
6	2	16	Phase 2 Red	151
6	2	17	Phase 1 Red	



[illegible]

LONG LAKE RD. & X-OVER W. OF CROOKS  
CO. 739 ATS

ASSOCIATE CONSULTANT  
MANSELL ASSOCIATES INC.  
ENGINEERING CONSULTANTS

FREE CONSULTANT  
HAMPTON ENGINEERS  
ASSOCIATES INC.

LOAD	AMPS	WATTS
	0	0

OAKLAND COUNTY ROAD COMMISSION  
TRAFFIC - SAFETY DEPARTMENT  
SIGNAL WORK ORDER

LOCATION: WB Long Lake & Corporate DATE: 6/27/15

CITY/TOWNSHIP: Troy BY: Rachel Jones

COUNTY#: 740 STATE#: \_\_\_\_\_ CHARGES: 52591-0981 (Materials)  
52591-0989 (Labor)

PLEASE PERFORM THE FOLLOWING:

\_\_\_\_\_ ELECTRICAL DEVICE: \_\_\_\_\_ INSTALL \_\_\_\_\_ MODERNIZE \_\_\_\_\_ MAINTENANCE

\_\_\_\_\_ UNDERGROUND: \_\_\_\_\_

\_\_\_\_\_ EDISON OK: \_\_\_\_\_ YES \_\_\_\_\_ NO

JOB#: \_\_\_\_\_

\_\_\_\_\_ COORDINATE W/DISTRICT 7: \_\_\_\_\_

AUG - 7 2015

TRAFFIC OPERATIONS

DIAL..	1	1	1	1		2	2	2	2		3	3	3	3		4	4	4	4
SPLIT.	1	2	3	4		1	2	3	4		1	2	3	4		1	2	3	4
_____ CHANGE TIMING.....																			
_____ CHANGE OFFSET.....																			
_____ CHANGE CYCLE LENGTH.....																			
_____ ADD DIAL/SPLIT.....																			

☒ CHANGE BREAKOUT OR EPROM: Change personality (Rev 1)

\_\_\_\_\_ CHANGE HOURS OF OPERATION:

OLD: \_\_\_\_\_

NEW: \_\_\_\_\_

\_\_\_\_\_ REPROGRAM TBC

\_\_\_\_\_ INSTALL INTERCONNECT: \_\_\_\_\_ TBC \_\_\_\_\_ MINITROL \_\_\_\_\_ TONE

\_\_\_\_\_ MBT OK: \_\_\_\_\_ YES \_\_\_\_\_ NO

\_\_\_\_\_ NO CHANGE - RECORD CORRECTION

☒ OTHER: Swap out AWA controller w/Mod 52 SCATS controller. Install phone jack.

Swap out D-connector and hook up autoscope per paperwork. See attached for cabinet changes.

APPROVED BY:  DATE: 7/1/15

DATE INSTALLED: 8-5-15

INSTALLED BY: Jordan Haller

## **Cabinet Changes – CO 740 rev 1**

### **Load Switches – Per Paperwork**

Add load switches 4 and 6  
Remove load switches 1 and 7

### **Backpanel Jumpers – Per Paperwork**

Add           121-213, 173-174, 175-176, 177-178, 179-180, 185-186, 223-224, 229-230,  
                  233-PB1, 259-260, 261-262, 268-269, 273-274.

Remove       145-146, 147-148, 149-150, 157-224, 163-230, 179-202, 185-208, 233-234,  
                  235-236, 247-273, 251-269, 259-PB1.

### **Field Wiring – Hook up per Paperwork**

Unhook Long Lake off LS1 and hook up on LS2  
Unhook Corporate / Crossover off LS2 and hook up on LS4  
Unhook Long Lake Ped off LS8 and hook up on LS6  
Unhook Corporate / Crossover Ped off LS7 and hook up on LS8

### **Signal Monitor – Per Paperwork**

Switches	Add:	SSM 4
	Remove:	SSM 1

### **Flash Program – Wire per Paperwork**

Wire LS1 for No Flash  
Wire LS2 for FLA  
Wire LS4 for FLR

### **Autoscope – Per Paperwork**

Input Harness: Unhook Phase 1 and hook up Phase 4

### **Opticom – Per Paperwork**

Hook up per paperwork and check operation.

INTERSECTION :- 740: WB Long Lake & Corporate

DESCRIPTION PROMS :- X00740 / F4402

SOFTWARE :- Mod 52 SCATS

INPUTS :-

1. Crossover (LK)	9. -	Note: All detectors are autoscope
2. WB Long Lake L (LK)	10. -	(2004 cameras)
3. WB Long Lake CL (LK)	11. -	
4. WB Long Lake CR (LK)	12. -	
5. WB Long Lake R (LK)	13. -	
6. Corporate L (LK)	14. -	
7. Corporate R (LK)	15. -	
8. -	16. Opticom 1	

Ped 2. WB Long Lake Ped (North Leg) P.B.

Ped 4. Corporate Ped (East Leg) P.B.

APPROACHES :-

A APP 1 : WB Long Lake L,CL,CR,R

B APP 1 : Crossover

B APP 2 : Corporate L,R

C APP 1 : WB Long Lake L,CL,CR,R

D APP 1 : Crossover

D APP 2 : Corporate L,R

FLEXIDATA :-

SEQUENCE A,B,C,D A,B,C,D

AUTO REL

R- REL A A

R+ REL B B

Q- REL C C

Q+ REL D D

PEDESTRIANS :-

1. No Ped 1

2. WB Long Lake Ped (North Leg) (P+)

3. No Ped 3

4. Corporate Ped (East Leg) (P-)

SPECIAL FEATURES :-

Personality revision is 1 (=A).

A stage has a permanent demand.

Demand for Stage B in Flexi and Isol, set ZNEG to disable.

Pedestrians have automatic introduction using SCATS Y-.

Ped WB Long Lake Ped (North Leg) introduction is suppressed when OPTICOM is active.

Ped Corporate Ped (East Leg) introduction is suppressed when OPTICOM is active.

Opticom 1 calls A Stage.

BACKPANEL - M CABINET

LOAD SWITCH 2 - LONG LAKE

A FLA

LOAD SWITCH 4 - CORPORATE/CROSSOVER

B&C FLR

LOAD SWITCH 6 - LONG LAKE PED (NORTH LEG)

P1

LOAD SWITCH 8 - CORPORATE PED (EAST LEG)

P2

JUMPERS:

121-213,151-152,153-154,155-156,173-174,175-176,177-178,179-180,185-186,223-224,  
229-230,233-PB1,237-PB1,241-PB1,255-256,257-258,259-260,261-262,263-PB1,268-269,  
273-274.

SIGNAL MONITOR: NONE.

All switches OFF EXCEPT: Dual Select A&B; G&Y Enable; SSM 2,4.

Minimum Flash = 4 + 2 + 1.

\*\*\*\*\*  
\* CONTROLLER INFORMATION SHEET \*  
\* FOR SITE NO. 740 \*  
\* Rachel Jones \*  
\* 27-Jun-2015 \*  
\*\*\*\*\*

Checksums:

Times EC / 354  
Pers 8B / 213  
Total 67 / 147



# FLEXILINK PLAN DATA

Intersection # 740 State # - Date: 06/27/15 Prepared By: Rachel Jones

Intersection: WB Long Lake & Corporate City: Troy

Hours of Operation: Mon - Sat: 7am - 9pm Approved By: R. Jones

Hours of Flashing: Mon - Sat: 9pm - 7am, Sun: 24 Hours

				AM	PM					
		PL0	PL1	PL2	PL3	PL4	PL5	PL6	PL7	PL8
0	CL		80	120	120					
1	A		0	0	0					
2	B		55	71	91					
3	C		78	118	118					
4	D		79	119	119					
5	E									
6	F									
7	G									
8	R-									
9	R+									
10	Of (Y-)		40	74	117					
11	Y+	C								
12	Z-									
13	Z+									
14	Q-									
15	Q+									
16	XH									
17	XL									

**NOTE:** STAGES WITH ONE SECOND PHASE TIMES ARE SKIPPED

BLANK ENTRIES ARE DEFAULT VALUES = 0 FOR ENTRIES #0 - #7, #16 - #17

254 FOR ENTRIES #8 - #15

'C' ENTRY MEANS CONTINOUS = 255

							Timers		
Phase	Direction	Min	Max	ECO	Amber	All Red	Gap	Hdwy	Waste
A	WB Long Lake	10.0	60.0		4.3	2.0	4.0	1.2	10.0
B	Corporate / Crossover	5.0	20.0		3.6	2.2	3.0	1.2	10.0
C	WB Long Lake	5.0	20.0		4.3	2.0	3.0	1.2	10.0
D	Corporate / Crossover	5.0	20.0		3.6	2.2	3.0	1.2	10.0
E									
F									
G									

	Day	Hours	Plan#
SC1	8	7:00	2
SC2	8	9:00	1
SC3	8	15:00	3
SC4	8	19:00	1
SC5	9	21:00	0
SC6	7	7:00	1
SC7	14	0:00	0
SC8			
SC9			
SC10			

## Pedestrian Crossing Times

Direction	Walk	CL 1	CL 2
Long Lake Ped	7.0	15.0	3.3
Corporate Ped	7.0	9.0	2.8

Opticom Alarm Time (TSM16) = 200

## Normal Operating Mode

Isolated	Flexilink	Masterlink	Master Isolated	Flexi Isolated
		X		

## DAY OF WEEK CODE NUMBER

0	End of Schedule	4	WED	8	MON-FRI	12	MON,FRI,SAT
1	SUN	5	THUR	9	MON-SAT	13	SAT,SUN
2	MON	6	FRI	10	TUE,WED,THU	14	EVERY DAY
3	TUE	7	SAT	11	MON,FR!	15	NEVER

## Autoscope 37-Pin Male Output Harness (33457G2) Wiring

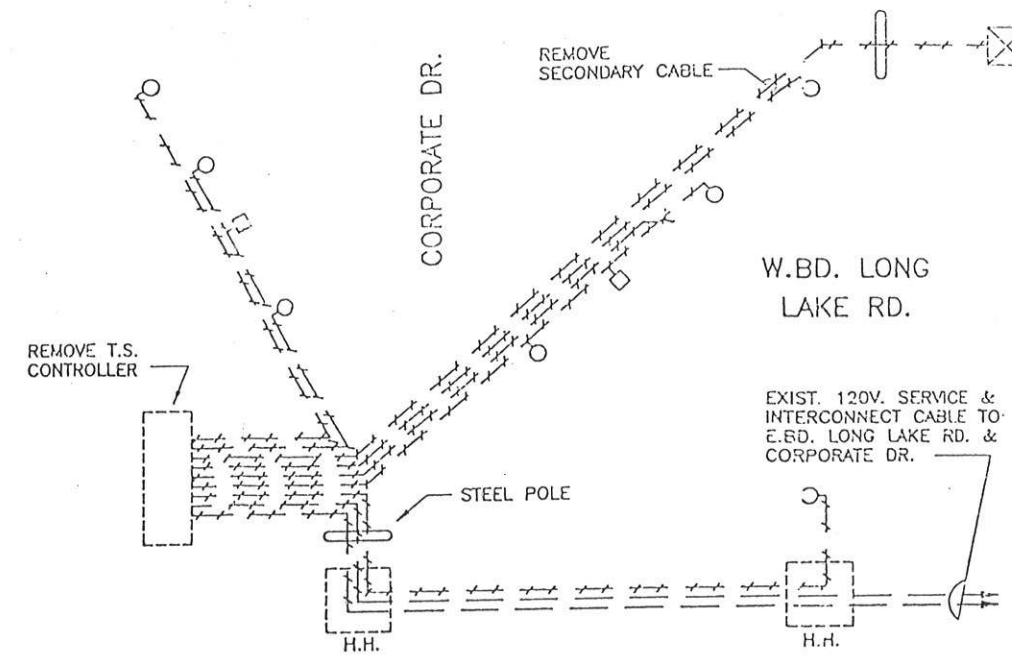
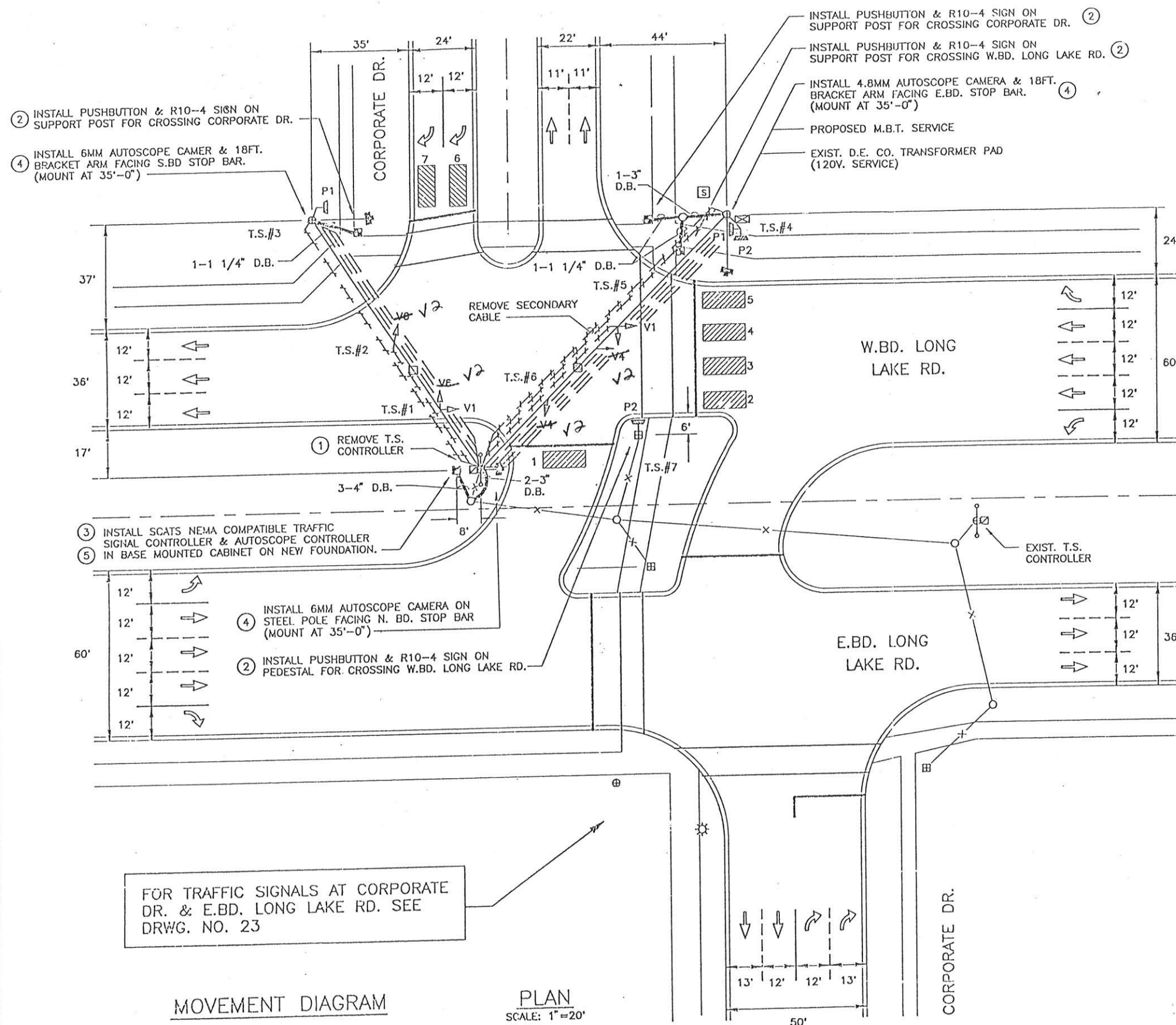
Co# 740

Autoscope Output Harness Pins #1 &amp; #20 to Logic Common &amp; Pins #18 &amp; #37 to +24 VDC

Camera Number	EIM Switch Position	EIM LED#	Output Harness Pin#	SCATS D-Conn. Term#	SCATS Detector Description
1	1	1	29	1	Crossover
	1	2	30		
	1	3	31		
	1	4	32		
	1	5	33		
	1	6	34		
	1	7	35		
	1	8	36		
2	2	1	10	2	Long Lake L
2	2	2	11	3	Long Lake LC
2	2	3	12	4	Long Lake RC
2	2	4	13	5	Long Lake RT
	2	5	14		
	2	6	15		
	2	7	16		
	2	8	17		
3	3	1	21	6	Corporate
3	3	2	22	7	Corporate RT
	3	3	23		
	3	4	24		
	3	5	25		
	3	6	26		
	3	7	27		
	3	8	28		
	4	1	2		
	4	2	3		
	4	3	4		
	4	4	5		
	4	5	6		
	4	6	7		
	4	7	8		
	4	8	9		

## Autoscope 37-Pin Female Input Harness (33457G3) Wiring

EIM Switch Position	EIM LED#	Input Harness Pin#	Phase Status Input From +24 VDC	Backpanel Terminal Position
5	1	29	Phase 8 Green	
5	1	30	Phase 7 Green	
5	1	31	Phase 6 Green	
5	1	32	Phase 5 Green	
5	1	33	Phase 4 Green	LS 4 GREEN (177)
5	1	34	Phase 3 Green	
5	1	35	Phase 2 Green	LS 2 GREEN (155)
5	1	36	Phase 1 Green	
6	2	10	Phase 8 Red	
6	2	11	Phase 7 Red	
6	2	12	Phase 6 Red	
6	2	13	Phase 5 Red	
6	2	14	Phase 4 Red	LS 4 RED (173)
6	2	15	Phase 3 Red	
6	2	16	Phase 2 Red	LS 2 RED (151)
6	2	17	Phase 1 Red	



REMOVAL WIRING DIAGRAM

REMOVAL OF EXIST. T.S. CABLES & INSTALLATION OF NEW T.S. CABLES SHALL BE INCLUDED IN THE INSTALLATION OF T.S. ON THIS CONTRACT.

LIST OF MATERIALS			
NO.	ITEM	QUANTITIES	CODE NO.
①	REMOVE CONTROLLER & CABINET	1 EACH	6910162
②	PUSHBUTTON & SIGN	4 EACH	6910267
③	SOLID STATE ACTUATED CONTROLLER & CABINET	1 EACH	6910337
④	AUTOSCOPE CAMERA	3 EACH	
⑤	AUTOSCOPE CONTROLLER	1 EACH	
	DIRECT BURIAL CONDUIT, 1-1 1/4"	40 LIN.FT.	6910351
	DIRECT BURIAL CONDUIT, 1-3"	20 LIN.FT.	6910362
	DIRECT BURIAL CONDUIT, 2-3"	15 LIN.FT.	6910355
	DIRECT BURIAL CONDUIT, 3-4"	5 LIN.FT.	
	HANDHOLE (ROUND)	1 EACH	6910369
	REMOVE SECONDARY CABLE	1-6 LIN.FT.	6910172
	BASE MOUNT CONTROLLER FOUNDATION	1 EACH	6910427
	600V. 1-2/C#4 SECONDARY CABLE	25 LIN.FT.	6910470
	600V. 1-12/C#14 P.J. CABLE (INTERCONNECT)	25 LIN.FT.	6910480
	CLAMP-ON BRACKET ARM, 18FT.	2 EACH	
	PUSHBUTTON SUPPORT	3 EACH	

CORPORATE DR. & W.BD. LONG LAKE RD.  
CO. 740

MANSELL ASSOCIATES INC.  
ENGINEERING CONSULTANTS  
3, 5th Grand Ave.  
Farmington, VT 05404  
(312) 473-7700

HAMPTON ENGINE ASSOCIATES INC.  
312-473-7700

LOAD	AMPS	WATTS
SIGNALS	0	0

OAKLAND COUNTY ROAD COMMISSION  
TRAFFIC - SAFETY DEPARTMENT  
SIGNAL WORK ORDER

LOCATION: Long Lake & X/O E/O Crooks DATE: 5/11/15

CITY/TOWNSHIP: Troy BY: Dawn Bierlein

COUNTY#: 738 STATE#: \_\_\_\_\_ CHARGES: 52591-0981 <sup>0989</sup>

PLEASE PERFORM THE FOLLOWING:

\_\_\_\_\_ ELECTRICAL DEVICE: \_\_\_\_\_ INSTALL \_\_\_\_\_ MODERNIZE \_\_\_\_\_ MAINTENANCE

\_\_\_\_\_ UNDERGROUND: \_\_\_\_\_

\_\_\_\_\_ EDISON OK: \_\_\_\_\_ YES \_\_\_\_\_ NO JOB#: \_\_\_\_\_ MAY 19 2015

\_\_\_\_\_ COORDINATE W/DISTRICT 7: \_\_\_\_\_

TRAFFIC OPERATIONS

DIAL..	1	1	1	1		2	2	2	2		3	3	3	3		4	4	4	4
SPLIT.	1	2	3	4		1	2	3	4		1	2	3	4		1	2	3	4
CHANGE TIMING.....																			
CHANGE OFFSET.....																			
CHANGE CYCLE LENGTH.....																			
ADD DIAL/SPLIT.....																			

\_\_\_\_\_ CHANGE BREAKOUT OR EPROM: \_\_\_\_\_

\_\_\_\_\_ CHANGE HOURS OF OPERATION:

OLD: \_\_\_\_\_

NEW: \_\_\_\_\_

\_\_\_\_\_ REPROGRAM TBC

\_\_\_\_\_ INSTALL INTERCONNECT: \_\_\_\_\_ TBC \_\_\_\_\_ MINITROL \_\_\_\_\_ TONE

\_\_\_\_\_ MBT OK: \_\_\_\_\_ YES \_\_\_\_\_ NO

X NO CHANGE - RECORD CORRECTION (237-PBI added; AS Paperwork)

\_\_\_\_\_ OTHER: \_\_\_\_\_

APPROVED BY: [Signature] DATE: 5/11/15

DATE INSTALLED: 5-12-15

INSTALLED BY: Glaser, Roberts



## **Cabinet Changes – CO 738 rev 1**

### **Load Switches – Per Paperwork**

Add load switch 4

Remove load switch 1

### **Backpanel Jumpers – Per Paperwork**

Add            151-152, 153-154, 155-156, 173-174, 175-176,  
                    177-178, 233-PB1, 259-260, 261-262.

Remove        233-234, 235-236, 259-PB1.

### **Field Wiring – Hook up per Paperwork**

### **Signal Monitor – Per Paperwork**

Add switch: SSM 4

Remove switch: SSM 1 (check switches to match paperwork)

### **Flash Program – Wire per Paperwork**

### **Autoscope – Per Paperwork**

Input Harness: Phase 1 deleted, Phase 4 added.

INTERSECTION :- 738 LONG LAKE CROSSOVER E CROOKS  
DESCRIPTION PROMS :- X00738D / F2002  
CONTROLLER TYPE :- STANDARD PERSONALITY CONTROLLER  
SOFTWARE TYPE : - MOD 52 SCATS

INPUTS :-

1. CROSSOVER TIMED (5 SEC)	12.
2. Long Lake (Dummy)	13. -
3. -	14. -
4. -	15. -
5. -	16. Opticom 1
6. -	
7. -	
8. -	
9. -	
10. -	
11. -	

Note: Detector 1 is Autoscope (2004 camera)  
Detector 2 is a Dummy detector - Hook up  
Det 2 to logic common on the D-Connector

APPROACHES :-

A APPR 1 : LONG LAKE  
B APPR 1 : CROSSOVER

FLEXIDATA :-

SEQUENCE	A,B	A,B
AUTO REL		
R- REL	A	A
R+ REL	B	B
Q- REL		
Q+ REL		
LOOKAHEAD		

SPECIAL FEATURES :-

The personality revision number is currently 1 (=A).  
A STAGE HAS PERMANENT DEMAND.  
DEMAND FOR STAGE B FLEXI AND ISOL, SET ZNEG TO DISABLE.  
Opticom 1 calls A stage.

BACKPANEL - SIZE M CABINET

LOAD SWITCH 2 - LONG LAKE	A	FLA
LOAD SWITCH 4 - CROSSOVER	B	FLR

JUMPERS:

121-213,151-152,153-154,155-156,173-174,175-176,177-178,  
233-PB1,241-PB1,255-256,257-258,259-260,261-262,263-PB1.

SIGNAL MONITOR: NONE

All switches OFF EXCEPT: Dual Select A&B; G&Y Enable; SSM 2,4.  
Minimum Flash = 4 + 2 + 1.

\*\*\*\*\*  
\* CONTROLLER INFORMATION SHEET \*  
\* FOR SITE NO. 738 \*  
\* DAWN BIERLEIN \*  
\* DATE :- 5-MAY-2015 \*  
\*\*\*\*\*

CHECKSUM  
TIMES: 58/130  
PERS: D8/330  
TOTAL: 80/200

# FLEXILINK PLAN DATA

**Intersection #** 738 **State #** - **Date:** 05/05/15 **Prepared By:** Dawn Bierlein  
**Intersection:** Long Lake & X/O East of Crooks **City:** Troy  
**Hours of Operation:** 7 Days: 7am-10pm **Approved By:** Rachel Jones  
**Hours of Flashing:** 7 Days: 10pm-7am

			AM	PM						
		PL0	PL1	PL2	PL3	PL4	PL5	PL6	PL7	PL8
0	CL		80	120	120					
1	A		0	0	0					
2	B		40	70	55					
3	C									
4	D									
5	E									
6	F									
7	G									
8	R-									
9	R+									
10	Of (Y-)		23	52	110					
11	Y+	C								
12	Z-									
13	Z+									
14	Q-									
15	Q+									
16	XH									
17	XL									

**NOTE:** STAGES WITH ONE SECOND PHASE TIMES ARE SKIPPED  
 BLANK ENTRIES ARE DEFAULT VALUES = 0 FOR ENTRIES #0 - #7, #16 - #17  
 254 FOR ENTRIES #8 - #15 'C' ENTRY MEANS CONTINUOUS = 255

							Timers		
Phase	Direction	Min	Max	ECO	Amber	All Red	Gap	Hdwy	Waste
A	Long Lake	10.0	60.0		4.3	2.3	3.0	1.2	10.0
B	Crossover	5.0	20.0		3.5	1.9	3.0	1.2	10.0
C									
D									
E									
F									
G									

	Day	Hours	Plan#
SC1	8	7:00	2
SC2	8	9:00	1
SC3	8	15:00	3
SC4	8	19:00	1
SC5	14	22:00	0
SC6	14	0:00	0
SC7	13	7:00	1
SC8			
SC9			
SC10			

## Pedestrian Crossing Times

Direction	Walk	CL 1	CL 2

TSM16 = Opticom alarm time (200 seconds)

## Normal Operating Mode

Isolated	Flexilink	Masterlink	Master Isolated	Flexi Isolated
		X		

## DAY OF WEEK CODE NUMBER

0	End of Schedule	4	WED	8	MON-FRI	12	MON,FRI,SAT
1	SUN	5	THUR	9	MON-SAT	13	SAT,SUN
2	MON	6	FRI	10	TUE,WED,THU	14	EVERY DAY
3	TUE	7	SAT	11	MON,FRI	15	NEVER

**Autoscope 37-Pin Male Output Harness (33457G2) Wiring**  
**Autoscope Output Harness Pins #1 & #20 to Logic Common & Pins #18 & #37 to +24 VDC**

738

Camera Number	EIM Switch Position	EIM LED#	Output Harness Pin#	SCATS D-Conn. Term#	SCATS Detector Description
1	1	1	29	1	Cross over ✓
	1	2	30		
	1	3	31		
	1	4	32		
	1	5	33		
	1	6	34		
	1	7	35		
	1	8	36		
	2	1	10		
	2	2	11		
	2	3	12		
	2	4	13		
	2	5	14		
	2	6	15		
	2	7	16		
	2	8	17		
	3	1	21		
	3	2	22		
	3	3	23		
	3	4	24		
	3	5	25		
	3	6	26		
	3	7	27		
	3	8	28		
	4	1	2		
	4	2	3		
	4	3	4		
	4	4	5		
	4	5	6		
	4	6	7		
	4	7	8		
	4	8	9		

**Autoscope 37-Pin Female Input Harness (33457G3) Wiring**

EIM Switch Position	EIM LED#	Input Harness Pin#	Phase Status Input From +24 VDC	Backpanel Terminal Position
5	1	29	Phase 8 Green	
5	1	30	Phase 7 Green	
5	1	31	Phase 6 Green	
5	1	32	Phase 5 Green	
5	1	33	Phase 4 Green	177
5	1	34	Phase 3 Green	
5	1	35	Phase 2 Green	155
5	1	36	Phase 1 Green	
6	2	10	Phase 8 Red	
6	2	11	Phase 7 Red	
6	2	12	Phase 6 Red	
6	2	13	Phase 5 Red	
6	2	14	Phase 4 Red	173
6	2	15	Phase 3 Red	
6	2	16	Phase 2 Red	151
6	2	17	Phase 1 Red	



Community Profiles

YOU ARE VIEWING DATA FOR:

City of Troy

500 W Big Beaver Rd  
Troy, MI 48084-5285  
<http://troymi.gov/>



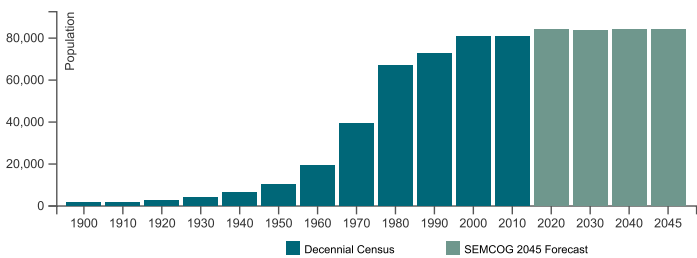
Census 2010 Population: 80,980  
Area: 33.6 square miles

VIEW COMMUNITY EXPLORER MAP

Population and Households

Link to American Community Survey (ACS) Profiles: **Select a Year**  **Social | Demographic**  
**Population and Household Estimates for Southeast Michigan, 2019**

Population Forecast



POPULATION:

Note for City of Troy : Incorporated as of the 1960 Census from Troy Township. Population numbers prior to 1960 are of the township.

Population and Households

Population and Households	Census 2010	Change 2000-2010	Pct Change 2000-2010	SEMCOG Jul 2019	SEMCOG 2045
Total Population	80,980	21	0.0%	84,547	83,911
Group Quarters Population	310	75	31.9%	1,180	1,498
Household Population	80,670	-54	-0.1%	83,367	82,413
Housing Units	32,907	2,035	6.6%	33,700	-
Households (Occupied Units)	30,703	685	2.3%	31,674	33,400
Residential Vacancy Rate	6.7%	3.9%	-	6.0%	-
Average Household Size	2.63	-0.06	-	2.63	2.47

Source: U.S. Census Bureau, SEMCOG Population and Household Estimates, and SEMCOG 2045 Regional Development Forecast

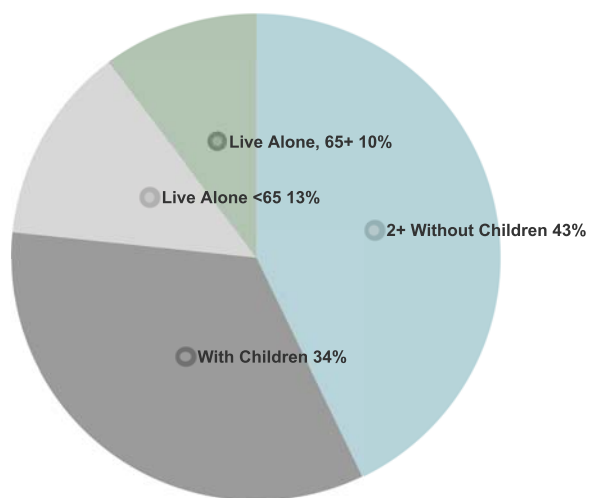
Components of Population Change

Components of Population Change	2000-2005 Avg.	2006-2010 Avg.	2011-2018 Avg.
<b>Natural Increase (Births - Deaths)</b>	455	281	251
<b>Births</b>	1,045	782	805
<b>Deaths</b>	590	501	554
<b>Net Migration (Movement In - Movement Out)</b>	-572	-160	325
<b>Population Change (Natural Increase + Net Migration)</b>	-117	121	576

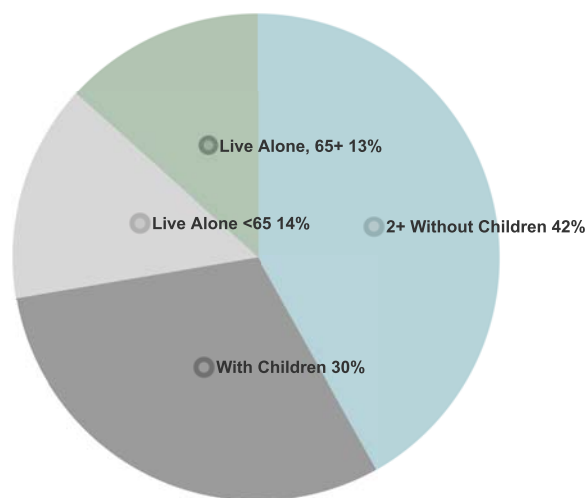
Source: Michigan Department of Community Health Vital Statistics, U.S. Census Bureau, and SEMCOG

## Household Types

ACS  
2018



SEMCOG  
2045



Household Types	Census 2010	ACS 2018	Change 2010-2018	Pct Change 2010-2018	SEMCOG 2045
<b>With Seniors 65+</b>	8,132	9,489	1,357	16.7%	13,589
<b>Without Seniors</b>	22,571	21,879	-692	-3.1%	19,811
<b>Live Alone, 65+</b>	2,961	3,227	266	9%	4,444
<b>Live Alone, &lt;65</b>	4,211	4,095	-116	-2.8%	4,808
<b>2+ Persons, With children</b>	10,639	10,602	-37	-0.3%	10,158
<b>2+ Persons, Without children</b>	12,892	13,444	552	4.3%	13,990
<b>Total Households</b>	<b>30,703</b>	<b>31,368</b>	<b>665</b>	<b>2.2%</b>	<b>33,400</b>

Source: U.S. Census Bureau, Decennial Census, 2014-2018 American Community Survey 5-Year Estimates, and SEMCOG 2045 Regional Development Forecast

# Community Profiles

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500 W Big Beaver Rd  
Troy, MI 48084-5285  
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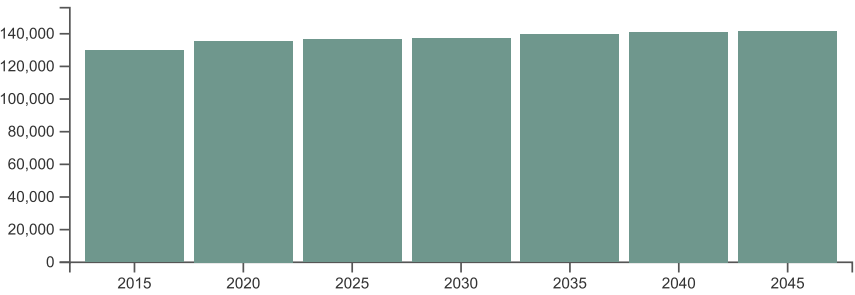
Census 2010 Population:  
80,980  
Area: 33.6 square miles

[VIEW COMMUNITY EXPLORER MAP](#)

### Economy & Jobs

Link to American Community Survey (ACS) Profiles: **Select a Year**  **Economic**

#### Forecasted Jobs



Source: **SEMCOG 2045 Regional Development Forecast**

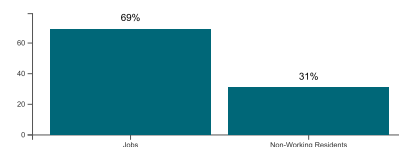
## Forecasted Jobs by Industry Sector

Forecasted Jobs By Industry Sector	2015	2020	2025	2030	2035	2040	2045	Change 2015- 2045	Pct Change 2015- 2045
<b>Natural Resources, Mining, &amp; Construction</b>	3,382	3,866	3,674	3,615	3,660	3,707	3,757	375	11.1%
<b>Manufacturing</b>	9,741	9,087	8,502	7,859	7,446	7,092	6,706	-3,035	-31.2%
<b>Wholesale Trade</b>	7,343	7,575	7,563	7,479	7,479	7,471	7,420	77	1%
<b>Retail Trade</b>	13,170	13,211	13,196	12,790	12,650	12,321	12,029	-1,141	-8.7%
<b>Transportation, Warehousing, &amp; Utilities</b>	2,005	1,924	1,904	1,878	1,890	1,920	1,934	-71	-3.5%
<b>Information &amp; Financial Activities</b>	20,010	19,620	19,939	20,138	20,688	21,117	21,399	1,389	6.9%
<b>Professional and Technical Services &amp; Corporate HQ</b>	28,941	32,973	33,905	35,412	36,643	37,167	37,528	8,587	29.7%
<b>Administrative, Support, &amp; Waste Services</b>	11,811	12,183	12,339	12,407	12,679	12,959	13,130	1,319	11.2%
<b>Education Services</b>	4,279	4,483	4,477	4,466	4,539	4,600	4,655	376	8.8%
<b>Healthcare Services</b>	13,239	14,096	14,543	14,751	15,424	16,202	16,758	3,519	26.6%
<b>Leisure &amp; Hospitality</b>	8,640	9,167	9,494	9,454	9,550	9,586	9,644	1,004	11.6%
<b>Other Services</b>	5,269	5,380	5,253	5,154	5,139	5,104	5,034	-235	-4.5%
<b>Public Administration</b>	1,812	1,830	1,825	1,810	1,805	1,804	1,796	-16	-0.9%
<b>Total Employment Numbers</b>	129,642	135,395	136,614	137,213	139,592	141,050	141,790	12,148	9.4%

Source: **SEMCOG 2045 Regional Development Forecast**

## Daytime Population

Daytime Population	ACS 2016
Jobs	94,365
Non-Working Residents	42,007
Age 15 and under	15,653
Not in labor force	24,045
Unemployed	2,309
Daytime Population	136,372



Source: **2012-2016 American Community Survey 5-Year Estimates** and **2012-2016 Census Transportation Planning Products Program (CTPP)**. For additional information, visit SEMCOG's **Interactive Commuting Patterns Map**

Note: The number of residents attending school outside Southeast Michigan is not available. Likewise, the number of students commuting into Southeast Michigan to attend school is also not known.



Community Profiles

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City of Troy

500 W Big Beaver Rd  
Troy, MI 48084-5285  
<http://troymi.gov/>



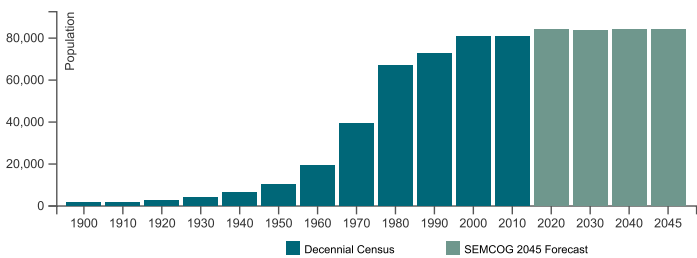
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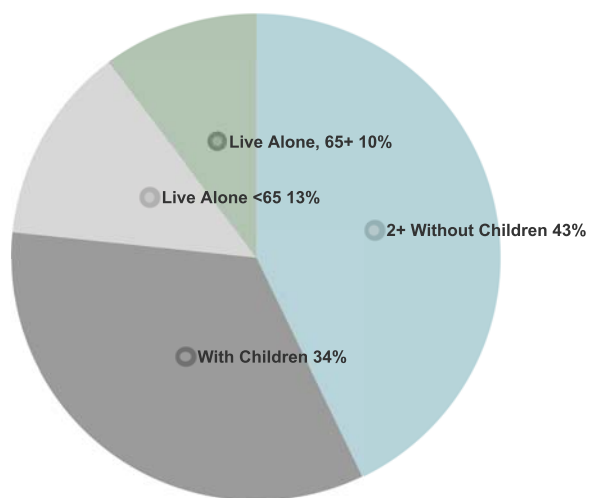
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<b>Births</b>	1,045	782	805
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<b>Net Migration (Movement In - Movement Out)</b>	-572	-160	325
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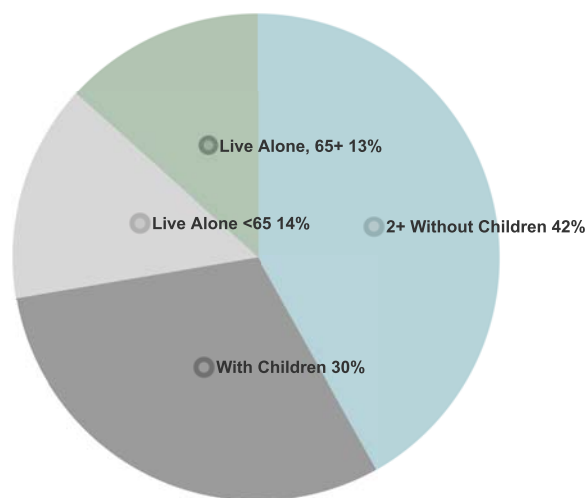
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ACS  
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SEMCOG  
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Source: U.S. Census Bureau, Decennial Census, 2014-2018 American Community Survey 5-Year Estimates, and SEMCOG 2045 Regional Development Forecast



## **Appendix B**

# **EXISTING TRAFFIC CONDITIONS**



The level of service criteria are given in Exhibit 20-2. As used here, control delay is defined as the total elapsed time from the time a vehicle stops at the end of the queue until the vehicle departs from the stop line; this time includes the time required for the vehicle to travel from the last-in-queue position to the first-in-queue position, including deceleration of vehicles from free-flow speed to the speed of vehicles in queue.

dā-B signals are present on the major street, upstream of the subject intersection, flows may not be random but will likely have some platoon structure. Although the procedures in this chapter provide a method for approximating the operations of a TWSC intersection with an upstream signal, the operations of such an intersection is arguably best handled by including it in a complete simulation

LEVEL OF SERVICE	AVERAGE CONTROL DELAY (sec/veh)
A	$\leq 10$
B	$> 10$ and $\leq 15$
C	$> 15$ and $\leq 25$
D	$> 25$ and $\leq 35$
E	$> 35$ and $\leq 50$
F	$> 50$

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\*!^æ!Ä^!æ Ä@æ Ä& Ä!}·â} æâ^â&çç!·^&çç!} Additionally, several driver behavior considerations  
combine to make delays at signalized intersections less onerous than at unsignalized intersections. For  
example, drivers at signalized intersections are able to relax during the red interval, where drivers on the  
minor approaches to unsignalized intersections must remain attentive to the task of identifying acceptable  
gaps and vehicle conflicts. Also, there is often much more variability in the amount of delay experienced  
by individual drivers at unsignalized than signalized intersections. For these reasons, it is considered that  
the total delay threshold for any given level of service is less for an unsignalized intersection than for a  
signalized intersection.

Source: Highway Capacity Manual, 6th Edition. Transportation Research Board, National Research Council

## Level of Service for Signalized Intersections

Level of service for signalized intersections is defined in terms of delay, which is a measure of driver discomfort and frustration, fuel consumption, and lost travel time. LOS can be characterized for the entire intersection, each intersection approach, and each lane group. Specifically, level-of-service (LOS) criteria are stated in terms of the average stopped delay per vehicle. The criteria are given in Exhibit 19-8. Delay may be measured in the field or estimated using procedures presented later in this chapter. Delay is a complex measure and is dependent on a number of variables, including the quality of progression, the cycle length, the green ratio, and the v/c ratio for the lane group in question.

**LOS A** describes operations with a control delay of 10 s/veh or less. This level is typically assigned when the volume-to-capacity ratio is low and either progression is extremely favorable or the cycle length is very short. If LOS A is the result of favorable progression, most vehicles arrive during a green indication and travel through the intersection without stopping.

**LOS B** describes operations with control delay between 10 and 20 s/veh. This level is typically assigned when the volume-to-capacity ratio is low and either progression is highly favorable or the cycle length is short. More vehicles stop than with LOS A.

Exhibit 19.8. Level-of-Service Criteria for Signalized Intersections (Motorized Vehicles)

LEVEL OF SERVICE	STOPPED DELAY PER VEHICLE (SEC)
A	$\leq 10.0$
B	$> 10.0$ and $\leq 20.0$
C	$> 20.0$ and $\leq 35.0$
D	$> 35.0$ and $\leq 55.0$
E	$> 55.0$ and $\leq 80.0$
F	$> 80.0$

*1. If the v/c ratio for a lane group exceeds 1.0, a LOS F is assigned to the individual lane group. LOS for approach-based and intersection-wide assessments are determined solely by the control delay.*

**LOS C** describes operations with control delay between 20 and 35 s/veh. This level is typically assigned when progression is favorable or the cycle length is moderate. Individual *cycle failures* (i.e. one or more queued vehicles are not able to depart as a result of insufficient capacity during the cycle) may begin to appear at this level. The number of vehicle stopping is significant, although many vehicles still pass through the intersection without stopping.

**LOS D** describes operations with control delay between 35 and 55 s/veh. This level is typically assigned when when the volume-to-capacity ratio is high and either progression is ineffective or the cycle length is long. Many vehicles stop and individual cycle failures are noticeable.

**LOS E** describes operations with control delay between 55 and 80 s/veh. This level is typically assigned when when the volume-to-capacity ratio is high, progression is unfavorable, and the cycle length is long. Individual cycle failures are frequent.

**LOS F** describes operations with control delay exceeding 80 s/veh or a volume-to-capacity ratio greater than 1.0. This level, considered to be unacceptable to most drivers, often occurs with over-saturation, that is, when arrival flow rates exceed the capacity of the intersection. This level is typically assigned when the volume-to-capacity ratio is high, progression is very poor, and the cycle length is long. Most cycles fail to clear the queue.























Source: Highway Capacity Manual, 6th Edition. Transportation Research Board, National Research Council

# HCM 6th Signalized Intersection Summary

## 10: Crooks Rd & Corporate Dr/I-75 Ramp

Existing Conditions

AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	184	447	81	735	544	881	0	528	383	523	1356	271
Future Volume (veh/h)	184	447	81	735	544	881	0	528	383	523	1356	271
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1969	1969	1969	1969	1969	1969	0	1969	1969	1969	1969	1969
Adj Flow Rate, veh/h	196	476	33	521	1271	437	0	671	212	551	1427	201
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	0	2	2	2	2	2
Cap, veh/h	184	476	291	545	1145	774	0	770	703	629	1935	601
Arrive On Green	0.17	0.17	0.17	0.29	0.29	0.29	0.00	0.13	0.13	0.17	0.36	0.36
Sat Flow, veh/h	1054	2732	1668	1875	3938	1668	0	5906	1668	3638	5375	1668
Grp Volume(v), veh/h	356	316	33	521	1271	437	0	671	212	551	1427	201
Grp Sat Flow(s),veh/h/ln	1916	1870	1668	1875	1969	1668	0	1969	1668	1819	1792	1668
Q Serve(g_s), s	20.9	20.1	2.0	32.7	34.9	22.8	0.0	13.4	10.1	17.7	27.8	10.5
Cycle Q Clear(g_c), s	20.9	20.1	2.0	32.7	34.9	22.8	0.0	13.4	10.1	17.7	27.8	10.5
Prop In Lane	0.55		1.00	1.00		1.00	0.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	334	326	291	545	1145	774	0	770	703	629	1935	601
V/C Ratio(X)	1.07	0.97	0.11	0.96	1.11	0.56	0.00	0.87	0.30	0.88	0.74	0.33
Avail Cap(c_a), veh/h	334	326	291	545	1145	774	0	770	703	703	1935	601
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	49.6	49.2	41.7	41.8	42.5	23.4	0.0	51.2	23.0	48.4	33.5	27.9
Incr Delay (d2), s/veh	68.3	41.5	0.2	27.7	62.1	1.0	0.0	12.9	1.1	11.7	2.6	1.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	16.2	13.0	0.8	19.0	26.4	8.9	0.0	7.3	6.4	8.8	12.0	4.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	117.8	90.7	41.9	69.4	104.6	24.3	0.0	64.1	24.1	60.1	36.0	29.4
LnGrp LOS	F	F	D	E	F	C	A	E	C	E	D	C
Approach Vol, veh/h	705			2229			883			2179		
Approach Delay, s/veh	102.1			80.7			54.5			41.5		
Approach LOS	F			F			D			D		
Timer - Assigned Phs	1	2	4		6		8					
Phs Duration (G+Y+Rc), s	27.6	22.4	42.0		50.0		28.0					
Change Period (Y+Rc), s	6.8	6.8	* 7.1		6.8		7.1					
Max Green Setting (Gmax), s	23.2	13.2	* 35		43.2		20.9					
Max Q Clear Time (g_c+I1), s	19.7	15.4	36.9		29.8		22.9					
Green Ext Time (p_c), s	1.0	0.0	0.0		7.8		0.0					

### Intersection Summary

HCM 6th Ctrl Delay 65.1

HCM 6th LOS E

### Notes

User approved volume balancing among the lanes for turning movement.

\* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

HCM 6th TWSC  
20: Corporate Dr & New King Dr

Existing Conditions  
AM Peak Hour

Intersection

Int Delay, s/veh 1.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑	↑	↑	↑
Traffic Vol, veh/h	94	700	789	26	12	34
Future Vol, veh/h	94	700	789	26	12	34
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	0	0	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	94	94	94	94	60	60
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	100	745	839	28	20	57

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	867	0	0 1412 420
Stage 1	-	-	- 839 -
Stage 2	-	-	- 573 -
Critical Hdwy	4.14	-	- 6.84 6.94
Critical Hdwy Stg 1	-	-	- 5.84 -
Critical Hdwy Stg 2	-	-	- 5.84 -
Follow-up Hdwy	2.22	-	- 3.52 3.32
Pot Cap-1 Maneuver	772	-	- 129 582
Stage 1	-	-	- 384 -
Stage 2	-	-	- 527 -
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	772	-	- 100 582
Mov Cap-2 Maneuver	-	-	- 100 -
Stage 1	-	-	- 299 -
Stage 2	-	-	- 527 -

Approach	EB	WB	SB
HCM Control Delay, s	2	0	21.8
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	772	-	-	-	100	582
HCM Lane V/C Ratio	0.13	-	-	-	0.2	0.097
HCM Control Delay (s)	10.4	0.9	-	-	49.8	11.9
HCM Lane LOS	B	A	-	-	E	B
HCM 95th %tile Q(veh)	0.4	-	-	-	0.7	0.3




# HCM Signalized Intersection Capacity Analysis

## 30: NB Crooks Rd & Tower Dr



Existing Conditions

AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰				↱↱		↱↱↱	↱			
Traffic Volume (vph)	67	577	0	0	0	195	0	743	108	0	0	0
Future Volume (vph)	67	577	0	0	0	195	0	743	108	0	0	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)		6.0				6.0		6.4	6.4			
Lane Util. Factor		1.00				0.88		0.91	1.00			
Frt		1.00				0.85		1.00	0.85			
Flt Protected		0.99				1.00		1.00	1.00			
Satd. Flow (prot)		1951				2933		5353	1667			
Flt Permitted		0.99				1.00		1.00	1.00			
Satd. Flow (perm)		1951				2933		5353	1667			
Peak-hour factor, PHF	0.89	0.89	0.89	0.73	0.73	0.73	0.95	0.95	0.95	0.92	0.92	0.92
Adj. Flow (vph)	75	648	0	0	0	267	0	782	114	0	0	0
RTOR Reduction (vph)	0	16	0	0	0	26	0	0	66	0	0	0
Lane Group Flow (vph)	0	707	0	0	0	241	0	782	48	0	0	0
Turn Type	custom	NA				Perm		NA	Perm			
Protected Phases		4						2!				
Permitted Phases	4 2!					8			2			
Actuated Green, G (s)		56.6				56.6		51.0	51.0			
Effective Green, g (s)		56.6				56.6		51.0	51.0			
Actuated g/C Ratio		0.47				0.47		0.42	0.42			
Clearance Time (s)		6.0				6.0		6.4	6.4			
Vehicle Extension (s)		4.5				4.5		3.0	3.0			
Lane Grp Cap (vph)		920				1383		2275	708			
v/s Ratio Prot								c0.15				
v/s Ratio Perm		0.36				0.08			0.03			
v/c Ratio		0.77				0.17		0.34	0.07			
Uniform Delay, d1		26.3				18.2		23.2	20.4			
Progression Factor		0.94				1.00		0.99	2.36			
Incremental Delay, d2		2.5				0.1		0.4	0.2			
Delay (s)		27.1				18.4		23.4	48.4			
Level of Service		C				B		C	D			
Approach Delay (s)		27.1			18.4			26.6			0.0	
Approach LOS		C			B			C			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			25.6			HCM 2000 Level of Service			C			
HCM 2000 Volume to Capacity ratio			0.57									
Actuated Cycle Length (s)			120.0			Sum of lost time (s)			12.4			
Intersection Capacity Utilization			67.8%			ICU Level of Service			C			
Analysis Period (min)			15									
! Phase conflict between lane groups.												
c Critical Lane Group												

HCM 6th TWSC  
40: SB Crooks Rd & N>S X/O N. of Long Lake

Existing Conditions  
AM Peak Hour

Intersection						
Int Delay, s/veh	0.4					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	40	0	0	0	0	1461
Future Vol, veh/h	40	0	0	0	0	1461
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	16974	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	75	75	92	92	91	91
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	53	0	0	0	0	1605

Major/Minor	Minor1	Major2	
Conflicting Flow All	642	-	-
Stage 1	0	-	-
Stage 2	642	-	-
Critical Hdwy	5.74	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	6.04	-	-
Follow-up Hdwy	3.82	-	-
Pot Cap-1 Maneuver	467	0	-
Stage 1	-	0	-
Stage 2	443	0	-
Platoon blocked, %			-
Mov Cap-1 Maneuver	467	-	-
Mov Cap-2 Maneuver	467	-	-
Stage 1	-	-	-
Stage 2	443	-	-

Approach	WB	SB
HCM Control Delay, s	13.7	0
HCM LOS	B	



Minor Lane/Major Mvmt	WBLn1	SBT
Capacity (veh/h)	467	-
HCM Lane V/C Ratio	0.114	-
HCM Control Delay (s)	13.7	-
HCM Lane LOS	B	-
HCM 95th %tile Q(veh)	0.4	-

HCM 6th TWSC  
50: NB Crooks Rd & S>N X/O N. of Long Lake

Existing Conditions  
AM Peak Hour

Intersection

Int Delay, s/veh 0.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	10	0	0	859	0	0
Future Vol, veh/h	10	0	0	859	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	16979	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	75	75	95	95	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	13	0	0	904	0	0

Major/Minor	Minor2	Major1		
Conflicting Flow All	362	-	-	0
Stage 1	0	-	-	-
Stage 2	362	-	-	-
Critical Hdwy	5.74	-	-	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	6.04	-	-	-
Follow-up Hdwy	3.82	-	-	-
Pot Cap-1 Maneuver	637	0	0	-
Stage 1	-	0	0	-
Stage 2	618	0	0	-
Platoon blocked, %				-
Mov Cap-1 Maneuver	637	-	-	-
Mov Cap-2 Maneuver	637	-	-	-
Stage 1	-	-	-	-
Stage 2	618	-	-	-

Approach	EB	NB
HCM Control Delay, s	10.8	0
HCM LOS	B	







Minor Lane/Major Mvmt	NBT	EBLn1
Capacity (veh/h)	-	637
HCM Lane V/C Ratio	-	0.021
HCM Control Delay (s)	-	10.8
HCM Lane LOS	-	B
HCM 95th %tile Q(veh)	-	0.1

# HCM Signalized Intersection Capacity Analysis

## 60: E>W X/O E. of Crooks & WB Long Lake Rd

Existing Conditions

AM Peak Hour

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations				↑↑↑	↑	
Traffic Volume (vph)	0	0	0	1350	86	0
Future Volume (vph)	0	0	0	1350	86	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000
Total Lost time (s)				6.6	5.4	
Lane Util. Factor				0.91	1.00	
Frt				1.00	1.00	
Flt Protected				1.00	0.95	
Satd. Flow (prot)				5353	1863	
Flt Permitted				1.00	0.95	
Satd. Flow (perm)				5353	1863	
Peak-hour factor, PHF	0.92	0.92	0.95	0.95	0.82	0.82
Adj. Flow (vph)	0	0	0	1421	105	0
RTOR Reduction (vph)	0	0	0	0	26	0
Lane Group Flow (vph)	0	0	0	1421	79	0
Turn Type				NA	Prot	
Protected Phases				6	8	
Permitted Phases						
Actuated Green, G (s)				97.6	10.4	
Effective Green, g (s)				97.6	10.4	
Actuated g/C Ratio				0.81	0.09	
Clearance Time (s)				6.6	5.4	
Vehicle Extension (s)				3.0	3.0	
Lane Grp Cap (vph)				4353	161	
v/s Ratio Prot				c0.27	c0.04	
v/s Ratio Perm						
v/c Ratio				0.33	0.49	
Uniform Delay, d1				2.8	52.3	
Progression Factor				1.00	0.84	
Incremental Delay, d2				0.2	2.3	
Delay (s)				3.0	46.2	
Level of Service				A	D	
Approach Delay (s)	0.0			3.0	46.2	
Approach LOS	A			A	D	
<b>Intersection Summary</b>						
HCM 2000 Control Delay			6.0	HCM 2000 Level of Service		A
HCM 2000 Volume to Capacity ratio			0.34			
Actuated Cycle Length (s)			120.0	Sum of lost time (s)		12.0
Intersection Capacity Utilization			45.9%	ICU Level of Service		A
Analysis Period (min)			15			
c Critical Lane Group						

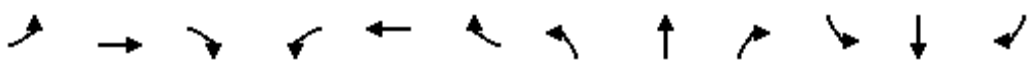


# HCM Signalized Intersection Capacity Analysis

## 70: NB Crooks Rd & WB Long Lake Rd

Existing Conditions

AM Peak Hour













												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑↑	↑		↑↑↑				
Traffic Volume (vph)	0	0	0	0	1263	173	0	686	0	0	0	0
Future Volume (vph)	0	0	0	0	1263	173	0	686	0	0	0	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)					11.9	11.9		5.9				
Lane Util. Factor					0.91	1.00		0.91				
Frt					1.00	0.85		1.00				
Flt Protected					1.00	1.00		1.00				
Satd. Flow (prot)					5353	1667		5353				
Flt Permitted					1.00	1.00		1.00				
Satd. Flow (perm)					5353	1667		5353				
Peak-hour factor, PHF	0.92	0.92	0.92	0.95	0.95	0.95	0.93	0.93	0.93	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	1329	182	0	738	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	82	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	1329	100	0	738	0	0	0	0
Turn Type					NA	Perm		NA				
Protected Phases					4			6				
Permitted Phases						4						
Actuated Green, G (s)					42.0	42.0		60.2				
Effective Green, g (s)					42.0	42.0		60.2				
Actuated g/C Ratio					0.35	0.35		0.50				
Clearance Time (s)					11.9	11.9		5.9				
Vehicle Extension (s)					3.0	3.0		3.0				
Lane Grp Cap (vph)					1873	583		2685				
v/s Ratio Prot					c0.25			c0.14				
v/s Ratio Perm						0.06						
v/c Ratio					0.71	0.17		0.27				
Uniform Delay, d1					33.7	27.0		17.3				
Progression Factor					0.96	1.01		0.00				
Incremental Delay, d2					1.2	0.1		0.2				
Delay (s)					33.7	27.5		0.3				
Level of Service					C	C		A				
Approach Delay (s)		0.0			33.0			0.3			0.0	
Approach LOS		A			C			A			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			22.2									
HCM 2000 Level of Service											C	
HCM 2000 Volume to Capacity ratio			0.48									
Actuated Cycle Length (s)			120.0									
Sum of lost time (s)											23.8	
Intersection Capacity Utilization			59.8%									
ICU Level of Service											B	
Analysis Period (min)			15									
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis

## 71: SB Crooks Rd & WB Long Lake Rd

Existing Conditions

AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑↑						↑↑↑	↑
Traffic Volume (vph)	0	0	0	0	1263	0	0	0	0	0	1188	143
Future Volume (vph)	0	0	0	0	1263	0	0	0	0	0	1188	143
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)					5.9						11.9	11.9
Lane Util. Factor					0.91						0.91	1.00
Frt					1.00						1.00	0.85
Flt Protected					1.00						1.00	1.00
Satd. Flow (prot)					5353						5353	1667
Flt Permitted					1.00						1.00	1.00
Satd. Flow (perm)					5353						5353	1667
Peak-hour factor, PHF	0.92	0.92	0.92	0.95	0.95	0.95	0.92	0.92	0.92	0.91	0.91	0.91
Adj. Flow (vph)	0	0	0	0	1329	0	0	0	0	0	1305	157
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	44
Lane Group Flow (vph)	0	0	0	0	1329	0	0	0	0	0	1305	113
Turn Type					NA						NA	Perm
Protected Phases					8						2	
Permitted Phases												2
Actuated Green, G (s)					48.0						54.2	54.2
Effective Green, g (s)					48.0						54.2	54.2
Actuated g/C Ratio					0.40						0.45	0.45
Clearance Time (s)					5.9						11.9	11.9
Vehicle Extension (s)					3.0						3.0	3.0
Lane Grp Cap (vph)					2141						2417	752
v/s Ratio Prot					c0.25						c0.24	
v/s Ratio Perm												0.07
v/c Ratio					0.62						0.54	0.15
Uniform Delay, d1					28.7						23.9	19.3
Progression Factor					0.00						1.00	1.00
Incremental Delay, d2					0.4						0.9	0.4
Delay (s)					0.5						24.7	19.8
Level of Service					A						C	B
Approach Delay (s)		0.0			0.5			0.0			24.2	
Approach LOS		A			A			A			C	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			12.9									HCM 2000 Level of Service B
HCM 2000 Volume to Capacity ratio			0.61									
Actuated Cycle Length (s)			120.0								23.8	
Intersection Capacity Utilization			59.8%									ICU Level of Service B
Analysis Period (min)			15									
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis

## 72: SB Crooks Rd & EB Long Lake Rd

Existing Conditions

AM Peak Hour

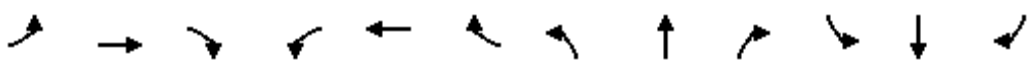
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑	↑								↑↑↑	
Traffic Volume (vph)	0	578	167	0	0	0	0	0	0	0	1188	0
Future Volume (vph)	0	578	167	0	0	0	0	0	0	0	1188	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)		11.9	11.9								5.9	
Lane Util. Factor		0.91	1.00								0.91	
Frt		1.00	0.85								1.00	
Flt Protected		1.00	1.00								1.00	
Satd. Flow (prot)		5353	1667								5353	
Flt Permitted		1.00	1.00								1.00	
Satd. Flow (perm)		5353	1667								5353	
Peak-hour factor, PHF	0.90	0.90	0.90	0.92	0.92	0.92	0.92	0.92	0.92	0.91	0.91	0.91
Adj. Flow (vph)	0	642	186	0	0	0	0	0	0	0	1305	0
RTOR Reduction (vph)	0	0	53	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	642	133	0	0	0	0	0	0	0	1305	0
Turn Type		NA	Perm								NA	
Protected Phases		4									6	
Permitted Phases			4									
Actuated Green, G (s)		42.0	42.0								60.2	
Effective Green, g (s)		42.0	42.0								60.2	
Actuated g/C Ratio		0.35	0.35								0.50	
Clearance Time (s)		11.9	11.9								5.9	
Vehicle Extension (s)		3.0	3.0								3.0	
Lane Grp Cap (vph)		1873	583								2685	
v/s Ratio Prot		c0.12									c0.24	
v/s Ratio Perm			0.08									
v/c Ratio		0.34	0.23								0.49	
Uniform Delay, d1		28.8	27.6								19.7	
Progression Factor		1.36	1.71								0.00	
Incremental Delay, d2		0.1	0.2								0.5	
Delay (s)		39.2	47.2								0.6	
Level of Service		D	D								A	
Approach Delay (s)		41.0			0.0			0.0			0.6	
Approach LOS		D			A			A			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			16.3									HCM 2000 Level of Service B
HCM 2000 Volume to Capacity ratio			0.45									
Actuated Cycle Length (s)			120.0								23.8	Sum of lost time (s)
Intersection Capacity Utilization			59.8%									ICU Level of Service B
Analysis Period (min)			15									
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis

## 73: NB Crooks Rd & EB Long Lake Rd

Existing Conditions

AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑						↑↑↑	↑			
Traffic Volume (vph)	0	578	0	0	0	0	0	686	149	0	0	0
Future Volume (vph)	0	578	0	0	0	0	0	686	149	0	0	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)		5.9						11.9	11.9			
Lane Util. Factor		0.91						0.91	1.00			
Frt		1.00						1.00	0.85			
Flt Protected		1.00						1.00	1.00			
Satd. Flow (prot)		5353						5353	1667			
Flt Permitted		1.00						1.00	1.00			
Satd. Flow (perm)		5353						5353	1667			
Peak-hour factor, PHF	0.90	0.90	0.90	0.92	0.92	0.92	0.93	0.93	0.93	0.92	0.92	0.92
Adj. Flow (vph)	0	642	0	0	0	0	0	738	160	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	88	0	0	0
Lane Group Flow (vph)	0	642	0	0	0	0	0	738	72	0	0	0
Turn Type		NA						NA	Perm			
Protected Phases		8						2				
Permitted Phases									2			
Actuated Green, G (s)		48.0						54.2	54.2			
Effective Green, g (s)		48.0						54.2	54.2			
Actuated g/C Ratio		0.40						0.45	0.45			
Clearance Time (s)		5.9						11.9	11.9			
Vehicle Extension (s)		3.0						3.0	3.0			
Lane Grp Cap (vph)		2141						2417	752			
v/s Ratio Prot		c0.12						c0.14				
v/s Ratio Perm									0.04			
v/c Ratio		0.30						0.31	0.10			
Uniform Delay, d1		24.5						20.9	18.9			
Progression Factor		0.00						1.00	1.00			
Incremental Delay, d2		0.1						0.3	0.3			
Delay (s)		0.1						21.3	19.1			
Level of Service		A						C	B			
Approach Delay (s)		0.1			0.0			20.9			0.0	
Approach LOS		A			A			C			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		12.2						HCM 2000 Level of Service	B			
HCM 2000 Volume to Capacity ratio		0.32										
Actuated Cycle Length (s)		120.0						Sum of lost time (s)	23.8			
Intersection Capacity Utilization		50.6%						ICU Level of Service	A			
Analysis Period (min)		15										
c Critical Lane Group												



HCM 6th TWSC  
80: E>W X/O W. of Crooks & WB Long Lake Rd

Existing Conditions  
AM Peak Hour

Intersection

Int Delay, s/veh 0

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations				↑↑↑	↑	
Traffic Vol, veh/h	0	0	0	1406	0	0
Future Vol, veh/h	0	0	0	1406	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	95	95	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	0	0	1480	0	0

Major/Minor	Major2	Minor1
Conflicting Flow All	-	592
Stage 1	-	0
Stage 2	-	592
Critical Hdwy	-	5.74
Critical Hdwy Stg 1	-	-
Critical Hdwy Stg 2	-	6.04
Follow-up Hdwy	-	3.82
Pot Cap-1 Maneuver	0	494
Stage 1	0	-
Stage 2	0	470
Platoon blocked, %	-	-
Mov Cap-1 Maneuver	-	494
Mov Cap-2 Maneuver	-	494
Stage 1	-	-
Stage 2	-	470

Approach	WB	NB
HCM Control Delay, s	0	0
HCM LOS		A

Minor Lane/Major Mvmt	NBLn1	WBT
Capacity (veh/h)	-	-
HCM Lane V/C Ratio	-	-
HCM Control Delay (s)	0	-
HCM Lane LOS	A	-
HCM 95th %tile Q(veh)	-	-

# HCM Signalized Intersection Capacity Analysis

## 90: EB Long Lake Rd & W>E X/O W. of Crooks

Existing Conditions  
AM Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑↑			↵	
Traffic Volume (vph)	0	483	0	0	262	0
Future Volume (vph)	0	483	0	0	262	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000
Total Lost time (s)		6.0			5.4	
Lane Util. Factor		0.91			1.00	
Frt		1.00			1.00	
Flt Protected		1.00			0.95	
Satd. Flow (prot)		5353			1863	
Flt Permitted		1.00			0.95	
Satd. Flow (perm)		5353			1863	
Peak-hour factor, PHF	0.91	0.91	0.92	0.92	0.91	0.91
Adj. Flow (vph)	0	531	0	0	288	0
RTOR Reduction (vph)	0	0	0	0	150	0
Lane Group Flow (vph)	0	531	0	0	138	0
Turn Type		NA			Prot	
Protected Phases		2			4	
Permitted Phases						
Actuated Green, G (s)		94.6			14.0	
Effective Green, g (s)		94.6			14.0	
Actuated g/C Ratio		0.79			0.12	
Clearance Time (s)		6.0			5.4	
Vehicle Extension (s)		3.0			3.0	
Lane Grp Cap (vph)		4219			217	
v/s Ratio Prot		c0.10			c0.07	
v/s Ratio Perm						
v/c Ratio		0.13			0.64	
Uniform Delay, d1		3.0			50.6	
Progression Factor		1.01			0.81	
Incremental Delay, d2		0.1			5.2	
Delay (s)		3.1			46.1	
Level of Service		A			D	
Approach Delay (s)		3.1	0.0		46.1	
Approach LOS		A	A		D	
<b>Intersection Summary</b>						
HCM 2000 Control Delay		18.2		HCM 2000 Level of Service		B
HCM 2000 Volume to Capacity ratio		0.19				
Actuated Cycle Length (s)		120.0		Sum of lost time (s)		11.4
Intersection Capacity Utilization		44.9%		ICU Level of Service		A
Analysis Period (min)		15				
c Critical Lane Group						

HCM 6th TWSC  
100: E>W X/O E. of Corporate & WB Long Lake Rd

Existing Conditions  
AM Peak Hour

Intersection						
Int Delay, s/veh	0.9					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations				↑↑↑	↑	
Traffic Vol, veh/h	0	0	0	1144	70	0
Future Vol, veh/h	0	0	0	1144	70	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	95	95	80	80
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	0	0	1204	88	0

Major/Minor	Major2	Minor1
Conflicting Flow All	-	482
Stage 1	-	0
Stage 2	-	482
Critical Hdwy	-	5.74
Critical Hdwy Stg 1	-	-
Critical Hdwy Stg 2	-	6.04
Follow-up Hdwy	-	3.82
Pot Cap-1 Maneuver	0	558
Stage 1	0	-
Stage 2	0	536
Platoon blocked, %	-	-
Mov Cap-1 Maneuver	-	558
Mov Cap-2 Maneuver	-	558
Stage 1	-	-
Stage 2	-	536

Approach	WB	NB
HCM Control Delay, s	0	12.6
HCM LOS		B


Minor Lane/Major Mvmt	NBLn1	WBT
Capacity (veh/h)	558	-
HCM Lane V/C Ratio	0.157	-
HCM Control Delay (s)	12.6	-
HCM Lane LOS	B	-
HCM 95th %tile Q(veh)	0.6	-

# HCM Signalized Intersection Capacity Analysis

## 110: Investment Dr & EB Long Lake Rd

Existing Conditions

AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑	↑						↑↑		↑	
Traffic Volume (vph)	0	488	138	0	0	0	0	0	65	0	70	0
Future Volume (vph)	0	488	138	0	0	0	0	0	65	0	70	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)		6.0	6.0						5.5		5.5	
Lane Util. Factor		0.91	1.00						0.88		1.00	
Frt		1.00	0.85						0.85		1.00	
Flt Protected		1.00	1.00						1.00		1.00	
Satd. Flow (prot)		5353	1667						2933		1961	
Flt Permitted		1.00	1.00						1.00		1.00	
Satd. Flow (perm)		5353	1667						2933		1961	
Peak-hour factor, PHF	0.93	0.93	0.93	0.92	0.92	0.92	0.84	0.84	0.84	0.78	0.78	0.78
Adj. Flow (vph)	0	525	148	0	0	0	0	0	77	0	90	0
RTOR Reduction (vph)	0	0	28	0	0	0	0	0	70	0	0	0
Lane Group Flow (vph)	0	525	120	0	0	0	0	0	7	0	90	0
Turn Type		NA	Perm						Perm		NA	
Protected Phases		2!									4	
Permitted Phases			2						8	4 2!		
Actuated Green, G (s)		97.6	97.6						10.9		10.9	
Effective Green, g (s)		97.6	97.6						10.9		10.9	
Actuated g/C Ratio		0.81	0.81						0.09		0.09	
Clearance Time (s)		6.0	6.0						5.5		5.5	
Vehicle Extension (s)		4.0	4.0						3.0		3.0	
Lane Grp Cap (vph)		4353	1355						266		178	
v/s Ratio Prot		c0.10									c0.05	
v/s Ratio Perm			0.07						0.00			
v/c Ratio		0.12	0.09						0.03		0.51	
Uniform Delay, d1		2.3	2.3						49.7		52.0	
Progression Factor		1.00	1.00						1.00		1.47	
Incremental Delay, d2		0.1	0.1						0.0		2.0	
Delay (s)		2.4	2.4						49.8		78.7	
Level of Service		A	A						D		E	
Approach Delay (s)		2.4			0.0			49.8			78.7	
Approach LOS		A			A			D			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			14.9									HCM 2000 Level of Service B
HCM 2000 Volume to Capacity ratio			0.16									
Actuated Cycle Length (s)			120.0									Sum of lost time (s) 11.5
Intersection Capacity Utilization			40.1%									ICU Level of Service A
Analysis Period (min)			15									
! Phase conflict between lane groups.												
c Critical Lane Group												















# HCM Signalized Intersection Capacity Analysis

## 120: Corporate Dr & WB Long Lake Rd

Existing Conditions

AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑↑	↑		↑				↑↑
Traffic Volume (vph)	0	0	0	0	890	254	38	213	0	0	0	177
Future Volume (vph)	0	0	0	0	890	254	38	213	0	0	0	177
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)					6.3	6.3		5.8				5.8
Lane Util. Factor					0.91	1.00		1.00				0.88
Frt					1.00	0.85		1.00				0.85
Flt Protected					1.00	1.00		0.99				1.00
Satd. Flow (prot)					5353	1667		1946				2933
Flt Permitted					1.00	1.00		0.99				1.00
Satd. Flow (perm)					5353	1667		1946				2933
Peak-hour factor, PHF	0.92	0.92	0.92	0.95	0.95	0.95	0.89	0.89	0.89	0.81	0.81	0.81
Adj. Flow (vph)	0	0	0	0	937	267	43	239	0	0	0	219
RTOR Reduction (vph)	0	0	0	0	0	75	0	25	0	0	0	112
Lane Group Flow (vph)	0	0	0	0	937	192	0	257	0	0	0	107
Turn Type					NA	Perm	custom	NA				Perm
Protected Phases					6!			8				
Permitted Phases						6	8 6!					4
Actuated Green, G (s)					86.3	86.3		21.6				21.6
Effective Green, g (s)					86.3	86.3		21.6				21.6
Actuated g/C Ratio					0.72	0.72		0.18				0.18
Clearance Time (s)					6.3	6.3		5.8				5.8
Vehicle Extension (s)					4.0	4.0		3.0				3.0
Lane Grp Cap (vph)					3849	1198		350				527
v/s Ratio Prot					c0.18							
v/s Ratio Perm						0.12		0.13				0.04
v/c Ratio					0.24	0.16		0.74				0.20
Uniform Delay, d1					5.7	5.3		46.5				41.9
Progression Factor					3.02	13.47		1.00				0.68
Incremental Delay, d2					0.1	0.3		7.8				0.1
Delay (s)					17.4	72.3		54.3				28.7
Level of Service					B	E		D				C
Approach Delay (s)		0.0			29.6			54.3			28.7	
Approach LOS		A			C			D			C	
Intersection Summary												
HCM 2000 Control Delay			33.6		HCM 2000 Level of Service						C	
HCM 2000 Volume to Capacity ratio			0.34									
Actuated Cycle Length (s)			120.0		Sum of lost time (s)						12.1	
Intersection Capacity Utilization			49.8%		ICU Level of Service						A	
Analysis Period (min)			15									
! Phase conflict between lane groups.												
c Critical Lane Group												

HCM 6th TWSC  
130: EB Long Lake Rd & W>E X/O W. of Investment

Existing Conditions  
AM Peak Hour

Intersection

Int Delay, s/veh 1.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑↑			↑	
Traffic Vol, veh/h	0	815	0	0	62	0
Future Vol, veh/h	0	815	0	0	62	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	16983	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	93	93	92	92	64	64
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	876	0	0	97	0



Major/Minor	Major1		Minor2	
Conflicting Flow All	-	0	350	-
Stage 1	-	-	0	-
Stage 2	-	-	350	-
Critical Hdwy	-	-	5.74	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	-	-	6.04	-
Follow-up Hdwy	-	-	3.82	-
Pot Cap-1 Maneuver	0	-	646	0
Stage 1	0	-	-	0
Stage 2	0	-	627	0
Platoon blocked, %	-	-	-	-
Mov Cap-1 Maneuver	-	-	646	-
Mov Cap-2 Maneuver	-	-	646	-
Stage 1	-	-	-	-
Stage 2	-	-	627	-

Approach	EB	SB
HCM Control Delay, s	0	11.6
HCM LOS		B

Minor Lane/Major Mvmt	EBT	SBLn1
Capacity (veh/h)	-	646
HCM Lane V/C Ratio	-	0.15
HCM Control Delay (s)	-	11.6
HCM Lane LOS	-	B
HCM 95th %tile Q(veh)	-	0.5

HCM 6th TWSC  
140: NB Crooks Rd & S>N X/O S. of Long Lake

Existing Conditions  
AM Peak Hour

Intersection						
Int Delay, s/veh	0.5					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	37	0	0	862	0	0
Future Vol, veh/h	37	0	0	862	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	16979	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	81	81	93	93	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	46	0	0	927	0	0

Major/Minor	Minor2	Major1		
Conflicting Flow All	371	-	-	0
Stage 1	0	-	-	-
Stage 2	371	-	-	-
Critical Hdwy	5.74	-	-	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	6.04	-	-	-
Follow-up Hdwy	3.82	-	-	-
Pot Cap-1 Maneuver	631	0	0	-
Stage 1	-	0	0	-
Stage 2	612	0	0	-
Platoon blocked, %				-
Mov Cap-1 Maneuver	631	-	-	-
Mov Cap-2 Maneuver	631	-	-	-
Stage 1	-	-	-	-
Stage 2	612	-	-	-

Approach	EB	NB
HCM Control Delay, s	11.2	0
HCM LOS	B	

Minor Lane/Major Mvmt	NBT	EBLn1
Capacity (veh/h)	-	631
HCM Lane V/C Ratio	-	0.072
HCM Control Delay (s)	-	11.2
HCM Lane LOS	-	B
HCM 95th %tile Q(veh)	-	0.2

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150: SB Crooks Rd & Investment Dr Performance by movement

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Movement	EBR	WBL	WBT	SBT	SBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.1	0.0	0.1	0.0	0.0	0.0
Total Delay (hr)	0.5	0.1	0.6	0.3	0.0	1.4
Total Del/Veh (s)	17.9	13.3	14.3	0.7	0.3	3.0




# HCM 6th Signalized Intersection Summary

## 10: Crooks Rd & Corporate Dr/I-75 Ramp

Existing Conditions

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔↔	↗	↗	↔↔	↗		↔↔↔	↗	↗↗	↔↔↔	↗
Traffic Volume (veh/h)	87	68	332	390	187	804	0	1402	782	462	715	97
Future Volume (veh/h)	87	68	332	390	187	804	0	1402	782	462	715	97
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1969	1969	1969	1969	1969	1969	0	1969	1969	1969	1969	1969
Adj Flow Rate, veh/h	95	74	144	283	329	650	0	1604	524	486	753	70
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.93	0.93	0.93	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	0	2	2	2	2	2
Cap, veh/h	186	186	166	348	366	1134	0	2051	889	560	2975	923
Arrive On Green	0.10	0.10	0.10	0.19	0.19	0.19	0.00	0.35	0.35	0.15	0.55	0.55
Sat Flow, veh/h	1875	1870	1668	1875	1969	3337	0	5906	1668	3638	5375	1668
Grp Volume(v), veh/h	95	74	144	283	329	650	0	1604	524	486	753	70
Grp Sat Flow(s),veh/h/ln	1875	1870	1668	1875	1969	1668	0	1969	1668	1819	1792	1668
Q Serve(g_s), s	6.2	4.8	11.1	18.8	21.2	20.8	0.0	31.6	27.8	17.0	9.5	2.5
Cycle Q Clear(g_c), s	6.2	4.8	11.1	18.8	21.2	20.8	0.0	31.6	27.8	17.0	9.5	2.5
Prop In Lane	1.00		1.00	1.00		1.00	0.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	186	186	166	348	366	1134	0	2051	889	560	2975	923
V/C Ratio(X)	0.51	0.40	0.87	0.81	0.90	0.57	0.00	0.78	0.59	0.87	0.25	0.08
Avail Cap(c_a), veh/h	186	186	166	359	377	1153	0	2051	889	649	2975	923
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	55.6	54.9	57.7	50.8	51.7	35.2	0.0	38.0	20.7	53.7	15.1	13.5
Incr Delay (d2), s/veh	2.3	1.4	35.8	13.0	23.3	0.7	0.0	3.1	2.9	11.5	0.2	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.1	2.3	6.3	10.0	12.8	8.5	0.0	15.3	16.0	8.5	3.7	1.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	57.9	56.3	93.6	63.7	75.0	35.9	0.0	41.1	23.5	65.2	15.3	13.7
LnGrp LOS	E	E	F	E	E	D	A	D	C	E	B	B
Approach Vol, veh/h		313			1262			2128			1309	
Approach Delay, s/veh		73.9			52.3			36.8			33.7	
Approach LOS		E			D			D			C	
Timer - Assigned Phs	1	2		4		6		8				
Phs Duration (G+Y+Rc), s	26.8	51.9		31.3		78.7		20.0				
Change Period (Y+Rc), s	6.8	6.8		* 7.1		6.8		7.1				
Max Green Setting (Gmax), s	23.2	41.2		* 25		71.2		12.9				
Max Q Clear Time (g_c+I1), s	19.0	33.6		23.2		11.5		13.1				
Green Ext Time (p_c), s	1.1	4.9		0.9		5.3		0.0				

### Intersection Summary

HCM 6th Ctrl Delay 42.2

HCM 6th LOS D

### Notes

User approved volume balancing among the lanes for turning movement.

\* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

HCM 6th TWSC  
20: Corporate Dr & New King Dr

Existing Conditions  
PM Peak Hour

Intersection

Int Delay, s/veh 2.7

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑	↑	↑	↑
Traffic Vol, veh/h	40	437	280	4	50	82
Future Vol, veh/h	40	437	280	4	50	82
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	0	0	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	72	72
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	43	475	304	4	69	114

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	308	0	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.14	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.22	-	-
Pot Cap-1 Maneuver	1249	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	1249	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	SB
HCM Control Delay, s	0.9	0	12.1
HCM LOS			B




















Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1249	-	-	-	395	867
HCM Lane V/C Ratio	0.035	-	-	-	0.176	0.131
HCM Control Delay (s)	8	0.2	-	-	16	9.8
HCM Lane LOS	A	A	-	-	C	A
HCM 95th %tile Q(veh)	0.1	-	-	-	0.6	0.5

# HCM Signalized Intersection Capacity Analysis

## 30: NB Crooks Rd & Tower Dr

Existing Conditions

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations						 		  				
Traffic Volume (vph)	107	110	0	0	0	653	0	1550	27	0	0	0
Future Volume (vph)	107	110	0	0	0	653	0	1550	27	0	0	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)		6.0				6.0		6.4	6.4			
Lane Util. Factor		1.00				0.88		0.91	1.00			
Frt		1.00				0.85		1.00	0.85			
Flt Protected		0.98				1.00		1.00	1.00			
Satd. Flow (prot)		1914				2933		5353	1667			
Flt Permitted		0.98				1.00		1.00	1.00			
Satd. Flow (perm)		1914				2933		5353	1667			
Peak-hour factor, PHF	0.76	0.76	0.76	0.79	0.79	0.79	0.93	0.93	0.93	0.92	0.92	0.92
Adj. Flow (vph)	141	145	0	0	0	827	0	1667	29	0	0	0
RTOR Reduction (vph)	0	19	0	0	0	19	0	0	13	0	0	0
Lane Group Flow (vph)	0	267	0	0	0	808	0	1667	16	0	0	0
Turn Type	custom	NA				Perm		NA	Perm			
Protected Phases		4						2!				
Permitted Phases	4 2!					8			2			
Actuated Green, G (s)		44.7				44.7		72.9	72.9			
Effective Green, g (s)		44.7				44.7		72.9	72.9			
Actuated g/C Ratio		0.34				0.34		0.56	0.56			
Clearance Time (s)		6.0				6.0		6.4	6.4			
Vehicle Extension (s)		4.5				4.5		3.0	3.0			
Lane Grp Cap (vph)		658				1008		3001	934			
v/s Ratio Prot								c0.31				
v/s Ratio Perm		0.14				c0.28			0.01			
v/c Ratio		0.41				0.80		0.56	0.02			
Uniform Delay, d1		32.5				38.6		18.2	12.7			
Progression Factor		1.18				1.00		1.00	1.00			
Incremental Delay, d2		0.5				5.2		0.7	0.0			
Delay (s)		38.7				43.8		19.0	12.7			
Level of Service		D				D		B	B			
Approach Delay (s)		38.7			43.8			18.9			0.0	
Approach LOS		D			D			B			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		28.2				HCM 2000 Level of Service		C				
HCM 2000 Volume to Capacity ratio		0.65										
Actuated Cycle Length (s)		130.0				Sum of lost time (s)		12.4				
Intersection Capacity Utilization		76.6%				ICU Level of Service		D				
Analysis Period (min)		15										
! Phase conflict between lane groups.												
c Critical Lane Group												

HCM 6th TWSC  
40: SB Crooks Rd & N>S X/O N. of Long Lake

Existing Conditions  
PM Peak Hour

Intersection						
Int Delay, s/veh	0.7					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰					↱↱↱
Traffic Vol, veh/h	47	0	0	0	0	1246
Future Vol, veh/h	47	0	0	0	0	1246
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	16974	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	60	60	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	78	0	0	0	0	1354

Major/Minor	Minor1	Major2
Conflicting Flow All	542	-
Stage 1	0	-
Stage 2	542	-
Critical Hdwy	5.74	-
Critical Hdwy Stg 1	-	-
Critical Hdwy Stg 2	6.04	-
Follow-up Hdwy	3.82	-
Pot Cap-1 Maneuver	522	0
Stage 1	-	0
Stage 2	499	0
Platoon blocked, %		-
Mov Cap-1 Maneuver	522	-
Mov Cap-2 Maneuver	522	-
Stage 1	-	-
Stage 2	499	-



Approach	WB	SB
HCM Control Delay, s	13.1	0
HCM LOS	B	

Minor Lane/Major Mvmt	WBLn1	SBT
Capacity (veh/h)	522	-
HCM Lane V/C Ratio	0.15	-
HCM Control Delay (s)	13.1	-
HCM Lane LOS	B	-
HCM 95th %tile Q(veh)	0.5	-



HCM 6th TWSC  
50: NB Crooks Rd & S>N X/O N. of Long Lake

Existing Conditions  
PM Peak Hour

Intersection						
Int Delay, s/veh	0.1					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	12	0	0	1342	0	0
Future Vol, veh/h	12	0	0	1342	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	16979	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	75	75	93	93	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	16	0	0	1443	0	0

Major/Minor	Minor2	Major1		
Conflicting Flow All	577	-	-	0
Stage 1	0	-	-	-
Stage 2	577	-	-	-
Critical Hdwy	5.74	-	-	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	6.04	-	-	-
Follow-up Hdwy	3.82	-	-	-
Pot Cap-1 Maneuver	502	0	0	-
Stage 1	-	0	0	-
Stage 2	479	0	0	-
Platoon blocked, %				-
Mov Cap-1 Maneuver	502	-	-	-
Mov Cap-2 Maneuver	502	-	-	-
Stage 1	-	-	-	-
Stage 2	479	-	-	-

Approach	EB	NB
HCM Control Delay, s	12.4	0
HCM LOS	B	

Minor Lane/Major Mvmt	NBT	EBLn1
Capacity (veh/h)	-	502
HCM Lane V/C Ratio	-	0.032
HCM Control Delay (s)	-	12.4
HCM Lane LOS	-	B
HCM 95th %tile Q(veh)	-	0.1

# HCM Signalized Intersection Capacity Analysis

## 60: E>W X/O E. of Crooks & WB Long Lake Rd

Existing Conditions  
PM Peak Hour


	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations				↑↑↑	↖	
Traffic Volume (vph)	0	0	0	894	53	0
Future Volume (vph)	0	0	0	894	53	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000
Total Lost time (s)				6.6	5.4	
Lane Util. Factor				0.91	1.00	
Frt				1.00	1.00	
Flt Protected				1.00	0.95	
Satd. Flow (prot)				5353	1863	
Flt Permitted				1.00	0.95	
Satd. Flow (perm)				5353	1863	
Peak-hour factor, PHF	0.92	0.92	0.95	0.95	0.87	0.87
Adj. Flow (vph)	0	0	0	941	61	0
RTOR Reduction (vph)	0	0	0	0	30	0
Lane Group Flow (vph)	0	0	0	941	31	0
Turn Type				NA	Prot	
Protected Phases				6	8	
Permitted Phases						
Actuated Green, G (s)				101.4	6.6	
Effective Green, g (s)				101.4	6.6	
Actuated g/C Ratio				0.85	0.05	
Clearance Time (s)				6.6	5.4	
Vehicle Extension (s)				3.0	3.0	
Lane Grp Cap (vph)				4523	102	
v/s Ratio Prot				c0.18	c0.02	
v/s Ratio Perm						
v/c Ratio				0.21	0.30	
Uniform Delay, d1				1.7	54.5	
Progression Factor				1.00	0.59	
Incremental Delay, d2				0.1	1.4	
Delay (s)				1.9	33.6	
Level of Service				A	C	
Approach Delay (s)	0.0			1.9	33.6	
Approach LOS	A			A	C	
<b>Intersection Summary</b>						
HCM 2000 Control Delay			3.8	HCM 2000 Level of Service		A
HCM 2000 Volume to Capacity ratio			0.21			
Actuated Cycle Length (s)			120.0	Sum of lost time (s)		12.0
Intersection Capacity Utilization			49.7%	ICU Level of Service		A
Analysis Period (min)			15			
c Critical Lane Group						

# HCM Signalized Intersection Capacity Analysis

## 70: NB Crooks Rd & WB Long Lake Rd

Existing Conditions

PM Peak Hour













												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑↑	↑		↑↑↑				
Traffic Volume (vph)	0	0	0	0	779	168	0	1174	0	0	0	0
Future Volume (vph)	0	0	0	0	779	168	0	1174	0	0	0	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)					11.9	11.9		5.9				
Lane Util. Factor					0.91	1.00		0.91				
Frt					1.00	0.85		1.00				
Flt Protected					1.00	1.00		1.00				
Satd. Flow (prot)					5353	1667		5353				
Flt Permitted					1.00	1.00		1.00				
Satd. Flow (perm)					5353	1667		5353				
Peak-hour factor, PHF	0.92	0.92	0.92	0.95	0.95	0.95	0.89	0.89	0.89	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	820	177	0	1319	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	53	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	820	124	0	1319	0	0	0	0
Turn Type					NA	Perm		NA				
Protected Phases					4			6				
Permitted Phases						4						
Actuated Green, G (s)					41.8	41.8		60.4				
Effective Green, g (s)					41.8	41.8		60.4				
Actuated g/C Ratio					0.35	0.35		0.50				
Clearance Time (s)					11.9	11.9		5.9				
Vehicle Extension (s)					3.0	3.0		3.0				
Lane Grp Cap (vph)					1864	580		2694				
v/s Ratio Prot					c0.15			c0.25				
v/s Ratio Perm						0.07						
v/c Ratio					0.44	0.21		0.49				
Uniform Delay, d1					30.1	27.5		19.6				
Progression Factor					0.99	1.05		0.00				
Incremental Delay, d2					0.2	0.2		0.5				
Delay (s)					30.1	29.0		0.6				
Level of Service					C	C		A				
Approach Delay (s)		0.0			29.9			0.6			0.0	
Approach LOS		A			C			A			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			13.2				HCM 2000 Level of Service			B		
HCM 2000 Volume to Capacity ratio			0.50									
Actuated Cycle Length (s)			120.0				Sum of lost time (s)			23.8		
Intersection Capacity Utilization			50.7%				ICU Level of Service			A		
Analysis Period (min)			15									
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis

## 71: SB Crooks Rd & WB Long Lake Rd

Existing Conditions

PM Peak Hour


												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑↑						↑↑↑	↑
Traffic Volume (vph)	0	0	0	0	779	0	0	0	0	0	971	179
Future Volume (vph)	0	0	0	0	779	0	0	0	0	0	971	179
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)					5.9						11.9	11.9
Lane Util. Factor					0.91						0.91	1.00
Frt					1.00						1.00	0.85
Flt Protected					1.00						1.00	1.00
Satd. Flow (prot)					5353						5353	1667
Flt Permitted					1.00						1.00	1.00
Satd. Flow (perm)					5353						5353	1667
Peak-hour factor, PHF	0.92	0.92	0.92	0.95	0.95	0.95	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	820	0	0	0	0	0	1055	195
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	49
Lane Group Flow (vph)	0	0	0	0	820	0	0	0	0	0	1055	146
Turn Type					NA						NA	Perm
Protected Phases					8						2	
Permitted Phases												2
Actuated Green, G (s)					47.8						54.4	54.4
Effective Green, g (s)					47.8						54.4	54.4
Actuated g/C Ratio					0.40						0.45	0.45
Clearance Time (s)					5.9						11.9	11.9
Vehicle Extension (s)					3.0						3.0	3.0
Lane Grp Cap (vph)					2132						2426	755
v/s Ratio Prot					c0.15						c0.20	
v/s Ratio Perm												0.09
v/c Ratio					0.38						0.43	0.19
Uniform Delay, d1					25.6						22.3	19.7
Progression Factor					0.00						1.00	1.00
Incremental Delay, d2					0.1						0.6	0.6
Delay (s)					0.1						22.9	20.2
Level of Service					A						C	C
Approach Delay (s)		0.0			0.1			0.0			22.5	
Approach LOS		A			A			A			C	
Intersection Summary												
HCM 2000 Control Delay			13.6		HCM 2000 Level of Service					B		
HCM 2000 Volume to Capacity ratio			0.44									
Actuated Cycle Length (s)			120.0		Sum of lost time (s)					23.8		
Intersection Capacity Utilization			50.7%		ICU Level of Service					A		
Analysis Period (min)			15									
c Critical Lane Group												



# HCM Signalized Intersection Capacity Analysis

## 72: SB Crooks Rd & EB Long Lake Rd

Existing Conditions  
PM Peak Hour


												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑	↑								↑↑↑	
Traffic Volume (vph)	0	1022	147	0	0	0	0	0	0	0	971	0
Future Volume (vph)	0	1022	147	0	0	0	0	0	0	0	971	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)		11.9	11.9								5.9	
Lane Util. Factor		0.91	1.00								0.91	
Frt		1.00	0.85								1.00	
Flt Protected		1.00	1.00								1.00	
Satd. Flow (prot)		5353	1667								5353	
Flt Permitted		1.00	1.00								1.00	
Satd. Flow (perm)		5353	1667								5353	
Peak-hour factor, PHF	0.78	0.78	0.78	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1310	188	0	0	0	0	0	0	0	1055	0
RTOR Reduction (vph)	0	0	53	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	1310	135	0	0	0	0	0	0	0	1055	0
Turn Type		NA	Perm								NA	
Protected Phases		4									6	
Permitted Phases			4									
Actuated Green, G (s)		41.8	41.8								60.4	
Effective Green, g (s)		41.8	41.8								60.4	
Actuated g/C Ratio		0.35	0.35								0.50	
Clearance Time (s)		11.9	11.9								5.9	
Vehicle Extension (s)		3.0	3.0								3.0	
Lane Grp Cap (vph)		1864	580								2694	
v/s Ratio Prot		c0.24									c0.20	
v/s Ratio Perm			0.08									
v/c Ratio		0.70	0.23								0.39	
Uniform Delay, d1		33.7	27.7								18.4	
Progression Factor		1.11	1.24								0.00	
Incremental Delay, d2		1.2	0.2								0.4	
Delay (s)		38.5	34.7								0.4	
Level of Service		D	C								A	
Approach Delay (s)		38.0			0.0			0.0			0.4	
Approach LOS		D			A			A			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			22.5									HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio			0.55									
Actuated Cycle Length (s)			120.0								23.8	
Intersection Capacity Utilization			51.4%									ICU Level of Service A
Analysis Period (min)			15									
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis

## 73: NB Crooks Rd & EB Long Lake Rd

Existing Conditions

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑						↑↑↑	↑			
Traffic Volume (vph)	0	1022	0	0	0	0	0	1174	362	0	0	0
Future Volume (vph)	0	1022	0	0	0	0	0	1174	362	0	0	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)		5.9						11.9	11.9			
Lane Util. Factor		0.91						0.91	1.00			
Frt		1.00						1.00	0.85			
Flt Protected		1.00						1.00	1.00			
Satd. Flow (prot)		5353						5353	1667			
Flt Permitted		1.00						1.00	1.00			
Satd. Flow (perm)		5353						5353	1667			
Peak-hour factor, PHF	0.78	0.78	0.78	0.92	0.92	0.92	0.89	0.89	0.89	0.92	0.92	0.92
Adj. Flow (vph)	0	1310	0	0	0	0	0	1319	407	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	44	0	0	0
Lane Group Flow (vph)	0	1310	0	0	0	0	0	1319	363	0	0	0
Turn Type		NA						NA	Perm			
Protected Phases		8						2				
Permitted Phases									2			
Actuated Green, G (s)		47.8						54.4	54.4			
Effective Green, g (s)		47.8						54.4	54.4			
Actuated g/C Ratio		0.40						0.45	0.45			
Clearance Time (s)		5.9						11.9	11.9			
Vehicle Extension (s)		3.0						3.0	3.0			
Lane Grp Cap (vph)		2132						2426	755			
v/s Ratio Prot		c0.24						c0.25				
v/s Ratio Perm									0.22			
v/c Ratio		0.61						0.54	0.48			
Uniform Delay, d1		28.8						23.8	22.9			
Progression Factor		0.00						1.00	1.00			
Incremental Delay, d2		0.4						0.9	2.2			
Delay (s)		0.4						24.7	25.1			
Level of Service		A						C	C			
Approach Delay (s)		0.4			0.0			24.8			0.0	
Approach LOS		A			A			C			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			14.3				HCM 2000 Level of Service		B			
HCM 2000 Volume to Capacity ratio			0.61									
Actuated Cycle Length (s)			120.0				Sum of lost time (s)		23.8			
Intersection Capacity Utilization			55.1%				ICU Level of Service		B			
Analysis Period (min)			15									
c Critical Lane Group												

HCM 6th TWSC  
80: E>W X/O W. of Crooks & WB Long Lake Rd

Existing Conditions  
PM Peak Hour

Intersection						
Int Delay, s/veh	0.2					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations				↑↑↑	↑	
Traffic Vol, veh/h	0	0	0	958	13	0
Future Vol, veh/h	0	0	0	958	13	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	63	63
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	0	0	1041	21	0

Major/Minor	Major2	Minor1
Conflicting Flow All	-	416
Stage 1	-	0
Stage 2	-	416
Critical Hdwy	-	5.74
Critical Hdwy Stg 1	-	-
Critical Hdwy Stg 2	-	6.04
Follow-up Hdwy	-	3.82
Pot Cap-1 Maneuver	0	600
Stage 1	0	-
Stage 2	0	580
Platoon blocked, %	-	-
Mov Cap-1 Maneuver	-	600
Mov Cap-2 Maneuver	-	600
Stage 1	-	-
Stage 2	-	580

Approach	WB	NB
HCM Control Delay, s	0	11.2
HCM LOS		B

Minor Lane/Major Mvmt	NBLn1	WBT
Capacity (veh/h)	600	-
HCM Lane V/C Ratio	0.034	-
HCM Control Delay (s)	11.2	-
HCM Lane LOS	B	-
HCM 95th %tile Q(veh)	0.1	-

# HCM Signalized Intersection Capacity Analysis

## 90: EB Long Lake Rd & W>E X/O W. of Crooks

Existing Conditions  
PM Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑↑			↵	
Traffic Volume (vph)	0	975	0	0	207	0
Future Volume (vph)	0	975	0	0	207	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000
Total Lost time (s)		6.0			5.4	
Lane Util. Factor		0.91			1.00	
Frt		1.00			1.00	
Flt Protected		1.00			0.95	
Satd. Flow (prot)		5353			1863	
Flt Permitted		1.00			0.95	
Satd. Flow (perm)		5353			1863	
Peak-hour factor, PHF	0.92	0.81	0.92	0.92	0.67	0.67
Adj. Flow (vph)	0	1204	0	0	309	0
RTOR Reduction (vph)	0	0	0	0	23	0
Lane Group Flow (vph)	0	1204	0	0	286	0
Turn Type		NA			Prot	
Protected Phases		2			4	
Permitted Phases						
Actuated Green, G (s)		84.2			24.4	
Effective Green, g (s)		84.2			24.4	
Actuated g/C Ratio		0.70			0.20	
Clearance Time (s)		6.0			5.4	
Vehicle Extension (s)		3.0			3.0	
Lane Grp Cap (vph)		3756			378	
v/s Ratio Prot		c0.22			c0.15	
v/s Ratio Perm						
v/c Ratio		0.32			0.76	
Uniform Delay, d1		6.9			45.0	
Progression Factor		0.96			0.99	
Incremental Delay, d2		0.2			8.1	
Delay (s)		6.8			52.7	
Level of Service		A			D	
Approach Delay (s)		6.8	0.0		52.7	
Approach LOS		A	A		D	
<b>Intersection Summary</b>						
HCM 2000 Control Delay		16.2		HCM 2000 Level of Service		B
HCM 2000 Volume to Capacity ratio		0.42				
Actuated Cycle Length (s)		120.0		Sum of lost time (s)		11.4
Intersection Capacity Utilization		46.9%		ICU Level of Service		A
Analysis Period (min)		15				

c Critical Lane Group



HCM 6th TWSC  
100: E>W X/O E. of Corporate & WB Long Lake Rd

Existing Conditions  
PM Peak Hour

Intersection						
Int Delay, s/veh	1.2					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations				↑↑↑	↑	
Traffic Vol, veh/h	0	0	0	764	59	0
Future Vol, veh/h	0	0	0	764	59	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	60	60
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	0	0	830	98	0

Major/Minor	Major2	Minor1
Conflicting Flow All	-	332
Stage 1	-	0
Stage 2	-	332
Critical Hdwy	-	5.74
Critical Hdwy Stg 1	-	-
Critical Hdwy Stg 2	-	6.04
Follow-up Hdwy	-	3.82
Pot Cap-1 Maneuver	0	659
Stage 1	0	-
Stage 2	0	641
Platoon blocked, %	-	-
Mov Cap-1 Maneuver	-	659
Mov Cap-2 Maneuver	-	659
Stage 1	-	-
Stage 2	-	641













Approach	WB	NB
HCM Control Delay, s	0	11.4
HCM LOS		B

Minor Lane/Major Mvmt	NBLn1	WBT
Capacity (veh/h)	659	-
HCM Lane V/C Ratio	0.149	-
HCM Control Delay (s)	11.4	-
HCM Lane LOS	B	-
HCM 95th %tile Q(veh)	0.5	-

# HCM Signalized Intersection Capacity Analysis

## 110: Investment Dr & EB Long Lake Rd

Existing Conditions  
PM Peak Hour


												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑	↗						↗↗		↖	
Traffic Volume (vph)	0	886	97	0	0	0	0	0	148	0	33	0
Future Volume (vph)	0	886	97	0	0	0	0	0	148	0	33	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)		6.0	6.0						5.5		5.5	
Lane Util. Factor		0.91	1.00						0.88		1.00	
Frt		1.00	0.85						0.85		1.00	
Flt Protected		1.00	1.00						1.00		1.00	
Satd. Flow (prot)		5353	1667						2933		1961	
Flt Permitted		1.00	1.00						1.00		1.00	
Satd. Flow (perm)		5353	1667						2933		1961	
Peak-hour factor, PHF	0.85	0.85	0.85	0.92	0.92	0.92	0.68	0.68	0.68	0.83	0.83	0.83
Adj. Flow (vph)	0	1042	114	0	0	0	0	0	218	0	40	0
RTOR Reduction (vph)	0	0	19	0	0	0	0	0	132	0	0	0
Lane Group Flow (vph)	0	1042	95	0	0	0	0	0	86	0	40	0
Turn Type		NA	Perm						Perm		NA	
Protected Phases		2									4	
Permitted Phases			2						8	4		
Actuated Green, G (s)		99.6	99.6						8.9		8.9	
Effective Green, g (s)		99.6	99.6						8.9		8.9	
Actuated g/C Ratio		0.83	0.83						0.07		0.07	
Clearance Time (s)		6.0	6.0						5.5		5.5	
Vehicle Extension (s)		4.0	4.0						3.0		3.0	
Lane Grp Cap (vph)		4442	1383						217		145	
v/s Ratio Prot		c0.19									0.02	
v/s Ratio Perm			0.06						c0.03			
v/c Ratio		0.23	0.07						0.39		0.28	
Uniform Delay, d1		2.2	1.8						53.0		52.5	
Progression Factor		1.00	1.00						1.00		1.46	
Incremental Delay, d2		0.1	0.1						1.2		1.0	
Delay (s)		2.3	1.9						54.2		77.7	
Level of Service		A	A						D		E	
Approach Delay (s)		2.2			0.0			54.2			77.7	
Approach LOS		A			A			D			E	
Intersection Summary												
HCM 2000 Control Delay			12.4		HCM 2000 Level of Service				B			
HCM 2000 Volume to Capacity ratio			0.25									
Actuated Cycle Length (s)			120.0		Sum of lost time (s)				11.5			
Intersection Capacity Utilization			43.3%		ICU Level of Service				A			
Analysis Period (min)			15									
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis

## 120: Corporate Dr & WB Long Lake Rd

Existing Conditions

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑↑	↑		↑				↑↑
Traffic Volume (vph)	0	0	0	0	751	39	102	34	0	0	0	448
Future Volume (vph)	0	0	0	0	751	39	102	34	0	0	0	448
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)					6.3	6.3		5.8				5.8
Lane Util. Factor					0.91	1.00		1.00				0.88
Frt					1.00	0.85		1.00				0.85
Flt Protected					1.00	1.00		0.96				1.00
Satd. Flow (prot)					5353	1667		1890				2933
Flt Permitted					1.00	1.00		0.96				1.00
Satd. Flow (perm)					5353	1667		1890				2933
Peak-hour factor, PHF	0.92	0.92	0.92	0.88	0.88	0.88	0.69	0.69	0.69	0.72	0.72	0.72
Adj. Flow (vph)	0	0	0	0	853	44	148	49	0	0	0	622
RTOR Reduction (vph)	0	0	0	0	0	15	0	50	0	0	0	89
Lane Group Flow (vph)	0	0	0	0	853	29	0	147	0	0	0	533
Turn Type					NA	Perm	custom	NA				Perm
Protected Phases					6!			8				
Permitted Phases						6	8 6!					4
Actuated Green, G (s)					79.7	79.7		28.2				28.2
Effective Green, g (s)					79.7	79.7		28.2				28.2
Actuated g/C Ratio					0.66	0.66		0.23				0.23
Clearance Time (s)					6.3	6.3		5.8				5.8
Vehicle Extension (s)					4.0	4.0		3.0				3.0
Lane Grp Cap (vph)					3555	1107		444				689
v/s Ratio Prot					c0.16							
v/s Ratio Perm						0.02		0.08				c0.18
v/c Ratio					0.24	0.03		0.33				0.77
Uniform Delay, d1					8.0	6.9		38.1				42.9
Progression Factor					2.44	5.24		1.00				1.00
Incremental Delay, d2					0.2	0.0		0.4				5.4
Delay (s)					19.8	36.1		38.5				48.3
Level of Service					B	D		D				D
Approach Delay (s)		0.0			20.6			38.5			48.3	
Approach LOS		A			C			D			D	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			32.7				HCM 2000 Level of Service			C		
HCM 2000 Volume to Capacity ratio			0.38									
Actuated Cycle Length (s)			120.0				Sum of lost time (s)			12.1		
Intersection Capacity Utilization			50.7%				ICU Level of Service			A		
Analysis Period (min)			15									
! Phase conflict between lane groups.												
c Critical Lane Group												

HCM 6th TWSC  
130: EB Long Lake Rd & W>E X/O W. of Investment



Existing Conditions  
PM Peak Hour

Intersection						
Int Delay, s/veh	0.8					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑↑↑			↑↓	
Traffic Vol, veh/h	0	1059	0	0	60	0
Future Vol, veh/h	0	1059	0	0	60	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	16983	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	85	85	92	92	75	75
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	1246	0	0	80	0
Major/Minor	Major1			Minor2		
Conflicting Flow All	-	0			498	-
Stage 1	-	-			0	-
Stage 2	-	-			498	-
Critical Hdwy	-	-			5.74	-
Critical Hdwy Stg 1	-	-			-	-
Critical Hdwy Stg 2	-	-			6.04	-
Follow-up Hdwy	-	-			3.82	-
Pot Cap-1 Maneuver	0	-			548	0
Stage 1	0	-			-	0
Stage 2	0	-			526	0
Platoon blocked, %		-				
Mov Cap-1 Maneuver	-	-			548	-
Mov Cap-2 Maneuver	-	-			548	-
Stage 1	-	-			-	-
Stage 2	-	-			526	-
Approach	EB			SB		
HCM Control Delay, s	0			12.7		
HCM LOS				B		
Minor Lane/Major Mvmt	EBT SBLn1					
Capacity (veh/h)	- 548					
HCM Lane V/C Ratio	- 0.146					
HCM Control Delay (s)	- 12.7					
HCM Lane LOS	- B					
HCM 95th %tile Q(veh)	- 0.5					



HCM 6th TWSC  
140: NB Crooks Rd & S>N X/O S. of Long Lake

Existing Conditions  
PM Peak Hour

Intersection						
Int Delay, s/veh	1.1					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	90	0	0	1540	0	0
Future Vol, veh/h	90	0	0	1540	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	16979	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	70	70	89	89	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	129	0	0	1730	0	0

Major/Minor	Minor2	Major1		
Conflicting Flow All	692	-	-	0
Stage 1	0	-	-	-
Stage 2	692	-	-	-
Critical Hdwy	5.74	-	-	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	6.04	-	-	-
Follow-up Hdwy	3.82	-	-	-
Pot Cap-1 Maneuver	441	0	0	-
Stage 1	-	0	0	-
Stage 2	417	0	0	-
Platoon blocked, %				-
Mov Cap-1 Maneuver	441	-	-	-
Mov Cap-2 Maneuver	441	-	-	-
Stage 1	-	-	-	-
Stage 2	417	-	-	-

Approach	EB	NB
HCM Control Delay, s	16.5	0
HCM LOS	C	

Minor Lane/Major Mvmt	NBT	EBLn1
Capacity (veh/h)	-	441
HCM Lane V/C Ratio	-	0.292
HCM Control Delay (s)	-	16.5
HCM Lane LOS	-	C
HCM 95th %tile Q(veh)	-	1.2

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150: SB Crooks Rd & Investment Dr Performance by movement

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Movement	EBR	WBL	WBT	SBT	SBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.1	0.0	0.0	0.0	0.0	0.0
Total Delay (hr)	1.2	0.0	0.1	0.2	0.0	1.6
Total Del/Veh (s)	17.8	9.8	11.8	0.7	0.0	3.9

## Intersection: 10: Crooks Rd &amp; Corporate Dr/I-75 Ramp

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	NB	SB
Directions Served	LT	T	R	L	LT	TR	R	T	T	TR	R	L
Maximum Queue (ft)	405	406	117	465	527	851	528	190	190	209	194	365
Average Queue (ft)	328	323	38	312	373	410	360	136	153	164	130	293
95th Queue (ft)	454	467	93	426	489	642	501	217	221	221	210	427
Link Distance (ft)	362	362	362		1654	1654		146	146	146	146	
Upstream Blk Time (%)	37	40				0		12	22	28	8	
Queuing Penalty (veh)	87	94				0		27	51	65	18	
Storage Bay Dist (ft)				700			750					325
Storage Blk Time (%)												11
Queuing Penalty (veh)												51

## Intersection: 10: Crooks Rd &amp; Corporate Dr/I-75 Ramp

Movement	SB	SB	SB	SB	SB
Directions Served	L	T	T	T	R
Maximum Queue (ft)	400	859	775	554	127
Average Queue (ft)	319	375	301	216	52
95th Queue (ft)	468	740	615	357	95
Link Distance (ft)		1954	1954	1954	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	325			700	
Storage Blk Time (%)	23	2		0	
Queuing Penalty (veh)	104	9		0	

## Intersection: 20: Corporate Dr &amp; New King Dr

Movement	EB	EB	WB	WB	WB	SB	SB
Directions Served	LT	T	T	T	R	L	R
Maximum Queue (ft)	480	441	170	169	13	133	61
Average Queue (ft)	345	310	32	36	1	58	17
95th Queue (ft)	862	877	177	188	11	184	45
Link Distance (ft)	732	732	362	362	362	382	382
Upstream Blk Time (%)	12	13	0				
Queuing Penalty (veh)	46	51	0				
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							

## Intersection: 30: NB Crooks Rd &amp; Tower Dr

Movement	EB	WB	WB	NB	NB	NB	NB
Directions Served	LT	R	R	T	T	T	R
Maximum Queue (ft)	74	111	36	210	251	293	134
Average Queue (ft)	55	47	6	69	90	122	28
95th Queue (ft)	62	86	25	178	217	259	86
Link Distance (ft)	17	505	505	562	562	562	
Upstream Blk Time (%)	46						
Queuing Penalty (veh)	294						
Storage Bay Dist (ft)							275
Storage Blk Time (%)						1	
Queuing Penalty (veh)						1	

## Intersection: 31: SB Crooks Rd &amp; Dummy Node/Tower Dr

Movement	SB	SB
Directions Served	L	T
Maximum Queue (ft)	488	432
Average Queue (ft)	302	15
95th Queue (ft)	500	166
Link Distance (ft)		585
Upstream Blk Time (%)		0
Queuing Penalty (veh)		1
Storage Bay Dist (ft)	375	
Storage Blk Time (%)	4	
Queuing Penalty (veh)	18	

## Intersection: 40: SB Crooks Rd &amp; N&gt;S X/O N. of Long Lake

Movement	WB
Directions Served	L
Maximum Queue (ft)	55
Average Queue (ft)	22
95th Queue (ft)	51
Link Distance (ft)	17
Upstream Blk Time (%)	7
Queuing Penalty (veh)	3
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	



## Intersection: 41: NB Crooks Rd &amp; N&gt;S X/O N. of Long Lake

Movement	NB
Directions Served	L
Maximum Queue (ft)	32
Average Queue (ft)	2
95th Queue (ft)	14
Link Distance (ft)	543
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 50: NB Crooks Rd &amp; S&gt;N X/O N. of Long Lake

Movement	EB
Directions Served	L
Maximum Queue (ft)	31
Average Queue (ft)	8
95th Queue (ft)	30
Link Distance (ft)	13
Upstream Blk Time (%)	1
Queuing Penalty (veh)	0
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 51: SB Crooks Rd &amp; S&gt;N X/O N. of Long Lake

Movement	SB	SB	SB	SB	SB
Directions Served	L	T	T	T	T
Maximum Queue (ft)	75	452	478	453	129
Average Queue (ft)	3	164	185	111	12
95th Queue (ft)	48	368	386	326	87
Link Distance (ft)		446	446	446	
Upstream Blk Time (%)		1	2	1	
Queuing Penalty (veh)		5	7	3	
Storage Bay Dist (ft)	225				150
Storage Blk Time (%)		9		5	
Queuing Penalty (veh)		1		16	

## Intersection: 60: E&gt;W X/O E. of Crooks &amp; WB Long Lake Rd

Movement	WB	WB	WB	NB
Directions Served	T	T	T	L
Maximum Queue (ft)	92	64	61	69
Average Queue (ft)	9	5	4	40
95th Queue (ft)	49	30	28	66
Link Distance (ft)	1483	1483	1483	21
Upstream Blk Time (%)				15
Queuing Penalty (veh)				13
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

## Intersection: 61: EB Long Lake Rd &amp; E&gt;W X/O E. of Crooks

Movement	EB
Directions Served	L
Maximum Queue (ft)	90
Average Queue (ft)	20
95th Queue (ft)	64
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	305
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 70: NB Crooks Rd &amp; WB Long Lake Rd

Movement	WB	WB	WB	WB
Directions Served	T	T	T	R
Maximum Queue (ft)	371	326	306	92
Average Queue (ft)	252	211	182	42
95th Queue (ft)	350	304	278	69
Link Distance (ft)	530	530	530	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				650
Storage Blk Time (%)				
Queuing Penalty (veh)				

## Intersection: 71: SB Crooks Rd &amp; WB Long Lake Rd

Movement	SB	SB	SB	SB
Directions Served	T	T	T	R
Maximum Queue (ft)	99	104	83	79
Average Queue (ft)	78	79	53	40
95th Queue (ft)	91	89	91	76
Link Distance (ft)	44	44	44	44
Upstream Blk Time (%)	48	53	16	8
Queuing Penalty (veh)	162	176	55	28
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

## Intersection: 72: SB Crooks Rd &amp; EB Long Lake Rd

Movement	EB	EB	EB	EB	SB
Directions Served	T	T	T	R	T
Maximum Queue (ft)	86	94	84	84	7
Average Queue (ft)	75	74	59	47	0
95th Queue (ft)	85	88	93	75	5
Link Distance (ft)	42	42	42	42	42
Upstream Blk Time (%)	45	42	27	9	0
Queuing Penalty (veh)	84	79	51	16	0
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

## Intersection: 73: NB Crooks Rd &amp; EB Long Lake Rd

Movement	NB	NB	NB	NB
Directions Served	T	T	T	R
Maximum Queue (ft)	105	103	102	86
Average Queue (ft)	88	80	84	38
95th Queue (ft)	116	119	115	71
Link Distance (ft)	64	64	64	64
Upstream Blk Time (%)	24	17	22	2
Queuing Penalty (veh)	49	35	46	3
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

## Intersection: 80: E&gt;W X/O W. of Crooks &amp; WB Long Lake Rd

## Movement

Directions Served

Maximum Queue (ft)

Average Queue (ft)

95th Queue (ft)

Link Distance (ft)

Upstream Blk Time (%)

Queuing Penalty (veh)

Storage Bay Dist (ft)

Storage Blk Time (%)

Queuing Penalty (veh)

## Intersection: 81: EB Long Lake Rd &amp; E&gt;W X/O W. of Crooks

## Movement

EB

EB

EB

EB

Directions Served

T

T

T

T

Maximum Queue (ft)

158

143

123

50

Average Queue (ft)

69

57

26

4

95th Queue (ft)

128

128

89

24

Link Distance (ft)

508

508

508

Upstream Blk Time (%)

Queuing Penalty (veh)

Storage Bay Dist (ft)

150

Storage Blk Time (%)

0

Queuing Penalty (veh)

0

## Intersection: 90: EB Long Lake Rd &amp; W&gt;E X/O W. of Crooks

## Movement

EB

EB

EB

SB

Directions Served

T

T

T

L

Maximum Queue (ft)

76

62

52

88

Average Queue (ft)

14

10

8

51

95th Queue (ft)

49

38

33

87

Link Distance (ft)

44

44

44

34

Upstream Blk Time (%)

1

1

0

9

Queuing Penalty (veh)

2

1

1

24

Storage Bay Dist (ft)

Storage Blk Time (%)

Queuing Penalty (veh)



## Intersection: 91: W&gt;E X/O W. of Crooks/S.E. Site Drive &amp; WB Long Lake Rd

Movement	WB
Directions Served	L
Maximum Queue (ft)	3
Average Queue (ft)	0
95th Queue (ft)	2
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	325
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 100: E&gt;W X/O E. of Corporate &amp; WB Long Lake Rd

Movement	NB
Directions Served	L
Maximum Queue (ft)	78
Average Queue (ft)	37
95th Queue (ft)	67
Link Distance (ft)	36
Upstream Blk Time (%)	13
Queuing Penalty (veh)	9
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 101: EB Long Lake Rd &amp; E&gt;W X/O E. of Corporate

Movement	EB	EB
Directions Served	L	T
Maximum Queue (ft)	46	7
Average Queue (ft)	2	0
95th Queue (ft)	19	4
Link Distance (ft)		520
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	375	
Storage Blk Time (%)		
Queuing Penalty (veh)		

## Intersection: 110: Investment Dr &amp; EB Long Lake Rd

Movement	EB	EB	EB	EB	NB	NB	SB
Directions Served	T	T	T	R	R	R	LT
Maximum Queue (ft)	45	38	44	47	55	29	70
Average Queue (ft)	24	8	12	15	20	7	46
95th Queue (ft)	51	30	37	40	40	23	85
Link Distance (ft)	13	13	13	13	755	755	35
Upstream Blk Time (%)	5	2	2	2			37
Queuing Penalty (veh)	8	3	3	3			26
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							

## Intersection: 111: Investment Dr &amp; WB Long Lake Rd

Movement	WB	WB	WB	WB	WB
Directions Served	L	T	T	T	T
Maximum Queue (ft)	64	204	220	202	111
Average Queue (ft)	12	59	74	76	26
95th Queue (ft)	44	146	167	163	71
Link Distance (ft)		428	428	428	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	225			300	
Storage Blk Time (%)		0			
Queuing Penalty (veh)		0			

## Intersection: 120: Corporate Dr &amp; WB Long Lake Rd

Movement	WB	WB	WB	WB	NB	SB	SB
Directions Served	T	T	T	R	LT	R	R
Maximum Queue (ft)	44	62	51	54	97	77	85
Average Queue (ft)	34	36	36	31	70	26	30
95th Queue (ft)	57	59	57	58	81	54	65
Link Distance (ft)	9	9	9	9	34	225	225
Upstream Blk Time (%)	12	12	12	7	70		
Queuing Penalty (veh)	34	35	35	19	177		
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							

## Intersection: 121: EB Long Lake Rd &amp; Corporate Dr

Movement	EB	EB	EB	EB	EB
Directions Served	L	T	T	T	T
Maximum Queue (ft)	320	62	6	24	13
Average Queue (ft)	124	6	0	1	1
95th Queue (ft)	240	27	5	11	8
Link Distance (ft)		562	562	562	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	375			275	
Storage Blk Time (%)	0				
Queuing Penalty (veh)	0				

## Intersection: 130: EB Long Lake Rd &amp; W&gt;E X/O W. of Investment

Movement	SB
Directions Served	L
Maximum Queue (ft)	51
Average Queue (ft)	29
95th Queue (ft)	51
Link Distance (ft)	33
Upstream Blk Time (%)	11
Queuing Penalty (veh)	8
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 131: W&gt;E X/O W. of Investment &amp; WB Long Lake Rd

Movement	WB
Directions Served	L
Maximum Queue (ft)	68
Average Queue (ft)	10
95th Queue (ft)	41
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	350
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 140: NB Crooks Rd &amp; S&gt;N X/O S. of Long Lake

Movement	EB
Directions Served	L
Maximum Queue (ft)	53
Average Queue (ft)	25
95th Queue (ft)	52
Link Distance (ft)	19
Upstream Blk Time (%)	6
Queuing Penalty (veh)	2
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 141: SB Crooks Rd &amp; S&gt;N X/O S. of Long Lake

Movement	SB	SB
Directions Served	L	T
Maximum Queue (ft)	31	5
Average Queue (ft)	4	0
95th Queue (ft)	20	3
Link Distance (ft)		410
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	375	
Storage Blk Time (%)		
Queuing Penalty (veh)		

## Intersection: 150: SB Crooks Rd &amp; Investment Dr

Movement	EB	EB	WB
Directions Served	R	R	LT
Maximum Queue (ft)	86	42	77
Average Queue (ft)	36	8	47
95th Queue (ft)	73	27	67
Link Distance (ft)	933	933	15
Upstream Blk Time (%)			44
Queuing Penalty (veh)			74
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			



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Intersection: 151: NB Crooks Rd & Investment Dr

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Movement	NB
Directions Served	L
Maximum Queue (ft)	145
Average Queue (ft)	39
95th Queue (ft)	108
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	325
Storage Blk Time (%)	
Queuing Penalty (veh)	

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Zone Summary

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Zone wide Queuing Penalty: 2210

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## Intersection: 10: Crooks Rd &amp; Corporate Dr/I-75 Ramp

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	NB	SB
Directions Served	LT	T	R	L	LT	TR	R	T	T	TR	R	L
Maximum Queue (ft)	150	84	229	286	314	346	340	202	203	200	192	336
Average Queue (ft)	74	37	106	169	214	225	201	180	185	185	157	208
95th Queue (ft)	128	76	204	254	290	316	301	204	193	192	222	323
Link Distance (ft)	362	362	362		1654	1654		146	146	146	146	
Upstream Blk Time (%)								30	40	47	13	
Queuing Penalty (veh)								162	219	256	71	
Storage Bay Dist (ft)				700			750					325
Storage Blk Time (%)												0
Queuing Penalty (veh)												1

## Intersection: 10: Crooks Rd &amp; Corporate Dr/I-75 Ramp

Movement	SB	SB	SB	SB	SB
Directions Served	L	T	T	T	R
Maximum Queue (ft)	365	220	164	160	50
Average Queue (ft)	230	96	88	81	21
95th Queue (ft)	345	166	146	142	44
Link Distance (ft)		1954	1954	1954	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	325			700	
Storage Blk Time (%)	2				
Queuing Penalty (veh)	4				

## Intersection: 20: Corporate Dr &amp; New King Dr

Movement	EB	SB	SB
Directions Served	LT	L	R
Maximum Queue (ft)	57	74	53
Average Queue (ft)	11	26	22
95th Queue (ft)	39	55	41
Link Distance (ft)	732	382	382
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 30: NB Crooks Rd & Tower Dr

Movement	EB	WB	WB	NB	NB	NB	NB
Directions Served	LT	R	R	T	T	T	R
Maximum Queue (ft)	85	477	419	397	465	510	330
Average Queue (ft)	54	276	191	136	188	243	29
95th Queue (ft)	71	432	373	328	387	462	166
Link Distance (ft)	17	505	505	562	562	562	
Upstream Blk Time (%)	61	0	0		0	0	
Queuing Penalty (veh)	134	0	0		0	0	
Storage Bay Dist (ft)							275
Storage Blk Time (%)						7	
Queuing Penalty (veh)						2	

Intersection: 31: SB Crooks Rd & Dummy Node/Tower Dr

Movement	SB	SB	SB
Directions Served	L	T	T
Maximum Queue (ft)	345	139	135
Average Queue (ft)	119	11	5
95th Queue (ft)	280	126	87
Link Distance (ft)		585	585
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	375		
Storage Blk Time (%)	2		
Queuing Penalty (veh)	8		

Intersection: 40: SB Crooks Rd & N>S X/O N. of Long Lake

Movement	WB
Directions Served	L
Maximum Queue (ft)	55
Average Queue (ft)	23
95th Queue (ft)	49
Link Distance (ft)	17
Upstream Blk Time (%)	7
Queuing Penalty (veh)	4
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 41: NB Crooks Rd &amp; N&gt;S X/O N. of Long Lake

Movement	NB
Directions Served	L
Maximum Queue (ft)	13
Average Queue (ft)	0
95th Queue (ft)	5
Link Distance (ft)	541
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 50: NB Crooks Rd &amp; S&gt;N X/O N. of Long Lake

Movement	EB	NB
Directions Served	L	T
Maximum Queue (ft)	35	7
Average Queue (ft)	12	0
95th Queue (ft)	36	5
Link Distance (ft)	13	67
Upstream Blk Time (%)	2	
Queuing Penalty (veh)	0	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

## Intersection: 51: SB Crooks Rd &amp; S&gt;N X/O N. of Long Lake

Movement	SB	SB	SB	SB	SB
Directions Served	L	T	T	T	T
Maximum Queue (ft)	5	277	285	231	87
Average Queue (ft)	0	121	136	55	6
95th Queue (ft)	3	234	248	170	47
Link Distance (ft)		446	446	446	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	225				150
Storage Blk Time (%)		1		2	
Queuing Penalty (veh)		0		5	



## Intersection: 60: E&gt;W X/O E. of Crooks &amp; WB Long Lake Rd

Movement	WB	WB	WB	NB
Directions Served	T	T	T	L
Maximum Queue (ft)	62	15	27	59
Average Queue (ft)	4	1	1	24
95th Queue (ft)	29	7	11	58
Link Distance (ft)	1483	1483	1483	21
Upstream Blk Time (%)				5
Queuing Penalty (veh)				3
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

## Intersection: 61: EB Long Lake Rd &amp; E&gt;W X/O E. of Crooks

Movement	EB
Directions Served	L
Maximum Queue (ft)	65
Average Queue (ft)	9
95th Queue (ft)	37
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	305
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 70: NB Crooks Rd &amp; WB Long Lake Rd

Movement	WB	WB	WB	WB
Directions Served	T	T	T	R
Maximum Queue (ft)	302	279	207	146
Average Queue (ft)	195	158	107	52
95th Queue (ft)	279	247	189	100
Link Distance (ft)	530	530	530	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				650
Storage Blk Time (%)				
Queuing Penalty (veh)				

## Intersection: 71: SB Crooks Rd &amp; WB Long Lake Rd

Movement	WB	WB	SB	SB	SB	SB
Directions Served	T	T	T	T	T	R
Maximum Queue (ft)	8	15	92	88	86	88
Average Queue (ft)	0	1	77	78	34	46
95th Queue (ft)	5	7	89	86	80	80
Link Distance (ft)	23	23	44	44	44	44
Upstream Blk Time (%)		0	37	45	8	8
Queuing Penalty (veh)		0	108	129	23	22
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

## Intersection: 72: SB Crooks Rd &amp; EB Long Lake Rd

Movement	EB	EB	EB	EB
Directions Served	T	T	T	R
Maximum Queue (ft)	91	85	93	79
Average Queue (ft)	76	75	74	38
95th Queue (ft)	82	80	88	67
Link Distance (ft)	42	42	42	42
Upstream Blk Time (%)	53	53	42	5
Queuing Penalty (veh)	157	155	125	16
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

## Intersection: 73: NB Crooks Rd &amp; EB Long Lake Rd

Movement	NB	NB	NB	NB
Directions Served	T	T	T	R
Maximum Queue (ft)	111	111	116	106
Average Queue (ft)	97	95	95	76
95th Queue (ft)	109	110	111	118
Link Distance (ft)	64	64	64	64
Upstream Blk Time (%)	35	31	28	16
Queuing Penalty (veh)	134	120	109	61
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

## Intersection: 80: E&gt;W X/O W. of Crooks &amp; WB Long Lake Rd

Movement	NB
Directions Served	L
Maximum Queue (ft)	31
Average Queue (ft)	8
95th Queue (ft)	30
Link Distance (ft)	27
Upstream Blk Time (%)	1
Queuing Penalty (veh)	0
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 81: EB Long Lake Rd &amp; E&gt;W X/O W. of Crooks

Movement	EB	EB	EB	EB
Directions Served	T	T	T	T
Maximum Queue (ft)	262	269	259	166
Average Queue (ft)	143	144	124	12
95th Queue (ft)	242	240	222	93
Link Distance (ft)	508	508	508	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				150
Storage Blk Time (%)	2		4	
Queuing Penalty (veh)	0		15	

## Intersection: 90: EB Long Lake Rd &amp; W&gt;E X/O W. of Crooks

Movement	EB	EB	EB	SB
Directions Served	T	T	T	L
Maximum Queue (ft)	80	65	64	92
Average Queue (ft)	15	14	9	53
95th Queue (ft)	55	51	38	95
Link Distance (ft)	44	44	44	34
Upstream Blk Time (%)	1	2	1	15
Queuing Penalty (veh)	5	6	3	35
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

## Intersection: 91: W&gt;E X/O W. of Crooks/S.E. Site Drive &amp; WB Long Lake Rd

Movement	WB
Directions Served	L
Maximum Queue (ft)	12
Average Queue (ft)	0
95th Queue (ft)	7
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	325
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 100: E&gt;W X/O E. of Corporate &amp; WB Long Lake Rd

Movement	NB
Directions Served	L
Maximum Queue (ft)	57
Average Queue (ft)	29
95th Queue (ft)	50
Link Distance (ft)	36
Upstream Blk Time (%)	7
Queuing Penalty (veh)	5
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 101: EB Long Lake Rd &amp; E&gt;W X/O E. of Corporate

Movement	EB	EB	EB	EB
Directions Served	L	T	T	T
Maximum Queue (ft)	4	33	39	8
Average Queue (ft)	0	2	2	0
95th Queue (ft)	3	16	19	5
Link Distance (ft)		520	520	520
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	375			
Storage Blk Time (%)				
Queuing Penalty (veh)				



## Intersection: 110: Investment Dr &amp; EB Long Lake Rd

Movement	EB	EB	EB	EB	NB	NB	SB
Directions Served	T	T	T	R	R	R	LT
Maximum Queue (ft)	59	51	50	39	69	38	65
Average Queue (ft)	35	21	16	11	31	11	25
95th Queue (ft)	60	50	42	35	55	30	58
Link Distance (ft)	13	13	13	13	755	755	35
Upstream Blk Time (%)	8	4	3	1			14
Queuing Penalty (veh)	21	11	7	3			5
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							

## Intersection: 111: Investment Dr &amp; WB Long Lake Rd

Movement	WB	WB	WB	WB	WB
Directions Served	L	T	T	T	T
Maximum Queue (ft)	15	84	119	106	14
Average Queue (ft)	1	15	25	27	1
95th Queue (ft)	6	55	81	81	8
Link Distance (ft)		428	428	428	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	225			300	
Storage Blk Time (%)					
Queuing Penalty (veh)					

## Intersection: 120: Corporate Dr &amp; WB Long Lake Rd

Movement	WB	WB	WB	WB	NB	SB	SB
Directions Served	T	T	T	R	LT	R	R
Maximum Queue (ft)	46	42	50	46	82	125	121
Average Queue (ft)	24	26	28	10	54	61	58
95th Queue (ft)	51	53	56	36	89	107	99
Link Distance (ft)	9	9	9	9	34	225	225
Upstream Blk Time (%)	6	6	7	1	38		
Queuing Penalty (veh)	13	12	14	2	54		
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							

## Intersection: 121: EB Long Lake Rd &amp; Corporate Dr

Movement	EB	EB	EB	EB	EB
Directions Served	L	T	T	T	T
Maximum Queue (ft)	127	70	35	29	6
Average Queue (ft)	25	21	5	3	0
95th Queue (ft)	84	54	21	16	6
Link Distance (ft)		562	562	562	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	375			275	
Storage Blk Time (%)					
Queuing Penalty (veh)					

## Intersection: 130: EB Long Lake Rd &amp; W&gt;E X/O W. of Investment

Movement	SB
Directions Served	L
Maximum Queue (ft)	58
Average Queue (ft)	28
95th Queue (ft)	51
Link Distance (ft)	33
Upstream Blk Time (%)	11
Queuing Penalty (veh)	7
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 131: W&gt;E X/O W. of Investment &amp; WB Long Lake Rd

Movement	WB
Directions Served	L
Maximum Queue (ft)	37
Average Queue (ft)	6
95th Queue (ft)	27
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	350
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 140: NB Crooks Rd &amp; S&gt;N X/O S. of Long Lake

Movement	EB
Directions Served	L
Maximum Queue (ft)	63
Average Queue (ft)	41
95th Queue (ft)	67
Link Distance (ft)	19
Upstream Blk Time (%)	33
Queuing Penalty (veh)	34
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 141: SB Crooks Rd &amp; S&gt;N X/O S. of Long Lake

Movement	SB
Directions Served	L
Maximum Queue (ft)	140
Average Queue (ft)	33
95th Queue (ft)	97
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	375
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 150: SB Crooks Rd &amp; Investment Dr

Movement	EB	EB	WB
Directions Served	R	R	LT
Maximum Queue (ft)	152	105	51
Average Queue (ft)	66	26	27
95th Queue (ft)	124	65	49
Link Distance (ft)	933	933	15
Upstream Blk Time (%)			14
Queuing Penalty (veh)			8
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

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Intersection: 151: NB Crooks Rd & Investment Dr

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Movement	NB
Directions Served	L
Maximum Queue (ft)	10
Average Queue (ft)	0
95th Queue (ft)	6
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	325
Storage Blk Time (%)	
Queuing Penalty (veh)	

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Zone Summary

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Zone wide Queuing Penalty: 2287

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# HCM 6th Signalized Intersection Summary

## 10: Crooks Rd & Corporate Dr/I-75 Ramp

Existing Conditions w/ Improvements

AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑↑	↑		↑↑↑	↑	↑↑	↑↑↑	↑
Traffic Volume (veh/h)	0	447	265	735	544	881	0	712	383	523	1356	271
Future Volume (veh/h)	0	447	265	735	544	881	0	712	383	523	1356	271
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	0	1969	1969	1969	1969	1969	0	1969	1969	1969	1969	1969
Adj Flow Rate, veh/h	0	476	176	782	533	686	0	793	260	551	1427	201
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.95	0.95	0.95
Percent Heavy Veh, %	0	2	2	2	2	2	0	2	2	2	2	2
Cap, veh/h	0	578	245	844	849	2015	0	1320	749	629	2436	756
Arrive On Green	0.00	0.15	0.15	0.23	0.43	0.43	0.00	0.22	0.22	0.17	0.45	0.45
Sat Flow, veh/h	0	3938	1668	3750	1969	3337	0	5906	1668	3638	5375	1668
Grp Volume(v), veh/h	0	476	176	782	533	686	0	793	260	551	1427	201
Grp Sat Flow(s),veh/h/ln	0	1969	1668	1875	1969	1668	0	1969	1668	1819	1792	1668
Q Serve(g_s), s	0.0	14.1	12.1	24.5	25.3	12.3	0.0	14.4	12.2	17.7	23.7	9.0
Cycle Q Clear(g_c), s	0.0	14.1	12.1	24.5	25.3	12.3	0.0	14.4	12.2	17.7	23.7	9.0
Prop In Lane	0.00		1.00	1.00		1.00	0.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	0	578	245	844	849	2015	0	1320	749	629	2436	756
V/C Ratio(X)	0.00	0.82	0.72	0.93	0.63	0.34	0.00	0.60	0.35	0.88	0.59	0.27
Avail Cap(c_a), veh/h	0	784	332	872	966	2215	0	1320	749	703	2436	756
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	49.7	48.8	45.5	26.6	11.8	0.0	41.8	21.6	48.4	24.4	20.4
Incr Delay (d2), s/veh	0.0	5.3	4.8	15.3	1.1	0.1	0.0	2.0	1.3	11.7	1.0	0.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	7.3	5.3	13.0	11.8	4.4	0.0	7.1	5.0	8.8	9.7	3.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	54.9	53.6	60.8	27.7	11.9	0.0	43.8	22.9	60.1	25.5	21.3
LnGrp LOS	A	D	D	E	C	B	A	D	C	E	C	C
Approach Vol, veh/h		652			2001			1053			2179	
Approach Delay, s/veh		54.6			35.3			38.6			33.8	
Approach LOS		D			D			D			C	
Timer - Assigned Phs	1	2	3	4		6		8				
Phs Duration (G+Y+Rc), s	27.6	33.6	34.1	24.7		61.2		58.8				
Change Period (Y+Rc), s	6.8	6.8	* 7.1	* 7.1		6.8		* 7.1				
Max Green Setting (Gmax), s	23.2	17.2	* 28	* 24		47.2		* 59				
Max Q Clear Time (g_c+I1), s	19.7	16.4	26.5	16.1		25.7		27.3				
Green Ext Time (p_c), s	1.0	0.4	0.5	1.5		10.3		5.1				

### Intersection Summary

HCM 6th Ctrl Delay 37.5

HCM 6th LOS D

### Notes

User approved volume balancing among the lanes for turning movement.


\* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

# HCM Signalized Intersection Capacity Analysis

## 30: NB Crooks Rd & Tower Dr

Existing Conditions w/ Improvements

AM Peak Hour


												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↗				↖		↑↑↑	↖			
Traffic Volume (vph)	251	577	0	0	0	195	0	743	108	0	0	0
Future Volume (vph)	251	577	0	0	0	195	0	743	108	0	0	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)		6.0				6.0		6.4	6.4			
Lane Util. Factor		1.00				0.88		0.91	1.00			
Frt		1.00				0.85		1.00	0.85			
Flt Protected		0.99				1.00		1.00	1.00			
Satd. Flow (prot)		1932				2933		5353	1667			
Flt Permitted		0.99				1.00		1.00	1.00			
Satd. Flow (perm)		1932				2933		5353	1667			
Peak-hour factor, PHF	0.89	0.89	0.89	0.73	0.73	0.73	0.95	0.95	0.95	0.92	0.92	0.92
Adj. Flow (vph)	282	648	0	0	0	267	0	782	114	0	0	0
RTOR Reduction (vph)	0	13	0	0	0	21	0	0	76	0	0	0
Lane Group Flow (vph)	0	917	0	0	0	246	0	782	38	0	0	0
Turn Type	custom	NA				Perm		NA	Perm			
Protected Phases		4						2!				
Permitted Phases	4 2!					8			2			
Actuated Green, G (s)		67.9				67.9		39.7	39.7			
Effective Green, g (s)		67.9				67.9		39.7	39.7			
Actuated g/C Ratio		0.57				0.57		0.33	0.33			
Clearance Time (s)		6.0				6.0		6.4	6.4			
Vehicle Extension (s)		4.5				4.5		3.0	3.0			
Lane Grp Cap (vph)		1093				1659		1770	551			
v/s Ratio Prot								c0.15				
v/s Ratio Perm		0.47				0.08			0.02			
v/c Ratio		0.84				0.15		0.44	0.07			
Uniform Delay, d1		21.5				12.3		31.5	27.5			
Progression Factor		0.84				1.00		1.16	3.09			
Incremental Delay, d2		4.6				0.1		0.8	0.2			
Delay (s)		22.8				12.4		37.2	85.2			
Level of Service		C				B		D	F			
Approach Delay (s)		22.8			12.4			43.3			0.0	
Approach LOS		C			B			D			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			30.3				HCM 2000 Level of Service		C			
HCM 2000 Volume to Capacity ratio			0.69									
Actuated Cycle Length (s)			120.0				Sum of lost time (s)		12.4			
Intersection Capacity Utilization			77.5%				ICU Level of Service		D			
Analysis Period (min)			15									
! Phase conflict between lane groups.												
c Critical Lane Group												

# HCM 6th Signalized Intersection Summary

## 10: Crooks Rd & Corporate Dr/I-75 Ramp

Existing Conditions w/ Improvements

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑↑	↑		↑↑↑	↑	↑↑	↑↑↑	↑
Traffic Volume (veh/h)	0	68	419	390	187	804	0	1489	782	462	715	97
Future Volume (veh/h)	0	68	419	390	187	804	0	1489	782	462	715	97
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	0	1969	1969	1969	1969	1969	0	1969	1969	1969	1969	1969
Adj Flow Rate, veh/h	0	74	183	424	203	602	0	1662	547	486	753	70
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.93	0.93	0.93	0.95	0.95	0.95
Percent Heavy Veh, %	0	2	2	2	2	2	0	2	2	2	2	2
Cap, veh/h	0	141	239	497	510	1378	0	2527	935	560	3408	1058
Arrive On Green	0.00	0.07	0.07	0.13	0.26	0.26	0.00	0.43	0.43	0.15	0.63	0.63
Sat Flow, veh/h	0	1969	3337	3750	1969	3337	0	5906	1668	3638	5375	1668
Grp Volume(v), veh/h	0	74	183	424	203	602	0	1662	547	486	753	70
Grp Sat Flow(s),veh/h/ln	0	1969	1668	1875	1969	1668	0	1969	1668	1819	1792	1668
Q Serve(g_s), s	0.0	4.7	7.0	14.4	11.1	16.8	0.0	29.1	27.9	17.0	7.7	2.1
Cycle Q Clear(g_c), s	0.0	4.7	7.0	14.4	11.1	16.8	0.0	29.1	27.9	17.0	7.7	2.1
Prop In Lane	0.00		1.00	1.00		1.00	0.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	0	141	239	497	510	1378	0	2527	935	560	3408	1058
V/C Ratio(X)	0.00	0.52	0.77	0.85	0.40	0.44	0.00	0.66	0.58	0.87	0.22	0.07
Avail Cap(c_a), veh/h	0	195	331	661	650	1615	0	2527	935	649	3408	1058
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	58.2	59.3	55.1	39.8	27.3	0.0	29.6	18.7	53.7	10.1	9.1
Incr Delay (d2), s/veh	0.0	3.0	6.9	8.2	0.5	0.2	0.0	1.4	2.7	11.5	0.1	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	2.5	3.2	7.3	5.4	6.7	0.0	13.5	11.1	8.5	2.9	0.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	61.2	66.2	63.3	40.3	27.6	0.0	31.0	21.3	65.2	10.3	9.2
LnGrp LOS	A	E	E	E	D	C	A	C	C	E	B	A
Approach Vol, veh/h		257			1229			2209			1309	
Approach Delay, s/veh		64.7			42.0			28.6			30.6	
Approach LOS		E			D			C			C	
Timer - Assigned Phs	1	2	3	4		6		8				
Phs Duration (G+Y+Rc), s	26.8	62.4	24.3	16.4		89.2		40.8				
Change Period (Y+Rc), s	6.8	6.8	* 7.1	* 7.1		6.8		* 7.1				
Max Green Setting (Gmax), s	23.2	43.2	* 23	* 13		73.2		* 43				
Max Q Clear Time (g_c+I1), s	19.0	31.1	16.4	9.0		9.7		18.8				
Green Ext Time (p_c), s	1.1	7.1	0.9	0.3		5.3		3.1				

### Intersection Summary

HCM 6th Ctrl Delay	34.3
HCM 6th LOS	C

### Notes

User approved volume balancing among the lanes for turning movement.


\* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

# HCM Signalized Intersection Capacity Analysis

## 30: NB Crooks Rd & Tower Dr

Existing Conditions w/ Improvements

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰				↱↱		↱↱↱	↱			
Traffic Volume (vph)	194	110	0	0	0	653	0	1550	27	0	0	0
Future Volume (vph)	194	110	0	0	0	653	0	1550	27	0	0	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)		6.0				6.0		6.4	6.4			
Lane Util. Factor		1.00				0.88		0.91	1.00			
Frt		1.00				0.85		1.00	0.85			
Flt Protected		0.97				1.00		1.00	1.00			
Satd. Flow (prot)		1900				2933		5353	1667			
Flt Permitted		0.97				1.00		1.00	1.00			
Satd. Flow (perm)		1900				2933		5353	1667			
Peak-hour factor, PHF	0.76	0.76	0.76	0.79	0.79	0.79	0.93	0.93	0.93	0.92	0.92	0.92
Adj. Flow (vph)	255	145	0	0	0	827	0	1667	29	0	0	0
RTOR Reduction (vph)	0	19	0	0	0	19	0	0	13	0	0	0
Lane Group Flow (vph)	0	381	0	0	0	808	0	1667	16	0	0	0
Turn Type	custom	NA				Perm		NA	Perm			
Protected Phases		4						2!				
Permitted Phases	4 2!					8			2			
Actuated Green, G (s)		44.7				44.7		72.9	72.9			
Effective Green, g (s)		44.7				44.7		72.9	72.9			
Actuated g/C Ratio		0.34				0.34		0.56	0.56			
Clearance Time (s)		6.0				6.0		6.4	6.4			
Vehicle Extension (s)		4.5				4.5		3.0	3.0			
Lane Grp Cap (vph)		653				1008		3001	934			
v/s Ratio Prot								c0.31				
v/s Ratio Perm		0.20				c0.28			0.01			
v/c Ratio		0.58				0.80		0.56	0.02			
Uniform Delay, d1		35.0				38.6		18.2	12.7			
Progression Factor		1.18				1.00		1.00	1.00			
Incremental Delay, d2		1.6				5.2		0.7	0.0			
Delay (s)		42.9				43.8		19.0	12.7			
Level of Service		D				D		B	B			
Approach Delay (s)		42.9			43.8			18.9			0.0	
Approach LOS		D			D			B			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		29.2				HCM 2000 Level of Service		C				
HCM 2000 Volume to Capacity ratio		0.65										
Actuated Cycle Length (s)		130.0				Sum of lost time (s)		12.4				
Intersection Capacity Utilization		81.2%				ICU Level of Service		D				
Analysis Period (min)		15										
! Phase conflict between lane groups.												
c Critical Lane Group												



## Intersection: 10: Crooks Rd &amp; Corporate Dr/I-75 Ramp

Movement	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB	NB	NB
Directions Served	T	TR	R	L	L	T	TR	R	T	T	TR	R
Maximum Queue (ft)	276	309	164	364	394	258	303	280	198	198	209	188
Average Queue (ft)	153	183	56	246	251	133	205	171	169	176	182	136
95th Queue (ft)	240	271	115	349	357	226	274	257	212	209	205	210
Link Distance (ft)	362	362	362			1654	1654		146	146	146	146
Upstream Blk Time (%)									31	36	43	7
Queuing Penalty (veh)									85	99	117	20
Storage Bay Dist (ft)				700	700			750				
Storage Blk Time (%)												
Queuing Penalty (veh)												

## Intersection: 10: Crooks Rd &amp; Corporate Dr/I-75 Ramp

Movement	SB	SB	SB	SB	SB	SB
Directions Served	L	L	T	T	T	R
Maximum Queue (ft)	374	425	1054	958	685	131
Average Queue (ft)	301	332	462	353	223	49
95th Queue (ft)	437	482	1033	914	529	90
Link Distance (ft)			1954	1954	1954	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	325	325				700
Storage Blk Time (%)	12	27	3		0	
Queuing Penalty (veh)	55	121	14		0	

## Intersection: 30: NB Crooks Rd &amp; Tower Dr

Movement	EB	WB	WB	NB	NB	NB	NB
Directions Served	LT	R	R	T	T	T	R
Maximum Queue (ft)	77	97	38	239	276	286	124
Average Queue (ft)	55	44	4	114	138	166	37
95th Queue (ft)	67	80	20	211	248	277	87
Link Distance (ft)	17	505	505	562	562	562	
Upstream Blk Time (%)	39						
Queuing Penalty (veh)	327						
Storage Bay Dist (ft)						275	
Storage Blk Time (%)						1	
Queuing Penalty (veh)						1	

## Zone Summary

Zone wide Queuing Penalty: 837

## Intersection: 10: Crooks Rd &amp; Corporate Dr/I-75 Ramp

Movement	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB	NB	NB
Directions Served	T	TR	R	L	L	T	TR	R	T	T	TR	R
Maximum Queue (ft)	95	169	131	242	260	214	308	296	200	220	206	215
Average Queue (ft)	33	76	58	133	164	91	184	163	184	187	186	171
95th Queue (ft)	72	136	107	219	243	174	267	257	197	200	196	224
Link Distance (ft)	362	362	362			1654	1654		146	146	146	146
Upstream Blk Time (%)									34	40	47	17
Queuing Penalty (veh)									195	226	269	99
Storage Bay Dist (ft)				700	700			750				
Storage Blk Time (%)												
Queuing Penalty (veh)												

## Intersection: 10: Crooks Rd &amp; Corporate Dr/I-75 Ramp

Movement	SB	SB	SB	SB	SB	SB
Directions Served	L	L	T	T	T	R
Maximum Queue (ft)	314	360	351	249	133	63
Average Queue (ft)	206	230	128	86	70	22
95th Queue (ft)	326	359	342	244	126	48
Link Distance (ft)			1954	1954	1954	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	325	325			700	
Storage Blk Time (%)	3	5	0			
Queuing Penalty (veh)	7	12	0			

## Intersection: 30: NB Crooks Rd &amp; Tower Dr

Movement	EB	WB	WB	NB	NB	NB	NB
Directions Served	LT	R	R	T	T	T	R
Maximum Queue (ft)	73	465	404	363	460	508	330
Average Queue (ft)	55	238	162	144	190	231	26
95th Queue (ft)	64	372	345	327	386	439	149
Link Distance (ft)	17	505	505	562	562	562	
Upstream Blk Time (%)	62	0				0	
Queuing Penalty (veh)	192	0				0	
Storage Bay Dist (ft)						275	
Storage Blk Time (%)						8	
Queuing Penalty (veh)						2	

## Zone Summary

Zone wide Queuing Penalty: 1002

## **Appendix C**























# **BACKGROUND TRAFFIC CONDITIONS**

# HCM 6th Signalized Intersection Summary

## 10: Crooks Rd & Corporate Dr/I-75 Ramp

### Background Conditions

AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	189	458	83	754	558	903	0	541	393	536	1390	278
Future Volume (veh/h)	189	458	83	754	558	903	0	541	393	536	1390	278
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1969	1969	1969	1969	1969	1969	0	1969	1969	1969	1969	1969
Adj Flow Rate, veh/h	201	487	35	535	1308	453	0	693	218	564	1463	209
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	0	2	2	2	2	2
Cap, veh/h	184	476	291	545	1145	779	0	753	698	640	1935	601
Arrive On Green	0.17	0.17	0.17	0.29	0.29	0.29	0.00	0.13	0.13	0.18	0.36	0.36
Sat Flow, veh/h	1056	2730	1668	1875	3938	1668	0	5906	1668	3638	5375	1668
Grp Volume(v), veh/h	365	323	35	535	1308	453	0	693	218	564	1463	209
Grp Sat Flow(s),veh/h/ln	1916	1870	1668	1875	1969	1668	0	1969	1668	1819	1792	1668
Q Serve(g_s), s	20.9	20.7	2.1	34.0	34.9	23.9	0.0	13.9	10.5	18.1	28.7	11.0
Cycle Q Clear(g_c), s	20.9	20.7	2.1	34.0	34.9	23.9	0.0	13.9	10.5	18.1	28.7	11.0
Prop In Lane	0.55		1.00	1.00		1.00	0.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	334	326	291	545	1145	779	0	753	698	640	1935	601
V/C Ratio(X)	1.09	0.99	0.12	0.98	1.14	0.58	0.00	0.92	0.31	0.88	0.76	0.35
Avail Cap(c_a), veh/h	334	326	291	545	1145	779	0	753	698	703	1935	601
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	49.6	49.5	41.8	42.2	42.5	23.4	0.0	51.7	23.4	48.2	33.8	28.1
Incr Delay (d2), s/veh	76.4	47.8	0.2	33.6	74.8	1.1	0.0	18.3	1.2	12.4	2.8	1.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	16.9	13.9	0.9	20.5	28.5	9.3	0.0	8.0	6.6	9.1	12.4	4.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	126.0	97.2	42.0	75.8	117.3	24.5	0.0	70.0	24.5	60.6	36.6	29.7
LnGrp LOS	F	F	D	E	F	C	A	E	C	E	D	C
Approach Vol, veh/h	723			2296			911			2236		
Approach Delay, s/veh	109.1			89.3			59.1			42.0		
Approach LOS	F			F			E			D		
Timer - Assigned Phs	1	2	4			6	8					
Phs Duration (G+Y+Rc), s	27.9	22.1	42.0			50.0	28.0					
Change Period (Y+Rc), s	6.8	6.8	* 7.1			6.8	7.1					
Max Green Setting (Gmax), s	23.2	13.2	* 35			43.2	20.9					
Max Q Clear Time (g_c+I1), s	20.1	15.9	36.9			30.7	22.9					
Green Ext Time (p_c), s	1.0	0.0	0.0			7.6	0.0					

### Intersection Summary

HCM 6th Ctrl Delay 70.0

HCM 6th LOS E

### Notes

User approved volume balancing among the lanes for turning movement.

\* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.






















Intersection						
Int Delay, s/veh	2					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕↕	↕↕	↗	↖	↗
Traffic Vol, veh/h	96	718	809	27	12	35
Future Vol, veh/h	96	718	809	27	12	35
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	0	0	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	94	94	94	94	60	60
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	102	764	861	29	20	58
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	890	0	-	0	1447	431
Stage 1	-	-	-	-	861	-
Stage 2	-	-	-	-	586	-
Critical Hdwy	4.14	-	-	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	2.22	-	-	-	3.52	3.32
Pot Cap-1 Maneuver	757	-	-	-	122	573
Stage 1	-	-	-	-	374	-
Stage 2	-	-	-	-	519	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	757	-	-	-	93	573
Mov Cap-2 Maneuver	-	-	-	-	93	-
Stage 1	-	-	-	-	286	-
Stage 2	-	-	-	-	519	-
Approach	EB	WB		SB		
HCM Control Delay, s	2.1	0		22.7		
HCM LOS	C					
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	757	-	-	-	93	573
HCM Lane V/C Ratio	0.135	-	-	-	0.215	0.102
HCM Control Delay (s)	10.5	1	-	-	54	12
HCM Lane LOS	B	A	-	-	F	B
HCM 95th %tile Q(veh)	0.5	-	-	-	0.8	0.3

# HCM Signalized Intersection Capacity Analysis

## 30: NB Crooks Rd & Tower Dr



Background Conditions

AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations						 		  				
Traffic Volume (vph)	68	592	0	0	0	200	0	762	110	0	0	0
Future Volume (vph)	68	592	0	0	0	200	0	762	110	0	0	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)		6.0				6.0		6.4	6.4			
Lane Util. Factor		1.00				0.88		0.91	1.00			
Frt		1.00				0.85		1.00	0.85			
Flt Protected		0.99				1.00		1.00	1.00			
Satd. Flow (prot)		1951				2933		5353	1667			
Flt Permitted		0.99				1.00		1.00	1.00			
Satd. Flow (perm)		1951				2933		5353	1667			
Peak-hour factor, PHF	0.89	0.89	0.89	0.73	0.73	0.73	0.95	0.95	0.95	0.92	0.92	0.92
Adj. Flow (vph)	76	665	0	0	0	274	0	802	116	0	0	0
RTOR Reduction (vph)	0	16	0	0	0	23	0	0	68	0	0	0
Lane Group Flow (vph)	0	725	0	0	0	251	0	802	48	0	0	0
Turn Type	custom	NA				Perm		NA	Perm			
Protected Phases		4						2!				
Permitted Phases	4 2!					8			2			
Actuated Green, G (s)		57.8				57.8		49.8	49.8			
Effective Green, g (s)		57.8				57.8		49.8	49.8			
Actuated g/C Ratio		0.48				0.48		0.41	0.41			
Clearance Time (s)		6.0				6.0		6.4	6.4			
Vehicle Extension (s)		4.5				4.5		3.0	3.0			
Lane Grp Cap (vph)		939				1412		2221	691			
v/s Ratio Prot								c0.15				
v/s Ratio Perm		0.37				0.09			0.03			
v/c Ratio		0.77				0.18		0.36	0.07			
Uniform Delay, d1		25.7				17.6		24.2	21.1			
Progression Factor		0.97				1.00		0.96	2.31			
Incremental Delay, d2		2.4				0.1		0.4	0.2			
Delay (s)		27.2				17.7		23.6	49.0			
Level of Service		C				B		C	D			
Approach Delay (s)		27.2			17.7			26.8			0.0	
Approach LOS		C			B			C			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		25.7				HCM 2000 Level of Service		C				
HCM 2000 Volume to Capacity ratio		0.58										
Actuated Cycle Length (s)		120.0				Sum of lost time (s)		12.4				
Intersection Capacity Utilization		69.1%				ICU Level of Service		C				
Analysis Period (min)		15										
! Phase conflict between lane groups.												
c Critical Lane Group												

HCM 6th TWSC  
40: SB Crooks Rd & N>S X/O N. of Long Lake

Background Conditions  
AM Peak Hour

Intersection						
Int Delay, s/veh	0.4					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	41	0	0	0	0	1498
Future Vol, veh/h	41	0	0	0	0	1498
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	16974	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	75	75	92	92	91	91
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	55	0	0	0	0	1646

Major/Minor	Minor1	Major2	
Conflicting Flow All	658	-	-
Stage 1	0	-	-
Stage 2	658	-	-
Critical Hdwy	5.74	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	6.04	-	-
Follow-up Hdwy	3.82	-	-
Pot Cap-1 Maneuver	459	0	-
Stage 1	-	0	-
Stage 2	434	0	-
Platoon blocked, %			-
Mov Cap-1 Maneuver	459	-	-
Mov Cap-2 Maneuver	459	-	-
Stage 1	-	-	-
Stage 2	434	-	-

Approach	WB	SB
HCM Control Delay, s	13.9	0
HCM LOS	B	



Minor Lane/Major Mvmt	WBLn1	SBT
Capacity (veh/h)	459	-
HCM Lane V/C Ratio	0.119	-
HCM Control Delay (s)	13.9	-
HCM Lane LOS	B	-
HCM 95th %tile Q(veh)	0.4	-

HCM 6th TWSC  
50: NB Crooks Rd & S>N X/O N. of Long Lake

Background Conditions  
AM Peak Hour

Intersection

Int Delay, s/veh 0.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	10	0	0	880	0	0
Future Vol, veh/h	10	0	0	880	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	16979	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	75	75	95	95	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	13	0	0	926	0	0

Major/Minor	Minor2	Major1	
Conflicting Flow All	370	-	0
Stage 1	0	-	-
Stage 2	370	-	-
Critical Hdwy	5.74	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	6.04	-	-
Follow-up Hdwy	3.82	-	-
Pot Cap-1 Maneuver	632	0	-
Stage 1	-	0	-
Stage 2	613	0	-
Platoon blocked, %			-
Mov Cap-1 Maneuver	632	-	-
Mov Cap-2 Maneuver	632	-	-
Stage 1	-	-	-
Stage 2	613	-	-

Approach	EB	NB
HCM Control Delay, s	10.8	0
HCM LOS	B	

Minor Lane/Major Mvmt	NBT	EBLn1
Capacity (veh/h)	-	632
HCM Lane V/C Ratio	-	0.021
HCM Control Delay (s)	-	10.8
HCM Lane LOS	-	B
HCM 95th %tile Q(veh)	-	0.1



# HCM Signalized Intersection Capacity Analysis

## 60: E>W X/O E. of Crooks & WB Long Lake Rd

Background Conditions


AM Peak Hour

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations				↑↑↑	↖	
Traffic Volume (vph)	0	0	0	1384	88	0
Future Volume (vph)	0	0	0	1384	88	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000
Total Lost time (s)				6.6	5.4	
Lane Util. Factor				0.91	1.00	
Frt				1.00	1.00	
Flt Protected				1.00	0.95	
Satd. Flow (prot)				5353	1863	
Flt Permitted				1.00	0.95	
Satd. Flow (perm)				5353	1863	
Peak-hour factor, PHF	0.92	0.92	0.95	0.95	0.82	0.82
Adj. Flow (vph)	0	0	0	1457	107	0
RTOR Reduction (vph)	0	0	0	0	24	0
Lane Group Flow (vph)	0	0	0	1457	83	0
Turn Type				NA	Prot	
Protected Phases				6	8	
Permitted Phases						
Actuated Green, G (s)				97.3	10.7	
Effective Green, g (s)				97.3	10.7	
Actuated g/C Ratio				0.81	0.09	
Clearance Time (s)				6.6	5.4	
Vehicle Extension (s)				3.0	3.0	
Lane Grp Cap (vph)				4340	166	
v/s Ratio Prot				c0.27	c0.04	
v/s Ratio Perm						
v/c Ratio				0.34	0.50	
Uniform Delay, d1				3.0	52.1	
Progression Factor				1.00	0.80	
Incremental Delay, d2				0.2	2.3	
Delay (s)				3.2	43.8	
Level of Service				A	D	
Approach Delay (s)	0.0			3.2	43.8	
Approach LOS	A			A	D	
<b>Intersection Summary</b>						
HCM 2000 Control Delay			5.9	HCM 2000 Level of Service		A
HCM 2000 Volume to Capacity ratio			0.35			
Actuated Cycle Length (s)			120.0	Sum of lost time (s)		12.0
Intersection Capacity Utilization			46.6%	ICU Level of Service		A
Analysis Period (min)			15			
c Critical Lane Group						

# HCM Signalized Intersection Capacity Analysis

## 70: NB Crooks Rd & WB Long Lake Rd

Background Conditions  
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑↑	↑		↑↑↑				
Traffic Volume (vph)	0	0	0	0	1295	177	0	703	0	0	0	0
Future Volume (vph)	0	0	0	0	1295	177	0	703	0	0	0	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)					11.9	11.9		5.9				
Lane Util. Factor					0.91	1.00		0.91				
Frt					1.00	0.85		1.00				
Flt Protected					1.00	1.00		1.00				
Satd. Flow (prot)					5353	1667		5353				
Flt Permitted					1.00	1.00		1.00				
Satd. Flow (perm)					5353	1667		5353				
Peak-hour factor, PHF	0.92	0.92	0.92	0.95	0.95	0.95	0.93	0.93	0.93	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	1363	186	0	756	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	76	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	1363	110	0	756	0	0	0	0
Turn Type					NA	Perm		NA				
Protected Phases					4			6				
Permitted Phases						4						
Actuated Green, G (s)					42.9	42.9		59.3				
Effective Green, g (s)					42.9	42.9		59.3				
Actuated g/C Ratio					0.36	0.36		0.49				
Clearance Time (s)					11.9	11.9		5.9				
Vehicle Extension (s)					3.0	3.0		3.0				
Lane Grp Cap (vph)					1913	595		2645				
v/s Ratio Prot					c0.25			c0.14				
v/s Ratio Perm						0.07						
v/c Ratio					0.71	0.18		0.29				
Uniform Delay, d1					33.2	26.5		17.9				
Progression Factor					0.96	0.98		0.00				
Incremental Delay, d2					1.2	0.1		0.3				
Delay (s)					33.2	26.3		0.3				
Level of Service					C	C		A				
Approach Delay (s)		0.0			32.4			0.3			0.0	
Approach LOS		A			C			A			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			21.9									
HCM 2000 Level of Service											C	
HCM 2000 Volume to Capacity ratio			0.49									
Actuated Cycle Length (s)			120.0								23.8	
Intersection Capacity Utilization			61.0%								B	
ICU Level of Service												
Analysis Period (min)			15									
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis

71: SB Crooks Rd & WB Long Lake Rd

Background Conditions

AM Peak Hour


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑↑						↑↑↑	↑
Traffic Volume (vph)	0	0	0	0	1295	0	0	0	0	0	1218	147
Future Volume (vph)	0	0	0	0	1295	0	0	0	0	0	1218	147
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)					5.9						11.9	11.9
Lane Util. Factor					0.91						0.91	1.00
Frt					1.00						1.00	0.85
Flt Protected					1.00						1.00	1.00
Satd. Flow (prot)					5353						5353	1667
Flt Permitted					1.00						1.00	1.00
Satd. Flow (perm)					5353						5353	1667
Peak-hour factor, PHF	0.92	0.92	0.92	0.95	0.95	0.95	0.92	0.92	0.92	0.91	0.91	0.91
Adj. Flow (vph)	0	0	0	0	1363	0	0	0	0	0	1338	162
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	45
Lane Group Flow (vph)	0	0	0	0	1363	0	0	0	0	0	1338	117
Turn Type					NA						NA	Perm
Protected Phases					8						2	
Permitted Phases												2
Actuated Green, G (s)					48.9						53.3	53.3
Effective Green, g (s)					48.9						53.3	53.3
Actuated g/C Ratio					0.41						0.44	0.44
Clearance Time (s)					5.9						11.9	11.9
Vehicle Extension (s)					3.0						3.0	3.0
Lane Grp Cap (vph)					2181						2377	740
v/s Ratio Prot					c0.25						c0.25	
v/s Ratio Perm												0.07
v/c Ratio					0.62						0.56	0.16
Uniform Delay, d1					28.3						24.7	19.9
Progression Factor					0.00						1.00	1.00
Incremental Delay, d2					0.4						1.0	0.5
Delay (s)					0.4						25.7	20.4
Level of Service					A						C	C
Approach Delay (s)		0.0			0.4			0.0			25.1	
Approach LOS		A			A			A			C	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			13.4									HCM 2000 Level of Service B
HCM 2000 Volume to Capacity ratio			0.63									
Actuated Cycle Length (s)			120.0								23.8	
Intersection Capacity Utilization			61.0%									ICU Level of Service B
Analysis Period (min)			15									
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis

## 72: SB Crooks Rd & EB Long Lake Rd

Background Conditions

AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑	↑								↑↑↑	
Traffic Volume (vph)	0	593	171	0	0	0	0	0	0	0	1218	0
Future Volume (vph)	0	593	171	0	0	0	0	0	0	0	1218	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)		11.9	11.9								5.9	
Lane Util. Factor		0.91	1.00								0.91	
Frt		1.00	0.85								1.00	
Flt Protected		1.00	1.00								1.00	
Satd. Flow (prot)		5353	1667								5353	
Flt Permitted		1.00	1.00								1.00	
Satd. Flow (perm)		5353	1667								5353	
Peak-hour factor, PHF	0.90	0.90	0.90	0.92	0.92	0.92	0.92	0.92	0.92	0.91	0.91	0.91
Adj. Flow (vph)	0	659	190	0	0	0	0	0	0	0	1338	0
RTOR Reduction (vph)	0	0	52	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	659	138	0	0	0	0	0	0	0	1338	0
Turn Type		NA	Perm								NA	
Protected Phases		4									6	
Permitted Phases			4									
Actuated Green, G (s)		42.9	42.9								59.3	
Effective Green, g (s)		42.9	42.9								59.3	
Actuated g/C Ratio		0.36	0.36								0.49	
Clearance Time (s)		11.9	11.9								5.9	
Vehicle Extension (s)		3.0	3.0								3.0	
Lane Grp Cap (vph)		1913	595								2645	
v/s Ratio Prot		c0.12									c0.25	
v/s Ratio Perm			0.08									
v/c Ratio		0.34	0.23								0.51	
Uniform Delay, d1		28.2	27.0								20.5	
Progression Factor		1.37	1.70								0.00	
Incremental Delay, d2		0.1	0.2								0.6	
Delay (s)		38.7	46.1								0.6	
Level of Service		D	D								A	
Approach Delay (s)		40.3			0.0			0.0			0.6	
Approach LOS		D			A			A			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			16.0									HCM 2000 Level of Service B
HCM 2000 Volume to Capacity ratio			0.47									
Actuated Cycle Length (s)			120.0								23.8	
Intersection Capacity Utilization			61.0%									ICU Level of Service B
Analysis Period (min)			15									
c Critical Lane Group												




# HCM Signalized Intersection Capacity Analysis

## 73: NB Crooks Rd & EB Long Lake Rd

Background Conditions

AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑						↑↑↑	↑			
Traffic Volume (vph)	0	593	0	0	0	0	0	703	153	0	0	0
Future Volume (vph)	0	593	0	0	0	0	0	703	153	0	0	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)		5.9						11.9	11.9			
Lane Util. Factor		0.91						0.91	1.00			
Frt		1.00						1.00	0.85			
Flt Protected		1.00						1.00	1.00			
Satd. Flow (prot)		5353						5353	1667			
Flt Permitted		1.00						1.00	1.00			
Satd. Flow (perm)		5353						5353	1667			
Peak-hour factor, PHF	0.90	0.90	0.90	0.92	0.92	0.92	0.93	0.93	0.93	0.92	0.92	0.92
Adj. Flow (vph)	0	659	0	0	0	0	0	756	165	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	89	0	0	0
Lane Group Flow (vph)	0	659	0	0	0	0	0	756	76	0	0	0
Turn Type		NA						NA	Perm			
Protected Phases		8						2				
Permitted Phases									2			
Actuated Green, G (s)		48.9						53.3	53.3			
Effective Green, g (s)		48.9						53.3	53.3			
Actuated g/C Ratio		0.41						0.44	0.44			
Clearance Time (s)		5.9						11.9	11.9			
Vehicle Extension (s)		3.0						3.0	3.0			
Lane Grp Cap (vph)		2181						2377	740			
v/s Ratio Prot		c0.12						c0.14				
v/s Ratio Perm									0.05			
v/c Ratio		0.30						0.32	0.10			
Uniform Delay, d1		24.0						21.6	19.4			
Progression Factor		0.00						1.00	1.00			
Incremental Delay, d2		0.1						0.4	0.3			
Delay (s)		0.1						21.9	19.7			
Level of Service		A						C	B			
Approach Delay (s)		0.1			0.0			21.5			0.0	
Approach LOS		A			A			C			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		12.6						HCM 2000 Level of Service	B			
HCM 2000 Volume to Capacity ratio		0.33										
Actuated Cycle Length (s)		120.0						Sum of lost time (s)	23.8			
Intersection Capacity Utilization		51.5%						ICU Level of Service	A			
Analysis Period (min)		15										
c Critical Lane Group												

HCM 6th TWSC  
80: E>W X/O W. of Crooks & WB Long Lake Rd

Background Conditions  
AM Peak Hour

Intersection						
Int Delay, s/veh	0					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations				↑↑↑	↑	
Traffic Vol, veh/h	0	0	0	1442	0	0
Future Vol, veh/h	0	0	0	1442	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	95	95	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	0	0	1518	0	0

Major/Minor	Major2	Minor1
Conflicting Flow All	-	607
Stage 1	-	0
Stage 2	-	607
Critical Hdwy	-	5.74
Critical Hdwy Stg 1	-	-
Critical Hdwy Stg 2	-	6.04
Follow-up Hdwy	-	3.82
Pot Cap-1 Maneuver	0	486
Stage 1	0	-
Stage 2	0	462
Platoon blocked, %	-	-
Mov Cap-1 Maneuver	-	486
Mov Cap-2 Maneuver	-	486
Stage 1	-	-
Stage 2	-	462

Approach	WB	NB
HCM Control Delay, s	0	0
HCM LOS		A

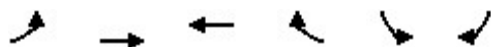
Minor Lane/Major Mvmt	NBLn1	WBT
Capacity (veh/h)	-	-
HCM Lane V/C Ratio	-	-
HCM Control Delay (s)	0	-
HCM Lane LOS	A	-
HCM 95th %tile Q(veh)	-	-

# HCM Signalized Intersection Capacity Analysis

## 90: EB Long Lake Rd & W>E X/O W. of Crooks

Background Conditions

AM Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑↑			↑	
Traffic Volume (vph)	0	495	0	0	269	0
Future Volume (vph)	0	495	0	0	269	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000
Total Lost time (s)		6.0			5.4	
Lane Util. Factor		0.91			1.00	
Frt		1.00			1.00	
Flt Protected		1.00			0.95	
Satd. Flow (prot)		5353			1863	
Flt Permitted		1.00			0.95	
Satd. Flow (perm)		5353			1863	
Peak-hour factor, PHF	0.91	0.91	0.92	0.92	0.91	0.91
Adj. Flow (vph)	0	544	0	0	296	0
RTOR Reduction (vph)	0	0	0	0	142	0
Lane Group Flow (vph)	0	544	0	0	154	0
Turn Type		NA			Prot	
Protected Phases		2			4	
Permitted Phases						
Actuated Green, G (s)		93.5			15.1	
Effective Green, g (s)		93.5			15.1	
Actuated g/C Ratio		0.78			0.13	
Clearance Time (s)		6.0			5.4	
Vehicle Extension (s)		3.0			3.0	
Lane Grp Cap (vph)		4170			234	
v/s Ratio Prot		c0.10			c0.08	
v/s Ratio Perm						
v/c Ratio		0.13			0.66	
Uniform Delay, d1		3.3			50.0	
Progression Factor		1.00			0.70	
Incremental Delay, d2		0.1			5.7	
Delay (s)		3.3			40.9	
Level of Service		A			D	
Approach Delay (s)		3.3	0.0		40.9	
Approach LOS		A	A		D	
<b>Intersection Summary</b>						
HCM 2000 Control Delay		16.6		HCM 2000 Level of Service		B
HCM 2000 Volume to Capacity ratio		0.20				
Actuated Cycle Length (s)		120.0		Sum of lost time (s)		11.4
Intersection Capacity Utilization		45.6%		ICU Level of Service		A
Analysis Period (min)		15				
c Critical Lane Group						


Intersection						
Int Delay, s/veh	0.9					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations				↑↑↑↑	↑	
Traffic Vol, veh/h	0	0	0	1173	72	0
Future Vol, veh/h	0	0	0	1173	72	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	95	95	80	80
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	0	0	1235	90	0
Major/Minor		Major2		Minor1		
Conflicting Flow All			-	-	494	-
Stage 1			-	-	0	-
Stage 2			-	-	494	-
Critical Hdwy			-	-	5.74	-
Critical Hdwy Stg 1			-	-	-	-
Critical Hdwy Stg 2			-	-	6.04	-
Follow-up Hdwy			-	-	3.82	-
Pot Cap-1 Maneuver			0	-	551	0
Stage 1			0	-	-	0
Stage 2			0	-	529	0
Platoon blocked, %				-		
Mov Cap-1 Maneuver			-	-	551	-
Mov Cap-2 Maneuver			-	-	551	-
Stage 1			-	-	-	-
Stage 2			-	-	529	-
Approach			WB		NB	
HCM Control Delay, s			0		12.8	
HCM LOS					B	
Minor Lane/Major Mvmt	NBLn1	WBT				
Capacity (veh/h)	551	-				
HCM Lane V/C Ratio	0.163	-				
HCM Control Delay (s)	12.8	-				
HCM Lane LOS	B	-				
HCM 95th %tile Q(veh)	0.6	-				



# HCM Signalized Intersection Capacity Analysis

## 110: Investment Dr & EB Long Lake Rd

Background Conditions  
AM Peak Hour


												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑	↑						↑↑		↑	
Traffic Volume (vph)	0	500	142	0	0	0	0	0	67	0	72	0
Future Volume (vph)	0	500	142	0	0	0	0	0	67	0	72	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)		6.0	6.0						5.5		5.5	
Lane Util. Factor		0.91	1.00						0.88		1.00	
Frt		1.00	0.85						0.85		1.00	
Flt Protected		1.00	1.00						1.00		1.00	
Satd. Flow (prot)		5353	1667						2933		1961	
Flt Permitted		1.00	1.00						1.00		1.00	
Satd. Flow (perm)		5353	1667						2933		1961	
Peak-hour factor, PHF	0.93	0.93	0.93	0.92	0.92	0.92	0.84	0.84	0.84	0.78	0.78	0.78
Adj. Flow (vph)	0	538	153	0	0	0	0	0	80	0	92	0
RTOR Reduction (vph)	0	0	29	0	0	0	0	0	73	0	0	0
Lane Group Flow (vph)	0	538	124	0	0	0	0	0	7	0	92	0
Turn Type		NA	Perm						Perm		NA	
Protected Phases		2!									4	
Permitted Phases			2						8	4 2!		
Actuated Green, G (s)		97.5	97.5						11.0		11.0	
Effective Green, g (s)		97.5	97.5						11.0		11.0	
Actuated g/C Ratio		0.81	0.81						0.09		0.09	
Clearance Time (s)		6.0	6.0						5.5		5.5	
Vehicle Extension (s)		4.0	4.0						3.0		3.0	
Lane Grp Cap (vph)		4349	1354						268		179	
v/s Ratio Prot		c0.10									c0.05	
v/s Ratio Perm			0.07						0.00			
v/c Ratio		0.12	0.09						0.03		0.51	
Uniform Delay, d1		2.3	2.3						49.6		52.0	
Progression Factor		1.00	1.00						1.00		1.45	
Incremental Delay, d2		0.1	0.1						0.0		2.2	
Delay (s)		2.4	2.4						49.7		77.6	
Level of Service		A	A						D		E	
Approach Delay (s)		2.4			0.0			49.7			77.6	
Approach LOS		A			A			D			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			14.8									HCM 2000 Level of Service B
HCM 2000 Volume to Capacity ratio			0.16									
Actuated Cycle Length (s)			120.0									Sum of lost time (s) 11.5
Intersection Capacity Utilization			40.7%									ICU Level of Service A
Analysis Period (min)			15									
! Phase conflict between lane groups.												
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis

## 120: Corporate Dr & WB Long Lake Rd

Background Conditions

AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑↑	↑		↑				↑↑
Traffic Volume (vph)	0	0	0	0	912	261	39	218	0	0	0	181
Future Volume (vph)	0	0	0	0	912	261	39	218	0	0	0	181
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)					6.3	6.3		5.8				5.8
Lane Util. Factor					0.91	1.00		1.00				0.88
Frt					1.00	0.85		1.00				0.85
Flt Protected					1.00	1.00		0.99				1.00
Satd. Flow (prot)					5353	1667		1946				2933
Flt Permitted					1.00	1.00		0.99				1.00
Satd. Flow (perm)					5353	1667		1946				2933
Peak-hour factor, PHF	0.92	0.92	0.92	0.95	0.95	0.95	0.89	0.89	0.89	0.81	0.81	0.81
Adj. Flow (vph)	0	0	0	0	960	275	44	245	0	0	0	223
RTOR Reduction (vph)	0	0	0	0	0	78	0	25	0	0	0	105
Lane Group Flow (vph)	0	0	0	0	960	197	0	265	0	0	0	118
Turn Type					NA	Perm	custom	NA				Perm
Protected Phases					6!			8				
Permitted Phases						6	8 6!					4
Actuated Green, G (s)					85.9	85.9		22.0				22.0
Effective Green, g (s)					85.9	85.9		22.0				22.0
Actuated g/C Ratio					0.72	0.72		0.18				0.18
Clearance Time (s)					6.3	6.3		5.8				5.8
Vehicle Extension (s)					4.0	4.0		3.0				3.0
Lane Grp Cap (vph)					3831	1193		356				537
v/s Ratio Prot					c0.18							
v/s Ratio Perm						0.12		0.14				0.04
v/c Ratio					0.25	0.17		0.74				0.22
Uniform Delay, d1					5.9	5.5		46.3				41.7
Progression Factor					3.03	13.63		1.00				0.70
Incremental Delay, d2					0.1	0.3		8.1				0.1
Delay (s)					18.0	75.1		54.5				29.2
Level of Service					B	E		D				C
Approach Delay (s)		0.0			30.8			54.5			29.2	
Approach LOS		A			C			D			C	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			34.5									
HCM 2000 Level of Service												C
HCM 2000 Volume to Capacity ratio			0.35									
Actuated Cycle Length (s)			120.0									
Sum of lost time (s)											12.1	
Intersection Capacity Utilization			50.6%									
ICU Level of Service												A
Analysis Period (min)			15									
! Phase conflict between lane groups.												
c Critical Lane Group												



HCM 6th TWSC  
130: EB Long Lake Rd & W>E X/O W. of Investment

Background Conditions  
AM Peak Hour

Intersection						
Int Delay, s/veh	1.2					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑↑↑			↑	
Traffic Vol, veh/h	0	835	0	0	64	0
Future Vol, veh/h	0	835	0	0	64	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	16983	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	93	93	92	92	64	64
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	898	0	0	100	0
Major/Minor	Major1		Minor2			
Conflicting Flow All	-	0			359	-
Stage 1	-	-			0	-
Stage 2	-	-			359	-
Critical Hdwy	-	-			5.74	-
Critical Hdwy Stg 1	-	-			-	-
Critical Hdwy Stg 2	-	-			6.04	-
Follow-up Hdwy	-	-			3.82	-
Pot Cap-1 Maneuver	0	-			639	0
Stage 1	0	-			-	0
Stage 2	0	-			621	0
Platoon blocked, %		-				
Mov Cap-1 Maneuver	-	-			639	-
Mov Cap-2 Maneuver	-	-			639	-
Stage 1	-	-			-	-
Stage 2	-	-			621	-
Approach	EB		SB			
HCM Control Delay, s	0		11.7			
HCM LOS			B			
Minor Lane/Major Mvmt	EBT SBLn1					
Capacity (veh/h)	- 639					
HCM Lane V/C Ratio	- 0.156					
HCM Control Delay (s)	- 11.7					
HCM Lane LOS	- B					
HCM 95th %tile Q(veh)	- 0.6					

HCM 6th TWSC  
140: NB Crooks Rd & S>N X/O S. of Long Lake

Background Conditions  
AM Peak Hour

Intersection						
Int Delay, s/veh	0.5					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	38	0	0	884	0	0
Future Vol, veh/h	38	0	0	884	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	16979	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	81	81	93	93	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	47	0	0	951	0	0

Major/Minor	Minor2	Major1	
Conflicting Flow All	380	-	0
Stage 1	0	-	-
Stage 2	380	-	-
Critical Hdwy	5.74	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	6.04	-	-
Follow-up Hdwy	3.82	-	-
Pot Cap-1 Maneuver	625	0	0
Stage 1	-	0	0
Stage 2	605	0	0
Platoon blocked, %			-
Mov Cap-1 Maneuver	625	-	-
Mov Cap-2 Maneuver	625	-	-
Stage 1	-	-	-
Stage 2	605	-	-

Approach	EB	NB
HCM Control Delay, s	11.2	0
HCM LOS	B	

Minor Lane/Major Mvmt	NBT	EBLn1
Capacity (veh/h)	-	625
HCM Lane V/C Ratio	-	0.075
HCM Control Delay (s)	-	11.2
HCM Lane LOS	-	B
HCM 95th %tile Q(veh)	-	0.2



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150: SB Crooks Rd & Investment Dr Performance by movement

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Movement	EBR	WBL	WBT	SBT	SBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.1	0.0	0.0	0.0	0.0	0.0
Total Delay (hr)	0.7	0.1	0.6	0.2	0.0	1.6
Total Del/Veh (s)	19.8	15.5	14.2	0.7	0.3	3.4

# HCM Signalized Intersection Capacity Analysis

## 10: Crooks Rd & Corporate Dr/I-75 Ramp

Background Conditions

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔↔	↔	↔	↔↔	↔		↔↔↔	↔	↔↔	↔↔↔	↔
Traffic Volume (vph)	89	70	340	400	192	824	0	1437	802	474	733	99
Future Volume (vph)	89	70	340	400	192	824	0	1437	802	474	733	99
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)		7.1	7.1	7.1	7.1	6.8		6.8	7.1	6.8	6.8	6.8
Lane Util. Factor		0.95	1.00	0.91	0.86	0.91		0.86	0.86	0.97	0.91	1.00
Frt		1.00	0.85	1.00	0.91	0.85		0.97	0.85	1.00	1.00	0.85
Flt Protected		0.97	1.00	0.95	1.00	1.00		1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		3624	1667	1695	3043	1517		4929	1433	3614	5353	1667
Flt Permitted		0.97	1.00	0.95	1.00	1.00		1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		3624	1667	1695	3043	1517		4929	1433	3614	5353	1667
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.93	0.93	0.93	0.95	0.95	0.95
Adj. Flow (vph)	97	76	370	435	209	896	0	1545	862	499	772	104
RTOR Reduction (vph)	0	0	134	0	234	58	0	22	78	0	0	47
Lane Group Flow (vph)	0	173	236	378	480	390	0	1842	465	499	772	57
Turn Type	Split	NA	Perm	Split	NA	pm+ov		NA	pm+ov	Prot	NA	Perm
Protected Phases	8	8		4	4	1		2		1	6	
Permitted Phases			8			4			2			6
Actuated Green, G (s)		12.9	12.9	24.9	24.9	47.4		41.9	66.8	22.5	71.2	71.2
Effective Green, g (s)		12.9	12.9	24.9	24.9	47.4		41.9	66.8	22.5	71.2	71.2
Actuated g/C Ratio		0.10	0.10	0.19	0.19	0.36		0.32	0.51	0.17	0.55	0.55
Clearance Time (s)		7.1	7.1	7.1	7.1	6.8		6.8	7.1	6.8	6.8	6.8
Vehicle Extension (s)		3.0	3.0	3.0	3.0	4.0		3.0	3.0	4.0	4.0	4.0
Lane Grp Cap (vph)		359	165	324	582	553		1588	736	625	2931	913
v/s Ratio Prot		0.05		c0.22	0.16	0.12		c0.37	0.12	c0.14	0.14	
v/s Ratio Perm			c0.14			0.14			0.20			0.03
v/c Ratio		0.48	1.43	1.17	0.82	0.71		1.16	0.63	0.80	0.26	0.06
Uniform Delay, d1		55.4	58.5	52.5	50.4	35.3		44.0	22.7	51.6	15.5	13.8
Progression Factor		1.00	1.00	1.00	1.00	1.00		1.05	1.16	1.00	1.00	1.00
Incremental Delay, d2		1.0	224.3	103.2	9.2	4.4		78.2	1.4	7.4	0.2	0.1
Delay (s)		56.4	282.9	155.8	59.7	39.7		124.3	27.7	59.0	15.8	13.9
Level of Service		E	F	F	E	D		F	C	E	B	B
Approach Delay (s)		210.7			77.5			102.5			31.3	
Approach LOS		F			E			F			C	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		89.3										
HCM 2000 Volume to Capacity ratio		1.11										
Actuated Cycle Length (s)		130.0										
Intersection Capacity Utilization		89.0%										
Analysis Period (min)		15										
c Critical Lane Group												




















Intersection						
Int Delay, s/veh	2.7					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕↕	↕↕	↗	↖	↗
Traffic Vol, veh/h	41	448	287	4	51	84
Future Vol, veh/h	41	448	287	4	51	84
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	0	0	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	72	72
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	45	487	312	4	71	117
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	316	0	-	0	646	156
Stage 1	-	-	-	-	312	-
Stage 2	-	-	-	-	334	-
Critical Hdwy	4.14	-	-	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	2.22	-	-	-	3.52	3.32
Pot Cap-1 Maneuver	1241	-	-	-	404	862
Stage 1	-	-	-	-	715	-
Stage 2	-	-	-	-	697	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1241	-	-	-	384	862
Mov Cap-2 Maneuver	-	-	-	-	384	-
Stage 1	-	-	-	-	679	-
Stage 2	-	-	-	-	697	-
Approach	EB	WB		SB		
HCM Control Delay, s	0.9	0		12.3		
HCM LOS				B		
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1241	-	-	-	384	862
HCM Lane V/C Ratio	0.036	-	-	-	0.184	0.135
HCM Control Delay (s)	8	0.2	-	-	16.5	9.8
HCM Lane LOS	A	A	-	-	C	A
HCM 95th %tile Q(veh)	0.1	-	-	-	0.7	0.5

# HCM Signalized Intersection Capacity Analysis

## 30: NB Crooks Rd & Tower Dr

Background Conditions



PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations						 		  				
Traffic Volume (vph)	110	112	0	0	0	669	0	1589	28	0	0	0
Future Volume (vph)	110	112	0	0	0	669	0	1589	28	0	0	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)		6.0				6.0		6.4	6.4			
Lane Util. Factor		1.00				0.88		0.91	1.00			
Frt		1.00				0.85		1.00	0.85			
Flt Protected		0.98				1.00		1.00	1.00			
Satd. Flow (prot)		1913				2933		5353	1667			
Flt Permitted		0.98				1.00		1.00	1.00			
Satd. Flow (perm)		1913				2933		5353	1667			
Peak-hour factor, PHF	0.76	0.76	0.76	0.79	0.79	0.79	0.93	0.93	0.93	0.92	0.92	0.92
Adj. Flow (vph)	145	147	0	0	0	847	0	1709	30	0	0	0
RTOR Reduction (vph)	0	19	0	0	0	19	0	0	13	0	0	0
Lane Group Flow (vph)	0	273	0	0	0	828	0	1709	17	0	0	0
Turn Type	custom	NA				Perm		NA	Perm			
Protected Phases		4						2!				
Permitted Phases	4 2!					8			2			
Actuated Green, G (s)		45.7				45.7		71.9	71.9			
Effective Green, g (s)		45.7				45.7		71.9	71.9			
Actuated g/C Ratio		0.35				0.35		0.55	0.55			
Clearance Time (s)		6.0				6.0		6.4	6.4			
Vehicle Extension (s)		4.5				4.5		3.0	3.0			
Lane Grp Cap (vph)		672				1031		2960	921			
v/s Ratio Prot								c0.32				
v/s Ratio Perm		0.14				c0.28			0.01			
v/c Ratio		0.41				0.80		0.58	0.02			
Uniform Delay, d1		31.9				38.1		19.1	13.1			
Progression Factor		1.16				1.00		1.00	1.00			
Incremental Delay, d2		0.5				5.1		0.8	0.0			
Delay (s)		37.6				43.2		19.9	13.1			
Level of Service		D				D		B	B			
Approach Delay (s)		37.6			43.2			19.8			0.0	
Approach LOS		D			D			B			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		28.5				HCM 2000 Level of Service		C				
HCM 2000 Volume to Capacity ratio		0.67										
Actuated Cycle Length (s)		130.0				Sum of lost time (s)		12.4				
Intersection Capacity Utilization		78.1%				ICU Level of Service		D				
Analysis Period (min)		15										
! Phase conflict between lane groups.												
c Critical Lane Group												



HCM 6th TWSC  
40: SB Crooks Rd & N>S X/O N. of Long Lake

Background Conditions  
PM Peak Hour

Intersection						
Int Delay, s/veh	0.7					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	48	0	0	0	0	1277
Future Vol, veh/h	48	0	0	0	0	1277
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	16974	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	60	60	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	80	0	0	0	0	1388



Major/Minor	Minor1	Major2	
Conflicting Flow All	555	-	-
Stage 1	0	-	-
Stage 2	555	-	-
Critical Hdwy	5.74	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	6.04	-	-
Follow-up Hdwy	3.82	-	-
Pot Cap-1 Maneuver	515	0	-
Stage 1	-	0	-
Stage 2	491	0	-
Platoon blocked, %			-
Mov Cap-1 Maneuver	515	-	-
Mov Cap-2 Maneuver	515	-	-
Stage 1	-	-	-
Stage 2	491	-	-

Approach	WB	SB
HCM Control Delay, s	13.3	0
HCM LOS	B	

Minor Lane/Major Mvmt	WBLn1	SBT
Capacity (veh/h)	515	-
HCM Lane V/C Ratio	0.155	-
HCM Control Delay (s)	13.3	-
HCM Lane LOS	B	-
HCM 95th %tile Q(veh)	0.5	-

HCM 6th TWSC  
50: NB Crooks Rd & S>N X/O N. of Long Lake

Background Conditions  
PM Peak Hour

Intersection						
Int Delay, s/veh	0.1					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	12	0	0	1376	0	0
Future Vol, veh/h	12	0	0	1376	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	16979	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	75	75	93	93	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	16	0	0	1480	0	0

Major/Minor	Minor2	Major1	
Conflicting Flow All	592	-	0
Stage 1	0	-	-
Stage 2	592	-	-
Critical Hdwy	5.74	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	6.04	-	-
Follow-up Hdwy	3.82	-	-
Pot Cap-1 Maneuver	494	0	-
Stage 1	-	0	-
Stage 2	470	0	-
Platoon blocked, %			-
Mov Cap-1 Maneuver	494	-	-
Mov Cap-2 Maneuver	494	-	-
Stage 1	-	-	-
Stage 2	470	-	-

Approach	EB	NB
HCM Control Delay, s	12.5	0
HCM LOS	B	

Minor Lane/Major Mvmt	NBT	EBLn1
Capacity (veh/h)	-	494
HCM Lane V/C Ratio	-	0.032
HCM Control Delay (s)	-	12.5
HCM Lane LOS	-	B
HCM 95th %tile Q(veh)	-	0.1

# HCM Signalized Intersection Capacity Analysis

## 60: E>W X/O E. of Crooks & WB Long Lake Rd

Background Conditions













PM Peak Hour

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations				↑↑↑	↖	
Traffic Volume (vph)	0	0	0	916	54	0
Future Volume (vph)	0	0	0	916	54	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000
Total Lost time (s)				6.6	5.4	
Lane Util. Factor				0.91	1.00	
Frt				1.00	1.00	
Flt Protected				1.00	0.95	
Satd. Flow (prot)				5353	1863	
Flt Permitted				1.00	0.95	
Satd. Flow (perm)				5353	1863	
Peak-hour factor, PHF	0.92	0.92	0.95	0.95	0.87	0.87
Adj. Flow (vph)	0	0	0	964	62	0
RTOR Reduction (vph)	0	0	0	0	28	0
Lane Group Flow (vph)	0	0	0	964	34	0
Turn Type				NA	Prot	
Protected Phases				6	8	
Permitted Phases						
Actuated Green, G (s)				101.3	6.7	
Effective Green, g (s)				101.3	6.7	
Actuated g/C Ratio				0.84	0.06	
Clearance Time (s)				6.6	5.4	
Vehicle Extension (s)				3.0	3.0	
Lane Grp Cap (vph)				4518	104	
v/s Ratio Prot				c0.18	c0.02	
v/s Ratio Perm						
v/c Ratio				0.21	0.32	
Uniform Delay, d1				1.8	54.5	
Progression Factor				1.00	0.57	
Incremental Delay, d2				0.1	1.5	
Delay (s)				1.9	32.3	
Level of Service				A	C	
Approach Delay (s)	0.0			1.9	32.3	
Approach LOS	A			A	C	
<b>Intersection Summary</b>						
HCM 2000 Control Delay			3.7	HCM 2000 Level of Service		A
HCM 2000 Volume to Capacity ratio			0.22			
Actuated Cycle Length (s)			120.0	Sum of lost time (s)		12.0
Intersection Capacity Utilization			50.7%	ICU Level of Service		A
Analysis Period (min)			15			
c Critical Lane Group						

# HCM Signalized Intersection Capacity Analysis

## 70: NB Crooks Rd & WB Long Lake Rd

Background Conditions  
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑↑↑	↑		↑↑↑↑				
Traffic Volume (vph)	0	0	0	0	798	172	0	1204	0	0	0	0
Future Volume (vph)	0	0	0	0	798	172	0	1204	0	0	0	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)					11.9	11.9		5.9				
Lane Util. Factor					0.91	1.00		0.91				
Frt					1.00	0.85		1.00				
Flt Protected					1.00	1.00		1.00				
Satd. Flow (prot)					5353	1667		5353				
Flt Permitted					1.00	1.00		1.00				
Satd. Flow (perm)					5353	1667		5353				
Peak-hour factor, PHF	0.92	0.92	0.92	0.95	0.95	0.95	0.89	0.89	0.89	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	840	181	0	1353	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	52	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	840	129	0	1353	0	0	0	0
Turn Type					NA	Perm		NA				
Protected Phases					4			6				
Permitted Phases						4						
Actuated Green, G (s)					42.3	42.3		59.9				
Effective Green, g (s)					42.3	42.3		59.9				
Actuated g/C Ratio					0.35	0.35		0.50				
Clearance Time (s)					11.9	11.9		5.9				
Vehicle Extension (s)					3.0	3.0		3.0				
Lane Grp Cap (vph)					1886	587		2672				
v/s Ratio Prot					c0.16			c0.25				
v/s Ratio Perm						0.08						
v/c Ratio					0.45	0.22		0.51				
Uniform Delay, d1					29.8	27.3		20.1				
Progression Factor					0.99	1.06		0.00				
Incremental Delay, d2					0.2	0.2		0.6				
Delay (s)					29.8	29.2		0.6				
Level of Service					C	C		A				
Approach Delay (s)		0.0			29.7			0.6			0.0	
Approach LOS		A			C			A			A	
Intersection Summary												
HCM 2000 Control Delay			13.1		HCM 2000 Level of Service						B	
HCM 2000 Volume to Capacity ratio			0.51									
Actuated Cycle Length (s)			120.0		Sum of lost time (s)						23.8	
Intersection Capacity Utilization			51.6%		ICU Level of Service						A	
Analysis Period (min)			15									
c Critical Lane Group												

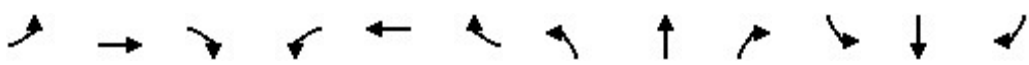


# HCM Signalized Intersection Capacity Analysis

71: SB Crooks Rd & WB Long Lake Rd

Background Conditions


PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑↑						↑↑↑	↑
Traffic Volume (vph)	0	0	0	0	798	0	0	0	0	0	995	184
Future Volume (vph)	0	0	0	0	798	0	0	0	0	0	995	184
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)					5.9						11.9	11.9
Lane Util. Factor					0.91						0.91	1.00
Frt					1.00						1.00	0.85
Flt Protected					1.00						1.00	1.00
Satd. Flow (prot)					5353						5353	1667
Flt Permitted					1.00						1.00	1.00
Satd. Flow (perm)					5353						5353	1667
Peak-hour factor, PHF	0.92	0.92	0.92	0.95	0.95	0.95	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	840	0	0	0	0	0	1082	200
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	46
Lane Group Flow (vph)	0	0	0	0	840	0	0	0	0	0	1082	154
Turn Type					NA						NA	Perm
Protected Phases					8						2	
Permitted Phases												2
Actuated Green, G (s)					48.3						53.9	53.9
Effective Green, g (s)					48.3						53.9	53.9
Actuated g/C Ratio					0.40						0.45	0.45
Clearance Time (s)					5.9						11.9	11.9
Vehicle Extension (s)					3.0						3.0	3.0
Lane Grp Cap (vph)					2154						2404	748
v/s Ratio Prot					c0.16						c0.20	
v/s Ratio Perm												0.09
v/c Ratio					0.39						0.45	0.21
Uniform Delay, d1					25.4						22.8	20.1
Progression Factor					0.00						1.00	1.00
Incremental Delay, d2					0.1						0.6	0.6
Delay (s)					0.1						23.4	20.7
Level of Service					A						C	C
Approach Delay (s)		0.0			0.1			0.0			23.0	
Approach LOS		A			A			A			C	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			13.9									HCM 2000 Level of Service B
HCM 2000 Volume to Capacity ratio			0.45									
Actuated Cycle Length (s)			120.0								23.8	
Intersection Capacity Utilization			51.6%									ICU Level of Service A
Analysis Period (min)			15									
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis

## 72: SB Crooks Rd & EB Long Lake Rd

Background Conditions  
PM Peak Hour

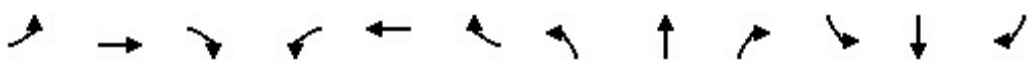
												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑	↑								↑↑↑	
Traffic Volume (vph)	0	1048	151	0	0	0	0	0	0	0	995	0
Future Volume (vph)	0	1048	151	0	0	0	0	0	0	0	995	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)		11.9	11.9								5.9	
Lane Util. Factor		0.91	1.00								0.91	
Frt		1.00	0.85								1.00	
Flt Protected		1.00	1.00								1.00	
Satd. Flow (prot)		5353	1667								5353	
Flt Permitted		1.00	1.00								1.00	
Satd. Flow (perm)		5353	1667								5353	
Peak-hour factor, PHF	0.78	0.78	0.78	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1344	194	0	0	0	0	0	0	0	1082	0
RTOR Reduction (vph)	0	0	52	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	1344	142	0	0	0	0	0	0	0	1082	0
Turn Type		NA	Perm								NA	
Protected Phases		4									6	
Permitted Phases			4									
Actuated Green, G (s)		42.3	42.3								59.9	
Effective Green, g (s)		42.3	42.3								59.9	
Actuated g/C Ratio		0.35	0.35								0.50	
Clearance Time (s)		11.9	11.9								5.9	
Vehicle Extension (s)		3.0	3.0								3.0	
Lane Grp Cap (vph)		1886	587								2672	
v/s Ratio Prot		c0.25									c0.20	
v/s Ratio Perm			0.08									
v/c Ratio		0.71	0.24								0.40	
Uniform Delay, d1		33.6	27.5								18.9	
Progression Factor		1.07	1.16								0.00	
Incremental Delay, d2		1.2	0.2								0.4	
Delay (s)		37.2	32.1								0.4	
Level of Service		D	C								A	
Approach Delay (s)		36.5			0.0			0.0			0.4	
Approach LOS		D			A			A			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			21.6				HCM 2000 Level of Service				C	
HCM 2000 Volume to Capacity ratio			0.57									
Actuated Cycle Length (s)			120.0				Sum of lost time (s)			23.8		
Intersection Capacity Utilization			52.3%				ICU Level of Service			A		
Analysis Period (min)			15									
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis

## 73: NB Crooks Rd & EB Long Lake Rd

### Background Conditions

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑						↑↑↑	↑			
Traffic Volume (vph)	0	1048	0	0	0	0	0	1204	371	0	0	0
Future Volume (vph)	0	1048	0	0	0	0	0	1204	371	0	0	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)		5.9						11.9	11.9			
Lane Util. Factor		0.91						0.91	1.00			
Frt		1.00						1.00	0.85			
Flt Protected		1.00						1.00	1.00			
Satd. Flow (prot)		5353						5353	1667			
Flt Permitted		1.00						1.00	1.00			
Satd. Flow (perm)		5353						5353	1667			
Peak-hour factor, PHF	0.78	0.78	0.78	0.92	0.92	0.92	0.89	0.89	0.89	0.92	0.92	0.92
Adj. Flow (vph)	0	1344	0	0	0	0	0	1353	417	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	45	0	0	0
Lane Group Flow (vph)	0	1344	0	0	0	0	0	1353	372	0	0	0
Turn Type		NA						NA	Perm			
Protected Phases		8						2				
Permitted Phases									2			
Actuated Green, G (s)		48.3						53.9	53.9			
Effective Green, g (s)		48.3						53.9	53.9			
Actuated g/C Ratio		0.40						0.45	0.45			
Clearance Time (s)		5.9						11.9	11.9			
Vehicle Extension (s)		3.0						3.0	3.0			
Lane Grp Cap (vph)		2154						2404	748			
v/s Ratio Prot		c0.25						c0.25				
v/s Ratio Perm									0.22			
v/c Ratio		0.62						0.56	0.50			
Uniform Delay, d1		28.6						24.4	23.4			
Progression Factor		0.00						1.00	1.00			
Incremental Delay, d2		0.4						1.0	2.4			
Delay (s)		0.4						25.3	25.8			
Level of Service		A						C	C			
Approach Delay (s)		0.4			0.0			25.4			0.0	
Approach LOS		A			A			C			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		14.6						HCM 2000 Level of Service	B			
HCM 2000 Volume to Capacity ratio		0.63										
Actuated Cycle Length (s)		120.0						Sum of lost time (s)	23.8			
Intersection Capacity Utilization		56.2%						ICU Level of Service	B			
Analysis Period (min)		15										
c Critical Lane Group												

HCM 6th TWSC  
80: E>W X/O W. of Crooks & WB Long Lake Rd

Background Conditions  
PM Peak Hour

Intersection						
Int Delay, s/veh	0.2					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations				↑↑↑	↑	
Traffic Vol, veh/h	0	0	0	982	13	0
Future Vol, veh/h	0	0	0	982	13	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	63	63
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	0	0	1067	21	0

Major/Minor	Major2	Minor1
Conflicting Flow All	-	- 427
Stage 1	-	- 0
Stage 2	-	- 427
Critical Hdwy	-	- 5.74
Critical Hdwy Stg 1	-	-
Critical Hdwy Stg 2	-	- 6.04
Follow-up Hdwy	-	- 3.82
Pot Cap-1 Maneuver	0	- 593
Stage 1	0	- 0
Stage 2	0	- 573
Platoon blocked, %	-	
Mov Cap-1 Maneuver	-	- 593
Mov Cap-2 Maneuver	-	- 593
Stage 1	-	-
Stage 2	-	- 573

Approach	WB	NB
HCM Control Delay, s	0	11.3
HCM LOS		B

Minor Lane/Major Mvmt	NBLn1	WBT
Capacity (veh/h)	593	-
HCM Lane V/C Ratio	0.035	-
HCM Control Delay (s)	11.3	-
HCM Lane LOS	B	-
HCM 95th %tile Q(veh)	0.1	-

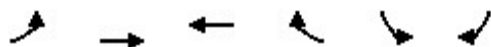


# HCM Signalized Intersection Capacity Analysis

## 90: EB Long Lake Rd & W>E X/O W. of Crooks

Background Conditions

PM Peak Hour




Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑↑			↵	
Traffic Volume (vph)	0	1000	0	0	212	0
Future Volume (vph)	0	1000	0	0	212	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000
Total Lost time (s)		6.0			5.4	
Lane Util. Factor		0.91			1.00	
Frt		1.00			1.00	
Flt Protected		1.00			0.95	
Satd. Flow (prot)		5353			1863	
Flt Permitted		1.00			0.95	
Satd. Flow (perm)		5353			1863	
Peak-hour factor, PHF	0.92	0.81	0.92	0.92	0.67	0.67
Adj. Flow (vph)	0	1235	0	0	316	0
RTOR Reduction (vph)	0	0	0	0	21	0
Lane Group Flow (vph)	0	1235	0	0	295	0
Turn Type		NA			Prot	
Protected Phases		2			4	
Permitted Phases						
Actuated Green, G (s)		83.6			25.0	
Effective Green, g (s)		83.6			25.0	
Actuated g/C Ratio		0.70			0.21	
Clearance Time (s)		6.0			5.4	
Vehicle Extension (s)		3.0			3.0	
Lane Grp Cap (vph)		3729			388	
v/s Ratio Prot		c0.23			c0.16	
v/s Ratio Perm						
v/c Ratio		0.33			0.76	
Uniform Delay, d1		7.2			44.7	
Progression Factor		0.95			0.97	
Incremental Delay, d2		0.2			8.3	
Delay (s)		7.0			51.7	
Level of Service		A			D	
Approach Delay (s)		7.0	0.0		51.7	
Approach LOS		A	A		D	
<b>Intersection Summary</b>						
HCM 2000 Control Delay		16.2		HCM 2000 Level of Service		B
HCM 2000 Volume to Capacity ratio		0.43				
Actuated Cycle Length (s)		120.0		Sum of lost time (s)		11.4
Intersection Capacity Utilization		47.7%		ICU Level of Service		A
Analysis Period (min)		15				
c Critical Lane Group						

Intersection						
Int Delay, s/veh	1.2					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations				↑↑↑↑	↗	
Traffic Vol, veh/h	0	0	0	783	60	0
Future Vol, veh/h	0	0	0	783	60	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	60	60
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	0	0	851	100	0
Major/Minor			Major2		Minor1	
Conflicting Flow All			-	-	340	-
Stage 1			-	-	0	-
Stage 2			-	-	340	-
Critical Hdwy			-	-	5.74	-
Critical Hdwy Stg 1			-	-	-	-
Critical Hdwy Stg 2			-	-	6.04	-
Follow-up Hdwy			-	-	3.82	-
Pot Cap-1 Maneuver			0	-	653	0
Stage 1			0	-	-	0
Stage 2			0	-	635	0
Platoon blocked, %				-		
Mov Cap-1 Maneuver			-	-	653	-
Mov Cap-2 Maneuver			-	-	653	-
Stage 1			-	-	-	-
Stage 2			-	-	635	-
Approach			WB		NB	
HCM Control Delay, s			0		11.5	
HCM LOS					B	
Minor Lane/Major Mvmt	NBLn1	WBT				
Capacity (veh/h)	653	-				
HCM Lane V/C Ratio	0.153	-				
HCM Control Delay (s)	11.5	-				
HCM Lane LOS	B	-				
HCM 95th %tile Q(veh)	0.5	-				

# HCM Signalized Intersection Capacity Analysis

## 110: Investment Dr & EB Long Lake Rd

Background Conditions  
PM Peak Hour


												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑	↑						↑↑		↑	
Traffic Volume (vph)	0	908	101	0	0	0	0	0	152	0	34	0
Future Volume (vph)	0	908	101	0	0	0	0	0	152	0	34	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)		6.0	6.0						5.5		5.5	
Lane Util. Factor		0.91	1.00						0.88		1.00	
Frt		1.00	0.85						0.85		1.00	
Flt Protected		1.00	1.00						1.00		1.00	
Satd. Flow (prot)		5353	1667						2933		1961	
Flt Permitted		1.00	1.00						1.00		1.00	
Satd. Flow (perm)		5353	1667						2933		1961	
Peak-hour factor, PHF	0.85	0.85	0.85	0.92	0.92	0.92	0.68	0.68	0.68	0.83	0.83	0.83
Adj. Flow (vph)	0	1068	119	0	0	0	0	0	224	0	41	0
RTOR Reduction (vph)	0	0	19	0	0	0	0	0	181	0	0	0
Lane Group Flow (vph)	0	1068	100	0	0	0	0	0	43	0	41	0
Turn Type		NA	Perm						Perm		NA	
Protected Phases		2									4	
Permitted Phases			2						8	4		
Actuated Green, G (s)		100.4	100.4						8.1		8.1	
Effective Green, g (s)		100.4	100.4						8.1		8.1	
Actuated g/C Ratio		0.84	0.84						0.07		0.07	
Clearance Time (s)		6.0	6.0						5.5		5.5	
Vehicle Extension (s)		4.0	4.0						3.0		3.0	
Lane Grp Cap (vph)		4478	1394						197		132	
v/s Ratio Prot		c0.20									c0.02	
v/s Ratio Perm			0.06						0.01			
v/c Ratio		0.24	0.07						0.22		0.31	
Uniform Delay, d1		2.0	1.7						53.0		53.3	
Progression Factor		1.00	1.00						1.00		1.46	
Incremental Delay, d2		0.1	0.1						0.6		1.3	
Delay (s)		2.1	1.8						53.5		79.2	
Level of Service		A	A						D		E	
Approach Delay (s)		2.1			0.0			53.5			79.2	
Approach LOS		A			A			D			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			12.2									HCM 2000 Level of Service B
HCM 2000 Volume to Capacity ratio			0.24									
Actuated Cycle Length (s)			120.0									Sum of lost time (s) 11.5
Intersection Capacity Utilization			44.1%									ICU Level of Service A
Analysis Period (min)			15									
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis

## 120: Corporate Dr & WB Long Lake Rd

Background Conditions

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑↑	↑		↑				↑↑
Traffic Volume (vph)	0	0	0	0	769	40	104	35	0	0	0	459
Future Volume (vph)	0	0	0	0	769	40	104	35	0	0	0	459
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)					6.3	6.3		5.8				5.8
Lane Util. Factor					0.91	1.00		1.00				0.88
Frt					1.00	0.85		1.00				0.85
Flt Protected					1.00	1.00		0.96				1.00
Satd. Flow (prot)					5353	1667		1890				2933
Flt Permitted					1.00	1.00		0.96				1.00
Satd. Flow (perm)					5353	1667		1890				2933
Peak-hour factor, PHF	0.92	0.92	0.92	0.88	0.88	0.88	0.69	0.69	0.69	0.72	0.72	0.72
Adj. Flow (vph)	0	0	0	0	874	45	151	51	0	0	0	638
RTOR Reduction (vph)	0	0	0	0	0	16	0	46	0	0	0	82
Lane Group Flow (vph)	0	0	0	0	874	29	0	156	0	0	0	556
Turn Type					NA	Perm	custom	NA				Perm
Protected Phases					6!			8				
Permitted Phases						6	8 6!					4
Actuated Green, G (s)					78.6	78.6		29.3				29.3
Effective Green, g (s)					78.6	78.6		29.3				29.3
Actuated g/C Ratio					0.65	0.65		0.24				0.24
Clearance Time (s)					6.3	6.3		5.8				5.8
Vehicle Extension (s)					4.0	4.0		3.0				3.0
Lane Grp Cap (vph)					3506	1091		461				716
v/s Ratio Prot					c0.16							
v/s Ratio Perm						0.02		0.08				c0.19
v/c Ratio					0.25	0.03		0.34				0.78
Uniform Delay, d1					8.5	7.3		37.4				42.3
Progression Factor					2.45	5.24		1.00				1.00
Incremental Delay, d2					0.2	0.0		0.4				5.3
Delay (s)					21.1	38.1		37.8				47.6
Level of Service					C	D		D				D
Approach Delay (s)		0.0			21.9			37.8			47.6	
Approach LOS		A			C			D			D	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			33.1		HCM 2000 Level of Service					C		
HCM 2000 Volume to Capacity ratio			0.39									
Actuated Cycle Length (s)			120.0		Sum of lost time (s)					12.1		
Intersection Capacity Utilization			51.5%		ICU Level of Service					A		
Analysis Period (min)			15									
! Phase conflict between lane groups.												
c Critical Lane Group												





HCM 6th TWSC  
130: EB Long Lake Rd & W>E X/O W. of Investment

Background Conditions  
PM Peak Hour

Intersection						
Int Delay, s/veh	0.8					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑↑↑			↑	
Traffic Vol, veh/h	0	1086	0	0	62	0
Future Vol, veh/h	0	1086	0	0	62	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	16983	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	85	85	92	92	75	75
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	1278	0	0	83	0
Major/Minor	Major1		Minor2			
Conflicting Flow All	-	0			511	-
Stage 1	-	-			0	-
Stage 2	-	-			511	-
Critical Hdwy	-	-			5.74	-
Critical Hdwy Stg 1	-	-			-	-
Critical Hdwy Stg 2	-	-			6.04	-
Follow-up Hdwy	-	-			3.82	-
Pot Cap-1 Maneuver	0	-			541	0
Stage 1	0	-			-	0
Stage 2	0	-			518	0
Platoon blocked, %		-				
Mov Cap-1 Maneuver	-	-			541	-
Mov Cap-2 Maneuver	-	-			541	-
Stage 1	-	-			-	-
Stage 2	-	-			518	-
Approach	EB			SB		
HCM Control Delay, s	0			12.9		
HCM LOS				B		
Minor Lane/Major Mvmt	EBT SBLn1					
Capacity (veh/h)	- 541					
HCM Lane V/C Ratio	- 0.153					
HCM Control Delay (s)	- 12.9					
HCM Lane LOS	- B					
HCM 95th %tile Q(veh)	- 0.5					

HCM 6th TWSC  
140: NB Crooks Rd & S>N X/O S. of Long Lake

Background Conditions  
PM Peak Hour

Intersection						
Int Delay, s/veh	1.2					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	92	0	0	1579	0	0
Future Vol, veh/h	92	0	0	1579	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	16979	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	70	70	89	89	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	131	0	0	1774	0	0
Major/Minor	Minor2		Major1			
Conflicting Flow All	710	-	-	0		
Stage 1	0	-	-	-		
Stage 2	710	-	-	-		
Critical Hdwy	5.74	-	-	-		
Critical Hdwy Stg 1	-	-	-	-		
Critical Hdwy Stg 2	6.04	-	-	-		
Follow-up Hdwy	3.82	-	-	-		
Pot Cap-1 Maneuver	432	0	0	-		
Stage 1	-	0	0	-		
Stage 2	408	0	0	-		
Platoon blocked, %				-		
Mov Cap-1 Maneuver	432	-	-	-		
Mov Cap-2 Maneuver	432	-	-	-		
Stage 1	-	-	-	-		
Stage 2	408	-	-	-		
Approach	EB		NB			
HCM Control Delay, s	16.9		0			
HCM LOS	C					
Minor Lane/Major Mvmt	NBT EBLn1					
Capacity (veh/h)	-		432			
HCM Lane V/C Ratio	-		0.304			
HCM Control Delay (s)	-		16.9			
HCM Lane LOS	-		C			
HCM 95th %tile Q(veh)	-		1.3			

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150: SB Crooks Rd & Investment Dr Performance by movement

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Movement	EBR	WBL	WBT	SBT	SBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.1	0.0	0.0	0.0	0.0	0.0
Total Delay (hr)	1.4	0.0	0.2	0.2	0.0	1.8
Total Del/Veh (s)	18.7	11.7	11.6	0.7	0.0	4.3

## Intersection: 10: Crooks Rd &amp; Corporate Dr/I-75 Ramp

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	NB	SB
Directions Served	LT	T	R	L	LT	TR	R	T	T	TR	R	L
Maximum Queue (ft)	412	406	152	449	489	772	526	196	214	199	194	375
Average Queue (ft)	377	379	48	310	362	397	349	141	156	164	134	329
95th Queue (ft)	437	438	108	425	484	617	492	210	221	218	207	450
Link Distance (ft)	362	362	362		1654	1654		146	146	146	146	
Upstream Blk Time (%)	61	65				0		16	24	31	8	
Queuing Penalty (veh)	148	159				0		38	56	72	18	
Storage Bay Dist (ft)				700			750					325
Storage Blk Time (%)												30
Queuing Penalty (veh)												137

## Intersection: 10: Crooks Rd &amp; Corporate Dr/I-75 Ramp

Movement	SB	SB	SB	SB	SB
Directions Served	L	T	T	T	R
Maximum Queue (ft)	425	1511	1463	1083	154
Average Queue (ft)	368	814	722	414	56
95th Queue (ft)	511	1750	1664	1105	103
Link Distance (ft)		1954	1954	1954	
Upstream Blk Time (%)		4	2	0	
Queuing Penalty (veh)		0	0	0	
Storage Bay Dist (ft)	325				700
Storage Blk Time (%)	47	2		0	
Queuing Penalty (veh)	217	9		0	

## Intersection: 20: Corporate Dr &amp; New King Dr

Movement	EB	EB	WB	WB	WB	SB	SB
Directions Served	LT	T	T	T	R	L	R
Maximum Queue (ft)	686	667	338	346	185	153	75
Average Queue (ft)	416	390	66	74	12	67	16
95th Queue (ft)	809	823	267	283	100	158	47
Link Distance (ft)	732	732	362	362	362	382	382
Upstream Blk Time (%)	7	8	0	0	0		
Queuing Penalty (veh)	27	31	0	1	0		
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							



## Intersection: 30: NB Crooks Rd &amp; Tower Dr

Movement	EB	WB	WB	NB	NB	NB	NB
Directions Served	LT	R	R	T	T	T	R
Maximum Queue (ft)	69	125	54	208	259	292	126
Average Queue (ft)	54	50	7	67	86	123	23
95th Queue (ft)	62	96	33	169	217	262	78
Link Distance (ft)	17	505	505	562	562	562	
Upstream Blk Time (%)	47						
Queuing Penalty (veh)	311						
Storage Bay Dist (ft)							275
Storage Blk Time (%)						1	0
Queuing Penalty (veh)						1	0

## Intersection: 31: SB Crooks Rd &amp; Dummy Node/Tower Dr

Movement	SB	SB	SB
Directions Served	L	T	T
Maximum Queue (ft)	488	466	233
Average Queue (ft)	307	47	8
95th Queue (ft)	504	304	120
Link Distance (ft)		585	585
Upstream Blk Time (%)		0	0
Queuing Penalty (veh)		3	0
Storage Bay Dist (ft)	375		
Storage Blk Time (%)	4		
Queuing Penalty (veh)	19		

## Intersection: 40: SB Crooks Rd &amp; N&gt;S X/O N. of Long Lake

Movement	WB
Directions Served	L
Maximum Queue (ft)	47
Average Queue (ft)	25
95th Queue (ft)	52
Link Distance (ft)	17
Upstream Blk Time (%)	9
Queuing Penalty (veh)	4
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 41: NB Crooks Rd &amp; N&gt;S X/O N. of Long Lake

Movement	NB
Directions Served	L
Maximum Queue (ft)	34
Average Queue (ft)	2
95th Queue (ft)	17
Link Distance (ft)	543
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 50: NB Crooks Rd &amp; S&gt;N X/O N. of Long Lake

Movement	EB
Directions Served	L
Maximum Queue (ft)	31
Average Queue (ft)	9
95th Queue (ft)	32
Link Distance (ft)	13
Upstream Blk Time (%)	1
Queuing Penalty (veh)	0
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 51: SB Crooks Rd &amp; S&gt;N X/O N. of Long Lake

Movement	SB	SB	SB	SB
Directions Served	T	T	T	T
Maximum Queue (ft)	433	437	386	187
Average Queue (ft)	163	181	97	18
95th Queue (ft)	351	365	303	107
Link Distance (ft)	446	446	446	
Upstream Blk Time (%)	2	2	1	
Queuing Penalty (veh)	9	10	4	
Storage Bay Dist (ft)				150
Storage Blk Time (%)	8		6	
Queuing Penalty (veh)	1		20	

## Intersection: 60: E&gt;W X/O E. of Crooks &amp; WB Long Lake Rd

Movement	WB	WB	WB	NB
Directions Served	T	T	T	L
Maximum Queue (ft)	86	60	72	67
Average Queue (ft)	13	5	9	42
95th Queue (ft)	56	28	42	69
Link Distance (ft)	1483	1483	1483	21
Upstream Blk Time (%)				16
Queuing Penalty (veh)				15
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

## Intersection: 61: EB Long Lake Rd &amp; E&gt;W X/O E. of Crooks

Movement	EB
Directions Served	L
Maximum Queue (ft)	97
Average Queue (ft)	25
95th Queue (ft)	73
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	305
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 70: NB Crooks Rd &amp; WB Long Lake Rd

Movement	WB	WB	WB	WB
Directions Served	T	T	T	R
Maximum Queue (ft)	405	381	314	105
Average Queue (ft)	263	221	180	45
95th Queue (ft)	369	330	275	81
Link Distance (ft)	530	530	530	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				650
Storage Blk Time (%)				
Queuing Penalty (veh)				

## Intersection: 71: SB Crooks Rd &amp; WB Long Lake Rd

Movement	WB	SB	SB	SB	SB
Directions Served	T	T	T	T	R
Maximum Queue (ft)	5	94	104	92	78
Average Queue (ft)	0	78	79	46	39
95th Queue (ft)	4	87	90	90	76
Link Distance (ft)	23	44	44	44	44
Upstream Blk Time (%)	0	49	54	16	8
Queuing Penalty (veh)	0	167	186	55	29
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

## Intersection: 72: SB Crooks Rd &amp; EB Long Lake Rd

Movement	EB	EB	EB	EB
Directions Served	T	T	T	R
Maximum Queue (ft)	91	88	83	81
Average Queue (ft)	75	73	58	46
95th Queue (ft)	83	86	95	76
Link Distance (ft)	42	42	42	42
Upstream Blk Time (%)	45	42	27	9
Queuing Penalty (veh)	86	81	52	18
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

## Intersection: 73: NB Crooks Rd &amp; EB Long Lake Rd

Movement	NB	NB	NB	NB
Directions Served	T	T	T	R
Maximum Queue (ft)	120	105	120	84
Average Queue (ft)	88	81	90	39
95th Queue (ft)	119	113	118	67
Link Distance (ft)	64	64	64	64
Upstream Blk Time (%)	23	17	25	1
Queuing Penalty (veh)	50	37	53	2
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

## Intersection: 80: E&gt;W X/O W. of Crooks &amp; WB Long Lake Rd

## Movement

Directions Served

Maximum Queue (ft)

Average Queue (ft)

95th Queue (ft)

Link Distance (ft)

Upstream Blk Time (%)

Queuing Penalty (veh)

Storage Bay Dist (ft)

Storage Blk Time (%)

Queuing Penalty (veh)

## Intersection: 81: EB Long Lake Rd &amp; E&gt;W X/O W. of Crooks

## Movement

EB

EB

EB

EB

Directions Served

T

T

T

T

Maximum Queue (ft)

149

115

98

75

Average Queue (ft)

65

51

23

6

95th Queue (ft)

128

111

79

35

Link Distance (ft)

508

508

508

Upstream Blk Time (%)

Queuing Penalty (veh)

Storage Bay Dist (ft)

150

Storage Blk Time (%)

0

Queuing Penalty (veh)

0

## Intersection: 90: EB Long Lake Rd &amp; W&gt;E X/O W. of Crooks

## Movement

EB

EB

EB

SB

Directions Served

T

T

T

L

Maximum Queue (ft)

75

69

49

86

Average Queue (ft)

16

11

8

50

95th Queue (ft)

53

44

33

86

Link Distance (ft)

44

44

44

34

Upstream Blk Time (%)

2

1

1

8

Queuing Penalty (veh)

3

2

1

23

Storage Bay Dist (ft)

Storage Blk Time (%)

Queuing Penalty (veh)



## Intersection: 91: W&gt;E X/O W. of Crooks/S.E. Site Drive &amp; WB Long Lake Rd

Movement	WB
Directions Served	L
Maximum Queue (ft)	3
Average Queue (ft)	0
95th Queue (ft)	2
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	325
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 100: E&gt;W X/O E. of Corporate &amp; WB Long Lake Rd

Movement	NB
Directions Served	L
Maximum Queue (ft)	64
Average Queue (ft)	33
95th Queue (ft)	61
Link Distance (ft)	36
Upstream Blk Time (%)	11
Queuing Penalty (veh)	8
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 101: EB Long Lake Rd &amp; E&gt;W X/O E. of Corporate

Movement	EB
Directions Served	L
Maximum Queue (ft)	14
Average Queue (ft)	1
95th Queue (ft)	9
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	375
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 110: Investment Dr &amp; EB Long Lake Rd

Movement	EB	EB	EB	EB	NB	NB	SB
Directions Served	T	T	T	R	R	R	LT
Maximum Queue (ft)	51	39	44	50	40	28	79
Average Queue (ft)	23	8	11	19	17	6	45
95th Queue (ft)	52	32	36	46	34	21	82
Link Distance (ft)	13	13	13	13	755	755	35
Upstream Blk Time (%)	5	1	2	2			37
Queuing Penalty (veh)	8	2	3	4			27
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							

## Intersection: 111: Investment Dr &amp; WB Long Lake Rd

Movement	WB	WB	WB	WB	WB
Directions Served	L	T	T	T	T
Maximum Queue (ft)	80	172	168	177	116
Average Queue (ft)	11	62	74	77	30
95th Queue (ft)	47	136	147	151	84
Link Distance (ft)		428	428	428	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	225			300	
Storage Blk Time (%)		0			
Queuing Penalty (veh)		0			

## Intersection: 120: Corporate Dr &amp; WB Long Lake Rd

Movement	WB	WB	WB	WB	NB	SB	SB
Directions Served	T	T	T	R	LT	R	R
Maximum Queue (ft)	53	61	62	54	87	76	84
Average Queue (ft)	38	40	39	36	69	25	26
95th Queue (ft)	54	56	58	55	83	57	57
Link Distance (ft)	9	9	9	9	34	225	225
Upstream Blk Time (%)	12	13	13	7	68		
Queuing Penalty (veh)	37	38	37	21	175		
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							

## Intersection: 121: EB Long Lake Rd &amp; Corporate Dr

Movement	EB	EB	EB	EB	EB
Directions Served	L	T	T	T	T
Maximum Queue (ft)	274	62	29	23	24
Average Queue (ft)	125	9	2	1	2
95th Queue (ft)	237	37	16	9	13
Link Distance (ft)		562	562	562	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	375			275	
Storage Blk Time (%)					
Queuing Penalty (veh)					

## Intersection: 130: EB Long Lake Rd &amp; W&gt;E X/O W. of Investment

Movement	SB
Directions Served	L
Maximum Queue (ft)	52
Average Queue (ft)	27
95th Queue (ft)	51
Link Distance (ft)	33
Upstream Blk Time (%)	9
Queuing Penalty (veh)	7
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 131: W&gt;E X/O W. of Investment &amp; WB Long Lake Rd

Movement	WB
Directions Served	L
Maximum Queue (ft)	49
Average Queue (ft)	9
95th Queue (ft)	35
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	350
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 140: NB Crooks Rd &amp; S&gt;N X/O S. of Long Lake

Movement	EB
Directions Served	L
Maximum Queue (ft)	53
Average Queue (ft)	23
95th Queue (ft)	50
Link Distance (ft)	19
Upstream Blk Time (%)	5
Queuing Penalty (veh)	2
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 141: SB Crooks Rd &amp; S&gt;N X/O S. of Long Lake

Movement	SB
Directions Served	L
Maximum Queue (ft)	40
Average Queue (ft)	4
95th Queue (ft)	22
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	375
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 150: SB Crooks Rd &amp; Investment Dr

Movement	EB	EB	WB	SB
Directions Served	R	R	LT	T
Maximum Queue (ft)	92	51	72	10
Average Queue (ft)	38	8	47	0
95th Queue (ft)	73	32	64	5
Link Distance (ft)	933	933	15	272
Upstream Blk Time (%)			45	
Queuing Penalty (veh)			77	
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

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Intersection: 151: NB Crooks Rd & Investment Dr

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Movement	NB
Directions Served	L
Maximum Queue (ft)	133
Average Queue (ft)	37
95th Queue (ft)	100
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	325
Storage Blk Time (%)	
Queuing Penalty (veh)	

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Zone Summary

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Zone wide Queuing Penalty: 2598

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## Intersection: 10: Crooks Rd &amp; Corporate Dr/I-75 Ramp

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	NB	SB
Directions Served	LT	T	R	L	LT	TR	R	T	T	TR	R	L
Maximum Queue (ft)	131	90	260	264	311	326	314	217	207	215	205	325
Average Queue (ft)	69	35	103	167	220	228	195	178	185	187	169	212
95th Queue (ft)	119	77	212	248	289	312	295	212	201	200	220	327
Link Distance (ft)	362	362	362		1654	1654		146	146	146	146	
Upstream Blk Time (%)			0					32	41	50	16	
Queuing Penalty (veh)			0					180	231	278	91	
Storage Bay Dist (ft)				700			750					325
Storage Blk Time (%)												1
Queuing Penalty (veh)												3

## Intersection: 10: Crooks Rd &amp; Corporate Dr/I-75 Ramp

Movement	SB	SB	SB	SB	SB
Directions Served	L	T	T	T	R
Maximum Queue (ft)	358	304	226	162	64
Average Queue (ft)	231	112	89	81	20
95th Queue (ft)	349	252	170	143	45
Link Distance (ft)		1954	1954	1954	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	325			700	
Storage Blk Time (%)	3	0			
Queuing Penalty (veh)	8	0			

## Intersection: 20: Corporate Dr &amp; New King Dr

Movement	EB	SB	SB
Directions Served	LT	L	R
Maximum Queue (ft)	60	70	71
Average Queue (ft)	14	25	24
95th Queue (ft)	43	56	47
Link Distance (ft)	732	382	382
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

## Intersection: 30: NB Crooks Rd &amp; Tower Dr

Movement	EB	WB	WB	NB	NB	NB	NB
Directions Served	LT	R	R	T	T	T	R
Maximum Queue (ft)	82	502	427	402	471	509	329
Average Queue (ft)	54	269	203	180	231	272	33
95th Queue (ft)	70	416	385	379	454	507	175
Link Distance (ft)	17	505	505	562	562	562	
Upstream Blk Time (%)	63	1	0		0	0	
Queuing Penalty (veh)	142	0	0		0	1	
Storage Bay Dist (ft)							275
Storage Blk Time (%)						12	
Queuing Penalty (veh)						3	

## Intersection: 31: SB Crooks Rd &amp; Dummy Node/Tower Dr

Movement	SB	SB
Directions Served	L	T
Maximum Queue (ft)	380	254
Average Queue (ft)	115	12
95th Queue (ft)	290	136
Link Distance (ft)		585
Upstream Blk Time (%)		0
Queuing Penalty (veh)		1
Storage Bay Dist (ft)	375	
Storage Blk Time (%)	2	
Queuing Penalty (veh)	8	

## Intersection: 40: SB Crooks Rd &amp; N&gt;S X/O N. of Long Lake

Movement	WB
Directions Served	L
Maximum Queue (ft)	64
Average Queue (ft)	26
95th Queue (ft)	52
Link Distance (ft)	17
Upstream Blk Time (%)	8
Queuing Penalty (veh)	5
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 41: NB Crooks Rd &amp; N&gt;S X/O N. of Long Lake

Movement	NB
Directions Served	L
Maximum Queue (ft)	56
Average Queue (ft)	3
95th Queue (ft)	25
Link Distance (ft)	541
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 50: NB Crooks Rd &amp; S&gt;N X/O N. of Long Lake

Movement	EB
Directions Served	L
Maximum Queue (ft)	38
Average Queue (ft)	11
95th Queue (ft)	36
Link Distance (ft)	13
Upstream Blk Time (%)	2
Queuing Penalty (veh)	0
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 51: SB Crooks Rd &amp; S&gt;N X/O N. of Long Lake

Movement	SB	SB	SB	SB	SB
Directions Served	L	T	T	T	T
Maximum Queue (ft)	64	407	411	353	146
Average Queue (ft)	2	146	162	80	6
95th Queue (ft)	44	299	311	239	62
Link Distance (ft)		446	446	446	
Upstream Blk Time (%)		0	1	0	
Queuing Penalty (veh)		1	2	1	
Storage Bay Dist (ft)	225				150
Storage Blk Time (%)		4		3	
Queuing Penalty (veh)		1		10	

## Intersection: 60: E&gt;W X/O E. of Crooks &amp; WB Long Lake Rd

Movement	WB	WB	WB	NB
Directions Served	T	T	T	L
Maximum Queue (ft)	32	26	14	63
Average Queue (ft)	2	1	1	24
95th Queue (ft)	17	10	11	56
Link Distance (ft)	1483	1483	1483	21
Upstream Blk Time (%)				5
Queuing Penalty (veh)				3
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

## Intersection: 61: EB Long Lake Rd &amp; E&gt;W X/O E. of Crooks

Movement	EB
Directions Served	L
Maximum Queue (ft)	51
Average Queue (ft)	6
95th Queue (ft)	30
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	305
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 70: NB Crooks Rd &amp; WB Long Lake Rd

Movement	WB	WB	WB	WB
Directions Served	T	T	T	R
Maximum Queue (ft)	296	256	203	112
Average Queue (ft)	196	160	99	49
95th Queue (ft)	278	240	179	91
Link Distance (ft)	530	530	530	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				650
Storage Blk Time (%)				
Queuing Penalty (veh)				

## Intersection: 71: SB Crooks Rd &amp; WB Long Lake Rd

Movement	SB	SB	SB	SB
Directions Served	T	T	T	R
Maximum Queue (ft)	102	92	79	81
Average Queue (ft)	79	79	32	44
95th Queue (ft)	89	86	74	78
Link Distance (ft)	44	44	44	44
Upstream Blk Time (%)	42	46	7	7
Queuing Penalty (veh)	124	135	22	21
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

## Intersection: 72: SB Crooks Rd &amp; EB Long Lake Rd

Movement	EB	EB	EB	EB
Directions Served	T	T	T	R
Maximum Queue (ft)	90	98	91	82
Average Queue (ft)	75	76	74	40
95th Queue (ft)	82	85	84	71
Link Distance (ft)	42	42	42	42
Upstream Blk Time (%)	51	52	42	7
Queuing Penalty (veh)	155	156	128	20
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

## Intersection: 73: NB Crooks Rd &amp; EB Long Lake Rd

Movement	NB	NB	NB	NB
Directions Served	T	T	T	R
Maximum Queue (ft)	130	111	124	106
Average Queue (ft)	98	95	92	77
95th Queue (ft)	113	109	120	116
Link Distance (ft)	64	64	64	64
Upstream Blk Time (%)	35	31	30	17
Queuing Penalty (veh)	140	122	118	69
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				



## Intersection: 80: E&gt;W X/O W. of Crooks &amp; WB Long Lake Rd

Movement	NB
Directions Served	L
Maximum Queue (ft)	35
Average Queue (ft)	11
95th Queue (ft)	36
Link Distance (ft)	27
Upstream Blk Time (%)	2
Queuing Penalty (veh)	0
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 81: EB Long Lake Rd &amp; E&gt;W X/O W. of Crooks

Movement	EB	EB	EB	EB
Directions Served	T	T	T	T
Maximum Queue (ft)	276	291	270	154
Average Queue (ft)	141	140	115	11
95th Queue (ft)	228	228	211	81
Link Distance (ft)	508	508	508	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				150
Storage Blk Time (%)	1		3	
Queuing Penalty (veh)	0		10	

## Intersection: 90: EB Long Lake Rd &amp; W&gt;E X/O W. of Crooks

Movement	EB	EB	EB	SB
Directions Served	T	T	T	L
Maximum Queue (ft)	83	86	57	89
Average Queue (ft)	20	17	8	54
95th Queue (ft)	64	57	36	95
Link Distance (ft)	44	44	44	34
Upstream Blk Time (%)	2	2	1	15
Queuing Penalty (veh)	7	6	2	35
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

## Intersection: 91: W&gt;E X/O W. of Crooks/S.E. Site Drive &amp; WB Long Lake Rd

Movement	WB
Directions Served	L
Maximum Queue (ft)	24
Average Queue (ft)	1
95th Queue (ft)	13
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	325
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 100: E&gt;W X/O E. of Corporate &amp; WB Long Lake Rd

Movement	NB
Directions Served	L
Maximum Queue (ft)	65
Average Queue (ft)	28
95th Queue (ft)	51
Link Distance (ft)	36
Upstream Blk Time (%)	6
Queuing Penalty (veh)	4
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 101: EB Long Lake Rd &amp; E&gt;W X/O E. of Corporate

Movement	EB	EB	EB
Directions Served	L	T	T
Maximum Queue (ft)	8	31	40
Average Queue (ft)	0	1	1
95th Queue (ft)	4	14	15
Link Distance (ft)		520	520
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	375		
Storage Blk Time (%)			
Queuing Penalty (veh)			

## Intersection: 110: Investment Dr &amp; EB Long Lake Rd

Movement	EB	EB	EB	EB	NB	NB	SB
Directions Served	T	T	T	R	R	R	LT
Maximum Queue (ft)	46	54	46	43	70	42	63
Average Queue (ft)	32	19	12	13	32	10	25
95th Queue (ft)	55	49	38	38	57	30	56
Link Distance (ft)	13	13	13	13	755	755	35
Upstream Blk Time (%)	7	4	2	1			13
Queuing Penalty (veh)	18	10	6	4			4
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							

## Intersection: 111: Investment Dr &amp; WB Long Lake Rd

Movement	WB	WB	WB	WB	WB
Directions Served	L	T	T	T	T
Maximum Queue (ft)	12	101	112	112	11
Average Queue (ft)	0	20	31	29	1
95th Queue (ft)	5	68	89	82	7
Link Distance (ft)		428	428	428	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	225			300	
Storage Blk Time (%)					
Queuing Penalty (veh)					

## Intersection: 120: Corporate Dr &amp; WB Long Lake Rd

Movement	WB	WB	WB	WB	NB	SB	SB
Directions Served	T	T	T	R	LT	R	R
Maximum Queue (ft)	51	43	56	39	82	124	130
Average Queue (ft)	26	29	30	9	52	62	57
95th Queue (ft)	54	55	57	32	85	107	97
Link Distance (ft)	9	9	9	9	34	225	225
Upstream Blk Time (%)	7	7	7	1	35		
Queuing Penalty (veh)	14	14	15	2	53		
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							

## Intersection: 121: EB Long Lake Rd &amp; Corporate Dr

Movement	EB	EB	EB	EB	EB
Directions Served	L	T	T	T	T
Maximum Queue (ft)	135	73	51	23	10
Average Queue (ft)	26	15	5	2	0
95th Queue (ft)	88	47	26	14	4
Link Distance (ft)		562	562	562	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	375			275	
Storage Blk Time (%)					
Queuing Penalty (veh)					

## Intersection: 130: EB Long Lake Rd &amp; W&gt;E X/O W. of Investment

Movement	SB
Directions Served	L
Maximum Queue (ft)	53
Average Queue (ft)	29
95th Queue (ft)	51
Link Distance (ft)	33
Upstream Blk Time (%)	14
Queuing Penalty (veh)	9
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 131: W&gt;E X/O W. of Investment &amp; WB Long Lake Rd

Movement	WB
Directions Served	L
Maximum Queue (ft)	53
Average Queue (ft)	8
95th Queue (ft)	36
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	350
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 140: NB Crooks Rd &amp; S&gt;N X/O S. of Long Lake

Movement	EB
Directions Served	L
Maximum Queue (ft)	75
Average Queue (ft)	44
95th Queue (ft)	69
Link Distance (ft)	19
Upstream Blk Time (%)	37
Queuing Penalty (veh)	36
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 141: SB Crooks Rd &amp; S&gt;N X/O S. of Long Lake

Movement	SB
Directions Served	L
Maximum Queue (ft)	158
Average Queue (ft)	39
95th Queue (ft)	106
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	375
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 150: SB Crooks Rd &amp; Investment Dr

Movement	EB	EB	WB	SB
Directions Served	R	R	LT	T
Maximum Queue (ft)	166	120	51	7
Average Queue (ft)	76	31	30	0
95th Queue (ft)	138	81	53	5
Link Distance (ft)	933	933	15	272
Upstream Blk Time (%)			19	
Queuing Penalty (veh)			11	
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				



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Intersection: 151: NB Crooks Rd & Investment Dr

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Movement	NB
Directions Served	L
Maximum Queue (ft)	41
Average Queue (ft)	3
95th Queue (ft)	20
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	325
Storage Blk Time (%)	
Queuing Penalty (veh)	

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Zone Summary

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Zone wide Queuing Penalty: 2438

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# HCM 6th Signalized Intersection Summary

## 10: Crooks Rd & Corporate Dr/I-75 Ramp

# Background Conditions w/ Improvements

AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑↑	↑		↑↑↑	↑	↑↑	↑↑↑	↑
Traffic Volume (veh/h)	0	458	272	754	558	903	0	730	393	536	1390	278
Future Volume (veh/h)	0	458	272	754	558	903	0	730	393	536	1390	278
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	0	1969	1969	1969	1969	1969	0	1969	1969	1969	1969	1969
Adj Flow Rate, veh/h	0	487	183	802	552	707	0	818	268	564	1463	209
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.95	0.95	0.95
Percent Heavy Veh, %	0	2	2	2	2	2	0	2	2	2	2	2
Cap, veh/h	0	565	239	858	850	2002	0	1345	762	612	2433	755
Arrive On Green	0.00	0.14	0.14	0.23	0.43	0.43	0.00	0.23	0.23	0.17	0.45	0.45
Sat Flow, veh/h	0	3938	1668	3750	1969	3337	0	5906	1668	3638	5375	1668
Grp Volume(v), veh/h	0	487	183	802	552	707	0	818	268	564	1463	209
Grp Sat Flow(s),veh/h/ln	0	1969	1668	1875	1969	1668	0	1969	1668	1819	1792	1668
Q Serve(g_s), s	0.0	14.5	12.7	25.2	26.6	12.9	0.0	14.9	12.5	18.3	24.6	9.4
Cycle Q Clear(g_c), s	0.0	14.5	12.7	25.2	26.6	12.9	0.0	14.9	12.5	18.3	24.6	9.4
Prop In Lane	0.00		1.00	1.00		1.00	0.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	0	565	239	858	850	2002	0	1345	762	612	2433	755
V/C Ratio(X)	0.00	0.86	0.76	0.93	0.65	0.35	0.00	0.61	0.35	0.92	0.60	0.28
Avail Cap(c_a), veh/h	0	627	266	872	888	2066	0	1345	762	612	2433	755
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	50.2	49.4	45.4	26.9	12.2	0.0	41.5	21.1	49.1	24.7	20.6
Incr Delay (d2), s/veh	0.0	11.0	11.3	16.7	1.6	0.1	0.0	2.1	1.3	19.7	1.1	0.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	7.9	6.0	13.5	12.5	4.6	0.0	7.3	5.1	9.7	10.1	3.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	61.2	60.7	62.1	28.5	12.3	0.0	43.6	22.4	68.8	25.8	21.5
LnGrp LOS	A	E	E	E	C	B	A	D	C	E	C	C
Approach Vol, veh/h		670			2061			1086			2236	
Approach Delay, s/veh		61.1			36.0			38.4			36.2	
Approach LOS		E			D			D			D	
Timer - Assigned Phs	1	2	3	4		6		8				
Phs Duration (G+Y+Rc), s	27.0	34.1	34.6	24.3		61.1		58.9				
Change Period (Y+Rc), s	6.8	6.8	* 7.1	* 7.1		6.8		* 7.1				
Max Green Setting (Gmax), s	20.2	25.0	* 28	* 19		52.0		* 54				
Max Q Clear Time (g_c+I1), s	20.3	16.9	27.2	16.5		26.6		28.6				
Green Ext Time (p_c), s	0.0	2.7	0.3	0.7		11.5		5.1				

### Intersection Summary

HCM 6th Ctrl Delay 39.3

HCM 6th LOS D

### Notes

User approved volume balancing among the lanes for turning movement.

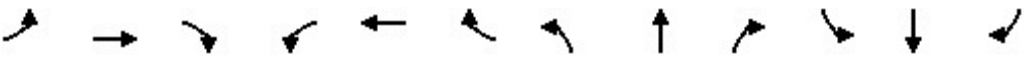
\* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

# HCM Signalized Intersection Capacity Analysis

## 30: NB Crooks Rd & Tower Dr

# Background Conditions w/ Improvements

AM Peak Hour

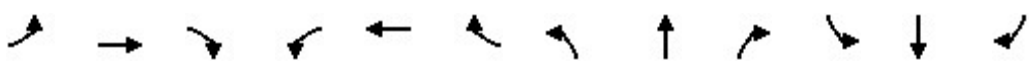
												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰				↱↱		↱↱↱	↱			
Traffic Volume (vph)	257	592	0	0	0	200	0	762	110	0	0	0
Future Volume (vph)	257	592	0	0	0	200	0	762	110	0	0	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)		6.0				6.0		6.4	6.4			
Lane Util. Factor		1.00				0.88		0.91	1.00			
Frt		1.00				0.85		1.00	0.85			
Flt Protected		0.99				1.00		1.00	1.00			
Satd. Flow (prot)		1932				2933		5353	1667			
Flt Permitted		0.99				1.00		1.00	1.00			
Satd. Flow (perm)		1932				2933		5353	1667			
Peak-hour factor, PHF	0.89	0.89	0.89	0.73	0.73	0.73	0.95	0.95	0.95	0.92	0.92	0.92
Adj. Flow (vph)	289	665	0	0	0	274	0	802	116	0	0	0
RTOR Reduction (vph)	0	13	0	0	0	18	0	0	79	0	0	0
Lane Group Flow (vph)	0	941	0	0	0	256	0	802	37	0	0	0
Turn Type	custom	NA				Perm		NA	Perm			
Protected Phases		4						2!				
Permitted Phases	4 2!					8			2			
Actuated Green, G (s)		69.6				69.6		38.0	38.0			
Effective Green, g (s)		69.6				69.6		38.0	38.0			
Actuated g/C Ratio		0.58				0.58		0.32	0.32			
Clearance Time (s)		6.0				6.0		6.4	6.4			
Vehicle Extension (s)		4.5				4.5		3.0	3.0			
Lane Grp Cap (vph)		1120				1701		1695	527			
v/s Ratio Prot								c0.15				
v/s Ratio Perm		0.49				0.09			0.02			
v/c Ratio		0.84				0.15		0.47	0.07			
Uniform Delay, d1		20.6				11.6		33.0	28.6			
Progression Factor		0.89				1.00		1.11	2.92			
Incremental Delay, d2		4.6				0.1		0.9	0.3			
Delay (s)		22.9				11.7		37.6	83.8			
Level of Service		C				B		D	F			
Approach Delay (s)		22.9			11.7			43.4			0.0	
Approach LOS		C			B			D			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		30.2				HCM 2000 Level of Service		C				
HCM 2000 Volume to Capacity ratio		0.71										
Actuated Cycle Length (s)		120.0				Sum of lost time (s)		12.4				
Intersection Capacity Utilization		79.1%				ICU Level of Service		D				
Analysis Period (min)		15										
! Phase conflict between lane groups.												
c Critical Lane Group												

# HCM 6th Signalized Intersection Summary

## 10: Crooks Rd & Corporate Dr/I-75 Ramp

# Background Conditions w/ Improvements

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑↑	↑		↑↑↑	↑	↑↑	↑↑↑	↑
Traffic Volume (veh/h)	0	70	429	400	192	824	0	1526	802	474	733	99
Future Volume (veh/h)	0	70	429	400	192	824	0	1526	802	474	733	99
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	0	1969	1969	1969	1969	1969	0	1969	1969	1969	1969	1969
Adj Flow Rate, veh/h	0	76	194	435	209	624	0	1711	563	499	772	72
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.93	0.93	0.93	0.95	0.95	0.95
Percent Heavy Veh, %	0	2	2	2	2	2	0	2	2	2	2	2
Cap, veh/h	0	146	247	491	511	1359	0	2561	942	537	3405	1057
Arrive On Green	0.00	0.07	0.07	0.13	0.26	0.26	0.00	0.43	0.43	0.15	0.63	0.63
Sat Flow, veh/h	0	1969	3337	3750	1969	3337	0	5906	1668	3638	5375	1668
Grp Volume(v), veh/h	0	76	194	435	209	624	0	1711	563	499	772	72
Grp Sat Flow(s),veh/h/ln	0	1969	1668	1875	1969	1668	0	1969	1668	1819	1792	1668
Q Serve(g_s), s	0.0	4.8	7.4	14.8	11.4	17.7	0.0	30.0	28.8	17.6	8.0	2.1
Cycle Q Clear(g_c), s	0.0	4.8	7.4	14.8	11.4	17.7	0.0	30.0	28.8	17.6	8.0	2.1
Prop In Lane	0.00		1.00	1.00		1.00	0.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	0	146	247	491	511	1359	0	2561	942	537	3405	1057
V/C Ratio(X)	0.00	0.52	0.79	0.89	0.41	0.46	0.00	0.67	0.60	0.93	0.23	0.07
Avail Cap(c_a), veh/h	0	171	290	516	550	1425	0	2561	942	537	3405	1057
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	58.0	59.2	55.5	39.9	28.1	0.0	29.4	18.6	54.7	10.2	9.1
Incr Delay (d2), s/veh	0.0	2.9	11.5	16.2	0.5	0.2	0.0	1.4	2.8	23.0	0.2	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	2.5	3.5	8.1	5.6	7.1	0.0	13.9	11.4	9.6	3.0	0.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	60.9	70.7	71.8	40.4	28.3	0.0	30.8	21.4	77.7	10.3	9.2
LnGrp LOS	A	E	E	E	D	C	A	C	C	E	B	A
Approach Vol, veh/h		270			1268			2274			1343	
Approach Delay, s/veh		67.9			45.2			28.4			35.3	
Approach LOS		E			D			C			D	
Timer - Assigned Phs	1	2	3	4		6		8				
Phs Duration (G+Y+Rc), s	26.0	63.2	24.1	16.7		89.2		40.8				
Change Period (Y+Rc), s	6.8	6.8	* 7.1	* 7.1		6.8		* 7.1				
Max Green Setting (Gmax), s	19.2	53.8	* 18	* 11		79.8		* 36				
Max Q Clear Time (g_c+I1), s	19.6	32.0	16.8	9.4		10.0		19.7				
Green Ext Time (p_c), s	0.0	10.3	0.2	0.2		5.5		3.0				

### Intersection Summary

HCM 6th Ctrl Delay 36.4

HCM 6th LOS D

### Notes

User approved volume balancing among the lanes for turning movement.




















\* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

# HCM Signalized Intersection Capacity Analysis

## 30: NB Crooks Rd & Tower Dr

# Background Conditions w/ Improvements

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations						 		  				
Traffic Volume (vph)	199	112	0	0	0	669	0	1589	28	0	0	0
Future Volume (vph)	199	112	0	0	0	669	0	1589	28	0	0	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)		6.0				6.0		6.4	6.4			
Lane Util. Factor		1.00				0.88		0.91	1.00			
Frt		1.00				0.85		1.00	0.85			
Flt Protected		0.97				1.00		1.00	1.00			
Satd. Flow (prot)		1900				2933		5353	1667			
Flt Permitted		0.97				1.00		1.00	1.00			
Satd. Flow (perm)		1900				2933		5353	1667			
Peak-hour factor, PHF	0.76	0.76	0.76	0.79	0.79	0.79	0.93	0.93	0.93	0.92	0.92	0.92
Adj. Flow (vph)	262	147	0	0	0	847	0	1709	30	0	0	0
RTOR Reduction (vph)	0	19	0	0	0	19	0	0	13	0	0	0
Lane Group Flow (vph)	0	390	0	0	0	828	0	1709	17	0	0	0
Turn Type	custom	NA				Perm		NA	Perm			
Protected Phases		4						2!				
Permitted Phases	4 2!					8			2			
Actuated Green, G (s)		45.5				45.5		72.1	72.1			
Effective Green, g (s)		45.5				45.5		72.1	72.1			
Actuated g/C Ratio		0.35				0.35		0.55	0.55			
Clearance Time (s)		6.0				6.0		6.4	6.4			
Vehicle Extension (s)		4.5				4.5		3.0	3.0			
Lane Grp Cap (vph)		665				1026		2968	924			
v/s Ratio Prot								c0.32				
v/s Ratio Perm		0.21				c0.28			0.01			
v/c Ratio		0.59				0.81		0.58	0.02			
Uniform Delay, d1		34.6				38.3		18.9	13.0			
Progression Factor		1.18				1.00		1.00	1.00			
Incremental Delay, d2		1.6				5.3		0.8	0.0			
Delay (s)		42.3				43.5		19.8	13.1			
Level of Service		D				D		B	B			
Approach Delay (s)		42.3			43.5			19.6			0.0	
Approach LOS		D			D			B			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		29.5				HCM 2000 Level of Service		C				
HCM 2000 Volume to Capacity ratio		0.67										
Actuated Cycle Length (s)		130.0				Sum of lost time (s)		12.4				
Intersection Capacity Utilization		82.8%				ICU Level of Service		E				
Analysis Period (min)		15										
! Phase conflict between lane groups.												
c Critical Lane Group												



## Intersection: 10: Crooks Rd &amp; Corporate Dr/I-75 Ramp

Movement	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB	NB	NB
Directions Served	T	TR	R	L	L	T	TR	R	T	T	TR	R
Maximum Queue (ft)	391	406	286	409	407	299	328	324	193	194	200	184
Average Queue (ft)	271	301	80	257	263	161	225	195	141	160	172	138
95th Queue (ft)	417	439	186	365	367	254	300	277	189	208	205	205
Link Distance (ft)	362	362	362			1654	1654		146	146	146	146
Upstream Blk Time (%)	7	13	0						6	12	17	7
Queuing Penalty (veh)	16	33	0						17	33	47	21
Storage Bay Dist (ft)				700	700			750				
Storage Blk Time (%)												
Queuing Penalty (veh)												

## Intersection: 10: Crooks Rd &amp; Corporate Dr/I-75 Ramp

Movement	SB	SB	SB	SB	SB	SB
Directions Served	L	L	T	T	T	R
Maximum Queue (ft)	375	425	1934	1910	1769	127
Average Queue (ft)	350	394	1253	1172	756	48
95th Queue (ft)	448	512	2359	2340	1934	89
Link Distance (ft)			1954	1954	1954	
Upstream Blk Time (%)			21	8	1	
Queuing Penalty (veh)			0	0	0	
Storage Bay Dist (ft)	325	325				700
Storage Blk Time (%)	36	61	1		0	
Queuing Penalty (veh)	169	280	5		0	

## Intersection: 30: NB Crooks Rd &amp; Tower Dr

Movement	EB	WB	WB	NB	NB	NB	NB
Directions Served	LT	R	R	T	T	T	R
Maximum Queue (ft)	76	114	35	227	262	306	144
Average Queue (ft)	55	47	4	107	139	168	36
95th Queue (ft)	65	89	22	202	247	277	90
Link Distance (ft)	17	505	505	562	562	562	
Upstream Blk Time (%)	42						
Queuing Penalty (veh)	359						
Storage Bay Dist (ft)						275	
Storage Blk Time (%)						1	
Queuing Penalty (veh)						1	

## Zone Summary

Zone wide Queuing Penalty: 982

## Intersection: 10: Crooks Rd &amp; Corporate Dr/I-75 Ramp

Movement	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB	NB	NB
Directions Served	T	TR	R	L	L	T	TR	R	T	T	TR	R
Maximum Queue (ft)	108	179	144	282	304	221	335	285	211	217	202	204
Average Queue (ft)	35	89	67	151	177	92	198	174	180	185	186	167
95th Queue (ft)	84	152	125	250	269	176	294	268	214	208	198	224
Link Distance (ft)	362	362	362			1654	1654		146	146	146	146
Upstream Blk Time (%)									24	27	35	14
Queuing Penalty (veh)									137	158	201	79
Storage Bay Dist (ft)				700	700			750				
Storage Blk Time (%)												
Queuing Penalty (veh)												

## Intersection: 10: Crooks Rd &amp; Corporate Dr/I-75 Ramp

Movement	SB	SB	SB	SB	SB	SB
Directions Served	L	L	T	T	T	R
Maximum Queue (ft)	375	425	1626	1499	1198	43
Average Queue (ft)	329	370	872	780	189	21
95th Queue (ft)	458	523	1904	1790	690	44
Link Distance (ft)			1954	1954	1954	
Upstream Blk Time (%)			0			
Queuing Penalty (veh)			0			
Storage Bay Dist (ft)	325	325				700
Storage Blk Time (%)	39	60	0		0	
Queuing Penalty (veh)	96	145	0		0	

## Intersection: 30: NB Crooks Rd &amp; Tower Dr

Movement	EB	WB	WB	NB	NB	NB	NB
Directions Served	LT	R	R	T	T	T	R
Maximum Queue (ft)	78	514	444	430	471	506	274
Average Queue (ft)	55	263	186	182	235	270	35
95th Queue (ft)	66	432	400	382	441	486	176
Link Distance (ft)	17	505	505	562	562	562	
Upstream Blk Time (%)	67	1	1			0	
Queuing Penalty (veh)	213	0	0			0	
Storage Bay Dist (ft)							275
Storage Blk Time (%)						12	
Queuing Penalty (veh)						3	

## Zone Summary

Zone wide Queuing Penalty: 1033























## **Appendix D**

# **FUTURE TRAFFIC CONDITIONS**

# HCM 6th Signalized Intersection Summary

## 10: Crooks Rd & Corporate Dr/I-75 Ramp

Future Conditions  
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	213	503	83	890	676	903	0	586	433	536	1536	363
Future Volume (veh/h)	213	503	83	890	676	903	0	586	433	536	1536	363
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1969	1969	1969	1969	1969	1969	0	1969	1969	1969	1969	1969
Adj Flow Rate, veh/h	227	535	35	631	1501	453	0	770	240	564	1617	298
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	0	2	2	2	2	2
Cap, veh/h	188	472	291	545	1145	779	0	753	698	640	1935	601
Arrive On Green	0.17	0.17	0.17	0.29	0.29	0.29	0.00	0.13	0.13	0.18	0.36	0.36
Sat Flow, veh/h	1077	2708	1668	1875	3938	1668	0	5906	1668	3638	5375	1668
Grp Volume(v), veh/h	404	358	35	631	1501	453	0	770	240	564	1617	298
Grp Sat Flow(s),veh/h/ln	1915	1870	1668	1875	1969	1668	0	1969	1668	1819	1792	1668
Q Serve(g_s), s	20.9	20.9	2.1	34.9	34.9	23.9	0.0	15.3	11.7	18.1	33.0	16.7
Cycle Q Clear(g_c), s	20.9	20.9	2.1	34.9	34.9	23.9	0.0	15.3	11.7	18.1	33.0	16.7
Prop In Lane	0.56		1.00	1.00		1.00	0.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	334	326	291	545	1145	779	0	753	698	640	1935	601
V/C Ratio(X)	1.21	1.10	0.12	1.16	1.31	0.58	0.00	1.02	0.34	0.88	0.84	0.50
Avail Cap(c_a), veh/h	334	326	291	545	1145	779	0	753	698	703	1935	601
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	49.6	49.5	41.8	42.5	42.5	23.4	0.0	52.3	23.7	48.2	35.2	29.9
Incr Delay (d2), s/veh	119.2	79.5	0.2	89.8	146.2	1.1	0.0	38.6	1.3	12.4	4.5	2.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	20.9	16.8	0.9	29.4	39.8	9.3	0.0	10.0	7.4	9.1	14.5	6.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	168.8	129.1	42.0	132.4	188.7	24.5	0.0	90.9	25.1	60.6	39.6	32.8
LnGrp LOS	F	F	D	F	F	C	A	F	C	E	D	C
Approach Vol, veh/h		797			2585			1010			2479	
Approach Delay, s/veh		145.3			146.2			75.3			43.6	
Approach LOS		F			F			E			D	
Timer - Assigned Phs	1	2		4		6		8				
Phs Duration (G+Y+Rc), s	27.9	22.1		42.0		50.0		28.0				
Change Period (Y+Rc), s	6.8	6.8		* 7.1		6.8		7.1				
Max Green Setting (Gmax), s	23.2	13.2		* 35		43.2		20.9				
Max Q Clear Time (g_c+I1), s	20.1	17.3		36.9		35.0		22.9				
Green Ext Time (p_c), s	1.0	0.0		0.0		6.1		0.0				

### Intersection Summary

HCM 6th Ctrl Delay	98.6
HCM 6th LOS	F






### Notes

User approved volume balancing among the lanes for turning movement.

\* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

HCM 6th TWSC  
20: Corporate Dr & New King Dr

Future Conditions  
AM Peak Hour




















Intersection						
Int Delay, s/veh	2.4					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	96	787	1012	27	12	35
Future Vol, veh/h	96	787	1012	27	12	35
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	0	0	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	94	94	94	94	60	60
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	102	837	1077	29	20	58
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	1106	0	-	0	1700	539
Stage 1	-	-	-	-	1077	-
Stage 2	-	-	-	-	623	-
Critical Hdwy	4.14	-	-	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	2.22	-	-	-	3.52	3.32
Pot Cap-1 Maneuver	627	-	-	-	83	487
Stage 1	-	-	-	-	288	-
Stage 2	-	-	-	-	497	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	627	-	-	-	58	487
Mov Cap-2 Maneuver	-	-	-	-	58	-
Stage 1	-	-	-	-	200	-
Stage 2	-	-	-	-	497	-
Approach	EB	WB		SB		
HCM Control Delay, s	2.5	0		34.7		
HCM LOS	D					
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	627	-	-	-	58	487
HCM Lane V/C Ratio	0.163	-	-	-	0.345	0.12
HCM Control Delay (s)	11.9	1.4	-	-	96.7	13.4
HCM Lane LOS	B	A	-	-	F	B
HCM 95th %tile Q(veh)	0.6	-	-	-	1.2	0.4



# HCM Signalized Intersection Capacity Analysis

## 30: NB Crooks Rd & Tower Dr

Future Conditions  
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations						 		  				
Traffic Volume (vph)	69	591	0	0	0	200	0	846	110	0	0	0
Future Volume (vph)	69	591	0	0	0	200	0	846	110	0	0	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)		6.0				6.0		6.4	6.4			
Lane Util. Factor		1.00				0.88		0.91	1.00			
Frt		1.00				0.85		1.00	0.85			
Flt Protected		0.99				1.00		1.00	1.00			
Satd. Flow (prot)		1951				2933		5353	1667			
Flt Permitted		0.99				1.00		1.00	1.00			
Satd. Flow (perm)		1951				2933		5353	1667			
Peak-hour factor, PHF	0.89	0.89	0.89	0.73	0.73	0.73	0.95	0.95	0.95	0.92	0.92	0.92
Adj. Flow (vph)	78	664	0	0	0	274	0	891	116	0	0	0
RTOR Reduction (vph)	0	16	0	0	0	16	0	0	68	0	0	0
Lane Group Flow (vph)	0	726	0	0	0	258	0	891	48	0	0	0
Turn Type	custom	NA				Perm		NA	Perm			
Protected Phases		4						2!				
Permitted Phases	4 2!					8			2			
Actuated Green, G (s)		57.9				57.9		49.7	49.7			
Effective Green, g (s)		57.9				57.9		49.7	49.7			
Actuated g/C Ratio		0.48				0.48		0.41	0.41			
Clearance Time (s)		6.0				6.0		6.4	6.4			
Vehicle Extension (s)		4.5				4.5		3.0	3.0			
Lane Grp Cap (vph)		941				1415		2217	690			
v/s Ratio Prot								c0.17				
v/s Ratio Perm		0.37				0.09			0.03			
v/c Ratio		0.77				0.18		0.40	0.07			
Uniform Delay, d1		25.6				17.6		24.7	21.2			
Progression Factor		0.95				1.00		0.88	1.90			
Incremental Delay, d2		1.6				0.1		0.5	0.2			
Delay (s)		26.0				17.7		22.2	40.5			
Level of Service		C				B		C	D			
Approach Delay (s)		26.0			17.7			24.3			0.0	
Approach LOS		C			B			C			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		24.0				HCM 2000 Level of Service		C				
HCM 2000 Volume to Capacity ratio		0.60										
Actuated Cycle Length (s)		120.0				Sum of lost time (s)		12.4				
Intersection Capacity Utilization		70.7%				ICU Level of Service		C				
Analysis Period (min)		15										
! Phase conflict between lane groups.												
c Critical Lane Group												

HCM 6th TWSC  
40: SB Crooks Rd & N>S X/O N. of Long Lake

Future Conditions  
AM Peak Hour



Intersection						
Int Delay, s/veh	1.4					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰					↱↱↱
Traffic Vol, veh/h	115	0	0	0	0	1780
Future Vol, veh/h	115	0	0	0	0	1780
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	16974	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	75	75	92	92	91	91
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	153	0	0	0	0	1956
Major/Minor	Minor1	Major2				
Conflicting Flow All	782	-	-	-	-	-
Stage 1	0	-	-	-	-	-
Stage 2	782	-	-	-	-	-
Critical Hdwy	5.74	-	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	6.04	-	-	-	-	-
Follow-up Hdwy	3.82	-	-	-	-	-
Pot Cap-1 Maneuver	399	0	0	0	-	-
Stage 1	-	0	0	0	-	-
Stage 2	373	0	0	0	-	-
Platoon blocked, %						-
Mov Cap-1 Maneuver	399	-	-	-	-	-
Mov Cap-2 Maneuver	399	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	373	-	-	-	-	-
Approach	WB	SB				
HCM Control Delay, s	19.5	0				
HCM LOS	C					
Minor Lane/Major Mvmt	WBLn1	SBT				
Capacity (veh/h)	399	-				
HCM Lane V/C Ratio	0.384	-				
HCM Control Delay (s)	19.5	-				
HCM Lane LOS	C	-				
HCM 95th %tile Q(veh)	1.8	-				

HCM 6th TWSC  
50: NB Crooks Rd & S>N X/O N. of Long Lake

Future Conditions  
AM Peak Hour

Intersection

Int Delay, s/veh 1.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	93	0	0	955	0	0
Future Vol, veh/h	93	0	0	955	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	16979	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	75	75	95	95	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	124	0	0	1005	0	0

Major/Minor	Minor2	Major1	
Conflicting Flow All	402	-	0
Stage 1	0	-	-
Stage 2	402	-	-
Critical Hdwy	5.74	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	6.04	-	-
Follow-up Hdwy	3.82	-	-
Pot Cap-1 Maneuver	610	0	-
Stage 1	-	0	-
Stage 2	590	0	-
Platoon blocked, %			-
Mov Cap-1 Maneuver	610	-	-
Mov Cap-2 Maneuver	610	-	-
Stage 1	-	-	-
Stage 2	590	-	-

Approach	EB	NB
HCM Control Delay, s	12.4	0
HCM LOS	B	

Minor Lane/Major Mvmt	NBT	EBLn1
Capacity (veh/h)	-	610
HCM Lane V/C Ratio	-	0.203
HCM Control Delay (s)	-	12.4
HCM Lane LOS	-	B
HCM 95th %tile Q(veh)	-	0.8

# HCM Signalized Intersection Capacity Analysis

## 60: E>W X/O E. of Crooks & WB Long Lake Rd


Future Conditions  
AM Peak Hour

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations				↑↑↑	↖	
Traffic Volume (vph)	0	0	0	1534	140	0
Future Volume (vph)	0	0	0	1534	140	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000
Total Lost time (s)				6.6	5.4	
Lane Util. Factor				0.91	1.00	
Frt				1.00	1.00	
Flt Protected				1.00	0.95	
Satd. Flow (prot)				5353	1863	
Flt Permitted				1.00	0.95	
Satd. Flow (perm)				5353	1863	
Peak-hour factor, PHF	0.92	0.92	0.95	0.95	0.82	0.82
Adj. Flow (vph)	0	0	0	1615	171	0
RTOR Reduction (vph)	0	0	0	0	15	0
Lane Group Flow (vph)	0	0	0	1615	156	0
Turn Type				NA	Prot	
Protected Phases				6	8	
Permitted Phases						
Actuated Green, G (s)				92.5	15.5	
Effective Green, g (s)				92.5	15.5	
Actuated g/C Ratio				0.77	0.13	
Clearance Time (s)				6.6	5.4	
Vehicle Extension (s)				3.0	3.0	
Lane Grp Cap (vph)				4126	240	
v/s Ratio Prot				c0.30	c0.08	
v/s Ratio Perm						
v/c Ratio				0.39	0.65	
Uniform Delay, d1				4.5	49.7	
Progression Factor				1.00	0.87	
Incremental Delay, d2				0.3	6.0	
Delay (s)				4.8	49.4	
Level of Service				A	D	
Approach Delay (s)	0.0			4.8	49.4	
Approach LOS	A			A	D	
Intersection Summary						
HCM 2000 Control Delay			9.1	HCM 2000 Level of Service		A
HCM 2000 Volume to Capacity ratio			0.43			
Actuated Cycle Length (s)			120.0	Sum of lost time (s)		12.0
Intersection Capacity Utilization			49.9%	ICU Level of Service		A
Analysis Period (min)			15			
c Critical Lane Group						

# HCM Signalized Intersection Capacity Analysis

## 70: NB Crooks Rd & WB Long Lake Rd

Future Conditions  
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑↑	↑		↑↑↑				
Traffic Volume (vph)	0	0	0	0	1483	191	0	764	0	0	0	0
Future Volume (vph)	0	0	0	0	1483	191	0	764	0	0	0	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)					11.9	11.9		5.9				
Lane Util. Factor					0.91	1.00		0.91				
Frt					1.00	0.85		1.00				
Flt Protected					1.00	1.00		1.00				
Satd. Flow (prot)					5353	1667		5353				
Flt Permitted					1.00	1.00		1.00				
Satd. Flow (perm)					5353	1667		5353				
Peak-hour factor, PHF	0.92	0.92	0.92	0.95	0.95	0.95	0.93	0.93	0.93	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	1561	201	0	822	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	60	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	1561	141	0	822	0	0	0	0
Turn Type					NA	Perm		NA				
Protected Phases					4			6				
Permitted Phases						4						
Actuated Green, G (s)					46.2	46.2		56.0				
Effective Green, g (s)					46.2	46.2		56.0				
Actuated g/C Ratio					0.39	0.39		0.47				
Clearance Time (s)					11.9	11.9		5.9				
Vehicle Extension (s)					3.0	3.0		3.0				
Lane Grp Cap (vph)					2060	641		2498				
v/s Ratio Prot					c0.29			c0.15				
v/s Ratio Perm						0.08						
v/c Ratio					0.76	0.22		0.33				
Uniform Delay, d1					32.0	24.8		20.2				
Progression Factor					0.96	0.87		0.00				
Incremental Delay, d2					1.6	0.2		0.3				
Delay (s)					32.2	21.8		0.3				
Level of Service					C	C		A				
Approach Delay (s)		0.0			31.0			0.3			0.0	
Approach LOS		A			C			A			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		21.2			HCM 2000 Level of Service					C		
HCM 2000 Volume to Capacity ratio		0.56										
Actuated Cycle Length (s)		120.0			Sum of lost time (s)					23.8		
Intersection Capacity Utilization		65.0%			ICU Level of Service					C		
Analysis Period (min)		15										
c Critical Lane Group												

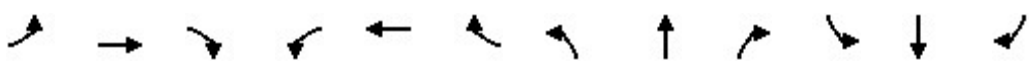


# HCM Signalized Intersection Capacity Analysis

71: SB Crooks Rd & WB Long Lake Rd

Future Conditions

AM Peak Hour













												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑↑						↑↑↑	↑
Traffic Volume (vph)	0	0	0	0	1483	0	0	0	0	0	1251	147
Future Volume (vph)	0	0	0	0	1483	0	0	0	0	0	1251	147
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)					5.9						11.9	11.9
Lane Util. Factor					0.91						0.91	1.00
Frt					1.00						1.00	0.85
Flt Protected					1.00						1.00	1.00
Satd. Flow (prot)					5353						5353	1667
Flt Permitted					1.00						1.00	1.00
Satd. Flow (perm)					5353						5353	1667
Peak-hour factor, PHF	0.92	0.92	0.92	0.95	0.95	0.95	0.92	0.92	0.92	0.91	0.91	0.91
Adj. Flow (vph)	0	0	0	0	1561	0	0	0	0	0	1375	162
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	47
Lane Group Flow (vph)	0	0	0	0	1561	0	0	0	0	0	1375	115
Turn Type					NA						NA	Perm
Protected Phases					8						2	
Permitted Phases												2
Actuated Green, G (s)					52.2						50.0	50.0
Effective Green, g (s)					52.2						50.0	50.0
Actuated g/C Ratio					0.44						0.42	0.42
Clearance Time (s)					5.9						11.9	11.9
Vehicle Extension (s)					3.0						3.0	3.0
Lane Grp Cap (vph)					2328						2230	694
v/s Ratio Prot					c0.29						c0.26	
v/s Ratio Perm												0.07
v/c Ratio					0.67						0.62	0.17
Uniform Delay, d1					27.0						27.5	21.9
Progression Factor					0.00						1.00	1.00
Incremental Delay, d2					0.5						1.3	0.5
Delay (s)					0.5						28.8	22.4
Level of Service					A						C	C
Approach Delay (s)		0.0			0.5			0.0			28.1	
Approach LOS		A			A			A			C	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			14.2									HCM 2000 Level of Service B
HCM 2000 Volume to Capacity ratio			0.68									
Actuated Cycle Length (s)			120.0								23.8	
Intersection Capacity Utilization			65.0%									ICU Level of Service C
Analysis Period (min)			15									
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis

## 72: SB Crooks Rd & EB Long Lake Rd

# Future Conditions

AM Peak Hour


												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑	↑								↑↑↑	
Traffic Volume (vph)	0	629	181	0	0	0	0	0	0	0	1251	0
Future Volume (vph)	0	629	181	0	0	0	0	0	0	0	1251	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)		11.9	11.9								5.9	
Lane Util. Factor		0.91	1.00								0.91	
Frt		1.00	0.85								1.00	
Flt Protected		1.00	1.00								1.00	
Satd. Flow (prot)		5353	1667								5353	
Flt Permitted		1.00	1.00								1.00	
Satd. Flow (perm)		5353	1667								5353	
Peak-hour factor, PHF	0.90	0.90	0.90	0.92	0.92	0.92	0.92	0.92	0.92	0.91	0.91	0.91
Adj. Flow (vph)	0	699	201	0	0	0	0	0	0	0	1375	0
RTOR Reduction (vph)	0	0	50	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	699	151	0	0	0	0	0	0	0	1375	0
Turn Type		NA	Perm								NA	
Protected Phases		4									6	
Permitted Phases			4									
Actuated Green, G (s)		46.2	46.2								56.0	
Effective Green, g (s)		46.2	46.2								56.0	
Actuated g/C Ratio		0.39	0.39								0.47	
Clearance Time (s)		11.9	11.9								5.9	
Vehicle Extension (s)		3.0	3.0								3.0	
Lane Grp Cap (vph)		2060	641								2498	
v/s Ratio Prot		c0.13									c0.26	
v/s Ratio Perm			0.09									
v/c Ratio		0.34	0.24								0.55	
Uniform Delay, d1		26.1	25.0								23.0	
Progression Factor		1.37	1.65								0.00	
Incremental Delay, d2		0.1	0.2								0.7	
Delay (s)		35.9	41.4								0.7	
Level of Service		D	D								A	
Approach Delay (s)		37.1			0.0			0.0			0.7	
Approach LOS		D			A			A			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			15.1				HCM 2000 Level of Service				B	
HCM 2000 Volume to Capacity ratio			0.48									
Actuated Cycle Length (s)			120.0				Sum of lost time (s)			23.8		
Intersection Capacity Utilization			65.0%				ICU Level of Service			C		
Analysis Period (min)			15									
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis

73: NB Crooks Rd & EB Long Lake Rd

Future Conditions

AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑						↑↑↑	↑			
Traffic Volume (vph)	0	629	0	0	0	0	0	764	215	0	0	0
Future Volume (vph)	0	629	0	0	0	0	0	764	215	0	0	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)		5.9						11.9	11.9			
Lane Util. Factor		0.91						0.91	1.00			
Frt		1.00						1.00	0.85			
Flt Protected		1.00						1.00	1.00			
Satd. Flow (prot)		5353						5353	1667			
Flt Permitted		1.00						1.00	1.00			
Satd. Flow (perm)		5353						5353	1667			
Peak-hour factor, PHF	0.90	0.90	0.90	0.92	0.92	0.92	0.93	0.93	0.93	0.92	0.92	0.92
Adj. Flow (vph)	0	699	0	0	0	0	0	822	231	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	82	0	0	0
Lane Group Flow (vph)	0	699	0	0	0	0	0	822	149	0	0	0
Turn Type		NA						NA	Perm			
Protected Phases		8						2				
Permitted Phases									2			
Actuated Green, G (s)		52.2						50.0	50.0			
Effective Green, g (s)		52.2						50.0	50.0			
Actuated g/C Ratio		0.44						0.42	0.42			
Clearance Time (s)		5.9						11.9	11.9			
Vehicle Extension (s)		3.0						3.0	3.0			
Lane Grp Cap (vph)		2328						2230	694			
v/s Ratio Prot		c0.13						c0.15				
v/s Ratio Perm									0.09			
v/c Ratio		0.30						0.37	0.21			
Uniform Delay, d1		22.0						24.1	22.4			
Progression Factor		0.00						1.00	1.00			
Incremental Delay, d2		0.1						0.5	0.7			
Delay (s)		0.1						24.6	23.1			
Level of Service		A						C	C			
Approach Delay (s)		0.1			0.0			24.3			0.0	
Approach LOS		A			A			C			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		14.6						HCM 2000 Level of Service	B			
HCM 2000 Volume to Capacity ratio		0.35										
Actuated Cycle Length (s)		120.0						Sum of lost time (s)	23.8			
Intersection Capacity Utilization		56.1%						ICU Level of Service	B			
Analysis Period (min)		15										
c Critical Lane Group												

HCM 6th TWSC  
80: E>W X/O W. of Crooks & WB Long Lake Rd

Future Conditions  
AM Peak Hour

Intersection						
Int Delay, s/veh	0.1					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations				↑↑↑	↑	
Traffic Vol, veh/h	0	0	0	1630	10	0
Future Vol, veh/h	0	0	0	1630	10	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	95	95	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	0	0	1716	11	0

Major/Minor	Major2	Minor1
Conflicting Flow All	-	686
Stage 1	-	0
Stage 2	-	686
Critical Hdwy	-	5.74
Critical Hdwy Stg 1	-	-
Critical Hdwy Stg 2	-	6.04
Follow-up Hdwy	-	3.82
Pot Cap-1 Maneuver	0	444
Stage 1	0	-
Stage 2	0	420
Platoon blocked, %	-	-
Mov Cap-1 Maneuver	-	444
Mov Cap-2 Maneuver	-	444
Stage 1	-	-
Stage 2	-	420

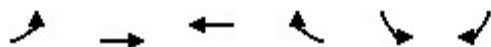
Approach	WB	NB
HCM Control Delay, s	0	13.3
HCM LOS		B

Minor Lane/Major Mvmt	NBLn1	WBT
Capacity (veh/h)	444	-
HCM Lane V/C Ratio	0.024	-
HCM Control Delay (s)	13.3	-
HCM Lane LOS	B	-
HCM 95th %tile Q(veh)	0.1	-

# HCM Signalized Intersection Capacity Analysis

## 90: EB Long Lake Rd & W>E X/O W. of Crooks

Future Conditions  
AM Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑↑			↑	
Traffic Volume (vph)	0	526	0	0	294	0
Future Volume (vph)	0	526	0	0	294	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000
Total Lost time (s)		6.0			5.4	
Lane Util. Factor		0.91			1.00	
Frt		1.00			1.00	
Flt Protected		1.00			0.95	
Satd. Flow (prot)		5353			1863	
Flt Permitted		1.00			0.95	
Satd. Flow (perm)		5353			1863	
Peak-hour factor, PHF	0.91	0.91	0.92	0.92	0.91	0.91
Adj. Flow (vph)	0	578	0	0	323	0
RTOR Reduction (vph)	0	0	0	0	121	0
Lane Group Flow (vph)	0	578	0	0	202	0
Turn Type		NA			Prot	
Protected Phases		2			4	
Permitted Phases						
Actuated Green, G (s)		90.1			18.5	
Effective Green, g (s)		90.1			18.5	
Actuated g/C Ratio		0.75			0.15	
Clearance Time (s)		6.0			5.4	
Vehicle Extension (s)		3.0			3.0	
Lane Grp Cap (vph)		4019			287	
v/s Ratio Prot		c0.11			c0.11	
v/s Ratio Perm						
v/c Ratio		0.14			0.70	
Uniform Delay, d1		4.2			48.2	
Progression Factor		1.11			0.47	
Incremental Delay, d2		0.1			6.5	
Delay (s)		4.7			28.9	
Level of Service		A			C	
Approach Delay (s)		4.7	0.0		28.9	
Approach LOS		A	A		C	
<b>Intersection Summary</b>						
HCM 2000 Control Delay		13.4		HCM 2000 Level of Service		B
HCM 2000 Volume to Capacity ratio		0.24				
Actuated Cycle Length (s)		120.0		Sum of lost time (s)		11.4
Intersection Capacity Utilization		47.0%		ICU Level of Service		A
Analysis Period (min)		15				
c Critical Lane Group						




Intersection						
Int Delay, s/veh	1					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations				↑↑↑↑	↗	
Traffic Vol, veh/h	0	0	0	1229	82	0
Future Vol, veh/h	0	0	0	1229	82	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	95	95	80	80
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	0	0	1294	103	0
Major/Minor			Major2		Minor1	
Conflicting Flow All			-	-	518	-
Stage 1			-	-	0	-
Stage 2			-	-	518	-
Critical Hdwy			-	-	5.74	-
Critical Hdwy Stg 1			-	-	-	-
Critical Hdwy Stg 2			-	-	6.04	-
Follow-up Hdwy			-	-	3.82	-
Pot Cap-1 Maneuver			0	-	536	0
Stage 1			0	-	-	0
Stage 2			0	-	514	0
Platoon blocked, %				-		
Mov Cap-1 Maneuver			-	-	536	-
Mov Cap-2 Maneuver			-	-	536	-
Stage 1			-	-	-	-
Stage 2			-	-	514	-
Approach			WB		NB	
HCM Control Delay, s			0		13.3	
HCM LOS					B	
Minor Lane/Major Mvmt	NBLn1	WBT				
Capacity (veh/h)	536	-				
HCM Lane V/C Ratio	0.191	-				
HCM Control Delay (s)	13.3	-				
HCM Lane LOS	B	-				
HCM 95th %tile Q(veh)	0.7	-				

# HCM Signalized Intersection Capacity Analysis

## 110: Investment Dr & EB Long Lake Rd













Future Conditions  
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑	↑						↑↑		↑	
Traffic Volume (vph)	0	541	142	0	0	0	0	0	67	0	72	0
Future Volume (vph)	0	541	142	0	0	0	0	0	67	0	72	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)		6.0	6.0						5.5		5.5	
Lane Util. Factor		0.91	1.00						0.88		1.00	
Frt		1.00	0.85						0.85		1.00	
Flt Protected		1.00	1.00						1.00		1.00	
Satd. Flow (prot)		5353	1667						2933		1961	
Flt Permitted		1.00	1.00						1.00		1.00	
Satd. Flow (perm)		5353	1667						2933		1961	
Peak-hour factor, PHF	0.93	0.93	0.93	0.92	0.92	0.92	0.84	0.84	0.84	0.78	0.78	0.78
Adj. Flow (vph)	0	582	153	0	0	0	0	0	80	0	92	0
RTOR Reduction (vph)	0	0	29	0	0	0	0	0	73	0	0	0
Lane Group Flow (vph)	0	582	124	0	0	0	0	0	7	0	92	0
Turn Type		NA	Perm						Perm		NA	
Protected Phases		2!									4	
Permitted Phases			2						8	4 2!		
Actuated Green, G (s)		97.5	97.5						11.0		11.0	
Effective Green, g (s)		97.5	97.5						11.0		11.0	
Actuated g/C Ratio		0.81	0.81						0.09		0.09	
Clearance Time (s)		6.0	6.0						5.5		5.5	
Vehicle Extension (s)		4.0	4.0						3.0		3.0	
Lane Grp Cap (vph)		4349	1354						268		179	
v/s Ratio Prot		c0.11									c0.05	
v/s Ratio Perm			0.07						0.00			
v/c Ratio		0.13	0.09						0.03		0.51	
Uniform Delay, d1		2.4	2.3						49.6		52.0	
Progression Factor		1.00	1.00						1.00		1.39	
Incremental Delay, d2		0.1	0.1						0.0		2.1	
Delay (s)		2.4	2.4						49.7		74.3	
Level of Service		A	A						D		E	
Approach Delay (s)		2.4			0.0			49.7			74.3	
Approach LOS		A			A			D			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			13.9									HCM 2000 Level of Service B
HCM 2000 Volume to Capacity ratio			0.17									
Actuated Cycle Length (s)			120.0									Sum of lost time (s) 11.5
Intersection Capacity Utilization			41.9%									ICU Level of Service A
Analysis Period (min)			15									
! Phase conflict between lane groups.												
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis

## 120: Corporate Dr & WB Long Lake Rd

Future Conditions  
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑↑	↑		↕				↗↘
Traffic Volume (vph)	0	0	0	0	927	273	39	310	0	0	0	226
Future Volume (vph)	0	0	0	0	927	273	39	310	0	0	0	226
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)					6.3	6.3		5.8				5.8
Lane Util. Factor					0.91	1.00		1.00				0.88
Frt					1.00	0.85		1.00				0.85
Flt Protected					1.00	1.00		0.99				1.00
Satd. Flow (prot)					5353	1667		1950				2933
Flt Permitted					1.00	1.00		0.99				1.00
Satd. Flow (perm)					5353	1667		1950				2933
Peak-hour factor, PHF	0.92	0.92	0.92	0.95	0.95	0.95	0.89	0.89	0.89	0.81	0.81	0.81
Adj. Flow (vph)	0	0	0	0	976	287	44	348	0	0	0	279
RTOR Reduction (vph)	0	0	0	0	0	98	0	23	0	0	0	93
Lane Group Flow (vph)	0	0	0	0	976	189	0	369	0	0	0	186
Turn Type					NA	Perm	custom	NA				Perm
Protected Phases					6!			8				
Permitted Phases						6	8 6!					4
Actuated Green, G (s)					79.1	79.1		28.8				28.8
Effective Green, g (s)					79.1	79.1		28.8				28.8
Actuated g/C Ratio					0.66	0.66		0.24				0.24
Clearance Time (s)					6.3	6.3		5.8				5.8
Vehicle Extension (s)					4.0	4.0		3.0				3.0
Lane Grp Cap (vph)					3528	1098		468				703
v/s Ratio Prot					c0.18							
v/s Ratio Perm						0.11		0.19				0.06
v/c Ratio					0.28	0.17		0.79				0.26
Uniform Delay, d1					8.5	7.9		42.8				37.0
Progression Factor					2.69	11.46		1.00				0.74
Incremental Delay, d2					0.2	0.3		8.6				0.1
Delay (s)					23.1	90.4		51.3				27.5
Level of Service					C	F		D				C
Approach Delay (s)		0.0			38.4			51.3			27.5	
Approach LOS		A			D			D			C	
Intersection Summary												
HCM 2000 Control Delay			39.4		HCM 2000 Level of Service						D	
HCM 2000 Volume to Capacity ratio			0.41									
Actuated Cycle Length (s)			120.0		Sum of lost time (s)						12.1	
Intersection Capacity Utilization			57.0%		ICU Level of Service						B	
Analysis Period (min)			15									
! Phase conflict between lane groups.												
c Critical Lane Group												



HCM 6th TWSC  
130: EB Long Lake Rd & W>E X/O W. of Investment

Future Conditions  
AM Peak Hour

Intersection						
Int Delay, s/veh	1.5					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑↑↑			↑	
Traffic Vol, veh/h	0	947	0	0	85	0
Future Vol, veh/h	0	947	0	0	85	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	16983	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	93	93	92	92	64	64
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	1018	0	0	133	0
Major/Minor	Major1			Minor2		
Conflicting Flow All	-	0			407	-
Stage 1	-	-			0	-
Stage 2	-	-			407	-
Critical Hdwy	-	-			5.74	-
Critical Hdwy Stg 1	-	-			-	-
Critical Hdwy Stg 2	-	-			6.04	-
Follow-up Hdwy	-	-			3.82	-
Pot Cap-1 Maneuver	0	-			606	0
Stage 1	0	-			-	0
Stage 2	0	-			586	0
Platoon blocked, %		-				
Mov Cap-1 Maneuver	-	-			606	-
Mov Cap-2 Maneuver	-	-			606	-
Stage 1	-	-			-	-
Stage 2	-	-			586	-
Approach	EB			SB		
HCM Control Delay, s	0			12.6		
HCM LOS				B		
Minor Lane/Major Mvmt	EBT SBLn1					
Capacity (veh/h)	- 606					
HCM Lane V/C Ratio	- 0.219					
HCM Control Delay (s)	- 12.6					
HCM Lane LOS	- B					
HCM 95th %tile Q(veh)	- 0.8					

HCM 6th TWSC  
140: NB Crooks Rd & S>N X/O S. of Long Lake

Future Conditions  
AM Peak Hour

Intersection						
Int Delay, s/veh	0.6					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	48	0	0	997	0	0
Future Vol, veh/h	48	0	0	997	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	16979	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	81	81	93	93	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	59	0	0	1072	0	0

Major/Minor	Minor2	Major1	
Conflicting Flow All	429	-	0
Stage 1	0	-	-
Stage 2	429	-	-
Critical Hdwy	5.74	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	6.04	-	-
Follow-up Hdwy	3.82	-	-
Pot Cap-1 Maneuver	592	0	-
Stage 1	-	0	-
Stage 2	571	0	-
Platoon blocked, %			-
Mov Cap-1 Maneuver	592	-	-
Mov Cap-2 Maneuver	592	-	-
Stage 1	-	-	-
Stage 2	571	-	-

Approach	EB	NB
HCM Control Delay, s	11.8	0
HCM LOS	B	

Minor Lane/Major Mvmt	NBT	EBLn1
Capacity (veh/h)	-	592
HCM Lane V/C Ratio	-	0.1
HCM Control Delay (s)	-	11.8
HCM Lane LOS	-	B
HCM 95th %tile Q(veh)	-	0.3



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150: SB Crooks Rd & Investment Dr Performance by movement

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Movement	EBR	WBL	WBT	SBT	SBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.1	0.0	0.0	0.0	0.0	0.0
Total Delay (hr)	0.6	0.1	0.7	0.3	0.0	1.6
Total Del/Veh (s)	18.5	12.7	14.8	0.7	0.4	3.3

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160: SB Crooks Rd & E. Site Drive Performance by movement

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Movement	EBR	SBT	SBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.8	0.0	0.0	0.1
Total Delay (hr)	0.5	0.5	0.1	1.1
Total Del/Veh (s)	15.7	1.2	0.7	2.1

Intersection						
Int Delay, s/veh	2.6					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	26	45	503	76	169	215
Future Vol, veh/h	26	45	503	76	169	215
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	100	-	-	500	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	81	81
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	28	49	547	83	209	265
Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	1140	315	0	0	630	0
Stage 1	589	-	-	-	-	-
Stage 2	551	-	-	-	-	-
Critical Hdwy	6.84	6.94	-	-	4.14	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	-	-	2.22	-
Pot Cap-1 Maneuver	194	681	-	-	948	-
Stage 1	517	-	-	-	-	-
Stage 2	541	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	151	681	-	-	948	-
Mov Cap-2 Maneuver	280	-	-	-	-	-
Stage 1	517	-	-	-	-	-
Stage 2	422	-	-	-	-	-
Approach	WB	NB	SB			
HCM Control Delay, s	13.8	0	4.3			
HCM LOS	B					
Minor Lane/Major Mvmt	NBT	NBRWBLn1WBLn2	SBL	SBT		
Capacity (veh/h)	-	- 280 681	948	-		
HCM Lane V/C Ratio	-	- 0.101 0.072	0.22	-		
HCM Control Delay (s)	-	- 19.3 10.7	9.9	-		
HCM Lane LOS	-	- C B	A	-		
HCM 95th %tile Q(veh)	-	- 0.3 0.2	0.8	-		

Intersection						
Int Delay, s/veh	1					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↔		↕↕	↕	↕	↕↕
Traffic Vol, veh/h	19	24	555	28	34	207
Future Vol, veh/h	19	24	555	28	34	207
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	100	500	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	81	81
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	21	26	603	30	42	256
Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	815	302	0	0	633	0
Stage 1	603	-	-	-	-	-
Stage 2	212	-	-	-	-	-
Critical Hdwy	6.84	6.94	-	-	4.14	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	-	-	2.22	-
Pot Cap-1 Maneuver	315	694	-	-	946	-
Stage 1	509	-	-	-	-	-
Stage 2	803	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	301	694	-	-	946	-
Mov Cap-2 Maneuver	406	-	-	-	-	-
Stage 1	509	-	-	-	-	-
Stage 2	768	-	-	-	-	-
Approach	WB	NB	SB			
HCM Control Delay, s	12.5	0	1.3			
HCM LOS	B					
Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT		
Capacity (veh/h)	-	-	528	946	-	
HCM Lane V/C Ratio	-	-	0.089	0.044	-	
HCM Control Delay (s)	-	-	12.5	9	-	
HCM Lane LOS	-	-	B	A	-	
HCM 95th %tile Q(veh)	-	-	0.3	0.1	-	

HCM 6th TWSC  
190: WB Long Lake Rd & S.W. Site Drive

Future Conditions  
AM Peak Hour

Intersection						
Int Delay, s/veh	0					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations			↑↑↑↑	↑		↑
Traffic Vol, veh/h	0	0	1269	42	0	3
Future Vol, veh/h	0	0	1269	42	0	3
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	0	-	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	95	95	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	0	1336	44	0	3

Major/Minor	Major2	Minor2		
Conflicting Flow All	-	0	-	668
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Critical Hdwy	-	-	-	7.14
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-
Follow-up Hdwy	-	-	-	3.92
Pot Cap-1 Maneuver	-	-	0	344
Stage 1	-	-	0	-
Stage 2	-	-	0	-
Platoon blocked, %	-	-		
Mov Cap-1 Maneuver	-	-	-	344
Mov Cap-2 Maneuver	-	-	-	-
Stage 1	-	-	-	-
Stage 2	-	-	-	-

Approach	WB	SB
HCM Control Delay, s	0	15.6
HCM LOS		C

Minor Lane/Major Mvmt	WBT	WBR	SBLn1
Capacity (veh/h)	-	-	344
HCM Lane V/C Ratio	-	-	0.009
HCM Control Delay (s)	-	-	15.6
HCM Lane LOS	-	-	C
HCM 95th %tile Q(veh)	-	-	0



HCM 6th TWSC  
91: S.E. Site Drive & WB Long Lake Rd

Future Conditions  
AM Peak Hour

Intersection												
Int Delay, s/veh	0.4											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↰	↑↑↑	↱					↱	
Traffic Vol, veh/h	0	0	0	269	1218	153	0	0	0	0	25	11
Future Vol, veh/h	0	0	0	269	1218	153	0	0	0	0	25	11
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	325	-	100	-	-	-	-	-	-
Veh in Median Storage, #	-	2	-	-	0	-	-	16974	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	91	95	95	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	296	1282	161	0	0	0	0	27	12

Major/Minor	Major2			Minor2		
Conflicting Flow All	0	0	0	-	1874	641
Stage 1	-	-	-	-	1874	-
Stage 2	-	-	-	-	0	-
Critical Hdwy	5.34	-	-	-	6.54	7.14
Critical Hdwy Stg 1	-	-	-	-	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	3.12	-	-	-	4.02	3.92
Pot Cap-1 Maneuver	-	-	-	0	71	358
Stage 1	-	-	-	0	120	-
Stage 2	-	-	-	0	-	-
Platoon blocked, %	-	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	-	-	0	358
Mov Cap-2 Maneuver	-	-	-	-	0	-
Stage 1	-	-	-	-	0	-
Stage 2	-	-	-	-	0	-























Approach	WB	SB
HCM Control Delay, s		16.3
HCM LOS		C

Minor Lane/Major Mvmt	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	-	-	-	358
HCM Lane V/C Ratio	-	-	-	0.109
HCM Control Delay (s)	-	-	-	16.3
HCM Lane LOS	-	-	-	C
HCM 95th %tile Q(veh)	-	-	-	0.4

# HCM 6th Signalized Intersection Summary

## 10: Crooks Rd & Corporate Dr/I-75 Ramp

Future Conditions  
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	279	248	340	434	304	824	0	1662	900	474	828	201
Future Volume (veh/h)	279	248	340	434	304	824	0	1662	900	474	828	201
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1969	1969	1969	1969	1969	1969	0	1969	1969	1969	1969	1969
Adj Flow Rate, veh/h	303	270	153	315	863	416	0	1922	626	499	872	180
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.93	0.93	0.93	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	0	2	2	2	2	2
Cap, veh/h	186	186	166	359	754	582	0	1999	884	571	2944	914
Arrive On Green	0.10	0.10	0.10	0.19	0.19	0.19	0.00	0.34	0.34	0.16	0.55	0.55
Sat Flow, veh/h	1875	1870	1668	1875	3938	1668	0	5906	1668	3638	5375	1668
Grp Volume(v), veh/h	303	270	153	315	863	416	0	1922	626	499	872	180
Grp Sat Flow(s),veh/h/ln	1875	1870	1668	1875	1969	1668	0	1969	1668	1819	1792	1668
Q Serve(g_s), s	12.9	12.9	11.8	21.2	24.9	24.9	0.0	41.5	36.7	17.4	11.4	7.1
Cycle Q Clear(g_c), s	12.9	12.9	11.8	21.2	24.9	24.9	0.0	41.5	36.7	17.4	11.4	7.1
Prop In Lane	1.00		1.00	1.00		1.00	0.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	186	186	166	359	754	582	0	1999	884	571	2944	914
V/C Ratio(X)	1.63	1.45	0.92	0.88	1.14	0.72	0.00	0.96	0.71	0.87	0.30	0.20
Avail Cap(c_a), veh/h	186	186	166	359	754	582	0	1999	884	649	2944	914
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	58.6	58.5	58.1	51.1	52.5	36.7	0.0	42.2	23.0	53.5	15.9	14.9
Incr Delay (d2), s/veh	306.0	232.0	48.3	20.9	80.2	4.2	0.0	12.9	4.8	12.2	0.3	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	21.9	18.0	7.2	12.0	20.6	12.0	0.0	21.7	21.5	8.7	4.5	2.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	364.5	290.6	106.4	72.0	132.8	40.9	0.0	55.1	27.8	65.7	16.1	15.4
LnGrp LOS	F	F	F	E	F	D	A	E	C	E	B	B
Approach Vol, veh/h		726			1594			2548			1551	
Approach Delay, s/veh		282.6			96.8			48.4			32.0	
Approach LOS		F			F			D			C	
Timer - Assigned Phs	1	2		4		6		8				
Phs Duration (G+Y+Rc), s	27.2	50.8		32.0		78.0		20.0				
Change Period (Y+Rc), s	6.8	6.8		* 7.1		6.8		7.1				
Max Green Setting (Gmax), s	23.2	41.2		* 25		71.2		12.9				
Max Q Clear Time (g_c+I1), s	19.4	43.5		26.9		13.4		14.9				
Green Ext Time (p_c), s	1.0	0.0		0.0		7.2		0.0				

### Intersection Summary

HCM 6th Ctrl Delay 82.9  
HCM 6th LOS F










### Notes

User approved volume balancing among the lanes for turning movement.

\* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

HCM 6th TWSC  
20: Corporate Dr & New King Dr




















Future Conditions  
PM Peak Hour

Intersection						
Int Delay, s/veh	2.6					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		 	 		 	 
Traffic Vol, veh/h	41	816	501	4	51	84
Future Vol, veh/h	41	816	501	4	51	84
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	0	0	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	72	72
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	45	887	545	4	71	117
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	549	0	-	0	1079	273
Stage 1	-	-	-	-	545	-
Stage 2	-	-	-	-	534	-
Critical Hdwy	4.14	-	-	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	2.22	-	-	-	3.52	3.32
Pot Cap-1 Maneuver	1017	-	-	-	213	725
Stage 1	-	-	-	-	545	-
Stage 2	-	-	-	-	552	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1017	-	-	-	194	725
Mov Cap-2 Maneuver	-	-	-	-	194	-
Stage 1	-	-	-	-	498	-
Stage 2	-	-	-	-	552	-
Approach	EB	WB		SB		
HCM Control Delay, s	0.7	0		19.6		
HCM LOS	C					
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1017	-	-	-	194	725
HCM Lane V/C Ratio	0.044	-	-	-	0.365	0.161
HCM Control Delay (s)	8.7	0.3	-	-	33.9	10.9
HCM Lane LOS	A	A	-	-	D	B
HCM 95th %tile Q(veh)	0.1	-	-	-	1.6	0.6

# HCM Signalized Intersection Capacity Analysis



## 30: NB Crooks Rd & Tower Dr

Future Conditions  
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations						 		  				
Traffic Volume (vph)	110	113	0	0	0	669	0	1912	28	0	0	0
Future Volume (vph)	110	113	0	0	0	669	0	1912	28	0	0	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)		6.0				6.0		6.4	6.4			
Lane Util. Factor		1.00				0.88		0.91	1.00			
Frt		1.00				0.85		1.00	0.85			
Flt Protected		0.98				1.00		1.00	1.00			
Satd. Flow (prot)		1914				2933		5353	1667			
Flt Permitted		0.98				1.00		1.00	1.00			
Satd. Flow (perm)		1914				2933		5353	1667			
Peak-hour factor, PHF	0.76	0.76	0.76	0.79	0.79	0.79	0.93	0.93	0.93	0.92	0.92	0.92
Adj. Flow (vph)	145	149	0	0	0	847	0	2056	30	0	0	0
RTOR Reduction (vph)	0	19	0	0	0	19	0	0	11	0	0	0
Lane Group Flow (vph)	0	275	0	0	0	828	0	2056	19	0	0	0
Turn Type	custom	NA				Perm		NA	Perm			
Protected Phases		4						2!				
Permitted Phases	4 2!					8			2			
Actuated Green, G (s)		45.7				45.7		71.9	71.9			
Effective Green, g (s)		45.7				45.7		71.9	71.9			
Actuated g/C Ratio		0.35				0.35		0.55	0.55			
Clearance Time (s)		6.0				6.0		6.4	6.4			
Vehicle Extension (s)		4.5				4.5		3.0	3.0			
Lane Grp Cap (vph)		672				1031		2960	921			
v/s Ratio Prot								c0.38				
v/s Ratio Perm		0.14				c0.28			0.01			
v/c Ratio		0.41				0.80		0.69	0.02			
Uniform Delay, d1		31.9				38.1		21.1	13.1			
Progression Factor		1.17				1.00		1.00	1.00			
Incremental Delay, d2		0.5				5.1		1.4	0.0			
Delay (s)		38.0				43.2		22.5	13.2			
Level of Service		D				D		C	B			
Approach Delay (s)		38.0			43.2			22.3			0.0	
Approach LOS		D			D			C			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		29.2				HCM 2000 Level of Service		C				
HCM 2000 Volume to Capacity ratio		0.74										
Actuated Cycle Length (s)		130.0				Sum of lost time (s)		12.4				
Intersection Capacity Utilization		84.1%				ICU Level of Service		E				
Analysis Period (min)		15										
! Phase conflict between lane groups.												
c Critical Lane Group												

HCM 6th TWSC  
40: SB Crooks Rd & N>S X/O N. of Long Lake

Future Conditions  
PM Peak Hour

Intersection						
Int Delay, s/veh	2.2					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	126	0	0	0	0	1406
Future Vol, veh/h	126	0	0	0	0	1406
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	16974	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	60	60	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	210	0	0	0	0	1528

Major/Minor	Minor1	Major2	
Conflicting Flow All	611	-	-
Stage 1	0	-	-
Stage 2	611	-	-
Critical Hdwy	5.74	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	6.04	-	-
Follow-up Hdwy	3.82	-	-
Pot Cap-1 Maneuver	483	0	-
Stage 1	-	0	-
Stage 2	459	0	-
Platoon blocked, %			-
Mov Cap-1 Maneuver	483	-	-
Mov Cap-2 Maneuver	483	-	-
Stage 1	-	-	-
Stage 2	459	-	-



Approach	WB	SB
HCM Control Delay, s	18.1	0
HCM LOS	C	

Minor Lane/Major Mvmt	WBLn1	SBT
Capacity (veh/h)	483	-
HCM Lane V/C Ratio	0.435	-
HCM Control Delay (s)	18.1	-
HCM Lane LOS	C	-
HCM 95th %tile Q(veh)	2.2	-



HCM 6th TWSC  
50: NB Crooks Rd & S>N X/O N. of Long Lake

Future Conditions  
PM Peak Hour

Intersection						
Int Delay, s/veh	12.6					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	335	0	0	1454	0	0
Future Vol, veh/h	335	0	0	1454	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	16979	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	75	75	93	93	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	447	0	0	1563	0	0

Major/Minor	Minor2	Major1	
Conflicting Flow All	625	-	0
Stage 1	0	-	-
Stage 2	625	-	-
Critical Hdwy	5.74	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	6.04	-	-
Follow-up Hdwy	3.82	-	-
Pot Cap-1 Maneuver	476	0	0
Stage 1	-	0	0
Stage 2	452	0	0
Platoon blocked, %			-
Mov Cap-1 Maneuver	476	-	-
Mov Cap-2 Maneuver	476	-	-
Stage 1	-	-	-
Stage 2	452	-	-











Approach	EB	NB
HCM Control Delay, s	56.9	0
HCM LOS	F	

Minor Lane/Major Mvmt	NBT	EBLn1
Capacity (veh/h)	-	476
HCM Lane V/C Ratio	-	0.938
HCM Control Delay (s)	-	56.9
HCM Lane LOS	-	F
HCM 95th %tile Q(veh)	-	11.2

# HCM Signalized Intersection Capacity Analysis

## 60: E>W X/O E. of Crooks & WB Long Lake Rd













Future Conditions  
PM Peak Hour

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations				  		
Traffic Volume (vph)	0	0	0	1040	112	0
Future Volume (vph)	0	0	0	1040	112	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000
Total Lost time (s)				6.6	5.4	
Lane Util. Factor				0.91	1.00	
Frt				1.00	1.00	
Flt Protected				1.00	0.95	
Satd. Flow (prot)				5353	1863	
Flt Permitted				1.00	0.95	
Satd. Flow (perm)				5353	1863	
Peak-hour factor, PHF	0.92	0.92	0.95	0.95	0.87	0.87
Adj. Flow (vph)	0	0	0	1095	129	0
RTOR Reduction (vph)	0	0	0	0	16	0
Lane Group Flow (vph)	0	0	0	1095	113	0
Turn Type				NA	Prot	
Protected Phases				6	8	
Permitted Phases						
Actuated Green, G (s)				95.3	12.7	
Effective Green, g (s)				95.3	12.7	
Actuated g/C Ratio				0.79	0.11	
Clearance Time (s)				6.6	5.4	
Vehicle Extension (s)				3.0	3.0	
Lane Grp Cap (vph)				4251	197	
v/s Ratio Prot				c0.20	c0.06	
v/s Ratio Perm						
v/c Ratio				0.26	0.57	
Uniform Delay, d1				3.2	51.1	
Progression Factor				1.00	0.65	
Incremental Delay, d2				0.1	2.9	
Delay (s)				3.3	36.1	
Level of Service				A	D	
Approach Delay (s)	0.0			3.3	36.1	
Approach LOS	A			A	D	
Intersection Summary						
HCM 2000 Control Delay			6.8	HCM 2000 Level of Service		A
HCM 2000 Volume to Capacity ratio			0.29			
Actuated Cycle Length (s)			120.0	Sum of lost time (s)		12.0
Intersection Capacity Utilization			57.6%	ICU Level of Service		B
Analysis Period (min)			15			
c Critical Lane Group						

# HCM Signalized Intersection Capacity Analysis

## 70: NB Crooks Rd & WB Long Lake Rd

Future Conditions  
PM Peak Hour













												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑↑↑	↗		↑↑↑↑				
Traffic Volume (vph)	0	0	0	0	969	183	0	1271	0	0	0	0
Future Volume (vph)	0	0	0	0	969	183	0	1271	0	0	0	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)					11.9	11.9		5.9				
Lane Util. Factor					0.91	1.00		0.91				
Frt					1.00	0.85		1.00				
Flt Protected					1.00	1.00		1.00				
Satd. Flow (prot)					5353	1667		5353				
Flt Permitted					1.00	1.00		1.00				
Satd. Flow (perm)					5353	1667		5353				
Peak-hour factor, PHF	0.92	0.92	0.92	0.95	0.95	0.95	0.89	0.89	0.89	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	1020	193	0	1428	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	50	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	1020	143	0	1428	0	0	0	0
Turn Type					NA	Perm		NA				
Protected Phases					4			6				
Permitted Phases						4						
Actuated Green, G (s)					45.3	45.3		56.9				
Effective Green, g (s)					45.3	45.3		56.9				
Actuated g/C Ratio					0.38	0.38		0.47				
Clearance Time (s)					11.9	11.9		5.9				
Vehicle Extension (s)					3.0	3.0		3.0				
Lane Grp Cap (vph)					2020	629		2538				
v/s Ratio Prot					c0.19			c0.27				
v/s Ratio Perm						0.09						
v/c Ratio					0.50	0.23		0.56				
Uniform Delay, d1					28.7	25.4		22.6				
Progression Factor					1.03	1.16		0.00				
Incremental Delay, d2					0.2	0.2		0.7				
Delay (s)					29.9	29.6		0.7				
Level of Service					C	C		A				
Approach Delay (s)		0.0			29.9			0.7			0.0	
Approach LOS		A			C			A			A	
Intersection Summary												
HCM 2000 Control Delay			14.1		HCM 2000 Level of Service						B	
HCM 2000 Volume to Capacity ratio			0.57									
Actuated Cycle Length (s)			120.0		Sum of lost time (s)						23.8	
Intersection Capacity Utilization			55.9%		ICU Level of Service						B	
Analysis Period (min)			15									
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis

71: SB Crooks Rd & WB Long Lake Rd

Future Conditions

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑↑						↑↑↑	↑
Traffic Volume (vph)	0	0	0	0	969	0	0	0	0	0	1253	183
Future Volume (vph)	0	0	0	0	969	0	0	0	0	0	1253	183
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)					5.9						11.9	11.9
Lane Util. Factor					0.91						0.91	1.00
Frt					1.00						1.00	0.85
Flt Protected					1.00						1.00	1.00
Satd. Flow (prot)					5353						5353	1667
Flt Permitted					1.00						1.00	1.00
Satd. Flow (perm)					5353						5353	1667
Peak-hour factor, PHF	0.92	0.92	0.92	0.95	0.95	0.95	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	1020	0	0	0	0	0	1362	199
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	47
Lane Group Flow (vph)	0	0	0	0	1020	0	0	0	0	0	1362	152
Turn Type					NA						NA	Perm
Protected Phases					8						2	
Permitted Phases												2
Actuated Green, G (s)					51.3						50.9	50.9
Effective Green, g (s)					51.3						50.9	50.9
Actuated g/C Ratio					0.43						0.42	0.42
Clearance Time (s)					5.9						11.9	11.9
Vehicle Extension (s)					3.0						3.0	3.0
Lane Grp Cap (vph)					2288						2270	707
v/s Ratio Prot					c0.19						c0.25	
v/s Ratio Perm												0.09
v/c Ratio					0.45						0.60	0.22
Uniform Delay, d1					24.3						26.7	21.9
Progression Factor					0.00						1.00	1.00
Incremental Delay, d2					0.1						1.2	0.7
Delay (s)					0.1						27.9	22.6
Level of Service					A						C	C
Approach Delay (s)		0.0			0.1			0.0			27.2	
Approach LOS		A			A			A			C	
Intersection Summary												
HCM 2000 Control Delay			16.5		HCM 2000 Level of Service						B	
HCM 2000 Volume to Capacity ratio			0.56									
Actuated Cycle Length (s)			120.0		Sum of lost time (s)						23.8	
Intersection Capacity Utilization			55.9%		ICU Level of Service						B	
Analysis Period (min)			15									
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis

## 72: SB Crooks Rd & EB Long Lake Rd

# Future Conditions

PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑	↑								↑↑↑	
Traffic Volume (vph)	0	1240	220	0	0	0	0	0	0	0	1253	0
Future Volume (vph)	0	1240	220	0	0	0	0	0	0	0	1253	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)		11.9	11.9								5.9	
Lane Util. Factor		0.91	1.00								0.91	
Frt		1.00	0.85								1.00	
Flt Protected		1.00	1.00								1.00	
Satd. Flow (prot)		5353	1667								5353	
Flt Permitted		1.00	1.00								1.00	
Satd. Flow (perm)		5353	1667								5353	
Peak-hour factor, PHF	0.78	0.78	0.78	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1590	282	0	0	0	0	0	0	0	1362	0
RTOR Reduction (vph)	0	0	50	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	1590	232	0	0	0	0	0	0	0	1362	0
Turn Type		NA	Perm								NA	
Protected Phases		4									6	
Permitted Phases			4									
Actuated Green, G (s)		45.3	45.3								56.9	
Effective Green, g (s)		45.3	45.3								56.9	
Actuated g/C Ratio		0.38	0.38								0.47	
Clearance Time (s)		11.9	11.9								5.9	
Vehicle Extension (s)		3.0	3.0								3.0	
Lane Grp Cap (vph)		2020	629								2538	
v/s Ratio Prot		c0.30									c0.25	
v/s Ratio Perm			0.14									
v/c Ratio		0.79	0.37								0.54	
Uniform Delay, d1		33.1	27.0								22.3	
Progression Factor		0.93	0.81								0.00	
Incremental Delay, d2		1.9	0.3								0.7	
Delay (s)		32.7	22.1								0.7	
Level of Service		C	C								A	
Approach Delay (s)		31.1			0.0			0.0			0.7	
Approach LOS		C			A			A			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			18.3									
HCM 2000 Volume to Capacity ratio			0.69									
Actuated Cycle Length (s)			120.0								23.8	
Intersection Capacity Utilization			60.6%									
Analysis Period (min)			15									
c Critical Lane Group												




# HCM Signalized Intersection Capacity Analysis

73: NB Crooks Rd & EB Long Lake Rd

Future Conditions

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑						↑↑↑	↑			
Traffic Volume (vph)	0	1240	0	0	0	0	0	1271	489	0	0	0
Future Volume (vph)	0	1240	0	0	0	0	0	1271	489	0	0	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)		5.9						11.9	11.9			
Lane Util. Factor		0.91						0.91	1.00			
Frt		1.00						1.00	0.85			
Flt Protected		1.00						1.00	1.00			
Satd. Flow (prot)		5353						5353	1667			
Flt Permitted		1.00						1.00	1.00			
Satd. Flow (perm)		5353						5353	1667			
Peak-hour factor, PHF	0.78	0.78	0.78	0.92	0.92	0.92	0.89	0.89	0.89	0.92	0.92	0.92
Adj. Flow (vph)	0	1590	0	0	0	0	0	1428	549	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	47	0	0	0
Lane Group Flow (vph)	0	1590	0	0	0	0	0	1428	502	0	0	0
Turn Type		NA						NA	Perm			
Protected Phases		8						2				
Permitted Phases									2			
Actuated Green, G (s)		51.3						50.9	50.9			
Effective Green, g (s)		51.3						50.9	50.9			
Actuated g/C Ratio		0.43						0.42	0.42			
Clearance Time (s)		5.9						11.9	11.9			
Vehicle Extension (s)		3.0						3.0	3.0			
Lane Grp Cap (vph)		2288						2270	707			
v/s Ratio Prot		c0.30						0.27				
v/s Ratio Perm									c0.30			
v/c Ratio		0.69						0.63	0.71			
Uniform Delay, d1		28.0						27.1	28.5			
Progression Factor		0.00						1.00	1.00			
Incremental Delay, d2		0.6						1.3	6.0			
Delay (s)		0.6						28.5	34.5			
Level of Service		A						C	C			
Approach Delay (s)		0.6			0.0			30.1			0.0	
Approach LOS		A			A			C			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		17.0						HCM 2000 Level of Service	B			
HCM 2000 Volume to Capacity ratio		0.75										
Actuated Cycle Length (s)		120.0						Sum of lost time (s)	23.8			
Intersection Capacity Utilization		66.4%						ICU Level of Service	C			
Analysis Period (min)		15										
c Critical Lane Group												

HCM 6th TWSC  
80: E>W X/O W. of Crooks & WB Long Lake Rd

Future Conditions  
PM Peak Hour

Intersection						
Int Delay, s/veh	0.3					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations				↑↑↑	↑	
Traffic Vol, veh/h	0	0	0	1152	23	0
Future Vol, veh/h	0	0	0	1152	23	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	63	63
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	0	0	1252	37	0

Major/Minor	Major2	Minor1
Conflicting Flow All	-	501
Stage 1	-	0
Stage 2	-	501
Critical Hdwy	-	5.74
Critical Hdwy Stg 1	-	-
Critical Hdwy Stg 2	-	6.04
Follow-up Hdwy	-	3.82
Pot Cap-1 Maneuver	0	547
Stage 1	0	-
Stage 2	0	524
Platoon blocked, %	-	-
Mov Cap-1 Maneuver	-	547
Mov Cap-2 Maneuver	-	547
Stage 1	-	-
Stage 2	-	524

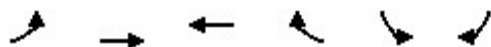
Approach	WB	NB
HCM Control Delay, s	0	12.1
HCM LOS		B

Minor Lane/Major Mvmt	NBLn1	WBT
Capacity (veh/h)	547	-
HCM Lane V/C Ratio	0.067	-
HCM Control Delay (s)	12.1	-
HCM Lane LOS	B	-
HCM 95th %tile Q(veh)	0.2	-

# HCM Signalized Intersection Capacity Analysis

## 90: EB Long Lake Rd & W>E X/O W. of Crooks

Future Conditions  
PM Peak Hour




Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑↑			↑	
Traffic Volume (vph)	0	1149	0	0	334	0
Future Volume (vph)	0	1149	0	0	334	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000
Total Lost time (s)		6.0			5.4	
Lane Util. Factor		0.91			1.00	
Frt		1.00			1.00	
Flt Protected		1.00			0.95	
Satd. Flow (prot)		5353			1863	
Flt Permitted		1.00			0.95	
Satd. Flow (perm)		5353			1863	
Peak-hour factor, PHF	0.92	0.81	0.92	0.92	0.67	0.67
Adj. Flow (vph)	0	1419	0	0	499	0
RTOR Reduction (vph)	0	0	0	0	10	0
Lane Group Flow (vph)	0	1419	0	0	489	0
Turn Type		NA			Prot	
Protected Phases		2			4	
Permitted Phases						
Actuated Green, G (s)		70.4			38.2	
Effective Green, g (s)		70.4			38.2	
Actuated g/C Ratio		0.59			0.32	
Clearance Time (s)		6.0			5.4	
Vehicle Extension (s)		3.0			3.0	
Lane Grp Cap (vph)		3140			593	
v/s Ratio Prot		c0.27			c0.26	
v/s Ratio Perm						
v/c Ratio		0.45			0.82	
Uniform Delay, d1		13.9			37.8	
Progression Factor		1.10			1.11	
Incremental Delay, d2		0.5			9.0	
Delay (s)		15.8			50.7	
Level of Service		B			D	
Approach Delay (s)		15.8	0.0		50.7	
Approach LOS		B	A		D	
<b>Intersection Summary</b>						
HCM 2000 Control Delay		24.9		HCM 2000 Level of Service		C
HCM 2000 Volume to Capacity ratio		0.58				
Actuated Cycle Length (s)		120.0		Sum of lost time (s)		11.4
Intersection Capacity Utilization		60.0%		ICU Level of Service		B
Analysis Period (min)		15				
c Critical Lane Group						

Intersection						
Int Delay, s/veh	1.3					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations				↑↑↑↑	↗	
Traffic Vol, veh/h	0	0	0	956	71	0
Future Vol, veh/h	0	0	0	956	71	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	60	60
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	0	0	1039	118	0
Major/Minor			Major2		Minor1	
Conflicting Flow All			-	-	416	-
Stage 1			-	-	0	-
Stage 2			-	-	416	-
Critical Hdwy			-	-	5.74	-
Critical Hdwy Stg 1			-	-	-	-
Critical Hdwy Stg 2			-	-	6.04	-
Follow-up Hdwy			-	-	3.82	-
Pot Cap-1 Maneuver			0	-	600	0
Stage 1			0	-	-	0
Stage 2			0	-	580	0
Platoon blocked, %				-		
Mov Cap-1 Maneuver			-	-	600	-
Mov Cap-2 Maneuver			-	-	600	-
Stage 1			-	-	-	-
Stage 2			-	-	580	-
Approach			WB		NB	
HCM Control Delay, s			0		12.5	
HCM LOS					B	
Minor Lane/Major Mvmt	NBLn1	WBT				
Capacity (veh/h)	600	-				
HCM Lane V/C Ratio	0.197	-				
HCM Control Delay (s)	12.5	-				
HCM Lane LOS	B	-				
HCM 95th %tile Q(veh)	0.7	-				

# HCM Signalized Intersection Capacity Analysis

## 110: Investment Dr & EB Long Lake Rd

Future Conditions  
PM Peak Hour













												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑	↑						↑↑		↑	
Traffic Volume (vph)	0	1068	100	0	0	0	0	0	152	0	34	0
Future Volume (vph)	0	1068	100	0	0	0	0	0	152	0	34	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)		6.0	6.0						5.5		5.5	
Lane Util. Factor		0.91	1.00						0.88		1.00	
Frt		1.00	0.85						0.85		1.00	
Flt Protected		1.00	1.00						1.00		1.00	
Satd. Flow (prot)		5353	1667						2933		1961	
Flt Permitted		1.00	1.00						1.00		1.00	
Satd. Flow (perm)		5353	1667						2933		1961	
Peak-hour factor, PHF	0.85	0.85	0.85	0.92	0.92	0.92	0.68	0.68	0.68	0.83	0.83	0.83
Adj. Flow (vph)	0	1256	118	0	0	0	0	0	224	0	41	0
RTOR Reduction (vph)	0	0	21	0	0	0	0	0	117	0	0	0
Lane Group Flow (vph)	0	1256	97	0	0	0	0	0	107	0	41	0
Turn Type		NA	Perm						Perm		NA	
Protected Phases		2									4	
Permitted Phases			2						8	4		
Actuated Green, G (s)		98.9	98.9						9.6		9.6	
Effective Green, g (s)		98.9	98.9						9.6		9.6	
Actuated g/C Ratio		0.82	0.82						0.08		0.08	
Clearance Time (s)		6.0	6.0						5.5		5.5	
Vehicle Extension (s)		4.0	4.0						3.0		3.0	
Lane Grp Cap (vph)		4411	1373						234		156	
v/s Ratio Prot		c0.23									0.02	
v/s Ratio Perm			0.06						c0.04			
v/c Ratio		0.28	0.07						0.46		0.26	
Uniform Delay, d1		2.4	2.0						52.7		51.9	
Progression Factor		1.00	1.00						1.00		1.31	
Incremental Delay, d2		0.2	0.1						1.4		0.9	
Delay (s)		2.6	2.1						54.1		68.9	
Level of Service		A	A						D		E	
Approach Delay (s)		2.5			0.0			54.1			68.9	
Approach LOS		A			A			D			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			11.3									HCM 2000 Level of Service B
HCM 2000 Volume to Capacity ratio			0.30									
Actuated Cycle Length (s)			120.0									Sum of lost time (s) 11.5
Intersection Capacity Utilization			49.3%									ICU Level of Service A
Analysis Period (min)			15									
c Critical Lane Group												



# HCM Signalized Intersection Capacity Analysis

## 120: Corporate Dr & WB Long Lake Rd

Future Conditions  
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑↑	↑		↑				↑↑
Traffic Volume (vph)	0	0	0	0	919	54	105	136	0	0	0	690
Future Volume (vph)	0	0	0	0	919	54	105	136	0	0	0	690
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)					6.3	6.3		5.8				5.8
Lane Util. Factor					0.91	1.00		1.00				0.88
Frt					1.00	0.85		1.00				0.85
Flt Protected					1.00	1.00		0.98				1.00
Satd. Flow (prot)					5353	1667		1919				2933
Flt Permitted					1.00	1.00		0.98				1.00
Satd. Flow (perm)					5353	1667		1919				2933
Peak-hour factor, PHF	0.92	0.92	0.92	0.88	0.88	0.88	0.69	0.69	0.69	0.72	0.72	0.72
Adj. Flow (vph)	0	0	0	0	1044	61	152	197	0	0	0	958
RTOR Reduction (vph)	0	0	0	0	0	30	0	21	0	0	0	37
Lane Group Flow (vph)	0	0	0	0	1044	31	0	328	0	0	0	921
Turn Type					NA	Perm	custom	NA				Perm
Protected Phases					6!			8				
Permitted Phases						6	8 6!					4
Actuated Green, G (s)					61.9	61.9		46.0				46.0
Effective Green, g (s)					61.9	61.9		46.0				46.0
Actuated g/C Ratio					0.52	0.52		0.38				0.38
Clearance Time (s)					6.3	6.3		5.8				5.8
Vehicle Extension (s)					4.0	4.0		3.0				3.0
Lane Grp Cap (vph)					2761	859		735				1124
v/s Ratio Prot					c0.20							
v/s Ratio Perm						0.02		0.17				c0.31
v/c Ratio					0.38	0.04		0.45				0.82
Uniform Delay, d1					17.5	14.3		27.5				33.3
Progression Factor					1.82	3.54		1.00				1.00
Incremental Delay, d2					0.4	0.1		0.4				4.8
Delay (s)					32.2	50.8		28.0				38.0
Level of Service					C	D		C				D
Approach Delay (s)		0.0			33.2			28.0			38.0	
Approach LOS		A			C			C			D	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			34.4		HCM 2000 Level of Service				C			
HCM 2000 Volume to Capacity ratio			0.57									
Actuated Cycle Length (s)			120.0		Sum of lost time (s)			12.1				
Intersection Capacity Utilization			67.0%		ICU Level of Service				C			
Analysis Period (min)			15									
! Phase conflict between lane groups.												
c Critical Lane Group												

HCM 6th TWSC  
130: EB Long Lake Rd & W>E X/O W. of Investment

Future Conditions  
PM Peak Hour



Intersection						
Int Delay, s/veh	3.1					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑↑↑			↑	
Traffic Vol, veh/h	0	1208	0	0	201	0
Future Vol, veh/h	0	1208	0	0	201	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	16983	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	85	85	92	92	75	75
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	1421	0	0	268	0
Major/Minor	Major1		Minor2			
Conflicting Flow All	-	0			568	-
Stage 1	-	-			0	-
Stage 2	-	-			568	-
Critical Hdwy	-	-			5.74	-
Critical Hdwy Stg 1	-	-			-	-
Critical Hdwy Stg 2	-	-			6.04	-
Follow-up Hdwy	-	-			3.82	-
Pot Cap-1 Maneuver	0	-			507	0
Stage 1	0	-			-	0
Stage 2	0	-			484	0
Platoon blocked, %		-				
Mov Cap-1 Maneuver	-	-			507	-
Mov Cap-2 Maneuver	-	-			507	-
Stage 1	-	-			-	-
Stage 2	-	-			484	-
Approach	EB			SB		
HCM Control Delay, s	0			19.8		
HCM LOS				C		
Minor Lane/Major Mvmt	EBT SBLn1					
Capacity (veh/h)	- 507					
HCM Lane V/C Ratio	- 0.529					
HCM Control Delay (s)	- 19.8					
HCM Lane LOS	- C					
HCM 95th %tile Q(veh)	- 3.1					

HCM 6th TWSC  
140: NB Crooks Rd & S>N X/O S. of Long Lake

Future Conditions  
PM Peak Hour

Intersection

Int Delay, s/veh 2.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	152	0	0	1704	0	0
Future Vol, veh/h	152	0	0	1704	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	16979	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	70	70	89	89	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	217	0	0	1915	0	0

Major/Minor	Minor2	Major1		
Conflicting Flow All	766	-	-	0
Stage 1	0	-	-	-
Stage 2	766	-	-	-
Critical Hdwy	5.74	-	-	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	6.04	-	-	-
Follow-up Hdwy	3.82	-	-	-
Pot Cap-1 Maneuver	406	0	0	-
Stage 1	-	0	0	-
Stage 2	381	0	0	-
Platoon blocked, %				-
Mov Cap-1 Maneuver	406	-	-	-
Mov Cap-2 Maneuver	406	-	-	-
Stage 1	-	-	-	-
Stage 2	381	-	-	-

Approach	EB	NB
HCM Control Delay, s	23.6	0
HCM LOS	C	

Minor Lane/Major Mvmt	NBT	EBLn1
Capacity (veh/h)	-	406
HCM Lane V/C Ratio	-	0.535
HCM Control Delay (s)	-	23.6
HCM Lane LOS	-	C
HCM 95th %tile Q(veh)	-	3.1

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150: SB Crooks Rd & Investment Dr Performance by movement

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Movement	EBR	WBL	WBT	SBT	SBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.1	0.0	0.0	0.0	0.0	0.0
Total Delay (hr)	1.9	0.0	0.3	0.3	0.0	2.5
Total Del/Veh (s)	25.0	15.6	18.9	0.9	0.1	5.4






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160: SB Crooks Rd & E. Site Drive Performance by movement

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Movement	EBR	SBT	SBR	All
Denied Delay (hr)	6.9	0.0	0.0	6.9
Denied Del/Veh (s)	43.6	0.0	0.0	13.4
Total Delay (hr)	10.4	1.2	0.0	11.6
Total Del/Veh (s)	69.2	3.9	0.3	22.9



Intersection						
Int Delay, s/veh	10.3					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	200	331	112	83	175	498
Future Vol, veh/h	200	331	112	83	175	498
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	100	-	-	500	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	72	72
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	217	360	122	90	243	692
Major/Minor	Minor1	Major1		Major2		
Conflicting Flow All	999	106	0	0	212	0
Stage 1	167	-	-	-	-	-
Stage 2	832	-	-	-	-	-
Critical Hdwy	6.84	6.94	-	-	4.14	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	-	-	2.22	-
Pot Cap-1 Maneuver	240	928	-	-	1356	-
Stage 1	845	-	-	-	-	-
Stage 2	388	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	~ 197	928	-	-	1356	-
Mov Cap-2 Maneuver	274	-	-	-	-	-
Stage 1	845	-	-	-	-	-
Stage 2	319	-	-	-	-	-
Approach	WB	NB		SB		
HCM Control Delay, s	27.5	0		2.1		
HCM LOS	D					
Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	274	928	1356	-
HCM Lane V/C Ratio	-	-	0.793	0.388	0.179	-
HCM Control Delay (s)	-	-	54.4	11.3	8.2	-
HCM Lane LOS	-	-	F	B	A	-
HCM 95th %tile Q(veh)	-	-	6.2	1.9	0.7	-
Notes						
~: Volume exceeds capacity		\$: Delay exceeds 300s		+: Computation Not Defined		*: All major volume in platoon

Intersection

Int Delay, s/veh 1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	31	37	158	32	39	659
Future Vol, veh/h	31	37	158	32	39	659
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	100	500	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	72	72
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	34	40	172	35	54	915

Major/Minor	Minor1	Major1	Major2
Conflicting Flow All	738	86	0
Stage 1	172	-	-
Stage 2	566	-	-
Critical Hdwy	6.84	6.94	-
Critical Hdwy Stg 1	5.84	-	-
Critical Hdwy Stg 2	5.84	-	-
Follow-up Hdwy	3.52	3.32	-
Pot Cap-1 Maneuver	353	956	-
Stage 1	841	-	-
Stage 2	532	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	339	956	-
Mov Cap-2 Maneuver	426	-	-
Stage 1	841	-	-
Stage 2	511	-	-

Approach	WB	NB	SB
HCM Control Delay, s	11.7	0	0.4
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	610	1361
HCM Lane V/C Ratio	-	-	0.121	0.04
HCM Control Delay (s)	-	-	11.7	7.8
HCM Lane LOS	-	-	B	A
HCM 95th %tile Q(veh)	-	-	0.4	0.1

HCM 6th TWSC  
190: WB Long Lake Rd & S.W. Site Drive

Future Conditions  
PM Peak Hour

Intersection						
Int Delay, s/veh	0.8					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations			↑↑↑	↑		↑
Traffic Vol, veh/h	0	0	947	80	0	60
Future Vol, veh/h	0	0	947	80	0	60
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	0	-	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	90	90	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	0	1052	89	0	65

Major/Minor	Major2	Minor2
Conflicting Flow All	-	0
Stage 1	-	-
Stage 2	-	-
Critical Hdwy	-	-
Critical Hdwy Stg 1	-	-
Critical Hdwy Stg 2	-	-
Follow-up Hdwy	-	-
Pot Cap-1 Maneuver	-	-
Stage 1	-	-
Stage 2	-	-
Platoon blocked, %	-	-
Mov Cap-1 Maneuver	-	-
Mov Cap-2 Maneuver	-	-
Stage 1	-	-
Stage 2	-	-

Approach	WB	SB
HCM Control Delay, s	0	15
HCM LOS		C

Minor Lane/Major Mvmt	WBT	WBR	SBLn1
Capacity (veh/h)	-	-	425
HCM Lane V/C Ratio	-	-	0.153
HCM Control Delay (s)	-	-	15
HCM Lane LOS	-	-	C
HCM 95th %tile Q(veh)	-	-	0.5

HCM 6th TWSC  
 91: W>E X/O W. of Crooks/S.E. Site Drive & WB Long Lake Rd

Future Conditions  
 PM Peak Hour

Intersection												
Int Delay, s/veh	2.9											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	212	866	97	0	0	0	0	122	90
Future Vol, veh/h	0	0	0	212	866	97	0	0	0	0	122	90
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	325	-	100	-	-	-	-	-	-
Veh in Median Storage, #	-	2	-	-	0	-	-	16974	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	67	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	316	941	105	0	0	0	0	133	98

Major/Minor	Major2			Minor2		
Conflicting Flow All	0	0	0	-	1573	471
Stage 1	-	-	-	-	1573	-
Stage 2	-	-	-	-	0	-
Critical Hdwy	5.34	-	-	-	6.54	7.14
Critical Hdwy Stg 1	-	-	-	-	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	3.12	-	-	-	4.02	3.92
Pot Cap-1 Maneuver	-	-	-	0 ~	109	461
Stage 1	-	-	-	0	169	-
Stage 2	-	-	-	0	-	-
Platoon blocked, %	-	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	-	-	0	461
Mov Cap-2 Maneuver	-	-	-	-	0	-
Stage 1	-	-	-	-	0	-
Stage 2	-	-	-	-	0	-

Approach	WB	SB
HCM Control Delay, s		20.4
HCM LOS		C

Minor Lane/Major Mvmt	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	-	-	-	461
HCM Lane V/C Ratio	-	-	-	0.5
HCM Control Delay (s)	-	-	-	20.4
HCM Lane LOS	-	-	-	C
HCM 95th %tile Q(veh)	-	-	-	2.7

Notes			
~: Volume exceeds capacity	\$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

## Intersection: 10: Crooks Rd &amp; Corporate Dr/I-75 Ramp

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	NB	SB
Directions Served	LT	T	R	L	LT	TR	R	T	T	TR	R	L
Maximum Queue (ft)	412	413	141	800	1698	1694	850	219	208	212	197	374
Average Queue (ft)	389	390	47	748	1252	1245	783	184	184	186	156	336
95th Queue (ft)	403	403	111	906	1962	1967	968	213	205	201	226	445
Link Distance (ft)	362	362	362		1654	1654		146	146	146	146	
Upstream Blk Time (%)	71	78			16	14		79	86	88	13	
Queuing Penalty (veh)	190	208			0	0		201	218	223	34	
Storage Bay Dist (ft)				700			750					325
Storage Blk Time (%)				23	45	33	1					28
Queuing Penalty (veh)				180	201	147	6					142

## Intersection: 10: Crooks Rd &amp; Corporate Dr/I-75 Ramp

Movement	SB	SB	SB	SB	SB
Directions Served	L	T	T	T	R
Maximum Queue (ft)	422	1214	1167	1065	190
Average Queue (ft)	377	749	640	433	77
95th Queue (ft)	502	1657	1523	1106	148
Link Distance (ft)		1954	1954	1954	
Upstream Blk Time (%)		2	1	0	
Queuing Penalty (veh)		0	0	0	
Storage Bay Dist (ft)	325				700
Storage Blk Time (%)	47	4		0	
Queuing Penalty (veh)	239	19		0	

## Intersection: 20: Corporate Dr &amp; New King Dr

Movement	EB	EB	WB	WB	WB	SB	SB
Directions Served	LT	T	T	T	R	L	R
Maximum Queue (ft)	774	787	356	362	298	183	64
Average Queue (ft)	667	666	79	85	22	94	17
95th Queue (ft)	936	953	304	313	147	264	46
Link Distance (ft)	732	732	362	362	362	382	382
Upstream Blk Time (%)	31	36	0	0	0		
Queuing Penalty (veh)	137	157	1	1	1		
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							



## Intersection: 30: NB Crooks Rd &amp; Tower Dr

Movement	EB	WB	WB	NB	NB	NB	NB
Directions Served	LT	R	R	T	T	T	R
Maximum Queue (ft)	80	135	71	227	248	318	83
Average Queue (ft)	55	55	9	63	81	122	23
95th Queue (ft)	66	100	42	165	199	259	58
Link Distance (ft)	17	505	505	562	562	562	
Upstream Blk Time (%)	49						
Queuing Penalty (veh)	327						
Storage Bay Dist (ft)							275
Storage Blk Time (%)						1	
Queuing Penalty (veh)						1	

## Intersection: 31: SB Crooks Rd &amp; Dummy Node/Tower Dr

Movement	SB	SB	SB	SB
Directions Served	L	T	T	TR
Maximum Queue (ft)	489	517	146	9
Average Queue (ft)	300	43	5	0
95th Queue (ft)	482	283	94	6
Link Distance (ft)		585	585	585
Upstream Blk Time (%)		0	0	
Queuing Penalty (veh)		1	0	
Storage Bay Dist (ft)	375			
Storage Blk Time (%)	3			
Queuing Penalty (veh)	20			

## Intersection: 40: SB Crooks Rd &amp; N&gt;S X/O N. of Long Lake

Movement	WB
Directions Served	L
Maximum Queue (ft)	60
Average Queue (ft)	41
95th Queue (ft)	62
Link Distance (ft)	17
Upstream Blk Time (%)	24
Queuing Penalty (veh)	28
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 41: NB Crooks Rd &amp; N&gt;S X/O N. of Long Lake

Movement	NB
Directions Served	L
Maximum Queue (ft)	87
Average Queue (ft)	15
95th Queue (ft)	55
Link Distance (ft)	543
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 50: NB Crooks Rd &amp; S&gt;N X/O N. of Long Lake

Movement	EB	NB
Directions Served	L	T
Maximum Queue (ft)	60	5
Average Queue (ft)	34	0
95th Queue (ft)	57	3
Link Distance (ft)	13	67
Upstream Blk Time (%)	12	
Queuing Penalty (veh)	12	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

## Intersection: 51: SB Crooks Rd &amp; S&gt;N X/O N. of Long Lake

Movement	SB	SB	SB	SB	SB
Directions Served	L	T	T	T	T
Maximum Queue (ft)	300	427	436	377	225
Average Queue (ft)	33	182	200	131	16
95th Queue (ft)	169	354	362	320	110
Link Distance (ft)		446	446	446	
Upstream Blk Time (%)		0	0	0	
Queuing Penalty (veh)		0	1	0	
Storage Bay Dist (ft)	225				150
Storage Blk Time (%)		8		6	
Queuing Penalty (veh)		8		22	

## Intersection: 60: E&gt;W X/O E. of Crooks &amp; WB Long Lake Rd

Movement	WB	WB	WB	NB
Directions Served	T	T	T	L
Maximum Queue (ft)	156	113	168	66
Average Queue (ft)	81	35	74	53
95th Queue (ft)	147	91	149	66
Link Distance (ft)	1483	1483	1483	21
Upstream Blk Time (%)				48
Queuing Penalty (veh)				67
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

## Intersection: 61: EB Long Lake Rd &amp; E&gt;W X/O E. of Crooks

Movement	EB
Directions Served	L
Maximum Queue (ft)	167
Average Queue (ft)	87
95th Queue (ft)	153
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	305
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 70: NB Crooks Rd &amp; WB Long Lake Rd

Movement	WB	WB	WB	WB
Directions Served	T	T	T	R
Maximum Queue (ft)	415	373	387	120
Average Queue (ft)	268	233	236	49
95th Queue (ft)	379	339	346	91
Link Distance (ft)	530	530	530	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				650
Storage Blk Time (%)				
Queuing Penalty (veh)				

## Intersection: 71: SB Crooks Rd &amp; WB Long Lake Rd

Movement	SB	SB	SB	SB
Directions Served	T	T	T	R
Maximum Queue (ft)	89	103	82	77
Average Queue (ft)	78	79	51	45
95th Queue (ft)	83	90	93	81
Link Distance (ft)	44	44	44	44
Upstream Blk Time (%)	51	57	18	12
Queuing Penalty (veh)	179	201	63	42
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

## Intersection: 72: SB Crooks Rd &amp; EB Long Lake Rd

Movement	EB	EB	EB	EB
Directions Served	T	T	T	R
Maximum Queue (ft)	81	95	93	82
Average Queue (ft)	74	73	61	49
95th Queue (ft)	83	88	94	79
Link Distance (ft)	42	42	42	42
Upstream Blk Time (%)	45	41	28	12
Queuing Penalty (veh)	90	84	57	25
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

## Intersection: 73: NB Crooks Rd &amp; EB Long Lake Rd

Movement	NB	NB	NB	NB
Directions Served	T	T	T	R
Maximum Queue (ft)	122	103	125	91
Average Queue (ft)	95	86	93	49
95th Queue (ft)	112	115	117	77
Link Distance (ft)	64	64	64	64
Upstream Blk Time (%)	31	19	25	2
Queuing Penalty (veh)	76	48	61	6
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

## Intersection: 80: E&gt;W X/O W. of Crooks &amp; WB Long Lake Rd

Movement	NB
Directions Served	L
Maximum Queue (ft)	31
Average Queue (ft)	6
95th Queue (ft)	25
Link Distance (ft)	27
Upstream Blk Time (%)	1
Queuing Penalty (veh)	0
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 81: EB Long Lake Rd &amp; E&gt;W X/O W. of Crooks

Movement	EB	EB	EB	EB
Directions Served	T	T	T	T
Maximum Queue (ft)	167	140	115	70
Average Queue (ft)	73	63	27	8
95th Queue (ft)	136	133	86	38
Link Distance (ft)	508	508	508	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				150
Storage Blk Time (%)	0		0	
Queuing Penalty (veh)	0		0	

## Intersection: 90: EB Long Lake Rd &amp; W&gt;E X/O W. of Crooks

Movement	EB	EB	EB	SB
Directions Served	T	T	T	L
Maximum Queue (ft)	66	70	70	87
Average Queue (ft)	15	10	10	54
95th Queue (ft)	51	38	42	91
Link Distance (ft)	44	44	44	34
Upstream Blk Time (%)	2	1	1	12
Queuing Penalty (veh)	3	1	2	34
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				



## Intersection: 91: W&gt;E X/O W. of Crooks/S.E. Site Drive &amp; WB Long Lake Rd

Movement	SB
Directions Served	TR
Maximum Queue (ft)	65
Average Queue (ft)	21
95th Queue (ft)	45
Link Distance (ft)	556
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 100: E&gt;W X/O E. of Corporate &amp; WB Long Lake Rd

Movement	NB
Directions Served	L
Maximum Queue (ft)	67
Average Queue (ft)	35
95th Queue (ft)	58
Link Distance (ft)	36
Upstream Blk Time (%)	13
Queuing Penalty (veh)	11
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 101: EB Long Lake Rd &amp; E&gt;W X/O E. of Corporate

Movement	EB	EB	EB	EB
Directions Served	L	T	T	T
Maximum Queue (ft)	18	18	7	16
Average Queue (ft)	1	1	0	1
95th Queue (ft)	12	12	4	11
Link Distance (ft)		520	520	520
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	375			
Storage Blk Time (%)				
Queuing Penalty (veh)				

## Intersection: 110: Investment Dr &amp; EB Long Lake Rd

Movement	EB	EB	EB	EB	NB	NB	SB
Directions Served	T	T	T	R	R	R	LT
Maximum Queue (ft)	46	47	44	48	44	38	70
Average Queue (ft)	26	11	10	19	19	8	49
95th Queue (ft)	53	36	35	44	38	26	84
Link Distance (ft)	13	13	13	13	755	755	35
Upstream Blk Time (%)	6	2	2	3			43
Queuing Penalty (veh)	10	3	4	5			31
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							

## Intersection: 111: Investment Dr &amp; WB Long Lake Rd

Movement	WB	WB	WB	WB	WB
Directions Served	L	T	T	T	T
Maximum Queue (ft)	64	198	224	215	118
Average Queue (ft)	11	87	95	94	27
95th Queue (ft)	41	171	188	176	79
Link Distance (ft)		428	428	428	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	225			300	
Storage Blk Time (%)		0			
Queuing Penalty (veh)		0			

## Intersection: 120: Corporate Dr &amp; WB Long Lake Rd

Movement	WB	WB	WB	WB	NB	SB	SB
Directions Served	T	T	T	R	LT	R	R
Maximum Queue (ft)	48	61	54	54	81	82	92
Average Queue (ft)	39	40	40	34	70	30	29
95th Queue (ft)	50	54	53	54	77	59	62
Link Distance (ft)	9	9	9	9	34	225	225
Upstream Blk Time (%)	16	17	16	8	69		
Queuing Penalty (veh)	48	50	48	24	241		
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							

## Intersection: 121: EB Long Lake Rd &amp; Corporate Dr

Movement	EB	EB	EB	EB	EB
Directions Served	L	T	T	T	T
Maximum Queue (ft)	357	65	23	29	17
Average Queue (ft)	157	9	1	2	2
95th Queue (ft)	285	37	10	15	11
Link Distance (ft)		562	562	562	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	375			275	
Storage Blk Time (%)	0				
Queuing Penalty (veh)	0				

## Intersection: 130: EB Long Lake Rd &amp; W&gt;E X/O W. of Investment

Movement	SB
Directions Served	L
Maximum Queue (ft)	56
Average Queue (ft)	33
95th Queue (ft)	52
Link Distance (ft)	33
Upstream Blk Time (%)	16
Queuing Penalty (veh)	15
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 131: W&gt;E X/O W. of Investment &amp; WB Long Lake Rd

Movement	WB
Directions Served	L
Maximum Queue (ft)	89
Average Queue (ft)	19
95th Queue (ft)	68
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	350
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 140: NB Crooks Rd &amp; S&gt;N X/O S. of Long Lake

Movement	EB
Directions Served	L
Maximum Queue (ft)	53
Average Queue (ft)	25
95th Queue (ft)	52
Link Distance (ft)	19
Upstream Blk Time (%)	8
Queuing Penalty (veh)	4
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 141: SB Crooks Rd &amp; S&gt;N X/O S. of Long Lake

Movement	SB
Directions Served	L
Maximum Queue (ft)	47
Average Queue (ft)	5
95th Queue (ft)	26
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	375
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 150: SB Crooks Rd &amp; Investment Dr

Movement	EB	EB	WB
Directions Served	R	R	LT
Maximum Queue (ft)	100	56	96
Average Queue (ft)	39	10	48
95th Queue (ft)	76	36	70
Link Distance (ft)	933	933	15
Upstream Blk Time (%)			46
Queuing Penalty (veh)			80
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

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Intersection: 151: NB Crooks Rd & Investment Dr

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Movement	NB
Directions Served	L
Maximum Queue (ft)	150
Average Queue (ft)	40
95th Queue (ft)	116
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	325
Storage Blk Time (%)	
Queuing Penalty (veh)	

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Zone Summary

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Zone wide Queuing Penalty: 4339

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## Intersection: 151: NB Crooks Rd &amp; Investment Dr

Movement	NB
Directions Served	L
Maximum Queue (ft)	147
Average Queue (ft)	39
95th Queue (ft)	107
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	325
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 160: SB Crooks Rd &amp; E. Site Drive

Movement	EB	EB	SB	SB	SB
Directions Served	R	R	T	T	T
Maximum Queue (ft)	82	41	75	84	57
Average Queue (ft)	39	9	4	4	2
95th Queue (ft)	67	28	37	41	31
Link Distance (ft)	600		265	265	265
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)		150			
Storage Blk Time (%)					0
Queuing Penalty (veh)					0

## Intersection: 170: Corporate Dr &amp; N. Site Drive

Movement	WB	WB	NB	SB
Directions Served	L	R	TR	L
Maximum Queue (ft)	52	61	20	159
Average Queue (ft)	17	27	1	44
95th Queue (ft)	44	54	10	107
Link Distance (ft)	504		335	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)		100		500
Storage Blk Time (%)	0			
Queuing Penalty (veh)	0			

## Intersection: 180: Corporate Dr &amp; W. Site Drive

Movement	WB	NB	NB	SB
Directions Served	LR	T	R	L
Maximum Queue (ft)	48	4	11	48
Average Queue (ft)	19	0	0	13
95th Queue (ft)	39	3	8	41
Link Distance (ft)	716	225		
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)			100	500
Storage Blk Time (%)				
Queuing Penalty (veh)				

## Intersection: 190: WB Long Lake Rd &amp; S.W. Site Drive

Movement	WB	WB	SB
Directions Served	T	T	R
Maximum Queue (ft)	8	4	23
Average Queue (ft)	0	0	2
95th Queue (ft)	6	3	13
Link Distance (ft)	82	82	460
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

## Intersection: 9000: SB Crooks Rd &amp; NB Crooks Rd/Crooks Rd

Movement	NB	NB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	T	T	T	R	R	R
Maximum Queue (ft)	154	234	242	248	188	37	34	33
Average Queue (ft)	60	88	105	121	69	3	1	1
95th Queue (ft)	124	223	238	254	185	17	15	13
Link Distance (ft)		527	527	527	527	146	146	146
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	375							
Storage Blk Time (%)								
Queuing Penalty (veh)								

## Intersection: 10: Crooks Rd &amp; Corporate Dr/I-75 Ramp

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	NB	SB
Directions Served	LT	T	R	L	LT	TR	R	T	T	TR	R	L
Maximum Queue (ft)	412	404	376	380	460	477	427	195	216	208	205	374
Average Queue (ft)	390	348	152	253	308	302	272	184	187	186	165	334
95th Queue (ft)	403	478	310	363	414	417	384	193	199	195	227	437
Link Distance (ft)	362	362	362		1654	1654		146	146	146	146	
Upstream Blk Time (%)	90	56	1					68	70	72	24	
Queuing Penalty (veh)	259	164	3					434	448	462	155	
Storage Bay Dist (ft)				700			750					325
Storage Blk Time (%)												32
Queuing Penalty (veh)												87

## Intersection: 10: Crooks Rd &amp; Corporate Dr/I-75 Ramp

Movement	SB	SB	SB	SB	SB
Directions Served	L	T	T	T	R
Maximum Queue (ft)	424	1028	924	577	89
Average Queue (ft)	374	676	588	205	36
95th Queue (ft)	491	1542	1448	669	68
Link Distance (ft)		1954	1954	1954	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	325			700	
Storage Blk Time (%)	49	0		0	
Queuing Penalty (veh)	136	0		0	

## Intersection: 20: Corporate Dr &amp; New King Dr

Movement	EB	EB	WB	WB	WB	SB	SB
Directions Served	LT	T	T	T	R	L	R
Maximum Queue (ft)	761	770	255	252	30	394	154
Average Queue (ft)	713	717	38	39	1	339	69
95th Queue (ft)	854	888	166	169	11	480	293
Link Distance (ft)	732	732	362	362	362	382	382
Upstream Blk Time (%)	39	50				72	15
Queuing Penalty (veh)	168	216				0	0
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							

## Intersection: 30: NB Crooks Rd &amp; Tower Dr

Movement	EB	WB	WB	NB	NB	NB	NB
Directions Served	LT	R	R	T	T	T	R
Maximum Queue (ft)	76	510	468	606	604	610	330
Average Queue (ft)	55	323	242	393	427	455	109
95th Queue (ft)	65	489	441	734	745	749	353
Link Distance (ft)	17	505	505	562	562	562	
Upstream Blk Time (%)	64	3	1	21	28	38	
Queuing Penalty (veh)	145	0	0	134	177	240	
Storage Bay Dist (ft)							275
Storage Blk Time (%)						50	
Queuing Penalty (veh)						14	

## Intersection: 31: SB Crooks Rd &amp; Dummy Node/Tower Dr

Movement	SB	SB	SB	SB
Directions Served	L	T	T	TR
Maximum Queue (ft)	398	292	203	53
Average Queue (ft)	129	27	7	2
95th Queue (ft)	312	199	102	34
Link Distance (ft)		585	585	585
Upstream Blk Time (%)		1	0	
Queuing Penalty (veh)		5	0	
Storage Bay Dist (ft)	375			
Storage Blk Time (%)	2	0		
Queuing Penalty (veh)	11	0		

## Intersection: 40: SB Crooks Rd &amp; N&gt;S X/O N. of Long Lake

Movement	WB	SB	SB	SB
Directions Served	L	T	T	T
Maximum Queue (ft)	60	163	139	128
Average Queue (ft)	39	23	18	15
95th Queue (ft)	62	207	170	150
Link Distance (ft)	17	611	611	611
Upstream Blk Time (%)	28	2		
Queuing Penalty (veh)	38	8		
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

## Intersection: 41: NB Crooks Rd &amp; N&gt;S X/O N. of Long Lake

Movement	NB	NB	NB	NB
Directions Served	L	T	T	T
Maximum Queue (ft)	280	423	431	452
Average Queue (ft)	27	133	158	176
95th Queue (ft)	139	463	513	551
Link Distance (ft)	541	541	541	541
Upstream Blk Time (%)		1	1	4
Queuing Penalty (veh)		5	7	21
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

## Intersection: 50: NB Crooks Rd &amp; S&gt;N X/O N. of Long Lake

Movement	EB	NB	NB
Directions Served	L	T	T
Maximum Queue (ft)	74	14	15
Average Queue (ft)	47	1	1
95th Queue (ft)	69	11	7
Link Distance (ft)	13	67	67
Upstream Blk Time (%)	44		
Queuing Penalty (veh)	152		
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

## Intersection: 51: SB Crooks Rd &amp; S&gt;N X/O N. of Long Lake

Movement	SB	SB	SB	SB	SB
Directions Served	L	T	T	T	T
Maximum Queue (ft)	267	429	447	383	182
Average Queue (ft)	118	233	233	157	26
95th Queue (ft)	277	438	414	368	130
Link Distance (ft)		446	446	446	
Upstream Blk Time (%)		8	1	0	
Queuing Penalty (veh)		45	7	0	
Storage Bay Dist (ft)	225				150
Storage Blk Time (%)	0	18		12	
Queuing Penalty (veh)	1	57		43	



## Intersection: 60: E&gt;W X/O E. of Crooks &amp; WB Long Lake Rd

Movement	WB	WB	WB	NB
Directions Served	T	T	T	L
Maximum Queue (ft)	320	258	194	66
Average Queue (ft)	76	35	46	47
95th Queue (ft)	272	212	169	73
Link Distance (ft)	1483	1483	1483	21
Upstream Blk Time (%)				54
Queuing Penalty (veh)				60
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

## Intersection: 61: EB Long Lake Rd &amp; E&gt;W X/O E. of Crooks

Movement	EB
Directions Served	L
Maximum Queue (ft)	144
Average Queue (ft)	50
95th Queue (ft)	112
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	305
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 70: NB Crooks Rd &amp; WB Long Lake Rd

Movement	WB	WB	WB	WB
Directions Served	T	T	T	R
Maximum Queue (ft)	382	332	228	147
Average Queue (ft)	230	191	151	63
95th Queue (ft)	365	287	220	119
Link Distance (ft)	530	530	530	
Upstream Blk Time (%)	4	0		
Queuing Penalty (veh)	14	0		
Storage Bay Dist (ft)				650
Storage Blk Time (%)				
Queuing Penalty (veh)				

## Intersection: 71: SB Crooks Rd &amp; WB Long Lake Rd

Movement	WB	WB	SB	SB	SB	SB
Directions Served	T	T	T	T	T	R
Maximum Queue (ft)	8	12	92	113	79	82
Average Queue (ft)	2	2	76	80	39	47
95th Queue (ft)	12	14	87	94	87	81
Link Distance (ft)	23	23	44	44	44	44
Upstream Blk Time (%)	6	3	55	53	14	14
Queuing Penalty (veh)	20	11	197	191	50	49
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

## Intersection: 72: SB Crooks Rd &amp; EB Long Lake Rd

Movement	EB	EB	EB	EB	SB	SB
Directions Served	T	T	T	R	T	T
Maximum Queue (ft)	89	80	90	79	41	7
Average Queue (ft)	73	72	74	48	12	0
95th Queue (ft)	84	83	84	90	62	6
Link Distance (ft)	42	42	42	42	42	42
Upstream Blk Time (%)	58	58	53	14	13	0
Queuing Penalty (veh)	211	213	195	53	54	0
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

## Intersection: 73: NB Crooks Rd &amp; EB Long Lake Rd

Movement	NB	NB	NB	NB
Directions Served	T	T	T	R
Maximum Queue (ft)	120	108	121	112
Average Queue (ft)	87	95	95	86
95th Queue (ft)	135	115	116	122
Link Distance (ft)	64	64	64	64
Upstream Blk Time (%)	32	34	33	25
Queuing Penalty (veh)	144	149	146	111
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

## Intersection: 80: E&gt;W X/O W. of Crooks &amp; WB Long Lake Rd

Movement	WB	WB	WB	NB
Directions Served	T	T	T	L
Maximum Queue (ft)	23	28	8	37
Average Queue (ft)	6	4	0	14
95th Queue (ft)	39	32	6	41
Link Distance (ft)	70	70	70	27
Upstream Blk Time (%)	6	3		4
Queuing Penalty (veh)	24	13		1
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

## Intersection: 81: EB Long Lake Rd &amp; E&gt;W X/O W. of Crooks

Movement	EB	EB	EB	EB	EB
Directions Served	L	T	T	T	T
Maximum Queue (ft)	75	384	372	351	225
Average Queue (ft)	3	220	218	202	29
95th Queue (ft)	48	417	417	415	132
Link Distance (ft)		508	508	508	
Upstream Blk Time (%)		11	11	11	
Queuing Penalty (veh)		49	48	48	
Storage Bay Dist (ft)	225				150
Storage Blk Time (%)		13		18	0
Queuing Penalty (veh)		3		64	0

## Intersection: 90: EB Long Lake Rd &amp; W&gt;E X/O W. of Crooks

Movement	EB	EB	EB	SB
Directions Served	T	T	T	L
Maximum Queue (ft)	92	81	84	88
Average Queue (ft)	34	34	27	64
95th Queue (ft)	87	86	74	97
Link Distance (ft)	44	44	44	34
Upstream Blk Time (%)	14	14	13	39
Queuing Penalty (veh)	52	52	47	133
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

## Intersection: 91: W&gt;E X/O W. of Crooks/S.E. Site Drive &amp; WB Long Lake Rd

Movement	WB	WB	WB	WB	SB
Directions Served	L	T	T	T	TR
Maximum Queue (ft)	119	107	107	107	498
Average Queue (ft)	36	33	31	17	249
95th Queue (ft)	210	214	207	152	592
Link Distance (ft)		390	390	390	556
Upstream Blk Time (%)	7	7	4	0	19
Queuing Penalty (veh)	0	26	17	1	0
Storage Bay Dist (ft)	325				
Storage Blk Time (%)	7	7			
Queuing Penalty (veh)	21	13			

## Intersection: 100: E&gt;W X/O E. of Corporate &amp; WB Long Lake Rd

Movement	NB
Directions Served	L
Maximum Queue (ft)	70
Average Queue (ft)	27
95th Queue (ft)	57
Link Distance (ft)	36
Upstream Blk Time (%)	7
Queuing Penalty (veh)	6
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 101: EB Long Lake Rd &amp; E&gt;W X/O E. of Corporate

Movement	EB	EB	EB	EB
Directions Served	L	T	T	T
Maximum Queue (ft)	24	188	189	172
Average Queue (ft)	1	63	59	58
95th Queue (ft)	10	328	316	313
Link Distance (ft)		520	520	520
Upstream Blk Time (%)		9	9	9
Queuing Penalty (veh)		33	33	33
Storage Bay Dist (ft)	375			
Storage Blk Time (%)		9		
Queuing Penalty (veh)		5		

## Intersection: 110: Investment Dr &amp; EB Long Lake Rd

Movement	EB	EB	EB	EB	NB	NB	SB
Directions Served	T	T	T	R	R	R	LT
Maximum Queue (ft)	54	50	46	34	194	159	57
Average Queue (ft)	36	23	20	11	56	34	22
95th Queue (ft)	57	51	50	34	191	174	52
Link Distance (ft)	13	13	13	13	755	755	35
Upstream Blk Time (%)	17	13	12	1			15
Queuing Penalty (veh)	47	35	33	3			5
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							

## Intersection: 111: Investment Dr &amp; WB Long Lake Rd

Movement	WB	WB	WB	WB	WB
Directions Served	L	T	T	T	T
Maximum Queue (ft)	5	211	220	227	33
Average Queue (ft)	0	62	69	71	2
95th Queue (ft)	3	159	166	160	16
Link Distance (ft)		428	428	428	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	225			300	
Storage Blk Time (%)		0			
Queuing Penalty (veh)		0			

## Intersection: 120: Corporate Dr &amp; WB Long Lake Rd

Movement	WB	WB	WB	WB	NB	SB	SB
Directions Served	T	T	T	R	LT	R	R
Maximum Queue (ft)	47	57	56	47	83	202	204
Average Queue (ft)	33	36	38	13	64	92	84
95th Queue (ft)	58	57	55	40	95	168	157
Link Distance (ft)	9	9	9	9	34	225	225
Upstream Blk Time (%)	13	13	16	2	60	0	0
Queuing Penalty (veh)	33	33	39	4	147	0	0
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							



## Intersection: 121: EB Long Lake Rd &amp; Corporate Dr

Movement	EB	EB	EB	EB	EB
Directions Served	L	T	T	T	T
Maximum Queue (ft)	302	196	181	179	6
Average Queue (ft)	101	69	54	54	0
95th Queue (ft)	216	324	311	312	4
Link Distance (ft)		562	562	562	
Upstream Blk Time (%)		7	7	7	
Queuing Penalty (veh)		33	31	30	
Storage Bay Dist (ft)	375				275
Storage Blk Time (%)	0	8		8	
Queuing Penalty (veh)	0	16		21	

## Intersection: 130: EB Long Lake Rd &amp; W&gt;E X/O W. of Investment

Movement	EB	EB	EB	SB
Directions Served	T	T	T	L
Maximum Queue (ft)	185	184	182	52
Average Queue (ft)	52	50	47	44
95th Queue (ft)	354	343	333	58
Link Distance (ft)	723	723	723	33
Upstream Blk Time (%)	6	5	5	57
Queuing Penalty (veh)	0	0	0	117
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

## Intersection: 131: W&gt;E X/O W. of Investment &amp; WB Long Lake Rd

Movement	WB	WB	WB
Directions Served	L	T	T
Maximum Queue (ft)	336	233	185
Average Queue (ft)	103	11	13
95th Queue (ft)	268	110	116
Link Distance (ft)		524	524
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	350		
Storage Blk Time (%)	4		
Queuing Penalty (veh)	21		

## Intersection: 140: NB Crooks Rd &amp; S&gt;N X/O S. of Long Lake

Movement	EB	NB	NB	NB
Directions Served	L	T	T	T
Maximum Queue (ft)	69	81	74	59
Average Queue (ft)	49	31	13	8
95th Queue (ft)	70	184	96	61
Link Distance (ft)	19	285	285	285
Upstream Blk Time (%)	73	8	0	
Queuing Penalty (veh)	114	43	1	
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

## Intersection: 141: SB Crooks Rd &amp; S&gt;N X/O S. of Long Lake

Movement	SB	SB	SB
Directions Served	L	T	T
Maximum Queue (ft)	373	404	314
Average Queue (ft)	193	117	29
95th Queue (ft)	428	435	198
Link Distance (ft)		410	410
Upstream Blk Time (%)	17	17	0
Queuing Penalty (veh)	0	95	1
Storage Bay Dist (ft)	375		
Storage Blk Time (%)	20	1	
Queuing Penalty (veh)	102	2	

## Intersection: 150: SB Crooks Rd &amp; Investment Dr

Movement	EB	EB	WB
Directions Served	R	R	LT
Maximum Queue (ft)	182	138	58
Average Queue (ft)	85	36	32
95th Queue (ft)	143	91	59
Link Distance (ft)	933	933	15
Upstream Blk Time (%)			25
Queuing Penalty (veh)			14
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

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Intersection: 151: NB Crooks Rd & Investment Dr

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Movement	NB	NB	NB	NB
Directions Served	L	T	T	T
Maximum Queue (ft)	58	214	214	214
Average Queue (ft)	6	55	51	26
95th Queue (ft)	31	381	364	256
Link Distance (ft)		842	842	842
Upstream Blk Time (%)		4	1	0
Queuing Penalty (veh)		0	0	0
Storage Bay Dist (ft)	325			
Storage Blk Time (%)		6		
Queuing Penalty (veh)		3		

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Zone Summary

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Zone wide Queuing Penalty: 7253

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## Intersection: 151: NB Crooks Rd &amp; Investment Dr

Movement	NB
Directions Served	L
Maximum Queue (ft)	37
Average Queue (ft)	3
95th Queue (ft)	19
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	325
Storage Blk Time (%)	
Queuing Penalty (veh)	

## Intersection: 160: SB Crooks Rd &amp; E. Site Drive

Movement	EB	EB	SB	SB	SB
Directions Served	R	R	T	T	T
Maximum Queue (ft)	572	200	77	29	4
Average Queue (ft)	273	156	3	1	0
95th Queue (ft)	503	267	40	16	3
Link Distance (ft)	600		232	232	232
Upstream Blk Time (%)	4		0		
Queuing Penalty (veh)	0		0		
Storage Bay Dist (ft)		150			
Storage Blk Time (%)	53	3			
Queuing Penalty (veh)	156	8			

## Intersection: 170: Corporate Dr &amp; N. Site Drive

Movement	WB	WB	NB	SB
Directions Served	L	R	TR	L
Maximum Queue (ft)	170	147	8	67
Average Queue (ft)	61	61	0	25
95th Queue (ft)	120	109	5	60
Link Distance (ft)	504		335	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)		100		500
Storage Blk Time (%)	3	0		
Queuing Penalty (veh)	9	1		

## Intersection: 180: Corporate Dr &amp; W. Site Drive

Movement	WB	SB
Directions Served	LR	L
Maximum Queue (ft)	61	39
Average Queue (ft)	23	6
95th Queue (ft)	46	27
Link Distance (ft)	716	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		500
Storage Blk Time (%)		
Queuing Penalty (veh)		

## Intersection: 190: WB Long Lake Rd &amp; S.W. Site Drive

Movement	WB	WB	SB
Directions Served	T	T	R
Maximum Queue (ft)	8	9	45
Average Queue (ft)	0	0	22
95th Queue (ft)	6	6	40
Link Distance (ft)	82	82	460
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

## Intersection: 9000: SB Crooks Rd &amp; NB Crooks Rd/Crooks Rd

Movement	NB	NB	NB	NB	NB	SB	SB
Directions Served	L	T	T	T	T	R	R
Maximum Queue (ft)	450	597	588	568	543	43	10
Average Queue (ft)	213	453	460	458	359	3	0
95th Queue (ft)	533	696	672	653	642	19	5
Link Distance (ft)		527	527	527	527	146	146
Upstream Blk Time (%)		8	9	11	2		
Queuing Penalty (veh)		56	56	74	11		
Storage Bay Dist (ft)	375						
Storage Blk Time (%)	0	22					
Queuing Penalty (veh)	0	28					















# HCM 6th Signalized Intersection Summary

## 10: Crooks Rd & Corporate Dr/I-75 Ramp

Future Conditions

AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑↑	↑↑	↑↑	↑		↑↑↑	↑↑	↑↑	↑↑↑	↑
Traffic Volume (veh/h)	0	503	296	890	676	903	0	799	433	536	1536	363
Future Volume (veh/h)	0	503	296	890	676	903	0	799	433	536	1536	363
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	0	1969	1969	1969	1969	1969	0	1969	1969	1969	1969	1969
Adj Flow Rate, veh/h	0	535	262	947	1039	466	0	850	339	564	1617	298
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.95	0.95	0.95
Percent Heavy Veh, %	0	2	2	2	2	2	0	2	2	2	2	2
Cap, veh/h	0	577	453	1008	1899	1098	0	911	1287	640	2161	671
Arrive On Green	0.00	0.15	0.15	0.27	0.48	0.48	0.00	0.17	0.17	0.18	0.40	0.40
Sat Flow, veh/h	0	3839	2937	3750	3938	1668	0	5552	2937	3638	5375	1668
Grp Volume(v), veh/h	0	535	262	947	1039	466	0	850	339	564	1617	298
Grp Sat Flow(s),veh/h/ln	0	1870	1468	1875	1969	1668	0	1792	1468	1819	1792	1668
Q Serve(g_s), s	0.0	16.9	9.9	29.6	22.3	15.9	0.0	18.7	8.8	18.1	30.9	15.6
Cycle Q Clear(g_c), s	0.0	16.9	9.9	29.6	22.3	15.9	0.0	18.7	8.8	18.1	30.9	15.6
Prop In Lane	0.00		1.00	1.00		1.00	0.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	0	577	453	1008	1899	1098	0	911	1287	640	2161	671
V/C Ratio(X)	0.00	0.93	0.58	0.94	0.55	0.42	0.00	0.93	0.26	0.88	0.75	0.44
Avail Cap(c_a), veh/h	0	577	453	1031	1923	1108	0	911	1287	703	2161	671
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(l)	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	50.1	47.1	42.9	21.9	9.7	0.0	49.2	21.4	48.2	30.7	26.1
Incr Delay (d2), s/veh	0.0	21.4	1.8	15.4	0.3	0.3	0.0	17.4	0.5	12.4	2.4	2.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	9.5	3.7	15.6	10.1	5.4	0.0	9.6	3.1	9.1	13.1	6.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	71.5	49.0	58.3	22.2	10.0	0.0	66.6	21.9	60.6	33.1	28.2
LnGrp LOS	A	E	D	E	C	A	A	E	C	E	C	C
Approach Vol, veh/h		797			2452			1189			2479	
Approach Delay, s/veh		64.1			33.8			53.8			38.8	
Approach LOS		E			C			D			D	
Timer - Assigned Phs	1	2	3	4		6		8				
Phs Duration (G+Y+Rc), s	27.9	27.1	39.4	25.6		55.0		65.0				
Change Period (Y+Rc), s	6.8	6.8	* 7.1	* 7.1		6.8		* 7.1				
Max Green Setting (Gmax), s	23.2	17.5	* 33	* 19		47.5		* 59				
Max Q Clear Time (g_c+I1), s	20.1	20.7	31.6	18.9		32.9		24.3				
Green Ext Time (p_c), s	1.0	0.0	0.6	0.0		9.6		6.7				

### Intersection Summary

HCM 6th Ctrl Delay 42.5

HCM 6th LOS D

### Notes

User approved volume balancing among the lanes for turning movement.




















\* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

# HCM Signalized Intersection Capacity Analysis

## 30: NB Crooks Rd & Tower Dr

Future Conditions

AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations								  				
Traffic Volume (vph)	282	591	0	0	0	200	0	846	110	0	0	0
Future Volume (vph)	282	591	0	0	0	200	0	846	110	0	0	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)	6.0	6.0				6.0		6.4	6.4			
Lane Util. Factor	0.95	0.95				0.88		0.91	1.00			
Frt	1.00	1.00				0.85		1.00	0.85			
Flt Protected	0.95	1.00				1.00		1.00	1.00			
Satd. Flow (prot)	1770	1858				2933		5353	1667			
Flt Permitted	0.95	1.00				1.00		1.00	1.00			
Satd. Flow (perm)	1770	1858				2933		5353	1667			
Peak-hour factor, PHF	0.89	0.89	0.89	0.73	0.73	0.73	0.95	0.95	0.95	0.92	0.92	0.92
Adj. Flow (vph)	317	664	0	0	0	274	0	891	116	0	0	0
RTOR Reduction (vph)	16	16	0	0	0	17	0	0	67	0	0	0
Lane Group Flow (vph)	269	680	0	0	0	257	0	891	49	0	0	0
Turn Type	Perm	NA				Perm		NA	Perm			
Protected Phases		4						2				
Permitted Phases	4					8			2			
Actuated Green, G (s)	57.3	57.3				57.3		50.3	50.3			
Effective Green, g (s)	57.3	57.3				57.3		50.3	50.3			
Actuated g/C Ratio	0.48	0.48				0.48		0.42	0.42			
Clearance Time (s)	6.0	6.0				6.0		6.4	6.4			
Vehicle Extension (s)	4.5	4.5				4.5		3.0	3.0			
Lane Grp Cap (vph)	845	887				1400		2243	698			
v/s Ratio Prot								c0.17				
v/s Ratio Perm	0.15	0.37				0.09			0.03			
v/c Ratio	0.32	0.77				0.18		0.40	0.07			
Uniform Delay, d1	19.3	25.8				18.0		24.3	20.9			
Progression Factor	0.78	0.89				1.00		0.88	1.95			
Incremental Delay, d2	0.2	2.9				0.1		0.5	0.2			
Delay (s)	15.4	25.8				18.1		22.0	40.8			
Level of Service	B	C				B		C	D			
Approach Delay (s)		22.8			18.1			24.1			0.0	
Approach LOS		C			B			C			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		22.8				HCM 2000 Level of Service		C				
HCM 2000 Volume to Capacity ratio		0.59										
Actuated Cycle Length (s)		120.0				Sum of lost time (s)		12.4				
Intersection Capacity Utilization		77.2%				ICU Level of Service		D				
Analysis Period (min)		15										
c Critical Lane Group												

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50: NB Crooks Rd & S>N X/O N. of Long Lake Performance by movement

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Movement	EBL	NBT	All
Denied Delay (hr)	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0
Total Delay (hr)	0.1	0.2	0.3
Total Del/Veh (s)	5.3	0.8	1.2

# HCM Signalized Intersection Capacity Analysis

## 120: Corporate Dr & WB Long Lake Rd

Future Conditions

AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑↑	↑		↑↑				↑↑
Traffic Volume (vph)	0	0	0	0	927	273	39	310	0	0	0	226
Future Volume (vph)	0	0	0	0	927	273	39	310	0	0	0	226
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)					6.3	6.3		5.8				5.8
Lane Util. Factor					0.91	1.00		0.95				0.88
Frt					1.00	0.85		1.00				0.85
Flt Protected					1.00	1.00		0.99				1.00
Satd. Flow (prot)					5353	1667		3705				2933
Flt Permitted					1.00	1.00		0.99				1.00
Satd. Flow (perm)					5353	1667		3705				2933
Peak-hour factor, PHF	0.92	0.92	0.92	0.95	0.95	0.95	0.89	0.89	0.89	0.81	0.81	0.81
Adj. Flow (vph)	0	0	0	0	976	287	44	348	0	0	0	279
RTOR Reduction (vph)	0	0	0	0	0	70	0	26	0	0	0	138
Lane Group Flow (vph)	0	0	0	0	976	217	0	366	0	0	0	141
Turn Type					NA	Perm	Perm	NA				Perm
Protected Phases					6			8				
Permitted Phases						6	8					4
Actuated Green, G (s)					90.6	90.6		17.3				17.3
Effective Green, g (s)					90.6	90.6		17.3				17.3
Actuated g/C Ratio					0.75	0.75		0.14				0.14
Clearance Time (s)					6.3	6.3		5.8				5.8
Vehicle Extension (s)					4.0	4.0		3.0				3.0
Lane Grp Cap (vph)					4041	1258		534				422
v/s Ratio Prot					c0.18							
v/s Ratio Perm						0.13		0.10				0.05
v/c Ratio					0.24	0.17		0.69				0.33
Uniform Delay, d1					4.4	4.1		48.8				46.2
Progression Factor					0.32	0.00		1.00				0.98
Incremental Delay, d2					0.1	0.3		3.6				0.4
Delay (s)					1.5	0.3		52.4				45.9
Level of Service					A	A		D				D
Approach Delay (s)		0.0			1.3			52.4			45.9	
Approach LOS		A			A			D			D	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		18.1			HCM 2000 Level of Service					B		
HCM 2000 Volume to Capacity ratio		0.31										
Actuated Cycle Length (s)		120.0			Sum of lost time (s)					12.1		
Intersection Capacity Utilization		48.7%			ICU Level of Service					A		
Analysis Period (min)		15										
c Critical Lane Group												

Intersection												
Int Delay, s/veh	0											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↰	↑↑↑	↱					↑	↱
Traffic Vol, veh/h	0	0	0	269	1218	153	0	0	0	0	25	11
Future Vol, veh/h	0	0	0	269	1218	153	0	0	0	0	25	11
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	325	-	100	-	-	-	-	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	16974	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	91	95	95	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	296	1282	161	0	0	0	0	27	12

Major/Minor	Major2			Minor2		
Conflicting Flow All	0	0	0	-	1874	641
Stage 1	-	-	-	-	1874	-
Stage 2	-	-	-	-	0	-
Critical Hdwy	5.34	-	-	-	6.54	7.14
Critical Hdwy Stg 1	-	-	-	-	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	3.12	-	-	-	4.02	3.92
Pot Cap-1 Maneuver	-	-	-	0	71	358
Stage 1	-	-	-	0	120	-
Stage 2	-	-	-	0	-	-
Platoon blocked, %	-	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	-	-	0	358
Mov Cap-2 Maneuver	-	-	-	-	0	-
Stage 1	-	-	-	-	0	-
Stage 2	-	-	-	-	0	-

Approach	WB			SB		
HCM Control Delay, s						
HCM LOS	-					
Minor Lane/Major Mvmt	WBL	WBT	WBR	SBLn1	SBLn2	
Capacity (veh/h)	-	-	-	-	358	
HCM Lane V/C Ratio	-	-	-	-	0.033	
HCM Control Delay (s)	-	-	-	-	15.4	
HCM Lane LOS	-	-	-	-	C	
HCM 95th %tile Q(veh)	-	-	-	-	0.1	




# HCM 6th Signalized Intersection Summary

## 10: Crooks Rd & Corporate Dr/I-75 Ramp

# Future Conditions w/ Improvements

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑↑	↑↑	↑↑	↑		↑↑↑	↑↑	↑↑	↑↑↑	↑
Traffic Volume (veh/h)	0	248	619	434	304	824	0	1941	900	474	828	201
Future Volume (veh/h)	0	248	619	434	304	824	0	1941	900	474	828	201
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	0	1969	1969	1969	1969	1969	0	1969	1969	1969	1969	1969
Adj Flow Rate, veh/h	0	270	401	472	330	624	0	2087	715	499	872	180
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.93	0.93	0.93	0.95	0.95	0.95
Percent Heavy Veh, %	0	2	2	2	2	2	0	2	2	2	2	2
Cap, veh/h	0	458	359	488	604	1537	0	2043	1498	559	3150	978
Arrive On Green	0.00	0.12	0.12	0.13	0.31	0.31	0.00	0.38	0.38	0.15	0.59	0.59
Sat Flow, veh/h	0	3839	2937	3750	1969	3337	0	5552	2937	3638	5375	1668
Grp Volume(v), veh/h	0	270	401	472	330	624	0	2087	715	499	872	180
Grp Sat Flow(s),veh/h/ln	0	1870	1468	1875	1969	1668	0	1792	1468	1819	1792	1668
Q Serve(g_s), s	0.0	8.9	15.9	16.3	18.1	16.1	0.0	49.4	20.5	17.5	10.4	6.5
Cycle Q Clear(g_c), s	0.0	8.9	15.9	16.3	18.1	16.1	0.0	49.4	20.5	17.5	10.4	6.5
Prop In Lane	0.00		1.00	1.00		1.00	0.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	0	458	359	488	604	1537	0	2043	1498	559	3150	978
V/C Ratio(X)	0.00	0.59	1.12	0.97	0.55	0.41	0.00	1.02	0.48	0.89	0.28	0.18
Avail Cap(c_a), veh/h	0	458	359	488	604	1537	0	2043	1498	593	3150	978
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(l)	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	54.0	57.0	56.3	37.5	23.3	0.0	40.3	20.6	54.0	13.3	12.5
Incr Delay (d2), s/veh	0.0	2.0	82.8	32.6	1.0	0.2	0.0	25.5	1.1	15.7	0.2	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	4.3	10.0	9.8	8.9	6.3	0.0	25.5	7.1	9.0	4.0	2.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	56.0	139.9	88.9	38.5	23.4	0.0	65.8	21.7	69.7	13.5	12.9
LnGrp LOS	A	E	F	F	D	C	A	F	C	E	B	B
Approach Vol, veh/h		671			1426			2802			1551	
Approach Delay, s/veh		106.1			48.6			54.6			31.5	
Approach LOS		F			D			D			C	
Timer - Assigned Phs	1	2	3	4		6		8				
Phs Duration (G+Y+Rc), s	26.8	56.2	24.0	23.0		83.0		47.0				
Change Period (Y+Rc), s	6.8	6.8	* 7.1	* 7.1		6.8		* 7.1				
Max Green Setting (Gmax), s	21.2	48.2	* 17	* 16		76.2		* 40				
Max Q Clear Time (g_c+I1), s	19.5	51.4	18.3	17.9		12.4		20.1				
Green Ext Time (p_c), s	0.5	0.0	0.0	0.0		7.2		3.6				

## Intersection Summary

HCM 6th Ctrl Delay 53.1

HCM 6th LOS D

## Notes

User approved volume balancing among the lanes for turning movement.





















\* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

# HCM Signalized Intersection Capacity Analysis

## 30: NB Crooks Rd & Tower Dr

Future Conditions w/ Improvements

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations						 		  				
Traffic Volume (vph)	389	112	0	0	0	669	0	1912	28	0	0	0
Future Volume (vph)	389	112	0	0	0	669	0	1912	28	0	0	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)	6.0	6.0				6.0		6.4	6.4			
Lane Util. Factor	0.95	0.95				0.88		0.91	1.00			
Frt	1.00	1.00				0.85		1.00	0.85			
Flt Protected	0.95	0.97				1.00		1.00	1.00			
Satd. Flow (prot)	1770	1812				2933		5353	1667			
Flt Permitted	0.95	0.97				1.00		1.00	1.00			
Satd. Flow (perm)	1770	1812				2933		5353	1667			
Peak-hour factor, PHF	0.76	0.76	0.76	0.79	0.79	0.79	0.93	0.93	0.93	0.92	0.92	0.92
Adj. Flow (vph)	512	147	0	0	0	847	0	2056	30	0	0	0
RTOR Reduction (vph)	18	18	0	0	0	18	0	0	12	0	0	0
Lane Group Flow (vph)	310	313	0	0	0	829	0	2056	18	0	0	0
Turn Type	Perm	NA				Perm		NA	Perm			
Protected Phases		4						2				
Permitted Phases	4					8			2			
Actuated Green, G (s)	47.8	47.8				47.8		69.8	69.8			
Effective Green, g (s)	47.8	47.8				47.8		69.8	69.8			
Actuated g/C Ratio	0.37	0.37				0.37		0.54	0.54			
Clearance Time (s)	6.0	6.0				6.0		6.4	6.4			
Vehicle Extension (s)	4.5	4.5				4.5		3.0	3.0			
Lane Grp Cap (vph)	650	666				1078		2874	895			
v/s Ratio Prot								c0.38				
v/s Ratio Perm	0.17	0.17				c0.28			0.01			
v/c Ratio	0.48	0.47				0.77		0.72	0.02			
Uniform Delay, d1	31.5	31.4				36.2		22.6	14.1			
Progression Factor	1.34	1.34				1.00		1.00	1.00			
Incremental Delay, d2	0.7	0.7				3.8		1.6	0.0			
Delay (s)	42.9	42.8				40.0		24.2	14.1			
Level of Service	D	D				D		C	B			
Approach Delay (s)		42.9			40.0			24.0			0.0	
Approach LOS		D			D			C			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			31.3			HCM 2000 Level of Service			C			
HCM 2000 Volume to Capacity ratio			0.74									
Actuated Cycle Length (s)			130.0			Sum of lost time (s)			12.4			
Intersection Capacity Utilization			104.1%			ICU Level of Service			G			
Analysis Period (min)			15									
c Critical Lane Group												

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50: NB Crooks Rd & S>N X/O N. of Long Lake Performance by movement

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










Movement	EBL	NBT	All
Denied Delay (hr)	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0
Total Delay (hr)	0.9	0.4	1.4
Total Del/Veh (s)	10.3	1.1	2.8

# HCM Signalized Intersection Capacity Analysis

## 120: Corporate Dr & WB Long Lake Rd

Future Conditions w/ Improvements

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑↑	↑		↑↑				↑↑
Traffic Volume (vph)	0	0	0	0	919	54	105	136	0	0	0	690
Future Volume (vph)	0	0	0	0	919	54	105	136	0	0	0	690
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)					6.3	6.3		5.8				5.8
Lane Util. Factor					0.91	1.00		0.95				0.88
Frt					1.00	0.85		1.00				0.85
Flt Protected					1.00	1.00		0.98				1.00
Satd. Flow (prot)					5353	1667		3646				2933
Flt Permitted					1.00	1.00		0.98				1.00
Satd. Flow (perm)					5353	1667		3646				2933
Peak-hour factor, PHF	0.92	0.92	0.92	0.88	0.88	0.88	0.69	0.69	0.69	0.72	0.72	0.72
Adj. Flow (vph)	0	0	0	0	1044	61	152	197	0	0	0	958
RTOR Reduction (vph)	0	0	0	0	0	30	0	21	0	0	0	37
Lane Group Flow (vph)	0	0	0	0	1044	31	0	328	0	0	0	921
Turn Type					NA	Perm	custom	NA				Perm
Protected Phases					6!			8				
Permitted Phases						6	8 6!					4
Actuated Green, G (s)					61.9	61.9		46.0				46.0
Effective Green, g (s)					61.9	61.9		46.0				46.0
Actuated g/C Ratio					0.52	0.52		0.38				0.38
Clearance Time (s)					6.3	6.3		5.8				5.8
Vehicle Extension (s)					4.0	4.0		3.0				3.0
Lane Grp Cap (vph)					2761	859		1397				1124
v/s Ratio Prot					c0.20							
v/s Ratio Perm						0.02		0.09				c0.31
v/c Ratio					0.38	0.04		0.23				0.82
Uniform Delay, d1					17.5	14.3		25.1				33.3
Progression Factor					1.79	3.45		1.00				1.00
Incremental Delay, d2					0.4	0.1		0.1				4.8
Delay (s)					31.7	49.5		25.2				38.0
Level of Service					C	D		C				D
Approach Delay (s)		0.0			32.7			25.2			38.0	
Approach LOS		A			C			C			D	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			33.7				HCM 2000 Level of Service			C		
HCM 2000 Volume to Capacity ratio			0.57									
Actuated Cycle Length (s)			120.0				Sum of lost time (s)			12.1		
Intersection Capacity Utilization			61.2%				ICU Level of Service			B		
Analysis Period (min)			15									
! Phase conflict between lane groups.												
c Critical Lane Group												

Intersection												
Int Delay, s/veh	2.4											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↰	↑↑↑	↱					↱	↰
Traffic Vol, veh/h	0	0	0	212	866	97	0	0	0	0	122	90
Future Vol, veh/h	0	0	0	212	866	97	0	0	0	0	122	90
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	325	-	100	-	-	-	-	-	0
Veh in Median Storage, #	-	2	-	-	0	-	-	16974	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	67	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	316	941	105	0	0	0	0	133	98
Major/Minor				Major2				Minor2				
Conflicting Flow All				0	0	0				-	1573	471
Stage 1				-	-	-				-	1573	-
Stage 2				-	-	-				-	0	-
Critical Hdwy				5.34	-	-				-	6.54	7.14
Critical Hdwy Stg 1				-	-	-				-	5.54	-
Critical Hdwy Stg 2				-	-	-				-	-	-
Follow-up Hdwy				3.12	-	-				-	4.02	3.92
Pot Cap-1 Maneuver				-	-	-				0 ~ 109	461	
Stage 1				-	-	-				0	169	-
Stage 2				-	-	-				0	-	-
Platoon blocked, %					-	-						
Mov Cap-1 Maneuver				-	-	-				-	0	461
Mov Cap-2 Maneuver				-	-	-				-	0	-
Stage 1				-	-	-				-	0	-
Stage 2				-	-	-				-	0	-
Approach				WB				SB				
HCM Control Delay, s										16.3		
HCM LOS										C		
Minor Lane/Major Mvmt	WBL	WBT	WBR	SBLn1	SBLn2							
Capacity (veh/h)	-	-	-	461	461							
HCM Lane V/C Ratio	-	-	-	0.358	0.141							
HCM Control Delay (s)	-	-	-	17.1	14.1							
HCM Lane LOS	-	-	-	C	B							
HCM 95th %tile Q(veh)	-	-	-	1.6	0.5							
Notes												
~: Volume exceeds capacity    \$: Delay exceeds 300s    +: Computation Not Defined    *: All major volume in platoon												



## Intersection: 10: Crooks Rd &amp; Corporate Dr/I-75 Ramp

Movement	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB	NB
Directions Served	T	T	R	R	L	L	T	TR	R	T	T	T
Maximum Queue (ft)	408	416	268	201	541	569	654	767	295	191	194	200
Average Queue (ft)	371	376	103	91	330	349	192	236	177	172	173	174
95th Queue (ft)	446	442	191	164	533	549	465	500	267	183	185	189
Link Distance (ft)	362	362	362	362			1641	1641		133	133	133
Upstream Blk Time (%)	54	60					0	0		76	76	78
Queuing Penalty (veh)	107	121					0	0		187	188	192
Storage Bay Dist (ft)					700	700			750			
Storage Blk Time (%)					0	0	0					
Queuing Penalty (veh)					0	1	0					

## Intersection: 10: Crooks Rd &amp; Corporate Dr/I-75 Ramp

Movement	NB	NB	SB	SB	SB	SB	SB	SB
Directions Served	R	R	L	L	T	T	T	R
Maximum Queue (ft)	157	170	519	554	928	1004	622	197
Average Queue (ft)	82	93	384	408	435	346	279	67
95th Queue (ft)	146	162	616	649	1013	924	686	130
Link Distance (ft)	133	133			1954	1954	1954	
Upstream Blk Time (%)	1	2			1	0		
Queuing Penalty (veh)	3	6			0	0		
Storage Bay Dist (ft)			525	525				700
Storage Blk Time (%)			7	13	0		0	
Queuing Penalty (veh)			36	66	0		0	

## Intersection: 30: NB Crooks Rd &amp; Tower Dr

Movement	EB	EB	WB	WB	NB	NB	NB	NB
Directions Served	L	LT	R	R	T	T	T	R
Maximum Queue (ft)	50	84	126	30	220	256	342	247
Average Queue (ft)	24	65	51	3	94	111	162	36
95th Queue (ft)	53	73	99	17	199	227	306	136
Link Distance (ft)	6	6	493	493	559	559	559	
Upstream Blk Time (%)	7	45						
Queuing Penalty (veh)	31	197						
Storage Bay Dist (ft)							275	
Storage Blk Time (%)							2	
Queuing Penalty (veh)							2	

**Intersection: 31: SB Crooks Rd & Dummy Node/Tower Dr**

Movement	SB	SB	SB	SB
Directions Served	L	L	T	TR
Maximum Queue (ft)	367	476	256	6
Average Queue (ft)	28	229	17	0
95th Queue (ft)	178	410	173	4
Link Distance (ft)			584	584
Upstream Blk Time (%)			0	
Queuing Penalty (veh)			1	
Storage Bay Dist (ft)	425	425		
Storage Blk Time (%)	0	1	0	
Queuing Penalty (veh)	0	6	0	

**Intersection: 50: NB Crooks Rd & S>N X/O N. of Long Lake**

Movement	EB	EB	NB	NB
Directions Served	L	L	T	T
Maximum Queue (ft)	36	60	3	3
Average Queue (ft)	13	31	0	0
95th Queue (ft)	37	52	3	3
Link Distance (ft)	1	1	58	58
Upstream Blk Time (%)	1	6		
Queuing Penalty (veh)	1	3		
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

**Intersection: 51: SB Crooks Rd & S>N X/O N. of Long Lake**

Movement	SB	SB	SB	SB	SB	SB
Directions Served	L	L	T	T	T	T
Maximum Queue (ft)	14	210	406	411	375	131
Average Queue (ft)	1	20	184	202	109	11
95th Queue (ft)	7	142	340	350	288	68
Link Distance (ft)			441	441	441	
Upstream Blk Time (%)			1	0	0	
Queuing Penalty (veh)			3	2	1	
Storage Bay Dist (ft)	225	225				150
Storage Blk Time (%)			7		4	0
Queuing Penalty (veh)			7		15	0

**Intersection: 91: W>E X/O W. of Crooks/S.E. Site Drive & WB Long Lake Rd**

Movement	SB	SB
Directions Served	T	R
Maximum Queue (ft)	48	30
Average Queue (ft)	16	7
95th Queue (ft)	40	24
Link Distance (ft)	557	557
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

**Intersection: 120: Corporate Dr & WB Long Lake Rd**

Movement	WB	WB	WB	WB	NB	NB	SB	SB
Directions Served	T	T	T	R	LT	T	R	R
Maximum Queue (ft)	44	40	45	42	77	96	85	86
Average Queue (ft)	16	13	17	14	53	81	37	38
95th Queue (ft)	42	37	42	38	81	92	69	72
Link Distance (ft)	2	2	2	2	28	28	225	225
Upstream Blk Time (%)	6	5	8	5	43	68		
Queuing Penalty (veh)	17	15	25	16	76	120		
Storage Bay Dist (ft)								
Storage Blk Time (%)								
Queuing Penalty (veh)								

**Intersection: 121: EB Long Lake Rd & Corporate Dr**

Movement	EB	EB	EB
Directions Served	L	L	T
Maximum Queue (ft)	146	173	77
Average Queue (ft)	45	83	11
95th Queue (ft)	123	156	43
Link Distance (ft)			562
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	375	375	
Storage Blk Time (%)			
Queuing Penalty (veh)			

**Zone Summary**

Zone wide Queuing Penalty: 1444

## Intersection: 10: Crooks Rd &amp; Corporate Dr/I-75 Ramp

Movement	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB	NB
Directions Served	T	T	R	R	L	L	T	TR	R	T	T	T
Maximum Queue (ft)	211	214	286	232	347	341	243	340	310	195	192	190
Average Queue (ft)	93	109	139	107	196	207	131	210	186	173	173	173
95th Queue (ft)	183	191	285	228	321	327	216	296	276	181	181	181
Link Distance (ft)	362	362	362	362			1641	1641		133	133	133
Upstream Blk Time (%)	0		3	1						62	64	65
Queuing Penalty (veh)	0		7	1						355	362	371
Storage Bay Dist (ft)					700	700			750			
Storage Blk Time (%)												
Queuing Penalty (veh)												

## Intersection: 10: Crooks Rd &amp; Corporate Dr/I-75 Ramp

Movement	NB	NB	SB	SB	SB	SB	SB	SB
Directions Served	R	R	L	L	T	T	T	R
Maximum Queue (ft)	173	179	566	604	1098	938	663	76
Average Queue (ft)	107	122	442	473	435	311	121	32
95th Queue (ft)	173	182	644	688	1265	1112	495	62
Link Distance (ft)	133	133			1954	1954	1954	
Upstream Blk Time (%)	3	5			0	0	0	
Queuing Penalty (veh)	16	26			0	0	0	
Storage Bay Dist (ft)			525	525				700
Storage Blk Time (%)			16	25	0		0	
Queuing Penalty (veh)			43	69	1		0	

## Intersection: 30: NB Crooks Rd &amp; Tower Dr

Movement	EB	EB	WB	WB	NB	NB	NB	NB
Directions Served	L	LT	R	R	T	T	T	R
Maximum Queue (ft)	63	94	491	392	582	604	618	330
Average Queue (ft)	44	67	267	127	491	523	559	86
95th Queue (ft)	57	81	437	316	720	706	700	309
Link Distance (ft)	6	6	493	493	559	559	559	
Upstream Blk Time (%)	37	77	1	0	34	37	47	
Queuing Penalty (veh)	92	194	0	0	218	237	302	
Storage Bay Dist (ft)								275
Storage Blk Time (%)							59	
Queuing Penalty (veh)							16	

**Intersection: 31: SB Crooks Rd & Dummy Node/Tower Dr**

Movement	SB	SB	SB	SB	SB
Directions Served	L	L	T	T	TR
Maximum Queue (ft)	436	492	432	300	50
Average Queue (ft)	141	226	72	13	2
95th Queue (ft)	385	471	368	139	50
Link Distance (ft)			584	584	584
Upstream Blk Time (%)			3	0	
Queuing Penalty (veh)			21	0	
Storage Bay Dist (ft)	425	425			
Storage Blk Time (%)	0	8	0		
Queuing Penalty (veh)	0	40	1		

**Intersection: 50: NB Crooks Rd & S>N X/O N. of Long Lake**

Movement	EB	EB	NB	NB	NB
Directions Served	L	L	T	T	T
Maximum Queue (ft)	58	74	25	4	19
Average Queue (ft)	34	54	1	0	1
95th Queue (ft)	49	73	12	4	10
Link Distance (ft)	1	1	58	58	58
Upstream Blk Time (%)	16	31	0		0
Queuing Penalty (veh)	27	52	0		0
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

**Intersection: 51: SB Crooks Rd & S>N X/O N. of Long Lake**

Movement	SB	SB	SB	SB	SB	SB
Directions Served	L	L	T	T	T	T
Maximum Queue (ft)	73	281	427	430	394	193
Average Queue (ft)	18	45	195	211	129	16
95th Queue (ft)	55	174	339	347	299	99
Link Distance (ft)			441	441	441	
Upstream Blk Time (%)			1	1	0	
Queuing Penalty (veh)			3	4	1	
Storage Bay Dist (ft)	225	225				150
Storage Blk Time (%)		0	6		5	
Queuing Penalty (veh)		0	22		18	



**Intersection: 91: W>E X/O W. of Crooks/S.E. Site Drive & WB Long Lake Rd**

Movement	WB	SB	SB
Directions Served	L	TR	R
Maximum Queue (ft)	34	321	261
Average Queue (ft)	3	144	70
95th Queue (ft)	28	325	248
Link Distance (ft)		557	557
Upstream Blk Time (%)		0	
Queuing Penalty (veh)		0	
Storage Bay Dist (ft)	325		
Storage Blk Time (%)			
Queuing Penalty (veh)			

**Intersection: 120: Corporate Dr & WB Long Lake Rd**

Movement	WB	WB	WB	WB	NB	NB	SB	SB
Directions Served	T	T	T	R	LT	T	R	R
Maximum Queue (ft)	43	49	51	36	66	94	185	182
Average Queue (ft)	26	28	28	8	41	73	89	81
95th Queue (ft)	47	48	48	29	74	98	155	145
Link Distance (ft)	2	2	2	2	28	28	225	225
Upstream Blk Time (%)	9	9	11	1	22	64	0	0
Queuing Penalty (veh)	22	23	27	3	29	77	0	0
Storage Bay Dist (ft)								
Storage Blk Time (%)								
Queuing Penalty (veh)								

**Zone Summary**

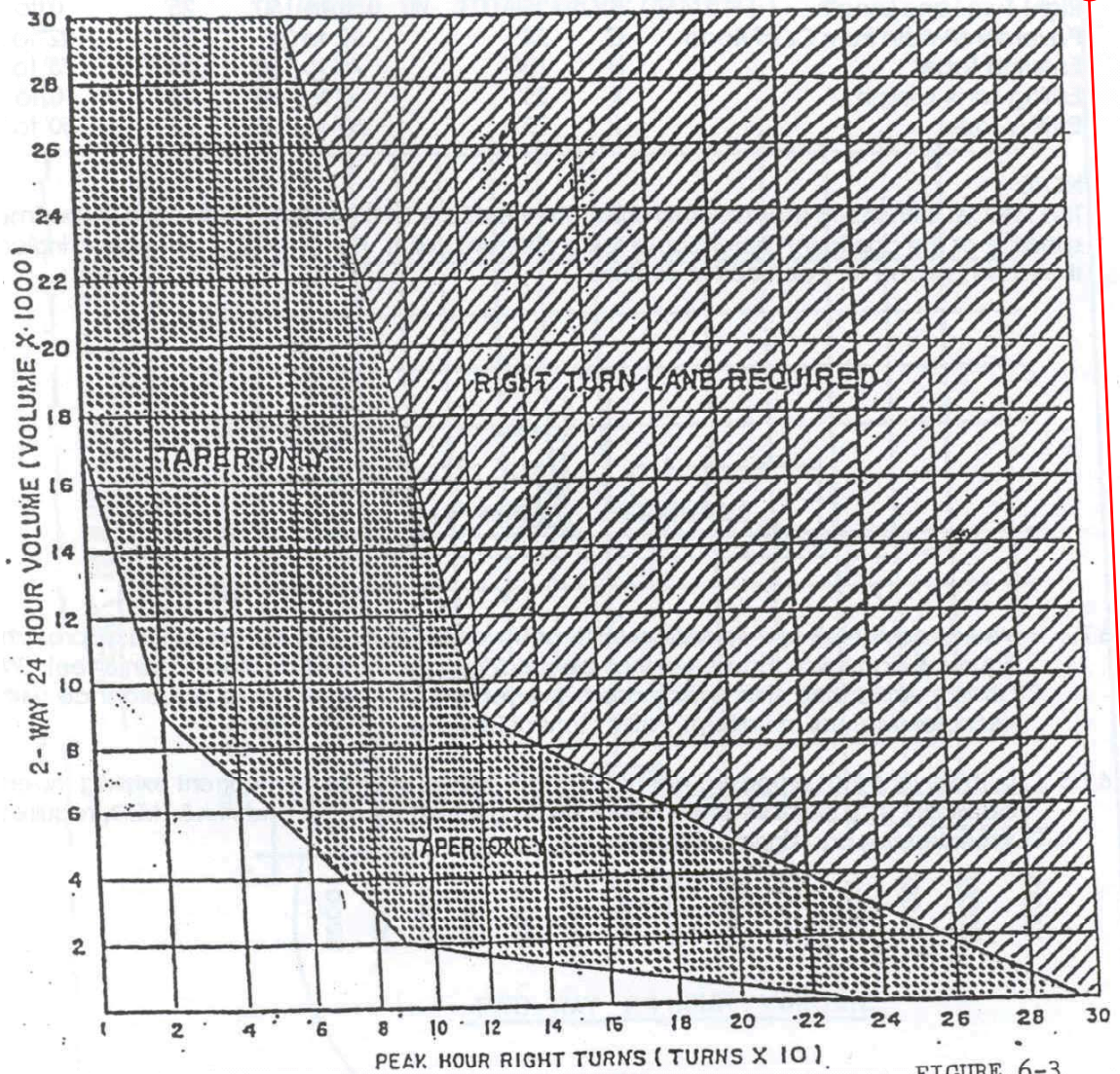
Zone wide Queuing Penalty: 2686

## **Appendix E**

# **WARRANT SUMMARIES**

## E. Site Drive & Crooks Road

### WARRANTS FOR RIGHT TURN DECELERATION LANE OR TAPER



AM: 356  
PM: 207

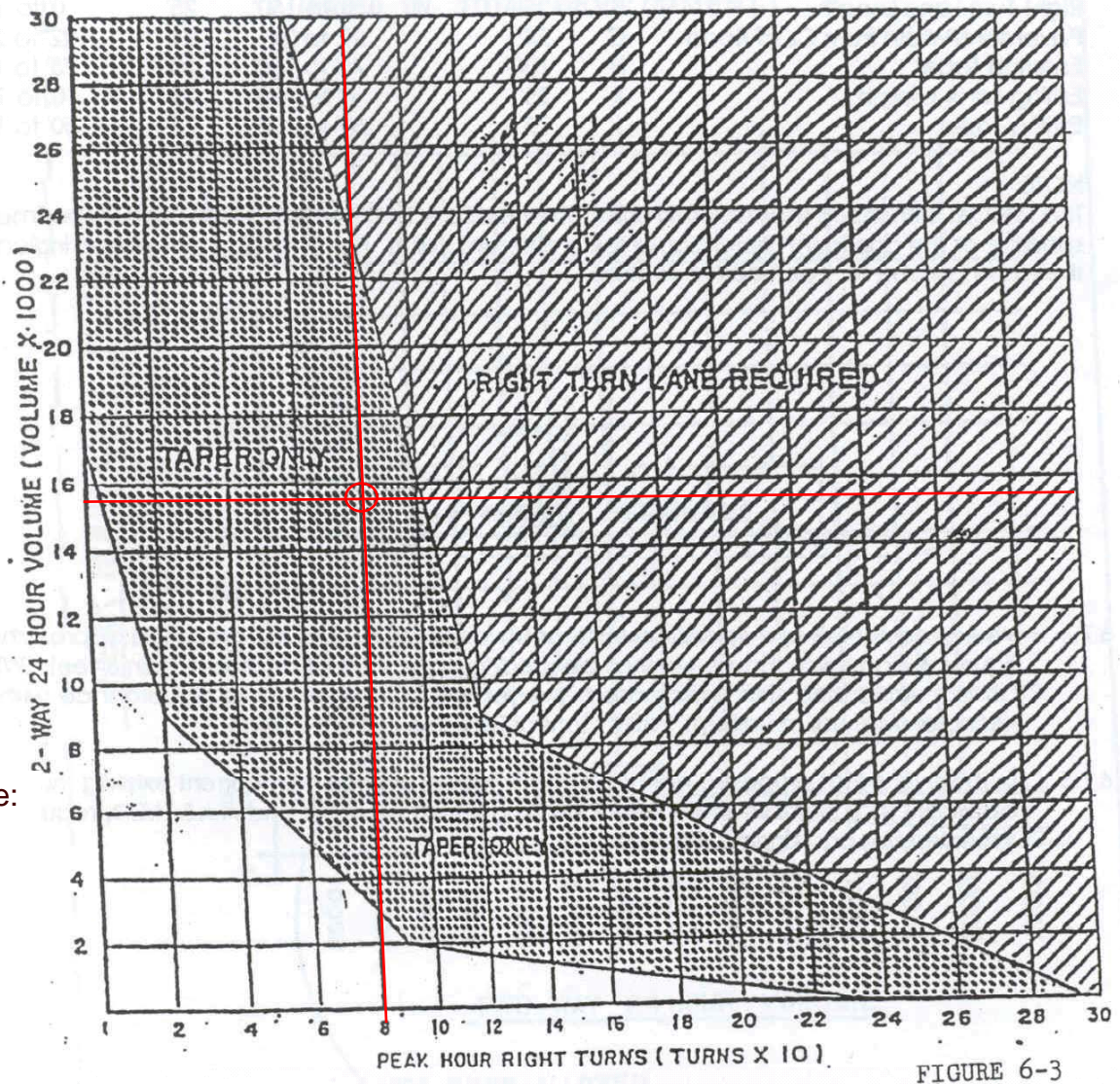
**RIGHT-TURN DECELERATION  
LANE RECOMMENDED.**

2-way 24-Hour Volume (RCOC 2018): 22,600 vpd  
Projected traffic volume (2025): 23,403 vpd  
Site generated traffic volume (40%): 9,911 vpd  
33,314 vpd



# N. Site Drive & Corporate Drive

## WARRANTS FOR RIGHT TURN DECELERATION LANE OR TAPER



AM: 76  
PM: 83

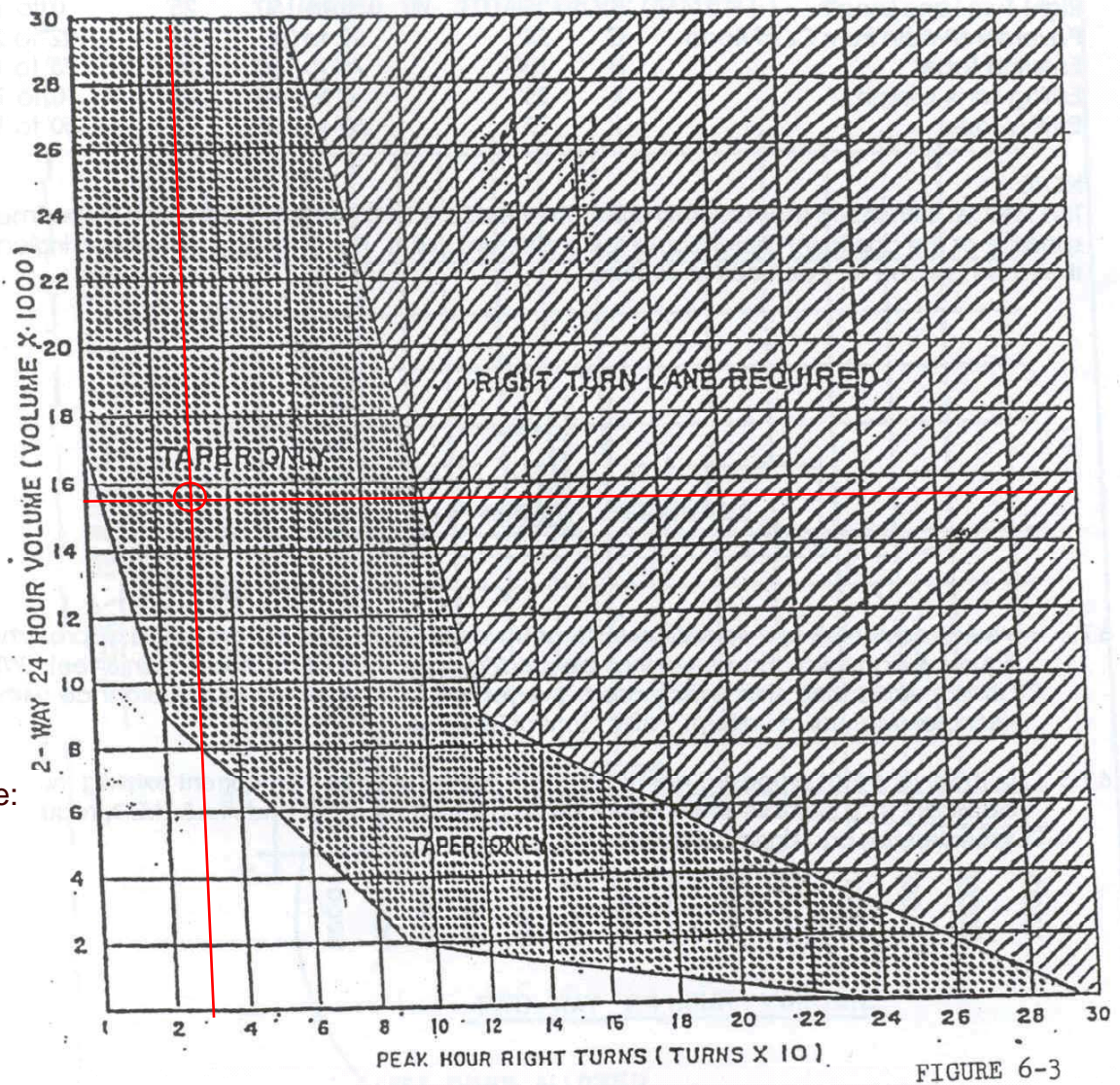
**RIGHT-TURN TAPER  
RECOMMENDED.**

2-way 24-Hour Volume (MDOT 2019): 8,100 vpd  
Projected traffic volume (2025): 8,346 vpd  
Site generated traffic volume (30%): 7,433 vpd  
15,779 vpd



# W. Site Drive & Corporate Drive

## WARRANTS FOR RIGHT TURN DECELERATION LANE OR TAPER



2-way 24-Hour Volume:  
15,779 vpd

AM: 28  
PM: 32

**RIGHT-TURN TAPER  
WARRANTED.**

2-way 24-Hour Volume (MDOT 2019): 8,100 vpd  
 Projected traffic volume (2025): 8,346 vpd  
 Site generated traffic volume (30%): 7,433 vpd  
 15,779 vpd



# S.W. Site Drive & Long Lake Road

## WARRANTS FOR RIGHT TURN DECELERATION LANE OR TAPER

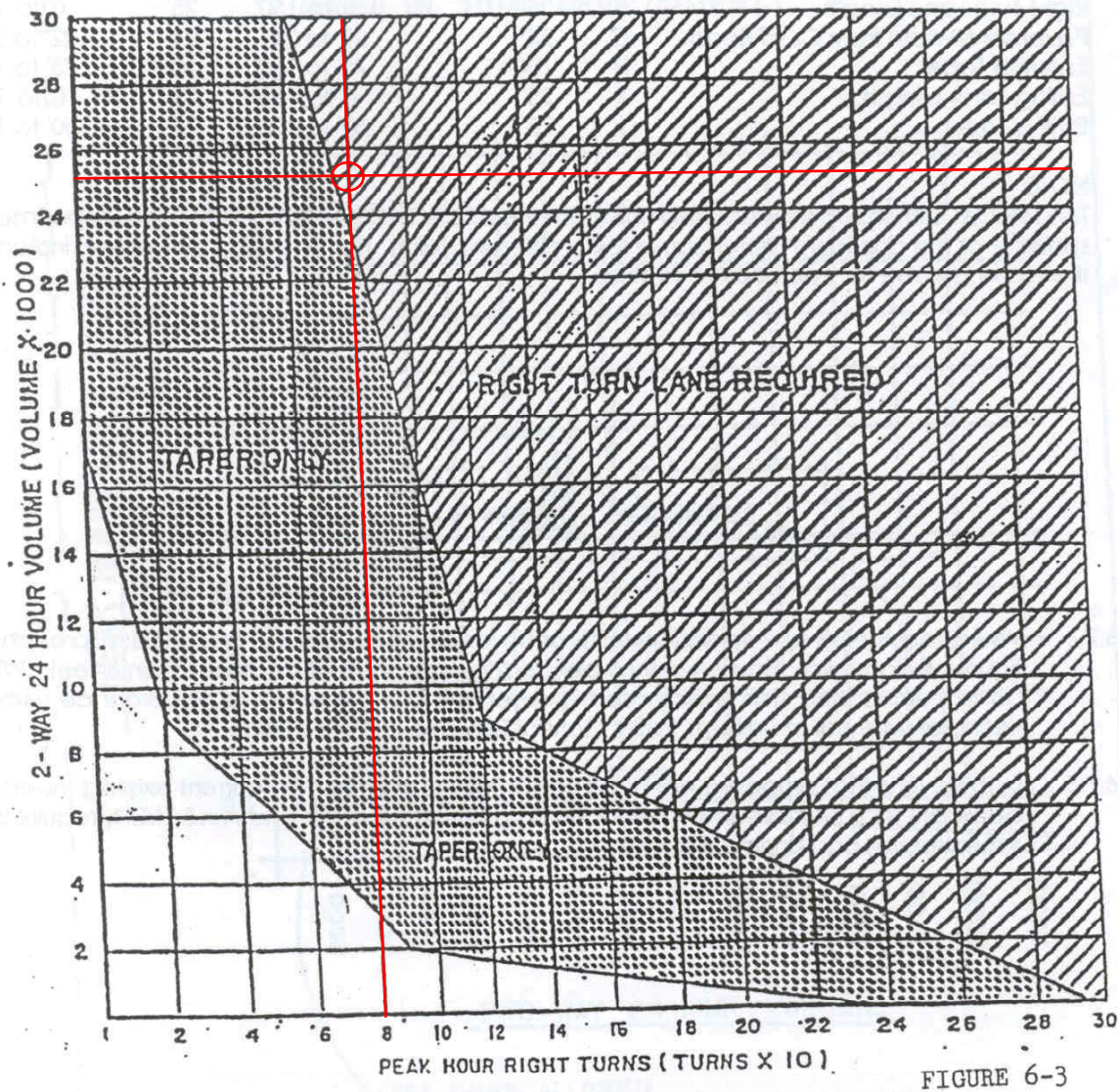


FIGURE 6-3

AM: 42  
PM: 80

**RIGHT-TURN DECELERATION  
LANE RECOMMENDED.**

2-way 24-Hour Volume (RCOC 2018): 17,250 vpd  
Projected traffic volume (2025): 17,863 vpd  
Site generated traffic volume (30%): 7,433 vpd  
25,296 vpd



# S.E. Site Drive & Long Lake Road

## WARRANTS FOR RIGHT TURN DECELERATION LANE OR TAPER

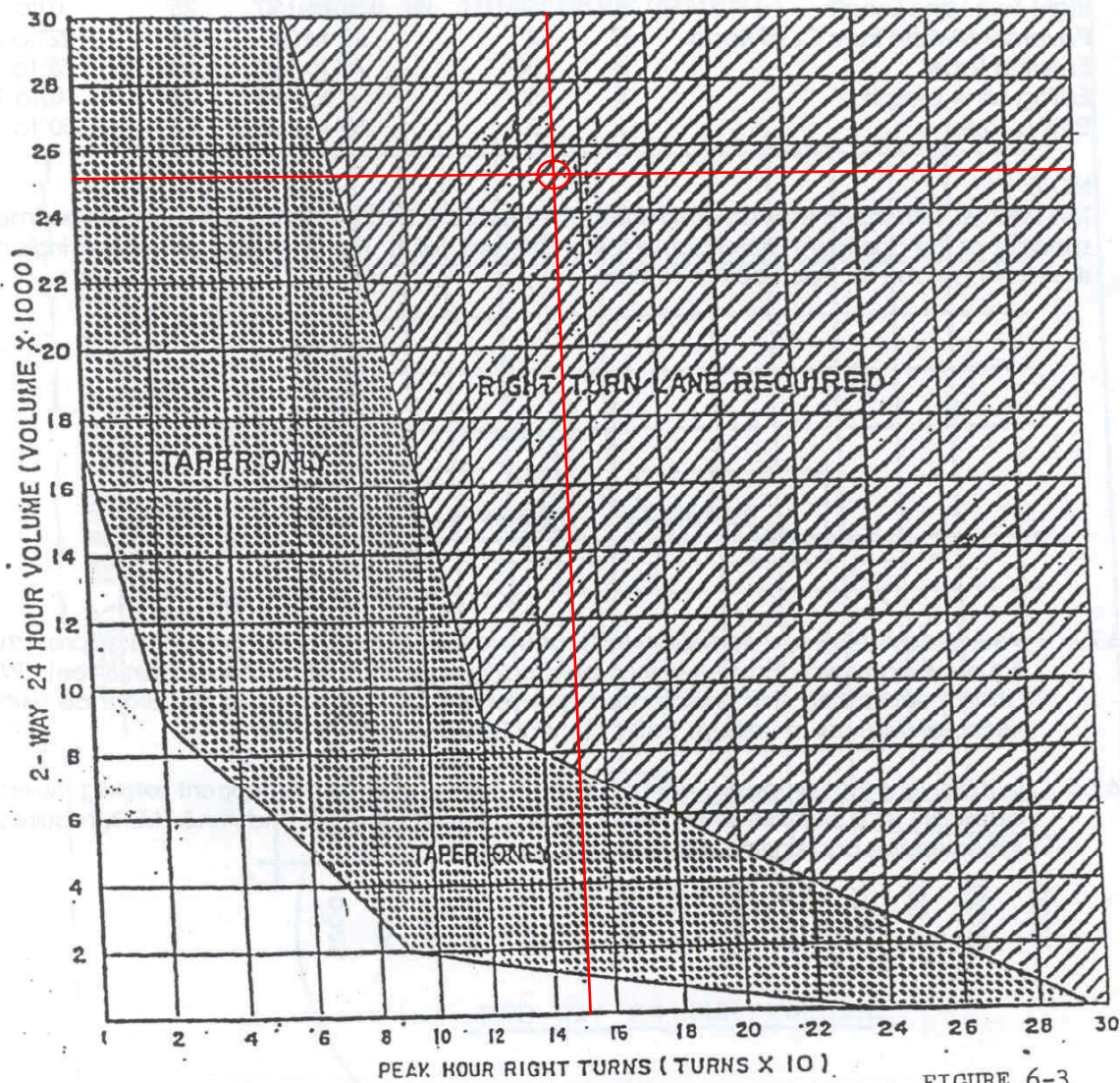


FIGURE 6-3

AM: 153  
PM: 97

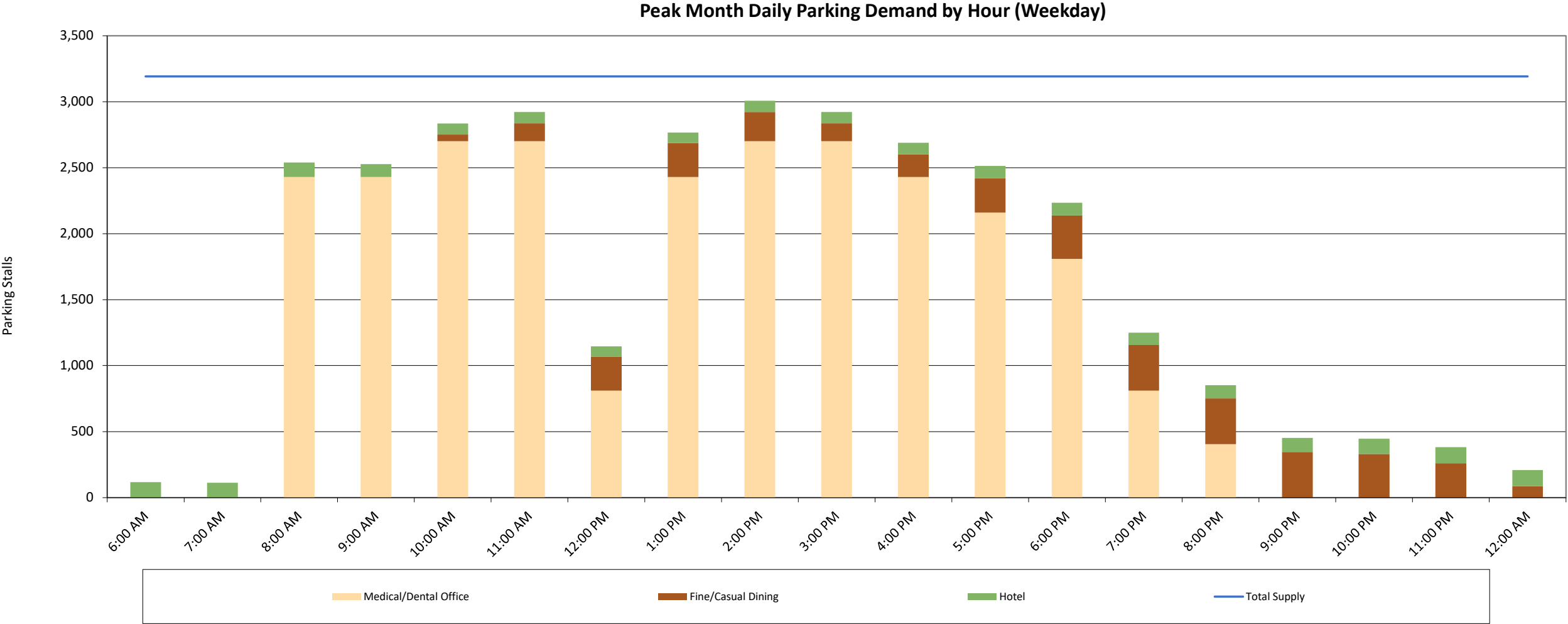
**RIGHT-TURN DECELERATION  
LANE RECOMMENDED.**

2-way 24-Hour Volume (RCOC 2018): 17,250 vpd  
Projected traffic volume (2025): 17,863 vpd  
Site generated traffic volume (30%): 7,433 vpd  
25,296 vpd

## **Appendix F**

# **SHARED PARKING SUMMARIES**

	6 AM	7 AM	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	8 PM	9 PM	10 PM	11 PM	12 AM
Fine/Casual Dining	0	0	0	0	51	137	257	257	223	137	171	260	329	346	346	346	329	260	87
Hotel-Business	115	109	97	85	73	73	67	67	73	73	79	85	91	91	97	103	115	121	121
Hotel Employees	1	3	11	11	11	11	11	11	11	11	8	8	5	2	2	2	2	1	1
Hotel (Restaurants)	0	0	1	1	1	1	2	2	1	1	1	1	1	1	1	1	0	0	0
Employee	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Employee	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medical/Dental Office	0	0	2,430	2,430	2,700	2,700	810	2,430	2,700	2,700	2,430	2,160	1,809	810	405	0	0	0	0
Total Parking Supply Required	117	113	2,539	2,527	2,837	2,922	1,146	2,766	3,008	2,922	2,689	2,514	2,234	1,250	851	452	447	382	209
Proposed Parking Supply	3,192	3,192	3,192	3,192	3,192	3,192	3,192	3,192	3,192	3,192	3,192	3,192	3,192	3,192	3,192	3,192	3,192	3,192	3,192
Difference	3,076	3,080	653	665	356	270	2,046	426	184	270	503	679	958	1,942	2,341	2,740	2,745	2,810	2,984
Percent Occupancy	4%	4%	80%	79%	89%	92%	36%	87%	94%	92%	84%	79%	70%	39%	27%	14%	14%	12%	7%



Land Use	Driving Adjustments				Captive Ratio Adjustments			
	Weekday		Weekend		Weekday		Weekend	
	Daytime	Evening	Daytime	Evening	Daytime	Evening	Daytime	Evening
Retail								
Retail (<400 ksf)	100%	100%	100%	100%	100%	100%	100%	100%
Employee	100%	100%	100%	100%	100%	100%	100%	100%
Retail (400 to 600 ksf)	100%	100%	100%	100%	100%	100%	100%	100%
Employee	100%	100%	100%	100%	100%	100%	100%	100%
Retail (600 ksf to 1,000 ksf)	100%	100%	100%	100%	100%	100%	100%	100%
Employee	100%	100%	100%	100%	100%	100%	100%	100%
Retail (1,000 ksf to 2,000 ksf)	100%	100%	100%	100%	100%	100%	100%	100%
Employee	100%	100%	100%	100%	100%	100%	100%	100%
Retail (over 2,000 ksf)	100%	100%	100%	100%	100%	100%	100%	100%
Employee	100%	100%	100%	100%	100%	100%	100%	100%
Supermarket/Grocery	100%	100%	100%	100%	100%	100%	100%	100%
Employee	100%	100%	100%	100%	100%	100%	100%	100%
Pharmacy	100%	100%	100%	100%	100%	100%	100%	100%
Employee	100%	100%	100%	100%	100%	100%	100%	100%
Discount Stores/Superstores	100%	100%	100%	100%	100%	100%	100%	100%
Employee	100%	100%	100%	100%	100%	100%	100%	100%
Home Improvement Stores/Garden	100%	100%	100%	100%	100%	100%	100%	100%
Employee	100%	100%	100%	100%	100%	100%	100%	100%
Food and Beverage								
Fine/Casual Dining	100%	100%	100%	100%	94%	96%	10%	10%
Employee	100%	100%	100%	100%	100%	100%	100%	100%
Family Restaurant	100%	100%	100%	100%	94%	96%	10%	10%
Employee	100%	100%	100%	100%	100%	100%	100%	100%
Fast Casual/Fast Food	100%	100%	100%	100%	100%	100%	100%	100%
Employee	100%	100%	100%	100%	100%	100%	100%	100%
Bar/Lounge/Night Club	100%	100%	100%	100%	94%	96%	10%	10%
Employee	100%	100%	100%	100%	100%	100%	100%	100%
Entertainment and Institutions								
Family Entertainment	100%	100%	100%	100%	100%	100%	100%	100%
Employee	100%	100%	100%	100%	100%	100%	100%	100%
Active Entertainment	100%	100%	100%	100%	100%	100%	100%	100%
Employee	100%	100%	100%	100%	100%	100%	100%	100%
Amusement Park/Water Park	100%	100%	100%	100%	100%	100%	100%	100%
Employee	100%	100%	100%	100%	100%	100%	100%	100%
Adult Active Entertainment	100%	100%	100%	100%	100%	100%	100%	100%
Employee	100%	100%	100%	100%	100%	100%	100%	100%
Cineplex	100%	100%	100%	100%	100%	100%	100%	100%
Employee	100%	100%	100%	100%	100%	100%	100%	100%
Specialty Movie Theatre	100%	100%	100%	100%	100%	100%	100%	100%
Employee	100%	100%	100%	100%	100%	100%	100%	100%
Live Theater	100%	100%	100%	100%	100%	100%	100%	100%
Employee	100%	100%	100%	100%	100%	100%	100%	100%
Outdoor Amphitheater	100%	100%	100%	100%	100%	100%	100%	100%
Employee	100%	100%	100%	100%	100%	100%	100%	100%
Public Park/Destination Open Space	100%	100%	100%	100%	100%	100%	100%	100%
Employee	100%	100%	100%	100%	100%	100%	100%	100%
Museum/Aquarium	100%	100%	100%	100%	100%	100%	100%	100%
Employee	100%	100%	100%	100%	100%	100%	100%	100%
Arena	100%	100%	100%	100%	100%	100%	100%	100%
Employee	100%	100%	100%	100%	100%	100%	100%	100%
Pro Football Stadium	100%	100%	100%	100%	100%	100%	100%	100%
Employee	100%	100%	100%	100%	100%	100%	100%	100%
Pro Baseball Stadium	100%	100%	100%	100%	100%	100%	100%	100%
Employee	100%	100%	100%	100%	100%	100%	100%	100%
Health Club	100%	100%	100%	100%	100%	100%	100%	100%



Health Club	100%	100%	100%	100%	100%	100%	100%	100%
Employee	100%	100%	100%	100%	100%	100%	100%	100%
Public Library	100%	100%	100%	100%	100%	100%	100%	100%
Employee	100%	100%	100%	100%	100%	100%	100%	100%
Convention Center	100%	100%	100%	100%	100%	100%	100%	100%
Employee	100%	100%	100%	100%	100%	100%	100%	100%
Hotel and Residential								
Hotel-Business	58%	58%	68%	68%	100%	100%	100%	100%
Hotel-Leisure	50%	50%	50%	50%	100%	100%	100%	100%
Hotel Employees	100%	100%	100%	100%	100%	100%	100%	100%
Restaurant/Lounge	63%	63%	54%	54%	90%	90%	30%	30%
Meeting/Banquet (0 to 20 sq ft/key)	68%	68%	68%	68%	60%	60%	70%	70%
Meeting/Banquet (20 to 50 sq ft/key)	68%	68%	68%	68%	60%	60%	70%	70%
Meeting/Banquet (50 to 100 sq ft/key)	68%	68%	68%	68%	60%	60%	70%	70%
Convention (100 to 200 sq ft/key)	68%	68%	68%	68%	60%	60%	70%	70%
Convention (> 200 sq ft/key)	68%	68%	68%	68%	60%	60%	70%	70%
Restaurant/Meeting Employees	100%	100%	100%	100%	100%	100%	100%	100%
Residential, Suburban								
Studio Efficiency	100%	100%	100%	100%	100%	100%	100%	100%
1 Bedroom	100%	100%	100%	100%	100%	100%	100%	100%
2 Bedrooms	100%	100%	100%	100%	100%	100%	100%	100%
3+ Bedrooms	100%	100%	100%	100%	100%	100%	100%	100%
Reserved	100%	100%	100%	100%	100%	100%	100%	100%
Visitor	100%	100%	100%	100%	100%	100%	100%	100%
Residential, Urban								
Studio Efficiency	100%	100%	100%	100%	100%	100%	100%	100%
1 Bedroom	100%	100%	100%	100%	100%	100%	100%	100%
2 Bedrooms	100%	100%	100%	100%	100%	100%	100%	100%
3+ Bedrooms	100%	100%	100%	100%	100%	100%	100%	100%
Reserved	100%	100%	100%	100%	100%	100%	100%	100%
Visitor	100%	100%	100%	100%	100%	100%	100%	100%
Active Senior Housing	100%	100%	100%	100%	100%	100%	100%	100%
Resident	100%	100%	100%	100%	100%	100%	100%	100%
Office								
Office <25 ksf	100%	100%	100%	100%	100%	100%	100%	100%
Reserved	100%	100%	100%	100%	100%	100%	100%	100%
Employee	100%	100%	100%	100%	100%	100%	100%	100%
Office 25 to 100 ksf	100%	100%	100%	100%	100%	100%	100%	100%
Reserved	100%	100%	100%	100%	100%	100%	100%	100%
Employee	100%	100%	100%	100%	100%	100%	100%	100%
Office =100 ksf	100%	100%	100%	100%	100%	100%	100%	100%
Reserved	100%	100%	100%	100%	100%	100%	100%	100%
Employee	100%	100%	100%	100%	100%	100%	100%	100%
Office 100 to 500 ksf	100%	100%	100%	100%	100%	100%	100%	100%
Reserved	100%	100%	100%	100%	100%	100%	100%	100%
Employee	100%	100%	100%	100%	100%	100%	100%	100%
Office >500 ksf	100%	100%	100%	100%	100%	100%	100%	100%
Reserved	100%	100%	100%	100%	100%	100%	100%	100%
Employee	100%	100%	100%	100%	100%	100%	100%	100%
Open Plan/High Density Office	100%	100%	100%	100%	100%	100%	100%	100%
Reserved	100%	100%	100%	100%	100%	100%	100%	100%
Employee	100%	100%	100%	100%	100%	100%	100%	100%
Medical/Dental Office	100%	100%	100%	100%	100%	100%	100%	100%
Employee	100%	100%	100%	100%	100%	100%	100%	100%
Day Care Center	100%	100%	100%	100%	100%	100%	100%	100%
Employee	100%	100%	100%	100%	100%	100%	100%	100%
Bank (Drive In Branch)	100%	100%	100%	100%	100%	100%	100%	100%
Employee	100%	100%	100%	100%	100%	100%	100%	100%

Formatted Time-of-Day Factors for Weekday Demand																			
Land Use	6 AM	7 AM	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	8 PM	9 PM	10 PM	11 PM	12 AM
Retail																			
Retail (<400 ksf)	1%	5%	15%	35%	60%	75%	100%	100%	95%	85%	85%	85%	90%	80%	65%	45%	15%	5%	0%
Employee	10%	15%	25%	45%	75%	95%	100%	100%	100%	100%	100%	100%	100%	100%	100%	60%	40%	20%	0%
Retail (400 to 600 ksf)	1%	5%	15%	35%	60%	75%	100%	100%	95%	85%	85%	85%	90%	80%	65%	45%	15%	5%	0%
Employee	10%	15%	25%	45%	75%	95%	100%	100%	100%	100%	100%	100%	100%	100%	90%	60%	40%	20%	0%
Retail (600 ksf to 1,000 ksf)	1%	5%	15%	35%	60%	75%	100%	100%	95%	85%	85%	85%	90%	80%	65%	45%	15%	5%	0%
Employee	10%	15%	25%	45%	75%	95%	100%	100%	100%	100%	100%	100%	100%	100%	90%	60%	40%	20%	0%
Retail (1,000 ksf to 2,000 ksf)	1%	5%	15%	35%	60%	75%	100%	100%	95%	85%	85%	85%	90%	80%	65%	45%	15%	5%	0%
Employee	10%	15%	25%	45%	75%	95%	100%	100%	100%	100%	100%	100%	100%	100%	90%	60%	40%	20%	0%
Retail (over 2,000 ksf)	1%	5%	15%	35%	60%	75%	100%	100%	95%	85%	85%	85%	90%	80%	65%	45%	15%	5%	0%
Employee	10%	15%	25%	45%	75%	95%	100%	100%	100%	100%	100%	100%	100%	100%	90%	60%	40%	20%	0%
Supermarket/Grocery	5%	20%	30%	50%	60%	67%	85%	90%	95%	97%	100%	100%	100%	85%	55%	35%	20%	5%	5%
Employee	20%	30%	40%	80%	90%	100%	100%	100%	100%	100%	100%	100%	80%	50%	35%	20%	20%	20%	20%
Pharmacy	5%	20%	30%	60%	60%	67%	85%	90%	95%	97%	100%	100%	100%	85%	55%	35%	20%	5%	5%
Employee	20%	30%	40%	80%	90%	100%	100%	100%	100%	100%	100%	100%	80%	50%	35%	20%	20%	20%	20%
Discount Stores/Superstores	15%	35%	45%	65%	75%	85%	100%	100%	100%	100%	95%	85%	75%	60%	45%	30%	10%	5%	1%
Employee	25%	45%	55%	75%	85%	100%	100%	100%	100%	100%	100%	95%	85%	70%	55%	40%	20%	20%	20%
Home Improvement Stores/Garden	15%	20%	35%	55%	85%	99%	100%	99%	98%	90%	85%	80%	75%	60%	50%	30%	10%	0%	0%
Employee	25%	30%	45%	65%	95%	100%	100%	100%	100%	100%	95%	90%	85%	70%	60%	40%	20%	0%	0%
Food and Beverage																			
Fine/Casual Dining	0%	0%	0%	0%	15%	40%	75%	75%	65%	40%	50%	75%	95%	100%	100%	100%	95%	75%	25%
Employee	0%	20%	50%	75%	90%	90%	90%	90%	75%	75%	100%	100%	100%	100%	100%	100%	100%	85%	35%
Family Restaurant	25%	50%	60%	75%	85%	90%	100%	90%	50%	45%	45%	75%	80%	80%	80%	60%	55%	50%	25%
Employee	50%	75%	90%	90%	100%	100%	100%	100%	100%	75%	75%	95%	95%	95%	95%	80%	65%	65%	35%
Fast Casual/Fast Food	5%	10%	20%	30%	55%	85%	100%	100%	90%	60%	55%	60%	85%	80%	50%	30%	20%	10%	5%
Employee	20%	20%	30%	40%	75%	100%	100%	100%	95%	70%	60%	70%	90%	90%	60%	40%	30%	20%	20%
Bar/Lounge/Night Club	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	25%	50%	75%	100%	100%	75%	50%
Employee	0%	0%	0%	5%	5%	5%	5%	10%	10%	10%	20%	45%	70%	100%	100%	100%	100%	90%	60%
Entertainment and Institutions																			
Family Entertainment	0%	0%	0%	0%	45%	65%	85%	95%	100%	95%	90%	70%	60%	45%	0%	0%	0%	0%	0%
Employee	0%	0%	5%	25%	75%	100%	100%	100%	100%	100%	100%	80%	70%	55%	10%	5%	5%	5%	5%
Active Entertainment	0%	0%	0%	0%	25%	65%	85%	90%	95%	95%	90%	95%	100%	95%	90%	65%	10%	0%	0%
Employee	5%	5%	5%	25%	75%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	75%	10%	5%	5%
Amusement Park/Water Park	0%	0%	0%	0%	25%	65%	85%	90%	95%	95%	90%	95%	100%	95%	90%	65%	10%	0%	0%
Employee	5%	5%	5%	25%	75%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	75%	10%	5%	5%
Adult Active Entertainment	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	25%	50%	75%	100%	100%	100%	100%
Employee	0%	0%	0%	5%	5%	5%	5%	10%	10%	10%	20%	45%	70%	100%	100%	100%	100%	100%	100%
Cineplex	0%	0%	0%	0%	0%	0%	20%	45%	55%	55%	55%	60%	60%	80%	100%	100%	80%	65%	40%
Employee	0%	0%	0%	0%	0%	10%	50%	60%	60%	75%	75%	100%	100%	100%	100%	100%	100%	70%	50%
Specialty Movie Theatre	0%	0%	0%	0%	0%	0%	20%	45%	55%	55%	55%	60%	60%	80%	100%	100%	80%	65%	40%
Employee	0%	0%	0%	0%	0%	10%	50%	60%	60%	75%	75%	100%	100%	100%	100%	100%	100%	70%	50%
Live Theater	0%	0%	0%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	25%	100%	100%	0%	0%	0%
Employee	0%	10%	10%	20%	20%	20%	30%	30%	30%	30%	30%	30%	100%	100%	100%	100%	30%	10%	5%
Outdoor Amphitheater	0%	0%	0%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	25%	100%	100%	0%	0%	0%
Employee	0%	10%	10%	20%	20%	20%	30%	30%	30%	30%	30%	30%	100%	100%	100%	100%	30%	10%	5%
Public Park/Destination Open Space	1%	5%	10%	25%	50%	65%	85%	95%	100%	95%	90%	70%	90%	100%	100%	100%	80%	50%	10%
Employee	5%	10%	25%	50%	75%	100%	100%	100%	100%	100%	100%	80%	100%	100%	100%	100%	100%	60%	20%
Museum/Aquarium	0%	0%	0%	0%	45%	65%	85%	95%	100%	95%	90%	85%	60%	30%	10%	0%	0%	0%	0%
Employee	5%	5%	5%	25%	75%	100%	100%	100%	100%	100%	100%	80%	75%	10%	5%	0%	0%	5%	5%
Arena	0%	0%	0%	1%	1%	1%	1%	1%	1%	1%	1%	1%	10%	25%	100%	100%	85%	0%	0%
Employee	0%	10%	10%	20%	20%	20%	30%	30%	30%	30%	30%	30%	100%	100%	100%	100%	30%	10%	5%
Pro Football Stadium	0%	0%	0%	1%	1%	1%	5%	5%	5%	5%	5%	5%	10%	50%	100%	100%	85%	25%	0%
Employee	0%	10%	10%	20%	20%	20%	30%	30%	30%	30%	30%	30%	100%	100%	100%	100%	100%	25%	10%
Pro Baseball Stadium	0%	0%	0%	1%	1%	1%	5%	5%	5%	5%	5%	5%	10%	50%	100%	100%	85%	25%	0%
Employee	0%	10%	10%	20%	20%	20%	30%	30%	30%	30%	30%	30%	100%	100%	100%	100%	100%	25%	10%
Health Club	70%	40%	40%	70%	70%	80%	60%	70%	70%	70%	80%	90%	100%	90%	80%	70%	35%	10%	0%
Employee	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	100%	100%	75%	50%	20%	20%	20%	0%

Employee	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	100%	100%	75%	50%	25%	25%	25%	0%
Public Library	0%	0%	0%	100%	100%	98%	98%	78%	72%	65%	70%	79%	60%	50%	40%	0%	0%	0%	0%
Employee	0%	10%	50%	100%	100%	100%	100%	100%	100%	100%	100%	90%	75%	50%	20%	10%	0%	0%	0%
Convention Center	0%	0%	50%	100%	100%	100%	100%	100%	100%	100%	100%	100%	50%	30%	30%	10%	0%	0%	0%
Employee	5%	30%	33%	33%	100%	100%	100%	100%	100%	100%	90%	70%	40%	25%	20%	20%	5%	0%	0%
Hotel and Residential																			
Hotel-Business	95%	90%	80%	70%	60%	60%	55%	55%	60%	60%	65%	70%	75%	75%	80%	85%	95%	100%	100%
Hotel-Leisure	95%	95%	90%	80%	70%	70%	65%	65%	70%	70%	75%	80%	85%	85%	90%	95%	95%	100%	100%
Hotel Employees	10%	30%	100%	100%	100%	100%	100%	100%	100%	100%	70%	70%	40%	20%	20%	20%	10%	5%	5%
Restaurant/Lounge	0%	10%	30%	10%	10%	5%	100%	100%	33%	10%	10%	30%	55%	60%	70%	67%	60%	40%	30%
Meeting/Banquet (0 to 20 sq ft/key)	0%	0%	30%	60%	60%	60%	65%	65%	65%	65%	65%	100%	100%	100%	100%	100%	50%	0%	0%
Meeting/Banquet (20 to 50 sq ft/key)	0%	0%	30%	60%	60%	60%	65%	65%	65%	65%	65%	100%	100%	100%	100%	100%	50%	0%	0%
Meeting/Banquet (50 to 100 sq ft/key)	0%	0%	30%	60%	60%	60%	65%	65%	65%	65%	65%	100%	100%	100%	100%	100%	50%	0%	0%
Convention (100 to 200 sq ft/key)	0%	0%	50%	100%	100%	100%	100%	100%	100%	100%	100%	100%	50%	30%	30%	10%	0%	0%	0%
Convention (> 200 sq ft/key)	0%	0%	50%	100%	100%	100%	100%	100%	100%	100%	100%	100%	50%	30%	30%	10%	0%	0%	0%
Restaurant/Meeting Employees	10%	10%	60%	100%	100%	100%	100%	100%	100%	100%	100%	100%	60%	40%	40%	20%	0%	0%	0%
Residential, Suburban	95%	80%	67%	55%	50%	45%	40%	40%	40%	40%	45%	50%	60%	70%	80%	85%	95%	97%	100%
Studio Efficiency	95%	80%	67%	55%	50%	45%	40%	40%	40%	40%	45%	50%	60%	70%	80%	85%	95%	97%	100%
1 Bedroom	95%	80%	67%	55%	50%	45%	40%	40%	40%	40%	45%	50%	60%	70%	80%	85%	95%	97%	100%
2 Bedrooms	95%	80%	67%	55%	50%	45%	40%	40%	40%	40%	45%	50%	60%	70%	80%	85%	95%	97%	100%
3+ Bedrooms	95%	80%	67%	55%	50%	45%	40%	40%	40%	40%	45%	50%	60%	70%	80%	85%	95%	97%	100%
Reserved	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Visitor	0%	10%	20%	20%	20%	20%	20%	20%	20%	20%	20%	40%	60%	100%	100%	100%	100%	80%	50%
Residential, Urban	95%	85%	75%	65%	60%	55%	50%	50%	55%	60%	65%	70%	75%	80%	85%	95%	97%	100%	100%
Studio Efficiency	95%	85%	75%	65%	60%	55%	50%	50%	55%	60%	65%	70%	75%	80%	85%	95%	97%	100%	100%
1 Bedroom	95%	85%	75%	65%	60%	55%	50%	50%	55%	60%	65%	70%	75%	80%	85%	95%	97%	100%	100%
2 Bedrooms	95%	85%	75%	65%	60%	55%	50%	50%	55%	60%	65%	70%	75%	80%	85%	95%	97%	100%	100%
3+ Bedrooms	95%	85%	75%	65%	60%	55%	50%	50%	55%	60%	65%	70%	75%	80%	85%	95%	97%	100%	100%
Reserved	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Visitor	0%	10%	20%	20%	20%	20%	20%	20%	20%	20%	20%	40%	60%	100%	100%	100%	100%	80%	50%
Active Senior Housing	95%	97%	100%	100%	99%	98%	98%	99%	98%	100%	99%	94%	96%	98%	97%	97%	97%	98%	98%
Residents	95%	97%	100%	100%	99%	98%	98%	99%	98%	100%	99%	94%	96%	98%	97%	97%	97%	98%	98%
Office																			
Office <25 ksf	0%	1%	20%	60%	100%	45%	15%	45%	95%	45%	15%	10%	5%	2%	1%	0%	0%	0%	0%
Reserved	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Employee	3%	15%	50%	90%	100%	100%	85%	85%	95%	95%	85%	60%	25%	15%	5%	3%	1%	0%	0%
Office 25 to 100 ksf	0%	1%	20%	60%	100%	45%	15%	45%	95%	45%	15%	10%	5%	2%	1%	0%	0%	0%	0%
Reserved	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Employee	3%	15%	50%	90%	100%	100%	85%	85%	95%	95%	85%	60%	25%	15%	5%	3%	1%	0%	0%
Office =100 ksf	0%	1%	20%	60%	100%	45%	15%	45%	95%	45%	15%	10%	5%	2%	1%	0%	0%	0%	0%
Reserved	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Employee	3%	15%	50%	90%	100%	100%	85%	85%	95%	95%	85%	60%	25%	15%	5%	3%	1%	0%	0%
Office 100 to 500 ksf	0%	1%	20%	60%	100%	45%	15%	45%	95%	45%	15%	10%	5%	2%	1%	0%	0%	0%	0%
Reserved	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Employee	3%	15%	50%	90%	100%	100%	85%	85%	95%	95%	85%	60%	25%	15%	5%	3%	1%	0%	0%
Office >500 ksf	0%	1%	20%	60%	100%	45%	15%	45%	95%	45%	15%	10%	5%	2%	1%	0%	0%	0%	0%
Reserved	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Employee	3%	15%	50%	90%	100%	100%	85%	85%	95%	95%	85%	60%	25%	15%	5%	3%	1%	0%	0%
Open Plan/High Density Office	0%	1%	20%	60%	100%	45%	15%	45%	95%	45%	15%	10%	5%	2%	1%	0%	0%	0%	0%
Reserved	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Employee	3%	15%	50%	90%	100%	100%	85%	85%	95%	95%	85%	60%	25%	15%	5%	3%	1%	0%	0%
Medical/Dental Office	0%	0%	90%	90%	100%	100%	30%	90%	100%	100%	90%	80%	67%	30%	15%	0%	0%	0%	0%
Employee	0%	20%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	67%	30%	15%	0%	0%	0%	0%
Day Care Center	0%	2%	25%	75%	20%	20%	20%	20%	20%	20%	100%	50%	20%	5%	0%	0%	0%	0%	0%
Employee	0%	50%	75%	90%	90%	90%	90%	90%	90%	100%	100%	100%	60%	40%	10%	0%	0%	0%	0%
Bank (Drive In Branch)	0%	0%	50%	90%	100%	50%	50%	50%	70%	50%	80%	100%	0%	0%	0%	0%	0%	0%	0%
Employee	0%	0%	60%	100%	100%	100%	100%	100%	100%	100%	100%	100%	0%	0%	0%	0%	0%	0%	0%

Shared Parking Demand Summary												
Peak Month: MAY -- Peak Periods: 11 AM, 2 PM												
Land Use	Project Data		Weekday				Weekday AM			Weekday PM		
			Base Ratio	Driving Adj	Non-Captive Ratio	Project Ratio	Peak Hr Adj	Peak Mo Adj	Estimated Parking	Peak Hr Adj	Peak Mo Adj	Estimated Parking
	Quantity	Unit					11 AM	May	Demand	2 PM	May	Demand
Food and Beverage												
Fine/Casual Dining	735	Seats	0.50	100%	94%	0.47	40%	99%	137	45%	94%	223
Employee			0.00	100%	100%	0.00	90%	100%	-	75%	100%	-
Entertainment and Institutions												
Hotel and Residential												
Hotel-Business	220	keys	1.00	58%	100%	0.58	60%	95%	73	60%	100%	73
Hotel-Leisure		keys	1.00	50%	100%	0.50	70%	90%	-	70%	100%	-
Hotel Employees	12	persons	1.00	100%	100%	1.00	100%	95%	11	100%	100%	11
Restaurant/Lounge	100	Seats	0.50	63%	90%	0.28	5%	96%	-	33%	92%	-
Meeting/Banquet (0 to 20 sq ft/key)		sf GLA	0.00	68%	60%	0.00	60%	100%	-	65%	100%	-
Meeting/Banquet (20 to 50 sq ft/key)		sf GLA	0.00	68%	60%	0.00	60%	100%	-	65%	100%	-
Meeting/Banquet (50 to 100 sq ft/key)		sf GLA	0.00	68%	60%	0.00	60%	100%	-	65%	100%	-
Convention (100 to 200 sq ft/key)		sf GLA	0.00	68%	60%	0.00	100%	60%	-	100%	55%	-
Convention (> 200 sq ft/key)		sf GLA	5.50	68%	60%	2.24	100%	60%	-	100%	55%	-
Restaurant/Meeting Employees	100	sf GLA	1.20	100%	100%	1.20	100%	100%	1	100%	100%	1
Office												
Medical/Dental Office	540,000	sf GFA	1.00	100%	100%	1.00	100%	100%	2,700	0%	100%	2,700
Employee			0.00	100%	100%	0.00	100%	100%	-	0%	100%	-
Additional Land Uses												
							Customer/Visitor	2,910	Customer		2,996	
							Employee/Resident	12	Employee/Resident		12	
							Total	2,922	Total		3,008	
							Shared Parking - Demand Reduction	13%			10%	

Land Use	Size	City Ordinance Parking Requirements	Parking Supply Requirements (per ordinance no shared parking)	Proposed Parking Supply	AM Peak Shared Parking Supply Requirements 11:00 AM	PM Peak Shared Parking Supply Requirements 2:00 PM
Office Space (Medical/Dental Office)	540000 sf GFA	1 space per 200 GFA	2,700	2,696	2,700	2,700
Hotel Development	75,000 SF (220 keys)	1 space per room	220	496	73	73
Hotel Development (Employees)	12 persons	1 space per employee	12		11	11
Hotel Development (Restaurant)	100 Seats	1 space per 2 seats	50		1	1
Retail (Restaurant)	21600 sf GLA (735 Seats)	1 space per 2 seats	368		137	223
Total (spaces)			3,350	3,192	2,922	3,008
Surplus (Deficit)			(4.9%)		8.5%	5.8%

	Parking Supply	Effective Capacity
Surface Parking	496	446
Parking Structure	2,696	2562
Total	3192	3008



## memorandum

**Date:** December 16, 2020

**To:** Bill Huotari, PE

**From:** Sara Merrill, PE, PTOE

**CC:** Stephen Dearing, PE, PTOE

**Re:** Long Lake PUD  
Traffic Review

I have reviewed the concept development submittal for the Long Lake PUD site. The proposed PUD site consists of a mixed-use development located at the northwest corner of Long Lake Road and Crooks Road. The PUD application was dated November 20, 2020, and included a conceptual masterplan development sketch, and a traffic impact study prepared by Fleis & Vandenbrink. Engineering site plans were not provided.

OHM offers the following comments:

1. A 220-room anchor hotel component is proposed. Typically, a hotel of this size might offer a restaurant, as well as a conference center or banquet facility space, and the PUD application lists conference center as a permitted use. Traffic impacts and parking requirements must be calculated separately for these uses. The parking study assumed 100-seat hotel restaurant but did not include a conference center. If the development will include these, the traffic impacts and required parking may be greater than indicated; additional road improvements and/or parking may be necessary.
2. There are three (3) standalone restaurants proposed. The PUD application indicates these could be restaurants or retail/entertainment. The traffic impact study assumes these will be "Quality Restaurant" (Land Use Code #931), as defined by the Institute of Transportation Engineers (ITE).

This area is surrounded by primarily office buildings, with few lunch dining options. It is likely that restaurants in this area will be open for lunch. A "High-Turnover Sit-Down Restaurant" (ITE Land Use Code #932) would be more appropriate, as it is also a permitted use and would provide a more conservative assessment of traffic impacts. "High-Turnover Sit-Down Restaurant" generates significantly more traffic than "Quality Restaurant", and the traffic impacts would be greater than indicated in the study. Descriptions of both restaurant types are attached.

Although the PUD agreement could stipulate limitations on the type of dining establishment permitted, it is our understanding that this poses challenges to city officials in administering these restrictions. Therefore, we recommend the traffic study be updated to utilize High-Turnover Sit-Down Restaurant. This may result in the need for additional road improvements, as well as additional parking.





3. Proposed site driveway locations should be evaluated and approved as part of the PUD agreement.
  - a. The traffic study notes that there are no site access driveways proposed at this time with the PUD, and that driveways will be further reviewed for access management and auxiliary lanes during site plan development. However, changing the number and location of site driveways could substantially alter the overall site layout. Driveway locations also impact the traffic impacts and improvements necessary on adjacent roads.
  - b. Site driveways should be located at least 200' from crossovers or intersections in order to provide a reasonable weave distance. A short weave distance is more likely to result in traffic crashes, as well as operational impacts. The conceptual development sketch does not depict crossover locations on Long Lake Road; however, it appears that the proposed site driveways are located too close to the existing crossovers. The traffic study notes that 125' minimum spacing has been provided, although it appears the Long Lake Road drives may be less than that.
  - c. Crooks Road and Long Lake Road are under the RCOC jurisdiction. Proposed driveway locations must be approved and permitted by RCOC.
4. Project phasing has not been clearly identified. The development areas depicted in the PUD application do not appear to relate to project phasing. The traffic study states *"There is no identifiable phasing plan at this juncture of the proposed development. The overall development is assumed to be phased over time, based on tenant opportunities and economic viability. As various areas are developed, a phasing plan will be formulated in a manner where all parking and building requirements are met throughout each phase."*
  - a. The site utilizes shared parking methodology, which reduces the number of parking spaces required for each use individually by realizing efficiencies in complementary uses. However, there may be insufficient parking if, for example, the restaurants are developed prior to the hotel or parking structure.
  - b. It is unclear when the site driveways and internal aisles will be developed. If only some of the driveways are constructed at a particular phase, the internal site circulation and traffic impacts may be adversely affected. For example, if the office buildings and parking structures are constructed first, without the drives to Long Lake Road, there could be significant traffic congestion at the site driveways.
  - c. Phasing of improvements to the adjacent road network must be considered. The traffic study identified many improvements necessary in order to mitigate impacts for the final build-out condition. However, it is unclear whether these will be constructed initially, or phased in over time, and which portions of the development would trigger specific road improvements.
5. The internal site layout should be modified to ensure safe and efficient traffic operations. The traffic study shows that traffic backups and queuing are expected at some of the site driveways. With the expected queue for traffic exiting the site (particularly using the east site drive to Crooks Road) extending 400'+, the internal intersections (including parking structure exits) may be blocked.

#### Traffic Impact Study

1. The proposed development is expected to generate a very substantial volume of traffic. The traffic study estimated that the proposed PUD development could generate close to 25,000 new vehicle trips per day, and over 2,100 new trips during the peak hour. As a point of reference, prior to the onset of the I-75 construction project, Crooks Road in the vicinity of the site carried approximately 23k vehicles



per day, and Long Lake Road carried approximately 18k vehicles per day. In order to accommodate such a large increase in traffic, it is critical that nearby roads and intersections be improved.

2. The traffic impact study proposes several improvements along Crooks Road and Long Lake Road to increase capacity. Both Crooks Road and Long Lake Road are under the jurisdiction of RCOC and must be approved and permitted. If RCOC does not concur with and approve the proposed changes, the proposed PUD development would generate significant vehicular congestion and lead to adverse impacts on the local road network.
3. The traffic study also proposes several changes at Crooks Road & I-75 Ramp/Corporate Drive. The I-75 ramps are under the jurisdiction of MDOT. Changes to the interchange will require approval by MDOT and Federal Highway Administration (FHWA). Typically, FHWA will require an *Interstate System Access Change Request*, which is a formal request with accompanying documents submitted by the State DOT to FHWA.

The phasing of the project and interchange improvements, if approved, must be considered. The approval process may take considerable time. If the request is not approved, or is not constructed prior to certain PUD development phases, the additional site-generated traffic volumes will result in significant delays and backups.

4. As stated above, traffic impacts may be greater than indicated in the study, due to the potential for a conference center or type of restaurant. Greater traffic impacts would likely result in further impacts to the local roads, and may necessitate additional roadway improvements.
5. The study proposes to eliminate eastbound direct left turns on Corporate Drive (turning onto northbound Crooks Road), instead requiring drivers to utilize a “Michigan Left” (right turn on Crooks, then U-turn at the next crossover). In this instance, the nearest crossover is located directly opposite Tower Drive. There have been longstanding complaints about the Tower Drive intersection, and it is our understanding that prohibiting U-turns at this location is being considered. Additional traffic analysis should be performed to evaluate the traffic impacts of the site, considering the potential for changes. In this instance, additional changes may be necessary in order to alleviate existing concerns on Tower Drive while also accommodating the site-generated traffic.
6. The traffic models show that, even with the proposed improvements, some intersections and movements are expected to reach a volume-to-capacity (v/c) ratio greater than 1.00. A v/c ratio over 1.00 means there is not sufficient capacity to accommodate the traffic volumes, and indicates that backups are likely to occur during peak periods. This was evident in traffic simulations, which showed intermittent intervals where turn lane queues extended beyond the storage lane, temporarily blocking adjacent through travel lanes.
7. On northbound Crooks Road, the proposed changes in combination with site-generated traffic result in backups at the Tower Drive signal extending nearly to Long Lake Road. This in turn results in fewer available gaps for traffic exiting business driveways (Troy Corporate Center), and thus longer delays and substantial queues at the unsignalized driveway. Traffic impacts of the PUD, as well as the recommended improvements to mitigate increased traffic congestion, must not unduly impact existing businesses.

## Parking

1. The overall parking calculations were based on the specific uses and building areas listed in the study. As mentioned above, if the PUD were to include a conference center or banquet facilities, or High-Turnover Sit-Down Restaurants, there may not be sufficient parking to accommodate these higher-



intensity uses. The parking calculations should be updated to ensure adequate parking.

2. The parking study assumes the office space will be comprised of 540,000 SF (usable) of medical office. Since medical office requires greater parking than traditional office buildings, this provides an acceptable conservative approach to the office building component.

However, the minimum number of ADA-accessible parking spaces must be sufficient to accommodate the proposed use. Parking for hospital outpatient facilities, rehabilitation, and outpatient physical therapy have substantially greater requirements for accessibility and would likely result in a net decrease of available parking in order to accommodate the additional cross-hatched spaces. It is unclear whether the conceptual plan has accounted for the potential need for additional accessible parking spaces.

3. As stated above, adequate parking must be provided for each phase of the development. An interim parking analysis will need to be performed for each proposed phase.

## Land Use: 932

### High-Turnover (Sit-Down) Restaurant

#### Description

This land use consists of sit-down, full-service eating establishments with typical duration of stay of approximately one hour. This type of restaurant is usually moderately priced and frequently belongs to a restaurant chain. Generally, these restaurants serve lunch and dinner; they may also be open for breakfast and are sometimes open 24 hours a day. These restaurants typically do not take reservations. Patrons commonly wait to be seated, are served by a waiter/waitress, order from menus and pay for their meal after they eat. Some facilities contained within this land use may also contain a bar area for serving food and alcoholic drinks. Fast casual restaurant (Land Use 930), quality restaurant (Land Use 931), fast-food restaurant without drive-through window (Land Use 933), fast-food restaurant with drive-through window (Land Use 934), and fast-food restaurant with drive-through window and no indoor seating (Land Use 935) are related uses.

#### Additional Data

***Users should exercise caution when applying statistics during the AM peak periods, as the sites contained in the database for this land use may or may not be open for breakfast. In cases where it was confirmed that the sites were not open for breakfast, data for the AM peak hour of the adjacent street traffic were removed from the database.***

The outdoor seating area is not included in the overall gross floor area. Therefore, the number of seats may be a more reliable independent variable on which to establish trip generation rates for facilities having significant outdoor seating.

Time-of-day distribution data for this land use for a weekday, Saturday, and Sunday are presented in Appendix A. For the 38 general urban/suburban sites with data, the overall highest vehicle volumes during the AM and PM on a weekday were counted between 11:45 a.m. and 12:45 p.m. and 12:00 and 1:00 p.m., respectively.

The sites were surveyed in the 1980s, the 1990s, the 2000s, and the 2010s in Alberta (CAN), California, Florida, Georgia, Indiana, Kentucky, Massachusetts, Minnesota, New Hampshire, New Jersey, New York, Ohio, Oklahoma, Oregon, Pennsylvania, South Dakota, Texas, Vermont, and Wisconsin.

#### Source Numbers

126, 269, 275, 280, 300, 301, 305, 338, 340, 341, 358, 384, 424, 432, 437, 438, 444, 507, 555, 577, 589, 617, 618, 728, 868, 884, 885, 903, 927, 944, 961, 962, 977

# Land Use: 931

## Quality Restaurant

### Description

This land use consists of high quality, full-service eating establishments with a typical duration of stay of at least one hour. Quality restaurants generally do not serve breakfast; some do not serve lunch; all serve dinner. This type of restaurant often requests and sometimes requires reservations and is generally not part of a chain. Patrons commonly wait to be seated, are served by a waiter/waitress, order from menus and pay for meals after they eat. While some of the study sites have lounge or bar facilities (serving alcoholic beverages), they are ancillary to the restaurant. Fast casual restaurant (Land Use 930) and high-turnover (sit-down) restaurant (Land Use 932) are related uses.

### Additional Data

The outdoor seating area is not included in the overall gross floor area. Therefore, the number of seats may be a more reliable independent variable on which to establish trip generation rates for facilities having significant outdoor seating.

The sites were surveyed in the 1980s and the 1990s in Alberta (CAN), California, Colorado, Florida, Indiana, Kentucky, New Jersey, and Utah.

### Source Numbers

126, 260, 291, 301, 338, 339, 368, 437, 440, 976



DATE: January 7, 2021  
TO: Planning Commission  
FROM: R. Brent Savidant, Community Development Director  
SUBJECT: MISCELANNEOUS BUSINESS – Correspondence from ZBA

Zoning Board of Appeals (ZBA) Representative Rahman asked that the attached information be presented to the Planning Commission for discussion, at the request of the Planning Commission.

The information provides background. ZBA Representative Rahman can provide further background during the meeting.

Attachment:

1. Information provided by ZBA Representative Rahman.

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## The City of Troy ZBA Meeting Follow up (meeting date: Nov 17, 2020)

- A variance request to construct a deck 3 feet from the rear property line
- The Zoning Ordinance requires the deck to be at least 25 feet from the rear property line (Cluster Option)
- The house has a higher elevation of 6 feet from the ground
- Building of a deck of any size would need variance from the ZBA
- The petitioner's application was denied
- The ZBA is looking for a clear guidance from the Planning Commission and the City Council for this type of situation



DATE: January 7, 2021  
TO: Planning Commission  
FROM: R. Brent Savidant, Community Development Director  
SUBJECT: ANNUAL ELECTION OF OFFICERS

The Planning Commission By-Laws call for the election of Officers (Chairperson and Vice Chairperson) and recommendation of appointment of Zoning Board of Appeals Representative each January at the Planning Commission Regular meeting.

The Chair shall take nominations from the floor for each position, with the election following immediately thereafter.

The Planning Commission By-Laws are attached for your information. Election provisions are in Article 3.

Attachment:

1. Planning Commission By-Laws

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# **BY-LAWS AND RULES OF PROCEDURE OF THE CITY OF TROY PLANNING COMMISSION**

## **ARTICLE I – COMPLIANCE AND AUTHORITY**

The City of Troy Planning Commission shall comply with all applicable statutes, perform any duties, and exercise the powers granted to the Planning Commission by the Michigan Planning Enabling Act, Public Act 33 of 2008, as amended, the Michigan Zoning Enabling Act, Public Act 110 of 2006, as amended, and the Open Meetings Act, Public Act 267 of 1976, as amended, and the City of Troy Charter and Ordinances. The By-Laws and Rules of Procedure are adopted pursuant to the authority of those statutes and the City Charter.

## **ARTICLE II – OFFICERS AND THEIR DUTIES**

- Section 1. The Planning Commission shall select from its membership a Chairperson and Vice-Chairperson who shall serve for a one (1) year term and who shall be eligible for re-election. The Planning Commission shall make a recommendation to City Council for a Zoning Board of Appeals Representative.
- Section 2. The Chairperson shall preside at all meetings and shall conduct all meetings in accordance with these by-laws and rules and in accordance with the usual duties conferred by parliamentary procedure on the position of Chairperson.
- Section 3. The Vice-Chairperson shall act in the capacity of the Chairperson in the absence of the Chairperson and shall succeed to the office of Chairperson in the event of a vacancy in that office, in which case the Planning Commission shall select a successor to the office of Vice-Chairperson at the earliest practicable time by election procedures as set out in Article III.
- Section 4. In the absence of both the Chairperson and the Vice-Chairperson, the Zoning Board of Appeals representative shall act as Chairperson for that meeting only. The temporary Chairperson shall have the same duties and privileges as the Chairperson.
- Section 5. The Chairperson and Vice-Chairperson may engage in discussion on all matters before the Planning Commission and shall have voting privileges.

### **ARTICLE III – ELECTION OF OFFICERS AND APPOINTMENT OF ZONING BOARD OF APPEALS (ZBA) REPRESENTATIVES**

- Section 1. Each January at the Regular Meeting, the Planning Commission shall:
- A. Conduct elections of Officers (Chairperson and Vice Chairperson); and
  - B. Recommend appointment for a Zoning Board of Appeals Representative.

The Chairperson shall take nominations from the floor with the election immediately thereafter.

- Section 2. Candidates receiving a majority vote of the total number of members shall be declared elected as a Planning Commission Officer or recommended as a Zoning Board of Appeals Representative.

- Section 3. The Planning Commission Officers shall take office immediately following their election. Officers shall hold their office for a term of one (1) year, or until their successors are elected and assume office. The Zoning Board of Appeals Representative shall assume his or her responsibilities following confirmation of the appointment by City Council. The Zoning Board of Appeals Representative shall hold office for a term of one (1) year, or until a successor is appointed by City Council and assumes office.

- Section 4. The Method of Voting on Nominees shall be as follows:

- A. The Chairperson shall ask for nominations from the floor. A second shall not be required in order to nominate a person as an Officer or Zoning Board of Appeals Representative. The Chairperson shall announce each nomination as he or she hears it. If it becomes apparent to the Chairperson that there are no further nominations, the Chairperson shall inquire “are there further nominations?” If there are no further nominations, the Chairperson shall declare the nominations closed.
- B. If there is only one nominee for each position, a single resolution may be used to elect all the officers. The resolution must be approved by a majority of Planning Commission members by a roll call vote.
- C. If there is only one nominee for a particular position, a resolution electing that person to the particular position shall be approved by a roll call vote.



- D. If there is more than one nominee for a position, voting shall take place by calling a rotating roll of the Planning Commission and each member is to indicate the name of the individual he or she wishes to fill the position. If one candidate receives a majority vote, that person shall be deemed elected and the Chairperson shall announce such election. If no candidate receives a majority vote, the candidate with the least number of votes shall be eliminated from the ensuing ballot and the procedure shall be repeated until one candidate receives a majority vote.

#### **ARTICLE IV – MEETINGS**

- Section 1. All meetings shall be posted at City Hall according to the Open Meetings Act. The notice shall include the place, date and time of the meeting.
- Section 2. All meetings shall be conducted in accordance with generally accepted parliamentary procedure. The current version of Robert's Rules of Orders can serve as a guide.
- Section 3. Regular Meetings of the Planning Commission shall be held on the second and fourth Tuesday of each month at 7:00 p.m. at the Troy City Hall, 500 West Big Beaver Road, Troy, Michigan. Site Location Meetings may be scheduled by the Planning Commission at any reasonable time in accordance with the Open Meetings Act. Any changes in the date or time of any meeting shall be posted and noticed in accordance with the Open Meetings Act. When a Regular Meeting date falls on or near a legal holiday, the Planning Commission may schedule a meeting on a suitable alternate date in the same month.
- Section 4. The Chairperson may call Special Meetings. In addition, it shall be the duty of the Chairperson to call a Special Meeting when requested to do so by an affirmative vote of a majority of the Planning Commission members present. The business which the Planning Commission may perform at a Special Meeting may be the same business that the Planning Commission performs at a Regular Meeting. Notice of the time, date and place of the Special Meeting shall be given in a manner as required by the Open Meetings Act and the Planning Director shall notify all members of the Planning Commission not less than 48 hours in advance of a Special Meetings.
- Section 5. The Chairperson may call Study Meetings. At Study Meetings, the Planning Commission shall not vote on any of the following matters: (1) any matter requiring a public hearing, (2) matters which must be finally approved by the Planning Commission such as Site Plan review applications and Special Use Requests, and (3) matters where the Planning Commission is acting in an advisory capacity, such as, Rezoning

Requests, Ordinance Text Amendments, Subdivision Plats, Street and Alley Vacations, or Planned Unit Development Proposals. It may vote on housekeeping matters such as setting public hearing dates and approving minutes.

Section 6. All meetings of the Planning Commission, including Regular, Special, Study or Site Location meetings shall be open to the general public unless exempted from public meeting requirements under the Open Meetings Act. The Planning Commission, with guidance provided by the City Attorney's Office, shall make the determination as to whether the meeting or a portion of the meeting is exempt under the Open Meetings Act, and shall pass an appropriate resolution setting forth its determination.

Section 7. A majority of the membership of the Planning Commission constitutes a quorum and the number of votes necessary to transact business is as follows:

- A. The affirmative vote of six (6) members shall be necessary in order to adopt or amend a Master Plan.
- B. A majority vote of the members is necessary for those matters on which the Planning Commission has final jurisdiction, as per Section 3.10 of the City of Troy Zoning Ordinance.
- C. A majority vote of those members present at a meeting shall be necessary for those matters on which the Planning Commission serves in an advisory capacity.
- D. Voting on items on the Business Agenda shall be by a rotating roll call. A record of the vote shall be kept as a part of the minutes.
- E. When a quorum is not present, no official action shall take place. The Chairperson or Planning Director shall announce to the Commission and anyone in attendance that there is no quorum and that all agenda items will be rescheduled for a specific date.
- F. The Chairperson may ask members who vote "no" on an item to explain the "no" vote for clarification purposes and to add to the public record.

Section 8. The Planning Director of the City of Troy or his or her designee shall serve as the Secretary of the Planning Commission and keep the minutes and records of the Commission, prepare the agenda of Regular Meetings, Special Meetings and Study Meetings with the Chairperson, provide notice of meetings to Planning Commission members, present agenda items to the Planning Commission at its meetings, attend to correspondence of the

Planning Commission, and perform such other duties as necessary to carry out the business of the Planning Commission.

## **ARTICLE V – ORDER OF BUSINESS**

The order of business at a Regular Meeting and Special Meetings shall be:

- A. Roll Call
- B. Approval of Agenda
- C. Approval of Minutes
- D. Public Comments for items not on the agenda
- E. Reports. Reports may include Zoning Board of Appeals reports, Downtown Development Authority reports, Planning and Zoning reports, and any other report on information that may be of interest to the Planning Commission as determined by the Planning Commission or Planning Department.
- F. Business Agenda. The business agenda may include postponed items, public hearings on zoning ordinance amendments and special use approval requests, preliminary site plan reviews, and any other matter that is before the Planning Commission seeking approval or a recommendation.
- G. Other Business
- H. Public Comments for items on the agenda.
- I. Planning Commissioner's Comments
- J. Adjournment

## **ARTICLE VI – PLANNING COMMISSION ACTIONS**

Following consideration of matters submitted to it in accordance with the provisions of the City Code of Ordinances or other applicable law, or referred to it by the City Council, the Planning Commission shall take one of the following actions:

- A. Approve the proposal, or recommend positive action by the City Council.
- B. Deny the proposal, or recommend negative action by the City Council.

- C. Approve a proposal modified to meet reasonable conditions, or recommend approval of a modified proposal meeting reasonable conditions by the City Council. However, the Planning Commission shall not place conditions on an approval of a recommendation to City Council for rezoning, except for conditional rezoning in accordance with Section 16.04 of the City of Troy Zoning Ordinance.
- D. Postpone action on the proposal to a specific date or upon the occurrence a specific event. The Planning Director or his or her designee shall monitor the matter and determine when such specific event has occurred so that the matter may be rescheduled. The Planning Commission shall indicate in the resolution the reason(s) for such action.

The Planning Commission shall act on all applications within a reasonable time. This shall not be construed to alter other time limits prescribed by the Charter, Code of Ordinances or State statutes.

## **ARTICLE VII – HEARINGS**

- Section 1. In addition to those required by law, the Planning Commission may in its discretion hold public hearings when it decides that such hearing will be in the public interest.
- Section 2. Notice of such hearings shall be published in the official newspaper of the City or in a newspaper of general circulation as required by the City Charter, Code of Ordinances and/or State statutes. The Planning Director or his or her designee shall take the necessary steps to see that notice is published in accordance with the City Charter, Code of Ordinances and/or State statutes.
- Section 3. Any request before the Planning Commission shall be presented in summary by the Planning Director or his or her representative or a designated member of the Planning Commission. The Planning Director may present additional information to the Planning Commission through personnel from other Departments and/or non-City employees, if the Planning Director believes that information would be helpful to the Planning Commission. Parties in interest shall have the privilege of the floor.
- Section 4. If the petitioner or petitioner's representative fails to appear for a scheduled hearing, the Planning Commission may proceed with the hearing in the absence of the petitioner and act on the proposal in accordance with Article VI. Adjournment of any scheduled hearing must be approved by a majority of the Planning Commission member in attendance. Requests for adjournment shall only be granted upon a demonstration of good cause.

Section 5. Public hearings and other proceedings conducted by the Planning Commission shall be run in an orderly and timely fashion. This shall be accomplished by the following procedure:

- A. If an agenda item does not formally require a public hearing, the Chairperson shall have the discretion to allow members of the public to address the agenda item. Once opened to the public for comment, the hearing shall be conducted in the same manner as a public hearing.
- B. After announcement by the Chairperson that the public hearing portion of the meeting for a specific agenda item is open, persons who wish to address the Planning Commission shall speak when recognized by the Chairperson and provide his/her name and address on the attendance sheet provided at the podium. All comments shall be addressed to the Chairperson.
- C. The Chairperson may order the removal of any member of the public that causes a breach of the peace during the public hearing.
- D. The Chairperson may place reasonable limits on the length of time speakers have to address an agenda item. The Planning Commission may override such time limitation by majority vote.

#### **ARTICLE VIII – COMMITTEES**

Section 1. Committees may be appointed as needed by the Chairperson for purposes and terms which the Planning Commission approves.

#### **ARTICLE IX – EMPLOYEES**

Section 1. The Planning Commission may recommend employment of such staff and/or experts as it sees fit to aid the Planning Commission in its work.

#### **ARTICLE X – AMENDMENTS**

These By-laws may be amended by a two-thirds vote of the entire membership of the Planning Commission.

#### **ARTICLE XI – ETHICS**

Planning Commission members shall adhere to the current version of the City of Troy Appointee Code of Ethics.

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