



PLANNING COMMISSION

SPECIAL MEETING

April 24, 2018, Council Chambers, 7:00 pm
201 West Ash Street, Mason, MI

AGENDA

- 1. CALL TO ORDER**
- 2. ROLL CALL**
- 3. PUBLIC COMMENT**
- 4. UNFINISHED BUSINESS**

A. Mason Hospitality Group LLC is seeking approval of a Special Use Permit and Preliminary Site Plan Review for permission to construct a private road with access to a new four-story, 44,376 sq. ft., 72-room hotel and conference center on vacant property located on the north side of West Kipp Road and west of US-127. The parcel is zoned C-2 General Commercial District.

1) Resolution 2018-03 – Approve Special Use Permit and Preliminary Site Plan Review to Construct a Private Road with Access to a New Four-story, 44,373 sq. ft., 72-room Hotel and Conference Center on Vacant Property Located on the North Side of West Kipp Road and West of US-127

- 5. NEW BUSINESS**

- 6. ADJOURN**

REMINDER:

Next Regular Meeting: May 15, 2018

(No meeting will be held on May 8, 2018 as
referenced in April 10, 2018 meeting)



City of Mason Planning Commission

Staff Report

TO: Planning Commission
FROM: Elizabeth A. Hude, AICP - Community Development Director
SUBJECT: W Kipp Rd – Hotel and Conference Center
DATE: April 19, 2018

Since the public hearing held on April 10, 2018, staff has received supplemental information related to the application submitted by Pat McCaffrey, President, Mason Hospitality Group LLC who is seeking approval of a Special Use Permit and Preliminary Site Plan Review for permission to construct a private road with access to a new four-story, 44,376 sq. ft., 84-room hotel and conference center on vacant property located on the north side of West Kipp Road and west of US-127. The parcel is zoned C-2 General Commercial District. The proposal is shown on the following plans submitted on March 8, 2018 available on the City of Mason website here <http://mason.mi.us/2018/Proposed%20Hotel%20Plan-Kipp%20Rd..pdf>.

The April 10, 2018 packet of materials, can be accessed here:
http://mason.mi.us/Data/PC/PCpackets/2018/041018_PCpacket.pdf

Attached for your review and consideration are the following:

- Draft minutes from the April 10, 2018 Planning Commission meeting including comments from the public hearing,
- A revised layout of the curb at the intersection of Kipp Rd and the proposed Franklin Farms Drive,
- Revised drawing showing 6" water supply, and
- A Traffic Impact Statement.

Based upon the supplemental information provided, it appears that the applicant has demonstrated compliance with the Mason Code sufficient for a Special Use Permit and Preliminary Site Plan approval. The Final Site Plan will need to address the remainder of the outstanding concerns noted in the materials contained in the April 10, 2018 packet.

Staff Recommendation

In accordance with

Special Use Permit: Chapter 94, Article VI, Sec. 94-191(f) Basis of determination.

(d) Review and decision. The planning commission may approve, approve with conditions, or deny an application for special use permit. The review of a special use permit application and the associated site plan shall be made by the planning commission in accordance with the procedures and standards specified in this chapter, and

Special Use Permit: Chapter 94, Article VI, Sec. 94-191(d)(1) which states that the planning commission may defer a decision in order to obtain that information deemed necessary to making an informed decision, and

Sec. 94-225. Preliminary site plan review and approval.

(h) Planning commission review. The planning commission shall have the authority to approve, approve with conditions, or deny an application for preliminary site plan review and approval in accordance with the requirements of section 94-224 of this chapter. The following review procedures shall be utilized when considering an application:

(1) The planning commission shall receive from the zoning official a copy of all material submitted.

(2) The planning commission shall receive a review and recommendation from the zoning official relative to the compliance of the preliminary site plan with the requirements of this chapter.

(3) The planning commission shall receive from the zoning official a review and/or recommendation from all appropriate local, state, and federal agencies.

(4) The planning commission shall utilize the criteria identified within section 94-227 of this chapter when reviewing an application.

(5) The planning commission may impose conditions when approving a preliminary site plan application. The conditions must be reasonable, directly related to the standards of this chapter, or determined to be necessary for the protection of the public health, safety, and welfare.

The following motion is offered for consideration:

MOTION

Motion to approve Resolution 2018-03 for Special Use Permit and Preliminary Site Plan Review which includes the following conditions:

A final site plan shall be submitted to the Planning Commission which satisfies the applicable standards for approval including:

1. Approved amendment to the zoning ordinance Sec. 94-173(i)(2)(e) to allow for a hotel with a maximum height of four stories and 45'.
2. Additional information to address questions raised by City staff and agencies.
3. Additional information to address questions raised in Landplan's review dated April 3, 2018.

Introduced:
Second:

**CITY OF MASON
PLANNING COMMISSION RESOLUTION No. 2018-03**

**APPROVE SPECIAL USE PERMIT AND PRELIMINARY SITE PLAN REVIEW TO
CONSTRUCT A PRIVATE ROAD WITH ACCESS TO A NEW FOUR-STORY,
44,373 SQ. FT., 72-ROOM HOTEL AND CONFERENCE CENTER ON VACANT
PROPERTY LOCATED ON THE NORTH SIDE OF WEST KIPP ROAD
AND WEST OF US-127**

April 24, 2018

WHEREAS, a request has been received from Pat McCaffrey, President, Mason Hospitality Group LLC for a Special Use Permit and Preliminary Site Plan approval to construct a private road with access to a new four-story, 44,373 sq. ft., 72-room hotel and conference center on vacant property located on the North side of West Kipp Road and West of US-127; and

WHEREAS, the proposal was shown on plans submitted March 8, 2018; and

WHEREAS, supplemental information was provided to address the needs for water supply, traffic impact, and road access; and

WHEREAS, the subject property is further described as Parcel numbers 33-19-10-08-378-001 and 33-19-10-08-378-002: The East $\frac{1}{2}$ of the Southeast $\frac{1}{4}$ of the Southwest $\frac{1}{4}$, Section 8, Town 2 North, Range 1 West, City of Mason, Ingham County, Michigan, except the South 12 rods thereof; and except land sold to Michigan State Highway Department for U.S. 127 Highway as relocated and established; and except beginning 770 feet North 0 degrees 04 minutes East and 660 feet West of South $\frac{1}{4}$ corner or section; thence North 0 degrees 04 minutes, East 557.5 feet, South 89 degrees 37 minutes, East 212.8 feet to Westerly right of way line of Highway U.S. 127, South 38 degrees 50 minutes East along said Westerly right of way line 559.8 feet to North bank of Willow Creek, South 77 degrees 52 minutes West 557.0 feet along North bank of Willow Creek to beginning; and except that part of East $\frac{1}{2}$ of East $\frac{1}{2}$ of Southeast $\frac{1}{4}$ of Southwest $\frac{1}{4}$ of Section 8, lying Northeasterly of right of way of U.S. 127 as relocated in Section 8; and except that part of East of $\frac{1}{2}$ of East $\frac{1}{2}$ of Southeast $\frac{1}{4}$ of Southwest $\frac{1}{4}$ of Section 8 lying North of Willow Bank Subdivision No. 1, South of Northbrook Farms Subdivision and East of the following described line: Beginning 264.00 feet South 89 degrees 33 minutes West along section line from South $\frac{1}{4}$ corner of said Section 8; thence North 0 degrees 27 minutes West 50 feet; thence North 89 degrees 33 minutes East 48.58 feet; thence North 44 degrees 33 minutes East 247.48 feet; thence North 0 degrees 27 minutes West 148.97 feet; thence North 8 degrees 57 minutes West 297.04 feet; thence North 25 degrees 57 minutes West 359.92 feet; thence North 35 degrees 03 minutes 52 seconds West 701.78 feet to a point of ending at the Northeast corner of Lot 21, Northbrook Farms, said last course intersecting the East boundary of said subdivision at an angle of 4 degrees 05 minutes 08 seconds; and

WHEREAS, the parcel is zoned C-2 (General Commercial district); and

WHEREAS, Section 94-222 states that any use within the C-2 zoning district requires site plan review; and

WHEREAS, Section 94-142. C2 General Commercial District (d) Uses authorized by special use permit. paragraph 7 indicates that the hotel use is permitted by special use permit in the C2 Zoning District; and

WHEREAS with the waivers and conditions listed herein, the plans will comply with the Special Use Permit Basis for Determination listed in Section 94-191(f) and Site Plan Review Standards listed in

WHEREAS, approval is granted with the following conditions:

A final site plan shall be submitted to the Planning Commission which satisfies the applicable standards for approval including:

1. Approved amendment to the zoning ordinance Sec. 94-173(i)(2)(e) to allow for a hotel with a maximum height of four stories and 45'.
2. Additional information to address questions raised by City staff and agencies.
3. Additional information to address questions raised in Landplan's review dated April 3, 2018.

NOW THEREFORE BE IT BE RESOLVED, that the Mason Planning Commission does hereby approve a Special Use Permit and Preliminary Site Plan review to construct a private road with access to a new four-story, 44,373 sq. ft., 72-room hotel and conference center on vacant property located on the North side of West Kipp Road and West of US-127 based on the plans received on March 8, 2018 and supplemental information received on April 24, 2018.

Yes ()

No ()

Absent ()

Vacant ()

CLERK'S CERTIFICATION: I hereby certify that the foregoing is a true and accurate copy of a resolution adopted by the Planning Commission at its regular meeting held Tuesday, April 24, 2018, the original of which is part of the Planning Commission minutes.

Sarah Jarvis, Clerk
City of Mason
Ingham County, Michigan

**CITY OF MASON
REGULAR PLANNING COMMISSION MEETING
MINUTES OF April 10, 2018
DRAFT**

Sabbadin called the meeting to order at 6:32 p.m. in the Council Chambers at 201 W. Ash Street, Mason, Michigan.

Present: Commissioners: Barna, Droscha, Feintuch, Hagle, Howe, Reeser, Sabbadin, Waxman (8)
Absent: Commissioners: (0)
Also present: Elizabeth A. Hude, AICP, Community Development Director

PUBLIC COMMENT

None.

APPROVAL OF MINUTES

MOTION by Howe, second by Waxman, to approve the Planning Commission meeting minutes from March 13, 2018.

Yes (8)

No (0)

Abstain (0)

MOTION PASSED

PUBLIC HEARING

A. Pat McCaffrey, President, Mason Hospitality Group LLC is seeking approval of a Special Use Permit and Preliminary Site Plan Review for permission to construct a private road with access to a new four-story, 44,376 sq. ft., 84-room hotel and conference center on vacant property located on the north side of West Kipp Road and west of US-127. The parcel is zoned C-2 General Commercial District.

Howe disclosed that his employer, DART Bank, had a financial interest in the project and asked if he should abstain. Sabbadin asked commissioners if there were concerns and for a motion asking Howe to abstain. No concerns were raised and no motion was offered. Howe remained as a voting member.

Chair Sabbadin opened the public hearing at 6:40 p.m.

Pat McCaffery, applicant, gave a brief introduction to the project and how it came about. He was approached by Ron Fors after a feasibility study was done demonstrating a hotel could be supported in the area. Choice hotels had also approached him with interest in building hotels. He felt this was a good location and is proposing the hotel in Mason as presented in the application materials.

Fred Fruehauf, 1005 Franklin Farm Drive stated his opposition to the project and concerns about lower property values as a result of the hotel. He is concerned that the project will wreck the whole neighborhood due to the lights, noise, car doors slamming and fights in the parking lot.

Steve Hubbard, 608 S. Lansing Street, asked if the city would have capacity with water/sewer

plant to support the hotel, and if the fire department had sufficient apparatus to reach the 4th floor. Mr. McCaffery responded that he had confirmed the answer to be yes to both questions in preparing the submittal. Mr. Hubbard also asked what happened to the connection through on Franklin Farm Drive? Reeser explained that it did not move forward due to issues with DEQ permits over the creek. Mr. Hubbard stated that Lansing and South Street were more congested as a result of traffic coming from the subdivision that would have otherwise used the road.

Jack Schripsema, President, Greater Lansing Convention & Visitors Bureau, spoke in support of the hotel project. He noted that the region has seen an explosion in demand for lodging. The Greater Lansing Area is now at the top of the list of areas in demand. Mason is underserved and will benefit from the project.

Fred Fruehauf, 1005 Franklin Farm Drive, repeated his opposition and cited the old hotels in Lansing that are full of drugs and prostitution. Debate took place as to the subjectivity of his statement. Sabbaddin gave him a warning regarding foul language.

Susan Naird, 1761 Tuttle, stated that she had moved here from Sterling Heights where she served as a zoning commissioner for eight years. She stated that commissioners should be careful in setting precedents as their decisions affect the future of the community.

Dennis Bradley, 570 Beacon Lake, Lifelong resident of the area, stated support for the hotel. Mason needs this project to support local businesses and restaurants. DART and other employers currently use hotels in Lansing and Okemos.

Kelly Sairls, 656 Kipp Road, grew up in Dansville, worked in Mason, recently moved from south side of Holt to Mason so her kids could go to schools here. She is opposed to the hotel in that location, behind her house. She asked why it couldn't be 2 stories instead of 4, that the traffic would be right next to her house. She is concerned about the clientele and the future management, citing Causeway Bay as an example. There are already several accidents on the curve. She asked if there would be 72 or 84 rooms, both were noted in the application. There is significant flooding in the lot, full of wildlife and ducks. She feels it is not a feasible location due to the wetlands and residential area.

Dorey Brown, 636 Kipp Road, stated opposition to the project. She is concerned about the noise and traffic. Kipp Road is dangerous, at least one car a month ends up in her driveway and she already has many other incidents of undesirable activity that she deals with on a regular basis there. When the field across the street is planted with corn, it reduces visibility. The flooding and drainage create icy conditions in the winter.

Fred Freuhauf, 1005 Franklin Farm Drive, stated concern about the city's lack of follow through on his street regarding sidewalks and trees. There are three to four vacant lots and no sidewalks in front of those.

Keith Hein, 1002 Eugenia Drive, stated when he moved to town he looked at the master plan and zoning and the Franklin Farms development of 300+ units was designated as greenspace/park. He is concerned about the through connection to Franklin Farms Drive north of the creek. He led the initiative to prevent that road from going through previously and would fight it if it came up again. He asked if there were adequate emergency services to serve the hotel now, does not want to see this as an excuse to connect the road. He believes the precedent for the 4-story hotel manipulates the commission to get the road. The city picked that location for the hotel to push the road.

Mr. McCaffery responded that the city had zero input on location. The concrete/steel building will be sprinkled and water service will be sufficient to serve the fire suppression system.

Ms. Sairls asked if there were any lawsuits against the property? She doesn't want the hotel in her backyard. How will her safety be ensured, privacy in her back yard? What will developers do for

them? Will there be sidewalks on Kipp Road, can the road handle the additional traffic?

Mr. McCaffery responded that there were no lawsuits against the property. There is a portion of the land that cannot be used for development that he is willing to give back to the community. They are also looking at a walkway along the east of the property. He recognized that she was upset and this was a tough situation.

Steve Hubbard, 608 S. Lansing, stated that this hotel would be Heb's death warrant. He wondered why the developer didn't go down Jewett Road where 140 acres were available. Alternative routes will be important in the future.

Keith Hein, 1002 Eugenia Drive, stated he was encouraged by the dialogue, the developers were trying, that this was not a 'take it or leave it' conversation. Previous administration told him in the past that the Franklin Farms subdivision was a 'done deal' and he could do nothing about it. He reiterated his position on the Franklin Farms Drive connection and asked that the matter not be brought up again.

Chair Sabbadin closed the public hearing at 7:25 p.m.

Sabbadin asked Hude to read written comments received into the record that were received during the open houses on Saturday and prior to the Tuesday public hearing. The four comments expressed support for the hotel and were received by John Brittain, Maureen Brittain, Becky Clinton, and one without a signature.

Waxman motioned to approve Resolution 2018-03, Reeser seconded. The following discussion took place:

Waxman recognized the concerns of residents, that this was a very big project, change is difficult. He stated this was the beginning of a process and that concerns needed to be addressed regarding the road extension and the water. Sidewalks were also important especially on Kipp Road.

Feintuch stated that every action is a precedent and this one involved four stories. She is in favor of the hotel and understands the need in the area. She operated a Bed and Breakfast and was full all of the time. Her concerns with the hotel relate to flooding, lights and the four stories. It is important to listen to the community.

Reeser stated that in all his years on the commission he did not feel that they were ever pushed around or had arms twisted. He pointed out the work on the master plan and specifically effort made on Temple Street and the studies over the years for different matters such as the food truck.

Sabbadin asked for confirmation about where water was coming from and if hydrants would be added. The water will come from service at the end of Franklin Farms Drive or Eugenia and hydrants will be added.

Discussion took place confirming that the site would be served by sanitary sewer line that runs parallel to US 127, and that storm runoff would be directed to a detention pond that would then flow to Willow Creek.

Barna asked for confirmation of handicap spaces to serve the needs of users including our aging population – a total of 7 will be provided.

Feintuch asked for clarification of why other Sleep Inns are two stories, but this is four. McCaffery explained that Choice Hotels won't allow two stories, and four is the only feasible way to make the proposed lot work given the floodplain issues.

Droscha motioned to amend the original motion and defer the discussion to the May 8 meeting, Waxman seconded.

Barna questioned the need to continue given that this was a preliminary site plan. Howe supported

Barna's statement.

Feintuch asked if this was similar basis as Klavon's – it must be approved if it meets requirements regardless of public comment. Hude stated that yes, if the commission had information to determine it met requirements, it could be approved.

Waxman stated concern about requiring sidewalks on Kipp. Hude explained that the developer could not be required to make public improvements offsite, the city would be responsible for sidewalks on Kipp Rd. Deb Stuart, City Administrator, clarified the city's policy on new sidewalks and that the cost for those improvements would be assessed to property owners. The sidewalk program will focus on improvements for the southwest quadrant of the city in 2022-23 but is only for repair of existing sidewalks.

Discussion took place on the creation of pedestrian access along the east of the property out to Kipp which would require crossing MDOT right of way for a stretch of 47 feet. MDOT requires a permit and the developer has looked into this, it is costly. McCaffery would like to give floodplain portion of the lot back to the city.

Note: Barna left the room.

Sabbadin asked for a vote to approve motion to postpone discussion to May 8.

Yes (5) Droscha, Feintuch, Hagle, Howe, Reeser, Sabbadin, Waxman

No (2) Howe, Reeser

Absent (1) Barna

MOTION PASSED

UNFINISHED BUSINESS

- A. Development Updates – The Administrators Report was distributed.
- B. Workplan Update – Public hearings for ordinance amendments were shifted from April to May due to the public hearing this evening.

NEW BUSINESS

- A. Discussion: Zoning Ordinance Text Amendment – Sec. 94-173(i) Hotel, motel, transient lodging facilities.

Hude provided a brief overview of the ordinance and recommended change to the ordinance that would allow a four-story hotel, up to 45 feet. The height restriction in a C-2 district is 45 feet but this is reduced for hotels.

Waxman proposed striking the sentence that references a height restriction and that an office building could be four stories. Feintuch stated that the use of the building was a factor. Office workers leave at 5 p.m. when adjacent residents are returning home. With a hotel, users are still in the building in the evening which could potentially impact privacy to residents.

Reeser offered that the age of the zoning may be a factor, that it was based on the old model for hotels, which were primarily two stories. Barna noted that the residential lots in this location were consistent with traditional country road development – lots on the edge of farmland, and that this could be a difficult transition.

Howe stated that this ordinance change would apply to any location where a hotel would be allowed, not just this site.

Feintuch stated that users are transient, in contrast to employees of an office building who are regular users. Three stories would be better for privacy. Does not feel the current four-story proposal fits in this spot and that we should listen to the community.

Waxman stated that the issue was about height anywhere, not just in this area.

Reeser stated that this was a good quality development, a national chain prototype, restricting the height could result in a lower grade hotel.

Discussion continued regarding examples of hotels in other communities, Meridian Township in particular where older hotels are two-three stories and newer hotels are being built at four stories. Everyone agreed it was an important discussion. The consensus was to prepare a draft for public hearing that struck the sentence in Sec 94-173(i)(2)e. completely.

LIAISON REPORT

Droscha provided an update on City Council meeting including a change to allow solid waste receptacles to be placed after 5pm the evening before pick-up, and that a workshop was held regarding Code of Conduct based on a session from the MML conference.

ADJOURN

The meeting adjourned at 8:38 p.m.

Lori Hagle, Secretary

From: Ron Fors
To: [Elizabeth Hude](#)
Cc: [Patrick McCaffrey](#); [Tony Burkholder](#); [Bob Ford](#)
Subject: RE: Follow-up - Items required
Date: Wednesday, April 18, 2018 5:53:55 PM

Elizabeth, In response to your email

- Road i.e. Drive issues

1. I will have Bob Ford forward you everything we have received from the traffic study consultant.
2. I forwarded you a revised drawing for the proposed connection Of Franklin Farms Dr. to Kipp road I will bring you a hard copy tomorrow
3. I have copy of all the paper work between the city and Bob Harter, the city and Esquire Development, The(city and or Wolverine Eng.) and the DEQ, regarding the then proposed road. I also have the paper work regarding Status of Bob Hurters “ Charitable” contribution of \$55,000.

I do not have in my possession the road commission’s approval letter, however I am told that it is a matter of public record.

We do understand that we will be responsible for the connection work at Kipp Rd. provided that work is not outside a typical request and requirements for curbing and radius’s etc.

You will note, we have not asked for public assistance to date

- Regarding the Water issue, attached you will find
 1. Our site plan shown on page C6 is the water line coming to the building (Plan by Bob Ford LAP)
 2. Also attached is a set of site plan By WB Services, shown the 6” water Line that is and has been used on all of the Hotels Patrick has developed and owns
 3. Also attached is an email from the architectural group associated with the Mason project. Please note his requirements, as to line size and water pressure.
 4. We will also have a letter for you from Advance Fire Protection (A Michigan Base contractor and Engineer) stating their verification, that a 6” water line is adequate for the proposed Hotel.

From: Elizabeth Hude [mailto:elizabethh@mason.mi.us]
Sent: Wednesday, April 18, 2018 1:49 PM
To: 'Ron Fors'; 'Ron Fors'
Subject: Follow-up - Items required

Hi Ron,

I wanted to follow up on our call. For next week we will need the following:

- Traffic Study confirming no impact to traffic that would require infrastructure improvements
- FF Drive/Kipp curb cut
 - new drawing showing greater separation between road and residential driveway
 - Approval of previously approved curb cut (2010)
 - How will costs of Kipp Rd improvements to accommodate curb cut and turning lanes be covered (note 2010 drawings)? Please note item # 14 in Landplan report referencing Sec 94-191(f) which prohibits creation of additional requirements at public cost.
- Water – letters referencing 6” pipe on prior builds

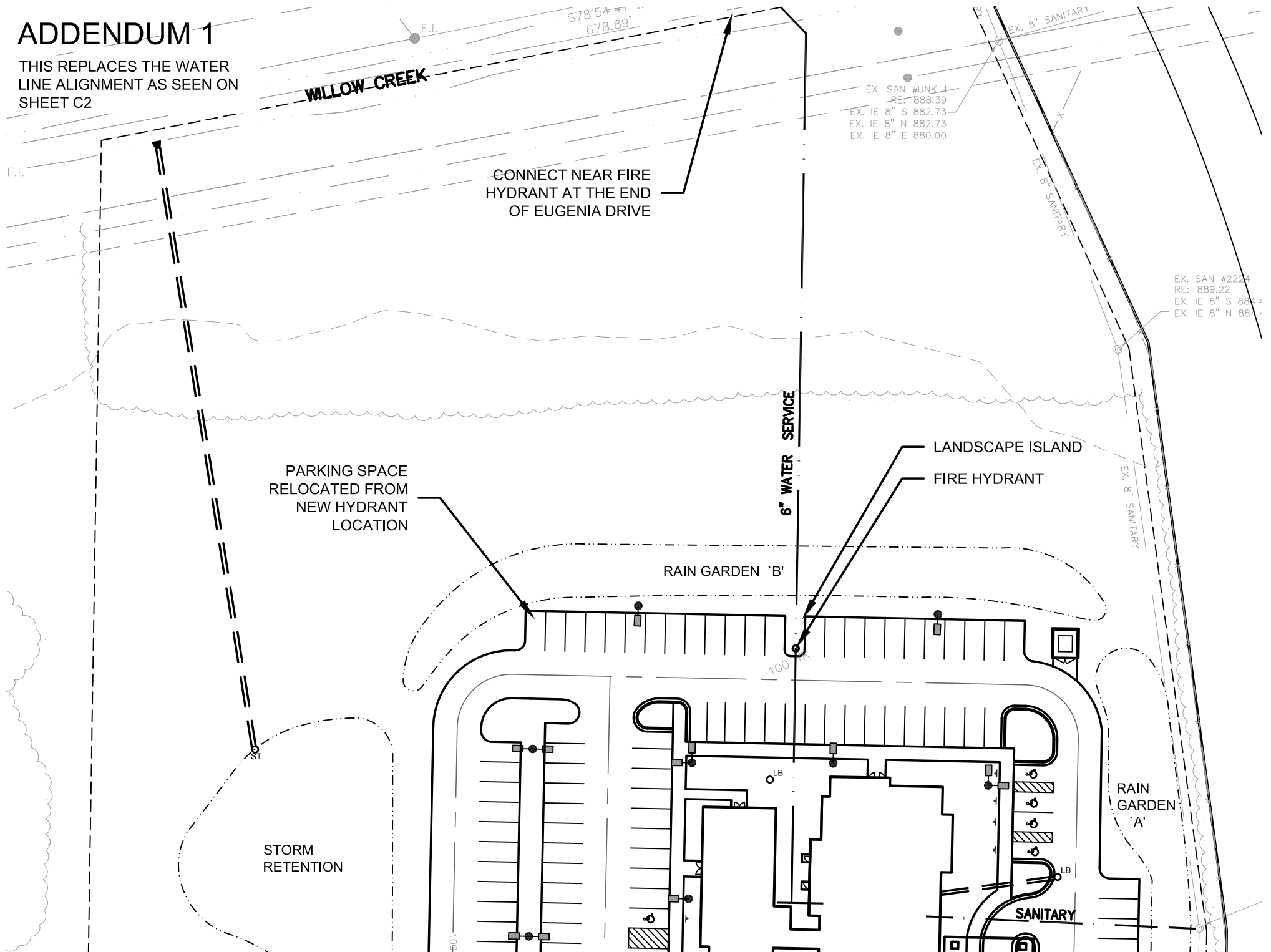
Anything you can get me today for the packets would be great. That way the PC has time to review prior to the meeting.

Thanks,
Elizabeth

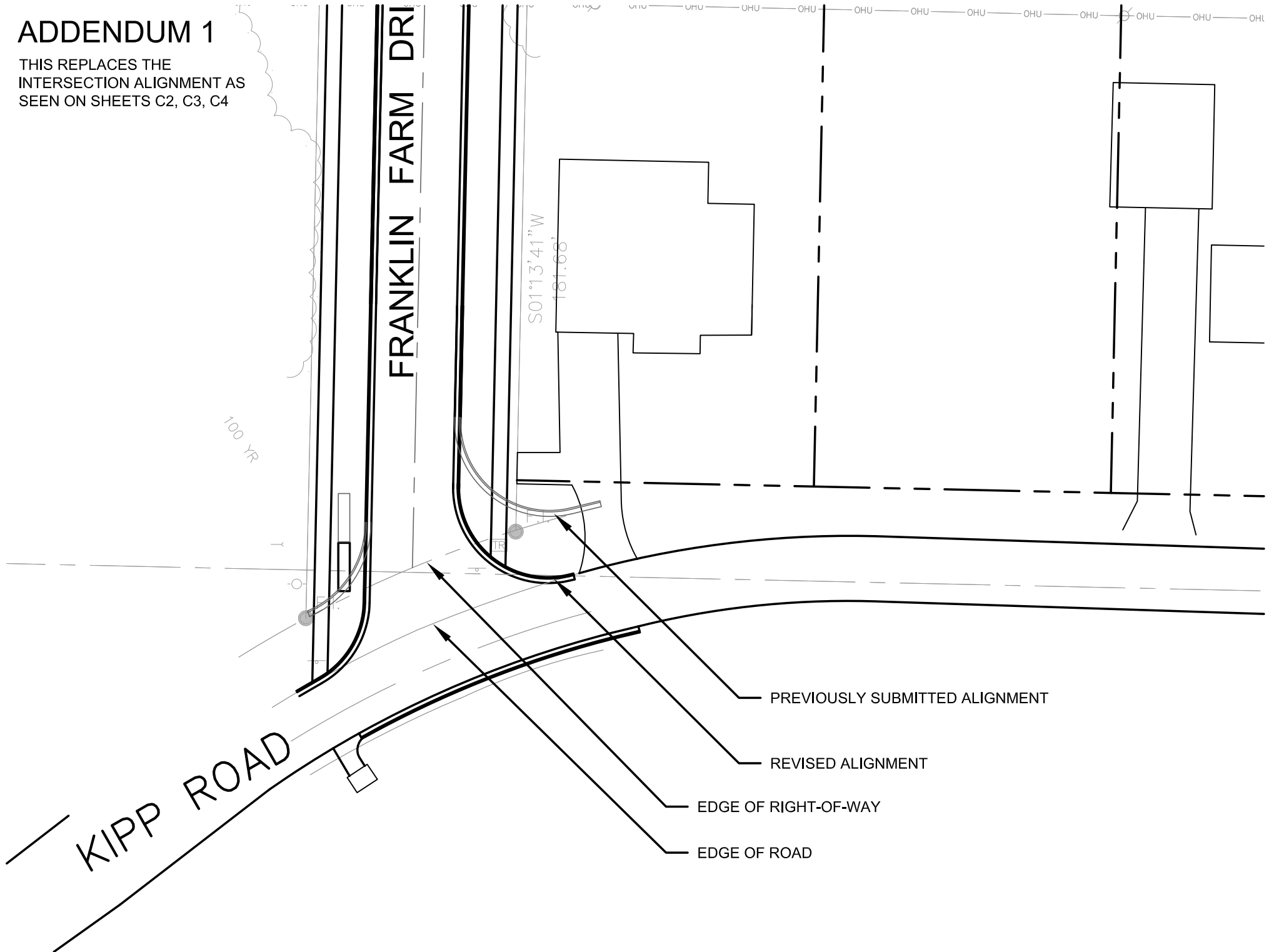
Elizabeth A. Hude, AICP
Community Development Director

City of Mason | Office: 517-978-0206
201 W. Ash Street | Mobile: 517-819-0645
Mason MI 48854 | FAX: 517-676-1330
<http://mason.mi.us> | elizabethh@mason.mi.us

THIS REPLACES THE WATER
LINE ALIGNMENT AS SEEN ON
SHEET C2



THIS REPLACES THE
INTERSECTION ALIGNMENT AS
SEEN ON SHEETS C2, C3, C4



Office: (517) 485-0472

Email: afpnunn@outlook.com



Advanced Fire Protection, Inc.

PO Box 272, Dewitt MI 48820

Design ■ Installation ■ Consulting ■

4-19-2018

*Timberland Development
4250 Charlar Dr
Holt, MI 48842
Ph 517-694-0577
Fx 517-694-7594*

Attn: Tony Burkholder

*Re: Sleep Inn
Mason, MI*

This letter is to verify that a 6" underground line will work to supply the fire protection system demand per NFPA #13.

Please feel free to contact me with any questions.

*Thank you,
Michael Nunn
Cell 517-202-7684*

April 20, 2018

Fellow Planning Commission members:

Due to work obligations I am unable to attend the special meeting of the planning commission.

I wanted to provide additional comment to the matter before the commission.

In the intervening time since our last meeting, I have had opportunity to further consider my position on the proposed hotel. While, I do have concerns about traffic, both foot and vehicle, I do not believe these concerns are reason to further delay the consideration and passage of the resolution before you. I believe that the conditions set forth by the planning department should be adopted as part of the preliminary site plan. A preliminary site plan is just that, an opportunity for us to provide input to the developer as to how our mutual visions can mesh to improve the project for the good of the community. I believe that this developer is willing to work with our community to make this project win-win. I understand that many residents are opposed to the project because of location and unanswered questions from the developer. The best way the developer can win these people over is to communicate with them on every step.

I would like the final site plan to include some idea of what the developer plans to do with the space that is unbuildable, be it park space or other uses. I also encourage the developer to come to us with a complete final site plan. One that does not require conditions for approval. While I understand that in a project of this scope, not every detail can be accounted for, the final site plan should be complete to the standards set forth by federal, state and local law. This will go a long way to build good will with the community.

Mr. Chairman, honorable fellow planning commission members, I believe that this project is in the best interest of the residents of the City of Mason. I believe that if we wish to attract a diverse economic and social population, this project will lay the groundwork to do so. Change is hard, it takes us out of our comfort zone. It makes us see the world around us differently and forces us to examine our place in the world. The planning commission is an instrument of change. I encourage passage of the resolution.

Sincerely,

A handwritten signature in black ink, appearing to read "Seth A. Waxman", followed by a long horizontal flourish.

Seth A. Waxman
Vice-Chair



TRAFFIC IMPACT STUDY

For The Proposed

Sleep Inn – Mainstay Hotel

City of Mason, Ingham County, MI

April, 2018

Prepared by:

**Traffic Engineering
Associates, Inc.**

PO Box 100 • Saranac, Michigan 48881

517/627-6028 FAX: 517/627-6040

Table of Contents

	Page
Executive Summary	I
Introduction	1
Project Description	2
Scope of Work	3
Aerial Site Map	4
Existing Conditions	5
Roadways & Intersections	6
Land Use	7
Existing Traffic Volumes	8
Level of Service Analysis for Existing Traffic	10
Level of Service Analysis for Existing Mitigated Traffic	14
Background Conditions	16
Background Traffic Volumes – Growth Related	17
Background Traffic Volumes – Development Related	17
Level of Service Analysis for Background Traffic	19
Future Conditions	22
Site Traffic Generation	23
Site Traffic Distribution	25
Level of Service Analysis for Future Traffic	28
Significant Findings	31
Intersection Improvement Considerations	32
Driveway Analysis for a Turn Lane or Taper	33
Recommendations	34
Supplemental Information	35
Site Plan	
Census Data	
Vehicle Volume Counts	
Timing Plans	
ICRD Guidelines for Right-Turn Lanes and Tapers	
ICRD Guidelines for Left-Turn Passing Lanes	
LOS Computations	



List of Tables

Table	Title	Page
1	Level of Service (LOS) Summary – Existing Traffic	12
2	Level of Service (LOS) Summary – Existing Mitigated Traffic	15
3	Level of Service (LOS) Summary – Background Traffic	20
4	Vehicle Trip Generation Summary – Proposed Sleep Inn – Mainstay Development	24
5	Level of Service (LOS) Summary –Future Traffic	29

List of Figures

Figure	Title	Page
1	Existing Traffic – Peak Hours	9
2	Background Growth Traffic – Peak Hours	18
3	Site Traffic – Peak Hours	26
4	Future Traffic – Peak Hours	27



EXECUTIVE SUMMARY

Traffic Engineering Associates, Inc. (TEA) conducted a traffic impact study for the proposed Sleep Inn – Mainstay Hotel development in the City of Mason, Ingham County, Michigan. The purpose of this study is to determine the impact of traffic to be generated on the surrounding road system. The new development will consist of a 72 room hotel.

The new development will be located north of Kipp Road and west of the US-127 highway. The proposed new hotel will have one (1) public road connection onto Kipp Road just west of the Jewett Road intersection. The proposed development is expected to be completed and fully occupied by summer of 2019 (18 months).

The existing weekday AM and PM peak hour traffic volumes are 7:30 – 8:30 AM and 4:45 – 5:45 PM at the key intersections. All existing turning movements at the studied intersections operate at an acceptable level of service (LOS D or better) except for two intersections along Kipp Road, the US-127 southbound off ramp and the Cedar Street/Meijer Driveway. The Cedar Street/Meijer Driveway and Kipp Road intersection traffic signal is scheduled to be revised by the Ingham County Road Department in the spring of 2018 to improve the level of service and the vehicle delay. This change will be considered as existing for the future development.

Background traffic represents future volumes without the traffic generated by the proposed Sleep Inn – Mainstay Hotel development. The background conditions included background growth for eighteen (18) months. Under background conditions, all studied intersections will operate at an acceptable level of service (LOS D or better) except for the US-127 southbound off ramp, the same as existing conditions.

The trip generation rates for the proposed Sleep Inn – Mainstay Hotel were derived from the ITE TRIP GENERATION MANUAL (10th edition). The proposed site is projected to have 72 total rooms, of which 37 are expected to be regular hotel rooms and 35 will be suites. For the purposes of this study, a comparison was conducted comparing the trip generation for a regular hotel and an all-suites hotel. The greater trip generator was used for this study.

A review of the two trip generations shows that the trip generation for a hotel with 72 regular rooms generated the highest trip volumes. It is projected that the proposed Sleep Inn – Mainstay Development will generate 31 vehicle trips in the AM peak hour, 28 vehicle trips in the PM peak hour, and 386 weekday trips.

Under future conditions, all studied intersections are projected to operate at an acceptable level of service (LOS D or better) except for the US-127 southbound off ramp. The findings of this study show that there are no recommendations to the existing road system.



INTRODUCTION



PROJECT DESCRIPTION

The purpose of this study is to determine the impact of traffic to be generated by the proposed Sleep Inn – Mainstay Hotel to be located in the City of Mason, Ingham County, Michigan. The new development will consist of a 72 room hotel; 37 regular rooms and 35 suites.

The new development will be located on the north side of Kipp Road, west of US-127. The proposed development will have one (1) access connection on Kipp Road. The proposed development is expected to be completed by the summer of 2019.



SCOPE OF WORK

The scope of work contained in this report is as follows:

- Analysis of existing traffic conditions on the adjoining street system, including the following intersections;
 - Kipp Road and Jewett Road
 - Kipp Road and US-127 Southbound Off Ramp
 - Kipp Road and US-127 Northbound Off Ramp
 - Kipp Road and Cedar Street/Meijer Driveway
 - Kipp Road and Hull Road/Jefferson Street
- Analysis of background traffic conditions on the adjoining street system, which includes the above listed intersections, for the future year summer of 2019 volumes without the proposed new Sleep Inn – Mainstay Hotel.
- Projection of future traffic volumes to be generated by the proposed new Sleep Inn – Mainstay Hotel for the future year.
- Analysis of the impact of future traffic for the proposed new Sleep Inn – Mainstay Hotel at the above listed intersections.
- Determination of what roadway and traffic control improvements, if any, will be needed to accommodate future traffic volumes for the proposed new Sleep Inn – Mainstay Hotel.





Aerial Site Map

EXISTING CONDITIONS



ROADWAYS AND INTERSECTIONS

Roadways

Kipp Road is an east-west, two-lane roadway in the project area with paved shoulders. The posted speed limit is prima facie 55 mph. The roadway is under the jurisdiction of the Ingham County Road Department. There are no bicycle lanes or sidewalks.

Intersections

Kipp Road and Jewett Road

The intersection of Kipp Road and Jewett Road is a stop sign controlled intersection with northbound Jewett Road stopping for Kipp Road. The east approach on Kipp Road has two (2) lanes; one (1) left-thru lane and one (1) outbound lane. The west approach on Kipp Road has two (2) lanes; one (1) thru-right turn lane and one (1) outbound lane. The south approach on Jewett Road is two (2) lanes with one (1) left turn-right turn lane and one (1) outbound lane. There are no marked pedestrian crossings at this intersection.

Kipp Road and US-127 Southbound Ramps

The intersection of Kipp Road and the US-127 Southbound Ramps is a stop sign controlled intersection with southbound US-127 Off Ramp stopping for Kipp Road. The east approach on Kipp Road has three (3) lanes; one (1) exclusive left turn lane, one (1) thru lane and one (1) outbound lane. The west approach on Kipp Road is two (2) lanes; one (1) thru-right lane and one outbound lane. The north approach on the southbound US-127 Off Ramp is two (2) lanes with one (1) left turn lane and one (1) right turn lane. The south approach on the southbound US-127 On Ramp is a single, outbound only lane. There are no marked pedestrian crossings at this intersection.

Kipp Road and US-127 Northbound Ramps

The intersection of Kipp Road and the US-127 Northbound Ramps is a stop sign controlled intersection with northbound US-127 Off Ramp stopping for Kipp Road. The west approach on Kipp Road has three (3) lanes; one (1) exclusive left turn lane, one (1) thru lane and one (1) outbound lane. The east approach has three (3) lanes; one (1) exclusive right turn lane, one (1) thru lane and one (1) outbound lane. The south approach on the northbound US-127 Off Ramp is two (2) lanes with one (1) left turn lane and one (1) right turn lane. The north approach on the northbound US-127 On Ramp is a single, outbound only lane. There are no marked pedestrian crossings at this intersection.

Kipp Road and Cedar Street/Meijer Driveway

The intersection of Kipp Road and Cedar Street/Meijer is controlled with a traffic signal. The west approach on Kipp Road is five (5) lanes; with one (1) exclusive right turn lane, one (1) thru lane, one (1) left-thru lane and two (2) outbound lanes. The east approach on Kipp Road has four (4) lanes; one (1) thru-right lane, one (1) left-thru lane and two (2) outbound lanes. The north approach on Cedar Street has three (3) lanes; with one (1) exclusive left turn lane, one (1) thru-right lane and one (1) outbound lane. The south approach on the Meijer Driveway has three (3) lanes; with one (1) exclusive left turn lane, one (1) thru-right lane and one (1) outbound lane. There are marked pedestrian crosswalks on the north, south



and west approaches with pedestrian crossing signals. There are sidewalks on the east and west side of Cedar Street, and a sidewalk on the north side of Kipp Road between Cedar Street and Jefferson Street.

Kipp Road and Hull Road/Jefferson Street

The intersection of Kipp Road and Hull Road/Jefferson Street is controlled with a traffic signal. The east and west approaches on Kipp Road have four (4) lanes; with one (1) thru-right lane, one (1) left-thru lane and two (2) outbound lanes. The north and south approaches on Hull Road and Jefferson Street have three (3) lanes; with one (1) exclusive left turn lane, one (1) thru-right lane and one (1) outbound lane. There are marked pedestrian crosswalks on the north, south and west approaches with pedestrian crossing signals. There is a sidewalk on the north side of Kipp Road between Cedar Street and Jefferson Street and also on the north side of Kipp Road east of Jefferson Street.

LAND USE

The surrounding land use is rural residential and farm land with US-127 to the immediate east of the site. Land uses around the US-127 interchange include various commercial entities such as gas stations, banks, and a Meijer store.



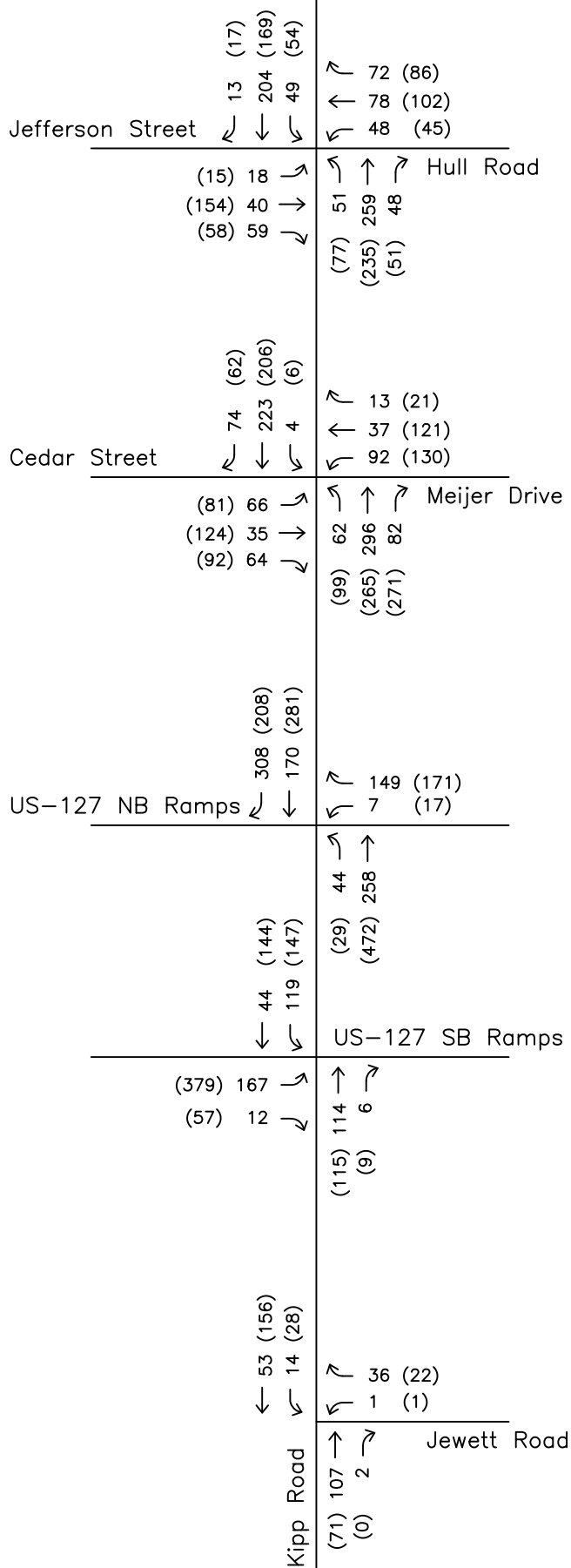
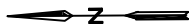
EXISTING TRAFFIC VOLUMES

TEA, Inc. conducted vehicle counts during the midweek, of a non-holiday week in the month of November, 2017, at the following locations:

- Kipp Road and Jewett Road
- Kipp Road and US-127 Southbound Off Ramp
- Kipp Road and US-127 Northbound Off Ramp
- Kipp Road and Cedar Street/Meijer Driveway
- Kipp Road and Hull Road/Jefferson Street

The existing weekday AM and PM peak hour traffic volumes are 7:30 – 8:30 AM and 4:45 – 5:45 PM at the key locations, respectively. The existing volumes are illustrated in **Figure 1**.





TRAFFIC ENGINEERING
ASSOCIATES, INC.
PO Box 100
Saranac, MI 48881
PHONE: (517) 627-6028
FAX: (517) 627-6040

LEGEND

XXX	AM	Pk	Hr	(7:30-8:30 AM)	Volumes
(XXX)	PM	Pk	Hr	(4:45-5:45 PM)	Volumes

FIGURE 1: Existing Traffic – Peak Hours

DATE: April, 2018

SCALE: NTS

PAGE: 9

LEVEL OF SERVICE ANALYSIS FOR EXISTING TRAFFIC

The critical intersections defined for this study were analyzed according to the methodologies published in the most recent edition of the *Highway Capacity Manual*. The analysis determines the “Level of Service” of the intersections and is based on factors such as the number and types of lanes, signal timing, traffic volumes, pedestrian activity, etc. The level of service (LOS) is defined by average vehicle delay in seconds created by a traffic control device for a given traffic movement or intersection approach.

Level of Service	Delay per Vehicle (seconds)	
	Non-Signalized	Signalized
A	< 10	<10
B	10 to 15	10 to 20
C	15 to 25	20 to 35
D	25 to 35	35 to 55
E	35 to 50	55 to 80
F	> 50	> 80

Levels of Service are expressed in a range from “A” to “F,” with “A” being the highest LOS and “F” representing the lowest LOS. Level of service “D” is considered the minimum acceptable LOS in an urban area.

The above table shows the thresholds for Levels of Service “A” through “F” for non-signalized and signalized intersections, respectively.

All Level of Service computations contained in this report were based upon the Synchro software package which is approved by the Michigan Department of Transportation (MDOT). Delay per vehicle includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay.

The Level of Service analysis for existing traffic at the subject intersections during the peak hours is summarized in **Table 1**.

All existing turning movements at the studied intersections operate at an acceptable level of service (LOS D or better) except for the following;

- During the PM peak hour, the southbound left turn from the US-127 off-ramp onto eastbound Kipp Road has a level of service F with a vehicle delay of 139.3 seconds.
- During the PM peak hour, the northbound left turn from the Meijer Driveway onto westbound Kipp Road has a level of service F with a vehicle delay of 92.4 seconds.

A review of the Synchro Simulation model at the intersection of Kipp Road and the southbound US-127 off-ramp during the PM peak hour shows a significant difference in the vehicle delay. The simulation model shows a vehicle delay of 16.5 seconds. The vehicle delay was based on five (5) simulated runs in the software.



Table 1
Level of Service (LOS) Summary
Existing Traffic

Location	Movement	Weekday AM Peak Hour		Weekday PM Peak Hour	
		Avg. Delay	LOS	Avg. Delay	LOS
Kipp Road and Jewett Road	EB Thru-Right	0.0	Free	0.0	Free
	WB Left-Right	7.7	A	7.4	A
	NB Left-Right	9.5	A	9.1	A
	Intersection	2.2	A	1.7	A
Kipp Road and US-127 Southbound Off Ramp	EB Thru-Right	0.0	Free	0.0	Free
	WB Thru	0.0	Free	0.0	Free
	WB Left	8.0	A	7.9	A
	SB Left	23.8	C	<u>139.3</u>	<u>F</u>
	SB Right	8.7	A	9.4	A
	Intersection	10.7	B	<u>67.7</u>	<u>F</u>
Kipp Road and US-127 Northbound Off Ramp	EB Left	7.9	A	8.0	A
	EB Thru	0.0	Free	0.0	Free
	WB Thru	0.0	Free	0.0	Free
	WB Right	0.0	Free	0.0	Free
	NB Left	14.8	B	19.6	C
	NB Right	12.3	B	16.2	C
	Intersection	2.3	A	2.8	A

Note: Delay = Average control delay per vehicle in seconds.
LOS = Level of Service



Table 1 (continued)
Level of Service (LOS) Summary
Existing Traffic

Location	Movement	Weekday AM Peak Hour		Weekday PM Peak Hour	
		Avg. Delay	LOS	Avg. Delay	LOS
Kipp Road and Cedar Street/Meijer Driveway	EB Left-Thru	22.9	C	26.2	C
	EB Right	4.9	A	5.3	A
	WB Left-Thru-Right	17.2	B	17.8	B
	NB Left	48.9	D	<u>92.4</u>	<u>F</u>
	NB Thru-Right	27.1	C	32.0	C
	SB Left	40.3	D	36.1	D
	SB Thru-Right	17.6	B	37.4	D
	Intersection	22.5	C	29.6	C
Kipp Road and Hull Road/Jefferson Street	EB Left-Thru-Right	6.3	A	6.4	A
	WB Left-Thru-Right	27.3	C	26.8	C
	NB Left	38.0	D	38.1	D
	NB Thru-Right	36.5	D	31.6	C
	SB Left	34.6	C	29.3	C
	SB Thru-Right	18.9	B	42.0	D
	Intersection	19.5	B	24.5	C

Note: Delay = Average control delay per vehicle in seconds.
LOS = Level of Service



LEVEL OF SERVICE ANALYSIS FOR EXISTING MITIGATED TRAFFIC

The Ingham County Road Department has plans to change the timing and phasing at the intersection of Kipp Road and Cedar Street/Meijer Driveway intersection in the spring of 2018. As this change will be in affect before the proposed Sleep Inn – Mainstay Hotel is completed and open for business in the summer of 2019, the existing mitigated traffic for this intersection shows the proposed new timing and phasing.

The Level of Service analysis for existing mitigated traffic at the intersection of Kipp Road and Cedar Street/Meijer Driveway during the AM and PM peak hours is summarized in **Table 2**. All existing mitigated turning movements at the studied intersection are projected to operate at an acceptable level of service (LOS D or better) during the AM and PM peak hours.

With the installation of the mitigated traffic signal timing, the existing level of service and vehicle delays for the northbound left turn from the Meijer driveway will be significantly improved. The proposed new timing and phasing for this intersection will be considered existing conditions for the purposes of this traffic study.



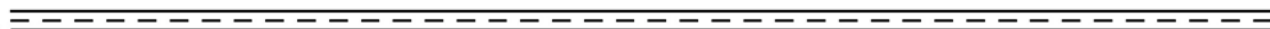
Table 2
Level of Service (LOS) Summary
Existing Mitigated Traffic

Location	Movement	Weekday AM Peak Hour		Weekday PM Peak Hour	
		Avg. Delay	LOS	Avg. Delay	LOS
Kipp Road and Cedar Street/Meijer Driveway	EB Left-Thru-Right	23.6	C	24.8	C
	EB Right	1.3	A	5.4	A
	WB Left-Thru-Right	50.3	D	26.8	C
	NB Left	34.3	C	40.3	D
	NB Thru-Right	34.6	C	38.1	D
	SB Left	30.4	C	22.2	C
	SB Thru-Right	23.4	C	40.0	D
	Intersection	31.4	C	26.6	C

Note: Delay = Average control delay per vehicle in seconds.
LOS = Level of Service



BACKGROUND CONDITIONS



BACKGROUND TRAFFIC VOLUMES – GROWTH RELATED

Background traffic represents future volumes without the traffic generated by the proposed Sleep Inn – Mainstay Hotel. The target year for completion is the summer of 2019; therefore, an eighteen (18) month growth rate was applied to the existing traffic volumes.

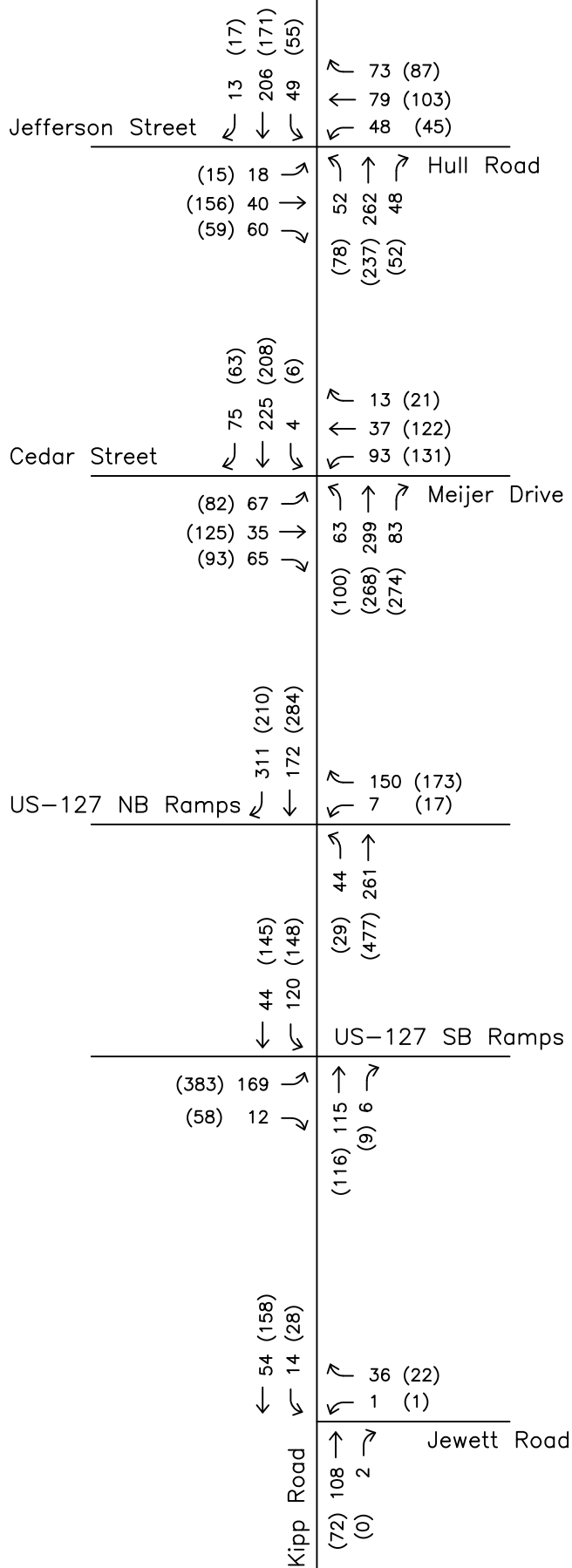
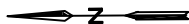
According to the US Census Bureau, the total population growth for the City of Mason from 2010 to 2016 is one point seven percent (1.7%); and the total population growth for Ingham County is two point five percent (2.5). Therefore, using the greater population growth for Ingham County, an annual exponential growth rate of zero point four two percent (0.42%) was used for the background growth period to project background traffic to the build out date for the summer of 2019 (1.5 years).

The proposed growth related background weekday AM and PM peak hour traffic volumes are illustrated in **Figure 2**.

BACKGROUND TRAFFIC VOLUMES – DEVELOPMENT RELATED

There were no new developments identified by the City of Mason Planning Department in the immediate area that would influence the background traffic for the proposed Sleep Inn – Mainstay Hotel; therefore, no background developments were included in the study.





TRAFFIC ENGINEERING
ASSOCIATES, INC.
PO Box 100
Saranac, MI 49881
PHONE: (517) 627-6028
FAX: (517) 627-6040

LEGEND

XXX	AM	Pk	Hr	(7:30-8:30 AM)	Volumes
(XXX)	PM	Pk	Hr	(4:45-5:45 PM)	Volumes

FIGURE 2: Background Traffic – Peak Hours

DATE: April, 2018

SCALE: NTS

LEVEL OF SERVICE ANALYSIS FOR BACKGROUND TRAFFIC

The level of service analysis for background 2019 traffic is summarized in **Table 3**. All existing roadway geometrics and traffic control devices were utilized for the background analysis. Under background conditions, it is anticipated that all movements will continue to operate at a good level of service (LOS D or better), except for the following;

- During the PM peak hour, the southbound left turn from the US-127 off-ramp onto eastbound Kipp Road is projected to have a level of service F with a vehicle delay of 148.7 seconds, an increase of 9.4 seconds from existing conditions.

A review of the Synchro Simulation model at the intersection of Kipp Road and the southbound US-127 off-ramp during the PM peak hour shows a significant difference in the vehicle delay. The simulation model shows a vehicle delay of 16.7 seconds.



Table 3
Level of Service (LOS) Summary
Background Traffic

Location	Movement	Weekday AM Peak Hour		Weekday PM Peak Hour	
		Avg. Delay	LOS	Avg. Delay	LOS
Kipp Road and Jewett Road	EB Thru-Right	0.0	Free	0.0	Free
	WB Left-Right	7.7	A	7.5	A
	NB Left-Right	9.5	A	9.1	A
	Intersection	2.2	A	1.7	A
Kipp Road and US-127 Southbound Off Ramp	EB Thru-Right	0.0	Free	0.0	Free
	WB Thru	0.0	Free	0.0	Free
	WB Left	8.0	A	7.9	A
	SB Left	24.3	C	<u>148.7</u>	<u>F</u>
	SB Right	8.7	A	9.4	A
	Intersection	10.8	B	<u>72.1</u>	<u>F</u>
Kipp Road and US-127 Northbound Off Ramp	EB Left	7.9	A	8.0	A
	EB Thru	0.0	Free	0.0	Free
	WB Thru	0.0	Free	0.0	Free
	WB Right	0.0	Free	0.0	Free
	NB Left	14.9	B	19.8	C
	NB Right	12.4	B	16.4	C
	Intersection	2.3	A	2.8	A

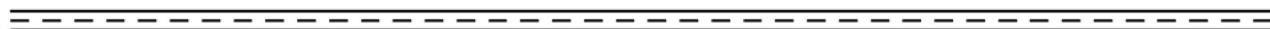
Note: Delay = Average control delay per vehicle in seconds.
LOS = Level of Service

Table 3 (continued)
Level of Service (LOS) Summary
Background Traffic

Location	Movement	Weekday AM Peak Hour		Weekday PM Peak Hour	
		Avg. Delay	LOS	Avg. Delay	LOS
Kipp Road and Cedar Street/Meijer Driveway	EB Left-Thru	23.7	C	25.1	C
	EB Right	1.3	A	5.4	A
	WB Left-Thru-Right	50.5	D	27.0	C
	NB Left	34.3	C	40.4	D
	NB Thru-Right	34.6	C	38.0	D
	SB Left	30.4	C	22.1	C
	SB Thru-Right	23.6	C	40.1	D
	Intersection	31.6	C	26.7	C
Kipp Road and Hull Road/Jefferson Street	EB Left-Thru-Right	12.9	B	11.7	B
	WB Left-Thru-Right	27.3	C	26.8	C
	NB Left	37.9	D	38.5	D
	NB Thru-Right	36.7	D	31.7	C
	SB Left	34.5	C	29.3	C
	SB Thru-Right	18.9	B	42.0	D
	Intersection	22.3	C	26.3	C

Note: Delay = Average control delay per vehicle in seconds.
LOS = Level of Service

FUTURE CONDITIONS



SITE TRAFFIC GENERATION

The trip generation rates for the proposed Sleep Inn – Mainstay Hotel were derived from the ITE TRIP GENERATION MANUAL (10th edition). The proposed site is projected to have 72 total rooms, of which 37 are expected to be regular hotel rooms and 35 will be suites. For the purposes of this study, a comparison was conducted comparing the trip generation for a regular hotel and an all-suites hotel. The greater trip generator was used for this study.

The ITE trip generation rates for Hotel (Land Use Code 310) were selected to represent the proposed 72 hotel rooms. The ITE description of Hotel is as follows:

A hotel is a place of lodging that provides sleeping accommodations and supporting facilities such as restaurants, cocktail lounges, meeting and banquet rooms or convention facilities, limited recreational facilities (pool, fitness room), and/or other retail service shops.

The ITE trip generation rates for All Suites Hotel (Land Use Code 311) were selected to represent the proposed 72 hotel rooms. The ITE description of All Suites Hotel is as follows:

An all-suites hotel is a place of lodging that provides sleeping accommodations, a small restaurant and lounge, and small amounts of meeting space. Each suite includes a sitting room and separate bedroom; limited kitchen facilities are provided within the suite.

A review of the two trip generations, as summarized in **Table 4**, shows that the trip generation for a hotel with 72 regular rooms generated the highest trip volumes. It is projected that the proposed Sleep Inn – Mainstay Development will generate 31 vehicle trips in the AM peak hour, 28 vehicle trips in the PM peak hour, and 386 weekday trips.



Table 4
Vehicle Trip Generation Summary
Sleep Inn – Mainstay Development

ITE Code	Hotel (310)	All Suites Hotel (311)
Size	72 Rooms	72 Rooms
AM Peak Hour Trips	31	24
In	18	13
Out	13	11
PM Peak Hour Trips	28	18
In	14	9
Out	14	9
Weekday Daily Trips	386	255



SITE TRAFFIC DISTRIBUTION

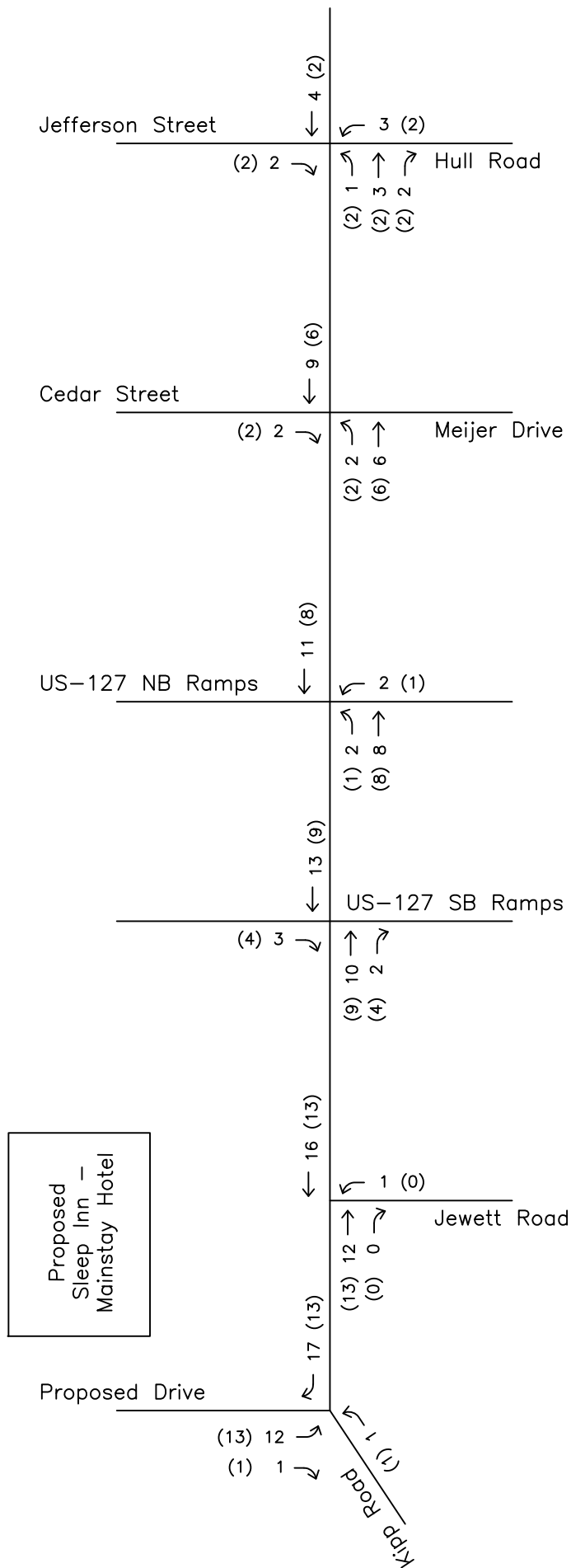
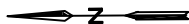
Traffic distribution for the proposed Sleep Inn – Mainstay Hotel development was distributed based on the surrounding roadway patterns. The distribution for the hotel generated traffic is as follows.

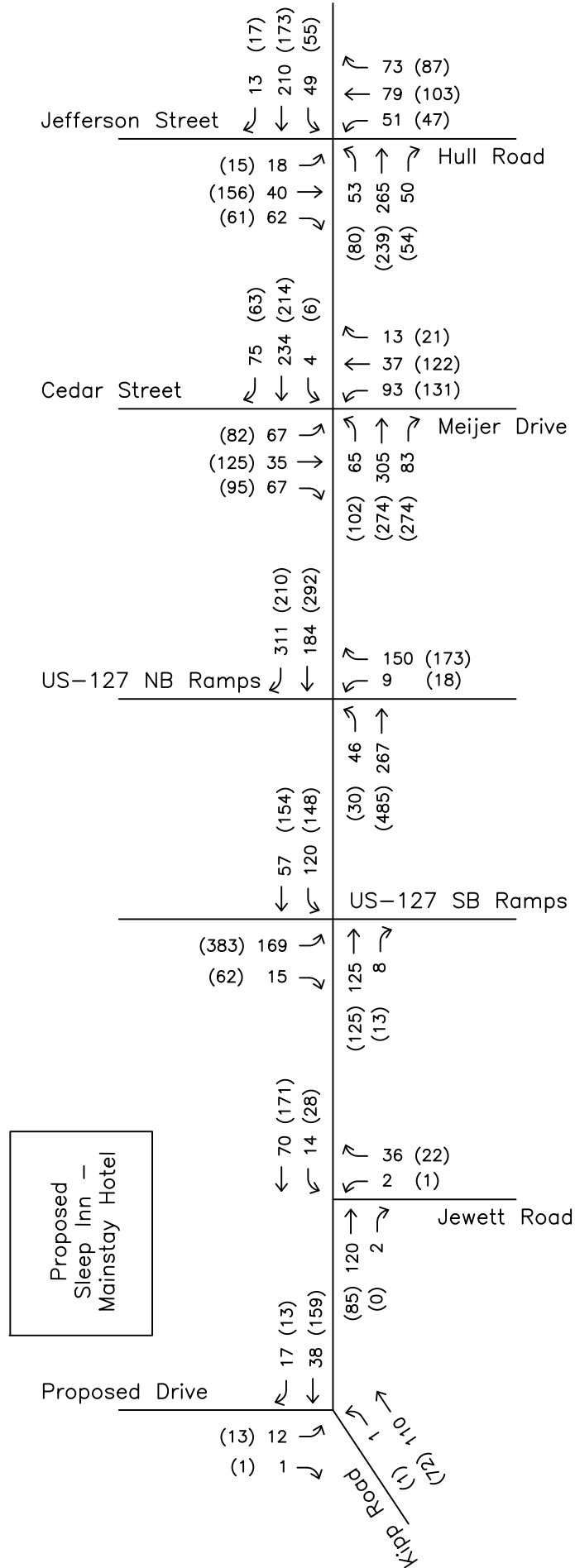
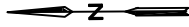
Direction of Approach and Departure	AM Peak Hour	PM Peak Hour
To/From the WEST on Kipp Road	9%	4%
To/From the EAST on Kipp Road	22%	14%
To/From the SOUTH on Jewett Road	3%	1%
To/From the NORTH on US-127 SB Off-Ramp	15%	26%
To/From the SOUTH on US-127 NB Off-Ramp	13%	11%
To/From the NORTH on Cedar Street	13%	17%
To/From the NORTH on Jefferson Street	9%	13%
To/From the SOUTH on Hull Road	16%	14%

The estimated site generated traffic for the proposed Sleep Inn – Mainstay Hotel development during the AM and PM peak hours is illustrated in **Figure 3**.

Adding the project site traffic (Figure 3) to the background traffic (Figure 2) generates the total anticipated future traffic which is displayed in **Figure 4**.







LEVEL OF SERVICE ANALYSIS FOR FUTURE TRAFFIC

The level of service analysis for future traffic is summarized in **Table 5**. Comparing future level of service conditions to background level of service conditions determines the impact that can be expected from the addition of traffic generated from the Sleep Inn – Mainstay Hotel development.

All background geometrics and traffic control were utilized for the future conditions. The proposed new driveway was modeled as a single lane with full access entering and exiting. It is anticipated that all movements will operate at an acceptable level of service (LOS D or better) except for the following movements;

- During the PM peak hour, the southbound left turn from the US-127 off-ramp onto eastbound Kipp Road is expected to have a level of service F with a vehicle delay of 164.6 seconds, an increase of 15.9 seconds from background conditions.

A review of the Synchro Simulation model at the intersection of Kipp Road and the southbound US-127 off-ramp during the PM peak hour shows a significant difference in the vehicle delay. The simulation model shows a vehicle delay of 17.2 seconds.



Table 5
Level of Service (LOS) Summary
Future Traffic

Location	Movement	Weekday AM Peak Hour		Weekday PM Peak Hour	
		Avg. Delay	LOS	Avg. Delay	LOS
Kipp Road and Jewett Road	EB Thru-Right	0.0	Free	0.0	Free
	WB Left-Right	7.7	A	7.5	A
	NB Left-Right	9.7	A	9.2	A
	Intersection	2.0	A	1.6	A
Kipp Road and US-127 Southbound Off Ramp	EB Thru-Right	0.0	Free	0.0	Free
	WB Thru	8.1	A	7.9	A
	WB Left	0.0	Free	0.0	Free
	SB Left	26.5	D	<u>164.6</u>	<u>F</u>
	SB Right	8.8	A	9.5	A
	Intersection	11.0	B	<u>77.5</u>	<u>F</u>
Kipp Road and US-127 Northbound Off Ramp	EB Left	7.9	A	8.1	A
	EB Thru	0.0	Free	0.0	Free
	WB Thru	0.0	Free	0.0	Free
	WB Right	0.0	Free	0.0	Free
	NB Left	15.5	C	20.4	C
	NB Right	12.5	B	16.7	C
	Intersection	2.4	A	2.8	A

Note: Delay = Average control delay per vehicle in seconds.
LOS = Level of Service



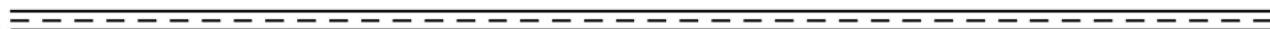
Table 5 (continued)
Level of Service (LOS) Summary
Future Traffic

Location	Movement	Weekday AM Peak Hour		Weekday PM Peak Hour	
		Avg. Delay	LOS	Avg. Delay	LOS
Kipp Road and Cedar Street/Meijer Driveway	EB Left-Thru	23.8	C	31.5	C
	EB Right	1.3	A	6.8	A
	WB Left-Thru-Right	50.7	D	49.6	D
	NB Left	34.3	C	40.2	D
	NB Thru-Right	34.6	C	38.3	D
	SB Left	30.4	C	23.6	C
	SB Thru-Right	23.1	C	48.0	D
	Intersection	31.7	C	34.3	C
Kipp Road and Hull Road/Jefferson Street	EB Left-Thru-Right	12.9	B	11.2	B
	WB Left-Thru-Right	27.4	C	26.9	C
	NB Left	38.5	D	38.6	D
	NB Thru-Right	36.7	D	31.2	C
	SB Left	34.5	C	29.0	C
	SB Thru-Right	18.5	B	42.0	D
	Intersection	22.4	C	26.1	C
Kipp Road and Hotel Driveway	EB Left-Thru	0.1	A	0.0	Free
	WB Thru-Right	0.0	Free	10.0	A
	SB Left-Right	9.8	A	0.1	A
	Intersection	0.5	A	0.5	A

Note: Delay = Average control delay per vehicle in seconds.
LOS = Level of Service



SIGNIFICANT FINDINGS



INTERSECTION IMPROVEMENT CONSIDERATIONS

Jewett Road and Kipp Road

There are not expected to be any significant changes to the level of service or the vehicle delay as a result of the proposed new Sleep Inn – Mainstay Hotel development. There are no recommended improvements for this intersection.

US-127 Southbound Off Ramp and Kipp Road

The vehicle delays experienced at this intersection during the PM peak hour are already existing. The addition of the future traffic generated by the proposed Sleep Inn – Mainstay Hotel development are not projected to create any significant changes to the level of service or the vehicle delay. There are no recommended improvements for this intersection.

US-127 Northbound Off Ramp and Kipp Road

There are not anticipated to be any significant changes to the level of service or the vehicle delay as a result of the proposed new Sleep Inn – Mainstay Hotel development. There are no recommended improvements for this intersection.

Cedar Street/Meijer Driveway and Kipp Road

There are not expected to be significant changes to the level of service or the vehicle delay as a result of the proposed new Sleep Inn – Mainstay Hotel development. There are no recommended improvements for this intersection. The current traffic signal timing and phasing is scheduled to be modified in the Spring of 2018; therefore, the new traffic signal timing and phasing was assumed to be existing for the future Summer of 2019 when the proposed Sleep Inn – Mainstay Hotel is open and operational.

Hull Road/Jefferson Street and Kipp Road

There are not projected to be significant changes to the level of service or the vehicle delay as a result of the proposed new Sleep Inn – Mainstay Hotel development. There are no recommended improvements for this intersection.



DRIVEWAY ANALYSIS FOR A TURN LANE OR TAPER

The Ingham County Road Department (ICRD) has roadway standards to determine the necessity of left turn passing flares or right turn lanes/tapers at commercial intersections. These standards are found in their “Rules, Standards and Procedures for Driveways, Banners and Parades Upon or Over Ingham County Road Commission Right of Way”. The proposed new driveway on Kipp Road is on the north side and just east of Jewett Road and will be a three-way intersection. Using the ICRD standards an analysis was conducted for the new proposed roadway on Kip Road.

Using the ICRD guidelines for left turn passing lanes, the results show that the project left turn volume does not meet the guidelines for a left turn passing lane at this intersection. Using the ICRD guidelines for right turn lanes or tapers, it shows that southbound Sleep Inn – Mainstay Hotel driveway does not meets the guidelines for a right turn taper at this intersection.



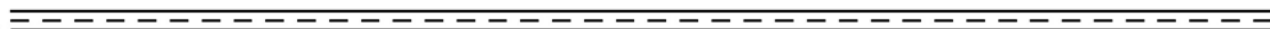
RECOMMENDATIONS

The findings of this study show that there are no recommendations to the existing road system as a result of the construction of the proposed Sleep Inn – Mainstay Hotel.

The traffic signal at the intersection of Cedar Street/Meijer Driveway and Kipp Road will be retimed during the spring of 2018; therefore, there are no recommendations to modify this traffic signal for the future development.

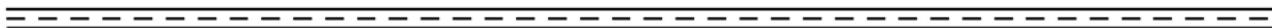


SUPPLEMENTAL INFORMATION



Supplemental Information

Site Plan
Census Data
Vehicle Volume Counts
Timing Plans
ICRD Guidelines for Right-Turn Lanes and Tapers
ICRD Guidelines for Left-Turn Passing Lanes
LOS Computations



REVISIONS
INITIALS
DATE
COMMENTS

MASON HOSPITALITY GROUP LLC

OWNER:
4205 CHALMERS DRIVE
SUITE #2
HOLT, MICHIGAN 48842
P: 517-694-0577

SLEEP INN - MAINSTAY HOTEL

NEW FACILITIES FOR:

WEST KIPP ROAD MASON, MICHIGAN

DATE: MARCH 8, 2018
DESIGNED BY:
CHECKED BY:
DRAWN BY:
PROJECT NO.: 17039
SCALE: HORIZ: 1" = 50'-0"
VERT: N/A

SITE PLAN LEGEND

-  LIGHT POLE - SITE LIGHTING TO COMPLY WITH THE STANDARDS OF SEC 94-177 (E)
-  STORM PIPE
-  WATER SERVICE
-  SANITARY
-  EASEMENT LINE
-  SETBACK LINE
-  PARKING SIGN

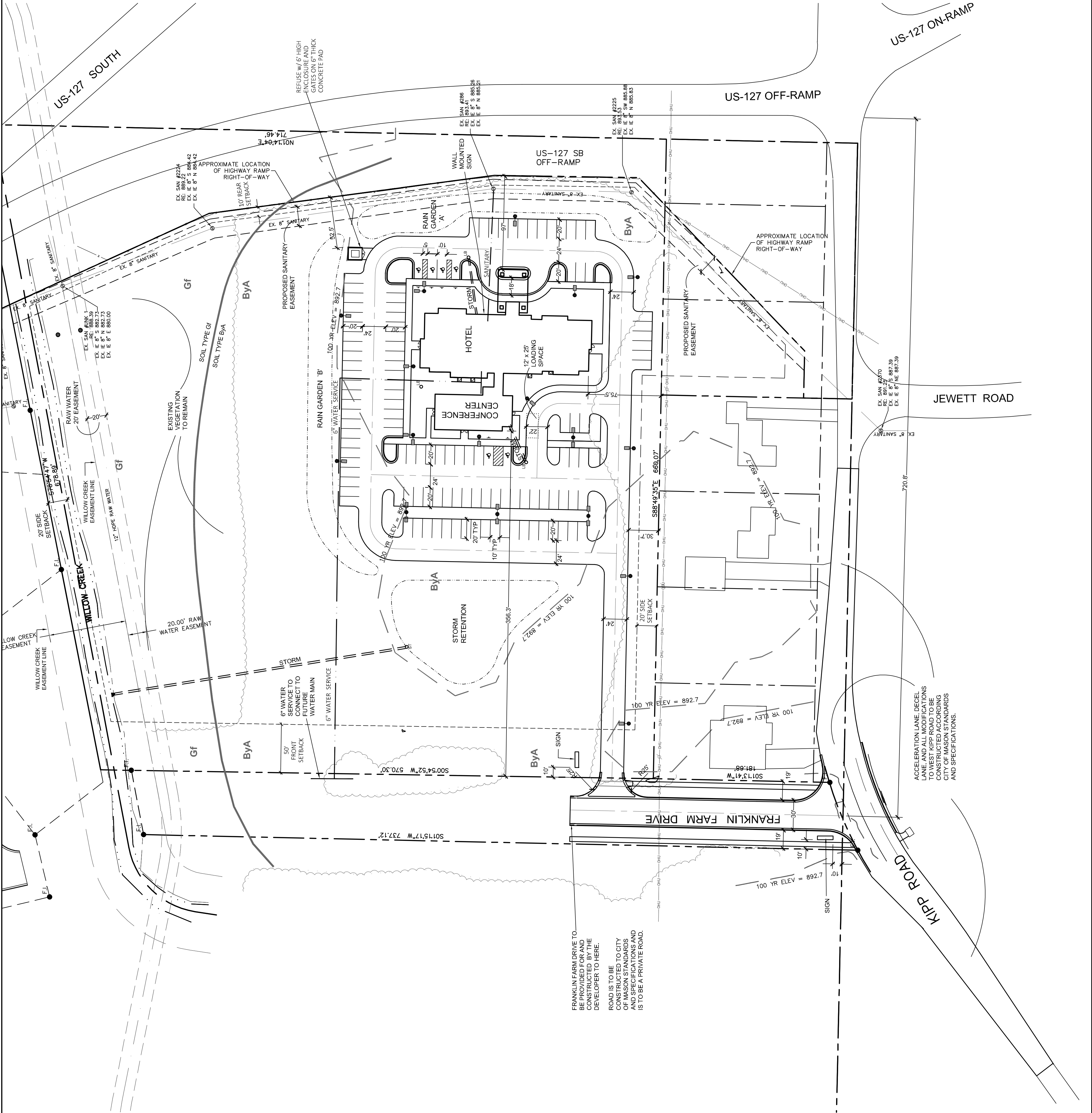
SITE PLAN NOTES:

1. PROJECT ZONING: C-2 GENERAL COMMERCIAL DISTRICT
2. EXISTING LAND USE: VACANT
3. PROPOSED LAND USE: HOTEL AND CONFERENCE CENTER
4. TOTAL SITE AREA (EXCLUDING US 127 ROW): 435,332 SFT (9.99 ACRES)
5. GROSS FLOOR AREA OF BUILDING: 13,966 SFT (0.32 ACRES)
HOTEL FLOOR AREA = 10,778 SFT
CONFERENCE CENTER FLOOR AREA = 3,188 SFT
6. PERCENTAGE OF BUILDING COVERAGE : 0.03%
7. BUILDING HEIGHT : 4 STORIES (45' MAXIMUM)
8. TOTAL IMPERVIOUS AREA : 100,995 SFT (2.31 ACRES)
9. NET AREA OF OPEN SPACE: 334,337 SFT (7.77 ACRES)
10. TOTAL AREA OF GRADING DISTURBANCE: 294,907 SFT (6.77 ACRES)
11. REQUIRED PARKING : HOTEL - 1 STALL PER BEDROOM
TOTAL NUMBER OF BEDROOMS = 84
12. TOTAL PROPOSED PARKING STALLS: 119 STALLS
(113) 10x20' STALLS
(6) BARRIER FREE STALLS
13. LANDSCAPE REQUIREMENTS:
PARKING LANDSCAPE = 100 SFT LANDSCAPED AREA AND 1 TREE PER 8 STALLS
SITE LANDSCAPE = 1 TREE / 10,000 SFT DISTURBED AREA
294,907 SFT / 10,000 = 29 TREES

LANDSCAPE BUFFER 'B' (SOUTH PROPERTY LINE) : 660 LFT (LESS US-127 ROW) = 592 LFT
TREES: 592 / 30 = 20 TREES
SHRUBS: 592 / 20 = 29.6 (4) = 118 SHRUBS

15. FLOODPLAIN ELEVATION = 892.7 PER FEMA MAPS.
16. EXISTING SOILS : SOIL TYPE B/A - BRADY SANDY LOAM 0 - 3% SLOPES
G/- GILFORD SANDY LOAM 0 - 2% SLOPES WITH GRAVELLY SUBSOIL
17. SIGNS : ALL FREESTANDING AND WALL MOUNTED SIGNS TO COMPLY WITH CHAPTER 58 OF THE ZONING ORDINANCE.

18. PARCEL TAX ID NUMBER : 33-19-10-08-378-002 & 33-19-10-09-378-001
19. PROPOSED GAS AND ELECTRIC SERVICE TO BE COORDINATED WITH UTILITY COMPANIES IN THE FINAL SUBMITTAL.



ACCELERATION LANE, DECEL LANE, AND ALL MODIFICATIONS TO WEST KIPP ROAD TO BE CONSTRUCTED ACCORDING TO THE MASSACHUSETTS STANDARDS AND SPECIFICATIONS.

FRANKLIN FARM DRIVE TO BE PROVIDED FOR AND CONSTRUCTED BY THE DEVELOPER TO HERE. ROAD IS TO BE CONSTRUCTED TO CITY OF MASON STANDARDS AND SPECIFICATIONS AND IS TO BE A PRIVATE ROAD.

US-127 ON-RAMP

US-127 OFF-RAMP

JEWETT ROAD

FRANKLIN FARM DRIVE

KIPP ROAD



Know what's below.
Call before you dig.

SITE LAYOUT PLAN

QuickFacts

Ingham County, Michigan; Mason city, Michigan

QuickFacts provides statistics for all states and counties, and for cities and towns with a *population of 5,000 or more*.

Table

All Topics	Ingham County, Michigan	Mason city, Michigan
Population estimates, July 1, 2017, (V2017)	290,186	NA
 PEOPLE		
Population		
Population estimates, July 1, 2017, (V2017)	290,186	NA
Population estimates, July 1, 2016, (V2016)	288,051	8,395
Population estimates base, April 1, 2010, (V2017)	280,891	NA
Population estimates base, April 1, 2010, (V2016)	280,891	8,252
Population, percent change - April 1, 2010 (estimates base) to July 1, 2017, (V2017)	3.3%	NA
Population, percent change - April 1, 2010 (estimates base) to July 1, 2016, (V2016)	2.5%	1.7%
Population, Census, April 1, 2010	280,895	8,252
Age and Sex		
Persons under 5 years, percent, July 1, 2016, (V2016)	5.6%	X
Persons under 5 years, percent, April 1, 2010	5.7%	5.2%
Persons under 18 years, percent, July 1, 2016, (V2016)	20.0%	X
Persons under 18 years, percent, April 1, 2010	20.9%	21.8%
Persons 65 years and over, percent, July 1, 2016, (V2016)	12.6%	X
Persons 65 years and over, percent, April 1, 2010	10.5%	13.5%
Female persons, percent, July 1, 2016, (V2016)	51.3%	X
Female persons, percent, April 1, 2010	51.4%	49.2%
Race and Hispanic Origin		
White alone, percent, July 1, 2016, (V2016) (a)	76.4%	X
Black or African American alone, percent, July 1, 2016, (V2016) (a)	12.2%	X
American Indian and Alaska Native alone, percent, July 1, 2016, (V2016) (a)	0.6%	X
Asian alone, percent, July 1, 2016, (V2016) (a)	6.7%	X
Native Hawaiian and Other Pacific Islander alone, percent, July 1, 2016, (V2016) (a)	0.1%	X
Two or More Races, percent, July 1, 2016, (V2016)	4.0%	X
Hispanic or Latino, percent, July 1, 2016, (V2016) (b)	7.7%	X
White alone, not Hispanic or Latino, percent, July 1, 2016, (V2016)	70.3%	X
Population Characteristics		
Veterans, 2012-2016	14,616	591
Foreign born persons, percent, 2012-2016	8.8%	2.4%
Housing		
Housing units, July 1, 2016, (V2016)	122,641	X
Housing units, April 1, 2010	121,281	3,574
Owner-occupied housing unit rate, 2012-2016	57.7%	59.7%
Median value of owner-occupied housing units, 2012-2016	\$119,100	\$115,800
Median selected monthly owner costs -with a mortgage, 2012-2016	\$1,225	\$1,275
Median selected monthly owner costs -without a mortgage, 2012-2016	\$518	\$595
Median gross rent, 2012-2016	\$809	\$875
Building permits, 2016	858	X
Families & Living Arrangements		
Households, 2012-2016	111,118	3,279
Persons per household, 2012-2016	2.39	2.35
Living in same house 1 year ago, percent of persons age 1 year+, 2012-2016	75.0%	77.2%
Language other than English spoken at home, percent of persons age 5 years+, 2012-2016	11.7%	3.4%
Education		
High school graduate or higher, percent of persons age 25 years+, 2012-2016	92.3%	93.6%

Traffic Engineering Associates, Inc.

PO Box 100, Saranac, MI 48881

517-627-6028

Location: Kipp Rd at Cedar St/ Meijer Dr
City/County: City of Mason
Weather: Cool
Counted By: TH

File Name : Kipp at Cedar - AM
Site Code : 11291703
Start Date : 11/29/2017
Page No : 1

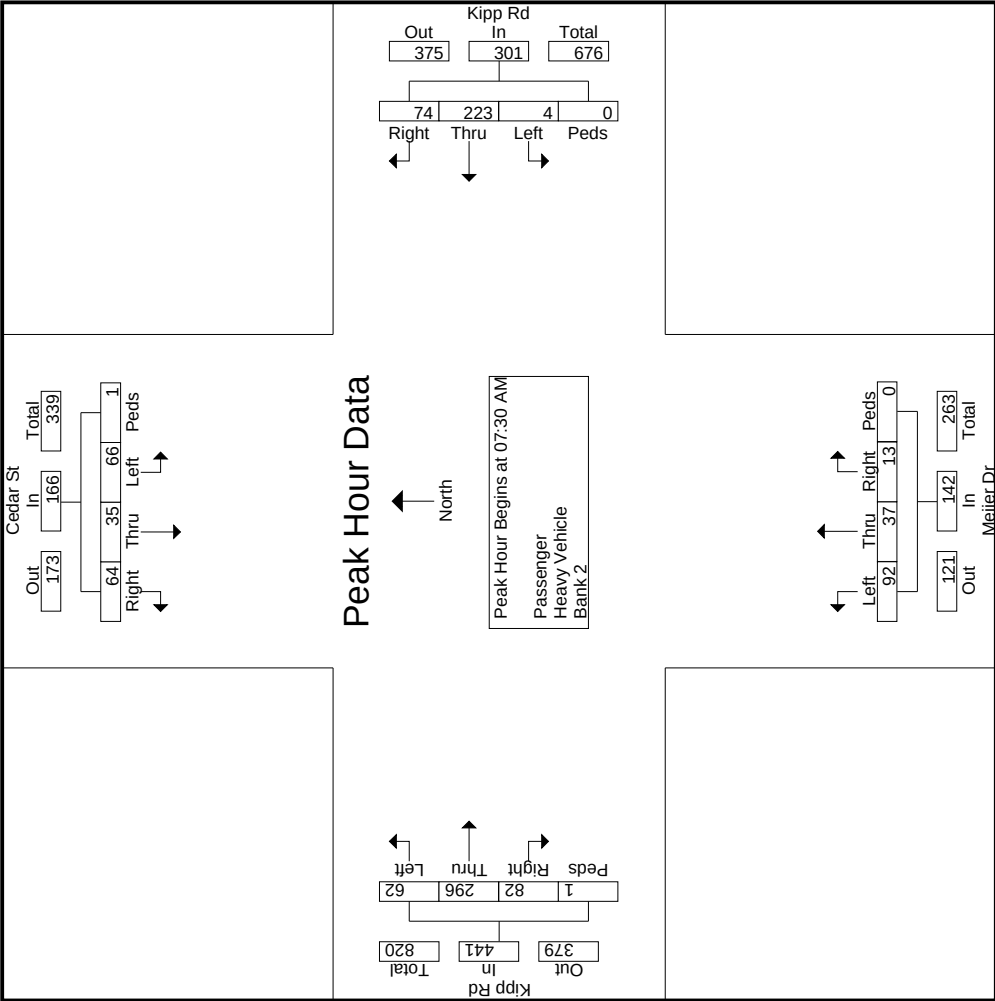
Groups Printed- Passenger - Heavy Vehicle - Bank 2

	Cedar St From North					Kipp Rd From East					Meijer Dr From South					Kipp Rd From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
07:00 AM	7	7	15	0	29	3	67	9	0	79	25	8	3	0	36	13	39	20	0	72	216
07:15 AM	8	5	17	0	30	0	83	13	0	96	28	8	0	0	36	18	63	42	0	123	285
07:30 AM	16	5	27	0	48	1	73	19	0	93	25	10	1	0	36	18	46	18	0	82	259
07:45 AM	20	10	15	0	45	0	44	13	0	57	24	6	3	0	33	23	70	27	0	120	255
Total	51	27	74	0	152	4	267	54	0	325	102	32	7	0	141	72	218	107	0	397	1015
08:00 AM	10	10	11	0	31	0	54	17	0	71	21	10	6	0	37	9	80	15	1	105	244
08:15 AM	20	10	11	1	42	3	52	25	0	80	22	11	3	0	36	12	100	22	0	134	292
08:30 AM	12	7	13	1	33	0	52	13	0	65	19	12	1	0	32	17	39	19	0	75	205
08:45 AM	9	11	9	0	29	2	35	12	0	49	12	6	1	0	19	11	24	14	0	49	146
Total	51	38	44	2	135	5	193	67	0	265	74	39	11	0	124	49	243	70	1	363	887
Grand Total	102	65	118	2	287	9	460	121	0	590	176	71	18	0	265	121	461	177	1	760	1902
Apprch %	35.5	22.6	41.1	0.7		1.5	78	20.5	0		66.4	26.8	6.8	0		15.9	60.7	23.3	0.1		
Total %	5.4	3.4	6.2	0.1	15.1	0.5	24.2	6.4	0	31	9.3	3.7	0.9	0	13.9	6.4	24.2	9.3	0.1	40	
Passenger	93	57	112	2	264	9	418	116	0	543	159	60	12	0	231	114	417	164	1	696	1734
% Passenger	91.2	87.7	94.9	100	92	100	90.9	95.9	0	92	90.3	84.5	66.7	0	87.2	94.2	90.5	92.7	100	91.6	91.2
Heavy Vehicle	9	8	6	0	23	0	42	5	0	47	17	11	6	0	34	7	44	13	0	64	168
% Heavy Vehicle	8.8	12.3	5.1	0	8	0	9.1	4.1	0	8	9.7	15.5	33.3	0	12.8	5.8	9.5	7.3	0	8.4	8.8
Bank 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bank 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	Cedar St From North					Kipp Rd From East					Meijer Dr From South					Kipp Rd From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	16	5	27	0	48	1	73	19	0	93	25	10	1	0	36	18	46	18	0	82	259
07:45 AM	20	10	15	0	45	0	44	13	0	57	24	6	3	0	33	23	70	27	0	120	255
08:00 AM	10	10	11	0	31	0	54	17	0	71	21	10	6	0	37	9	80	15	1	105	244
08:15 AM	20	10	11	1	42	3	52	25	0	80	22	11	3	0	36	12	100	22	0	134	292
Total Volume	66	35	64	1	166	4	223	74	0	301	92	37	13	0	142	62	296	82	1	441	1050
% App. Total	39.8	21.1	38.6	0.6		1.3	74.1	24.6	0		64.8	26.1	9.2	0		14.1	67.1	18.6	0.2		
PHF	.825	.875	.593	.250	.865	.333	.764	.740	.000	.809	.920	.841	.542	.000	.959	.674	.740	.759	.250	.823	.899

Location: Kipp Rd at Cedar St/ Meijer Dr
City/County: City of Mason
Weather: Cool
Counted By: TH

File Name : Kipp at Cedar - AM
Site Code : 11291703
Start Date : 11/29/2017
Page No : 2



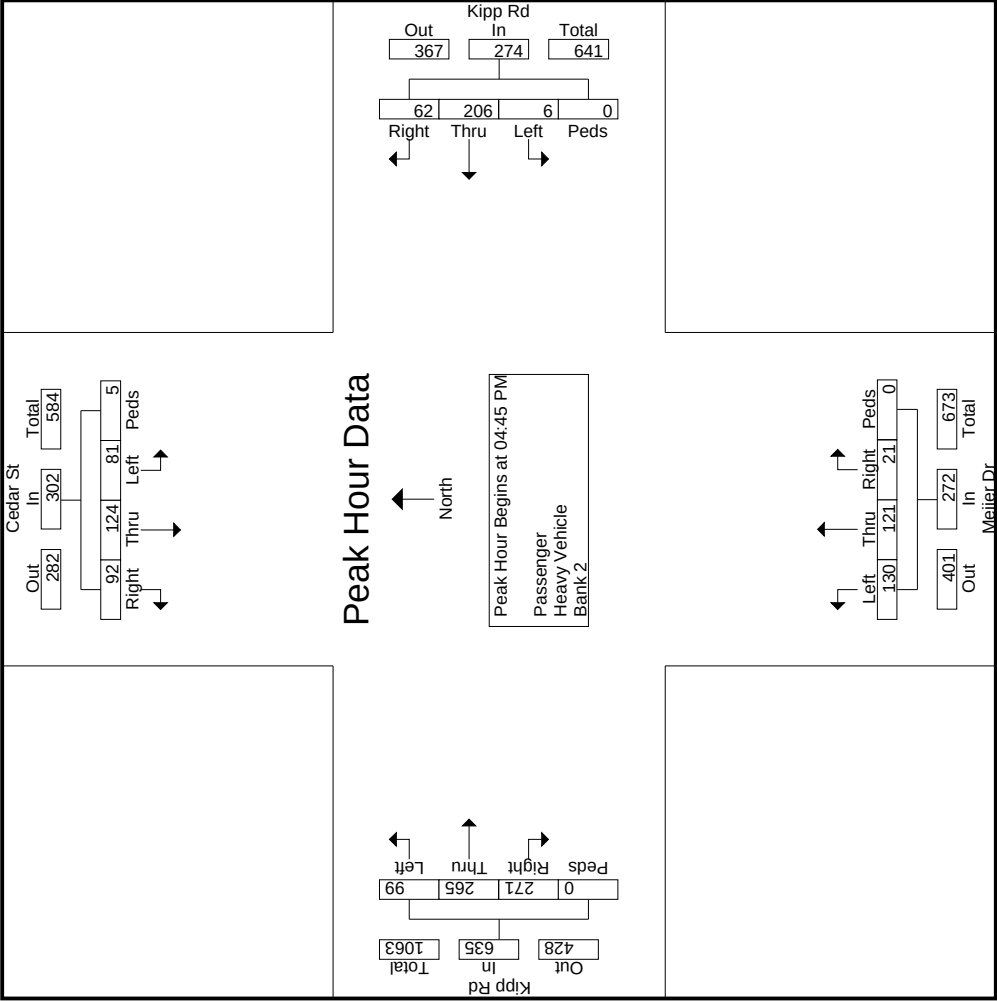
File Name : Kipp at Cedar - PM
Site Code : 11291703
Start Date : 11/29/2017
Page No : 1

	Cedar St From North						Kipp Rd From East						Meijer Dr From South						Kipp Rd From West							
Start Time	Left	Thru	Right	Peds	App. Total		Left	Thru	Right	Peds	App. Total		Left	Thru	Right	Peds	App. Total		Left	Thru	Right	Peds	App. Total		Int. Total	
04:00 PM	20	37	19	1	77								29	22	53	32	0	52		22	53	32	0	107		312
04:15 PM	15	29	14	2	60		1	49	15	1	66		33	32	6	0	71		27	54	58	0	139		336	
04:30 PM	12	37	19	0	68		0	48	16	0	64		31	30	3	0	64		25	56	46	0	127		323	
04:45 PM	20	35	18	0	73		1	40	17	0	58		41	25	4	0	70		27	72	62	0	161		362	
Total	67	138	70	3	278		2	198	63	1	264		134	109	14	0	257		101	235	198	0	534		1333	
05:00 PM	21	27	27	0	75		1	53	16	0	70		32	26	6	0	64		27	57	64	0	148		357	
05:15 PM	29	33	26	3	91		0	61	17	0	78		28	39	6	0	73		20	68	77	0	165		407	
05:30 PM	11	29	21	2	63		4	52	12	0	68		29	31	5	0	65		25	68	68	0	161		357	
05:45 PM	13	24	18	0	55		0	36	10	0	46		41	24	6	0	71		26	52	54	0	132		304	
Total	74	113	92	5	284		5	202	55	0	262		130	120	23	0	273		98	245	263	0	606		1425	
Grand Total	141	251	162	8	562		7	400	118	1	526		264	229	37	0	530		199	480	461	0	1140		2758	
Approch %	25.1	44.7	28.8	1.4			1.3	76	22.4	0.2			49.8	43.2	7	0			17.5	42.1	40.4	0				
Total %	5.1	9.1	5.9	0.3	20.4		0.3	14.5	4.3	0	19.1		9.6	8.3	1.3	0	19.2		7.2	17.4	16.7	0	41.3			
Passenger	134	246	158	8	546		6	374	114	1	495		257	227	37	0	521		196	447	453	0	1096		2658	
% Passenger	95	98	97.5	100	97.2		85.7	93.5	96.6	100	94.1		97.3	99.1	100	0	98.3		98.5	93.1	98.3	0	96.1		96.4	
Heavy Vehicle	7	5	4	0	16		1	26	4	0	31		7	2	0	0	9		3	33	8	0	44		100	
% Heavy Vehicle	5	2	2.5	0	2.8		14.3	6.5	3.4	0	5.9		2.7	0.9	0	0	1.7		1.5	6.9	1.7	0	3.9		3.6	
Bank 2	0	0	0	0	0		0	0	0	0	0		0	0	0	0	0		0	0	0	0	0		0	
% Bank 2	0	0	0	0	0		0	0	0	0	0		0	0	0	0	0		0	0	0	0	0		0	

	From North					From East					From South					From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:45 PM																					
04:45 PM	20	35	18	0	73	1	40	17	0	58	41	25	4	0	70	27	72	62	0	161	362
05:00 PM	21	27	27	0	75	1	53	16	0	70	32	26	6	0	64	27	57	64	0	148	357
05:15 PM	29	33	26	3	91	0	61	17	0	78	28	39	6	0	73	20	68	77	0	165	407
05:30 PM	11	29	21	2	63	4	52	12	0	68	29	31	5	0	65	25	68	68	0	161	357
Total Volume	81	124	92	5	302	6	206	62	0	274	130	121	21	0	272	99	265	271	0	635	1483
% App. Total	26.8	41.1	30.5	1.7		2.2	75.2	22.6	0		47.8	44.5	7.7	0		15.6	41.7	42.7	0		
PHF	.698	.886	.852	.417	.830	.375	.844	.912	.000	.878	.793	.776	.875	.000	.932	.917	.920	.880	.000	.962	.911

Location: Kipp Rd at Cedar St/Meijer Dr
City/County: City of Mason
Weather: Cool
Counted By: TH

File Name : Kipp at Cedar - PM
Site Code : 11291703
Start Date : 11/29/2017
Page No : 2



Location: Kipp Rd @ Jefferson St/Hull Rd
City/County: City of Mason
Weather: Cool
Counted By: DS

File Name : Kipp at Jefferson - AM
Site Code : 00112917
Start Date : 11/29/2017
Page No : 1

Groups Printed- Passenger - Heavy Vehicle - Bank 2

	Jefferson St From North					Kipp Rd From East					Hull Rd From South					Kipp Rd From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
07:00 AM	3	10	13	0	26	7	54	3	0	64	10	13	8	0	31	5	39	10	0	54	175
07:15 AM	2	10	27	0	39	8	56	1	0	65	9	19	8	0	36	11	44	11	0	66	206
07:30 AM	2	10	22	0	34	7	67	1	0	75	13	18	9	0	40	13	41	8	0	62	211
07:45 AM	5	9	11	0	25	18	46	2	0	66	9	28	12	1	50	13	49	11	0	73	214
Total	12	39	73	0	124	40	223	7	0	270	41	78	37	1	157	42	173	40	0	255	806
08:00 AM	7	14	15	0	36	11	45	0	0	56	12	16	18	0	46	16	58	18	0	92	230
08:15 AM	4	7	11	0	22	13	46	10	0	69	14	16	33	0	63	9	111	11	0	131	285
08:30 AM	6	15	5	0	26	14	64	5	0	83	8	14	14	0	36	11	58	4	0	73	218
08:45 AM	1	15	10	0	26	5	22	4	0	31	15	18	1	0	34	9	19	12	0	40	131
Total	18	51	41	0	110	43	177	19	0	239	49	64	66	0	179	45	246	45	0	336	864
Grand Total	30	90	114	0	234	83	400	26	0	509	90	142	103	1	336	87	419	85	0	591	1670
Approch %	12.8	38.5	48.7	0		16.3	78.6	5.1	0		26.8	42.3	30.7	0.3		14.7	70.9	14.4	0		
Total %	1.8	5.4	6.8	0	14	5	24	1.6	0	30.5	5.4	8.5	6.2	0.1	20.1	5.2	25.1	5.1	0	35.4	
Passenger	30	87	113	0	230	80	374	26	0	480	89	140	101	1	331	86	393	75	0	554	1595
% Passenger	100	96.7	99.1	0	98.3	96.4	93.5	100	0	94.3	98.9	98.6	98.1	100	98.5	98.9	93.8	88.2	0	93.7	95.5
Heavy Vehicle	0	3	1	0	4	3	26	0	0	29	1	2	2	0	5	1	26	10	0	37	75
% Heavy Vehicle																					
Bank 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bank 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	Jefferson St From North					Kipp Rd From East					Hull Rd From South					Kipp Rd From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:30 AM to 08:15 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	2	10	22				67			75											
07:45 AM	5	9	11	0	25	18	46	2	0	66	9	28	12	1	50	13	49	11	0	73	214
08:00 AM	7	14	15	0	36	11	45	0	0	56	12	16	18	0	46	16	58	18	0	92	230
08:15 AM	4	7	11	0	22	13	46	10	0	69	14	16	33	0	63	9	111	11	0	131	285
Total Volume	18	40	59	0	117	49	204	13	0	266	48	78	72	1	199	51	259	48	0	358	940
% App. Total	15.4	34.2	50.4	0		18.4	76.7	4.9	0		24.1	39.2	36.2	0.5		14.2	72.3	13.4	0		
PHF	.643	.714	.670	.000	.813	.681	.761	.325	.000	.887	.857	.696	.545	.250	.790	.797	.583	.667	.000	.683	.825

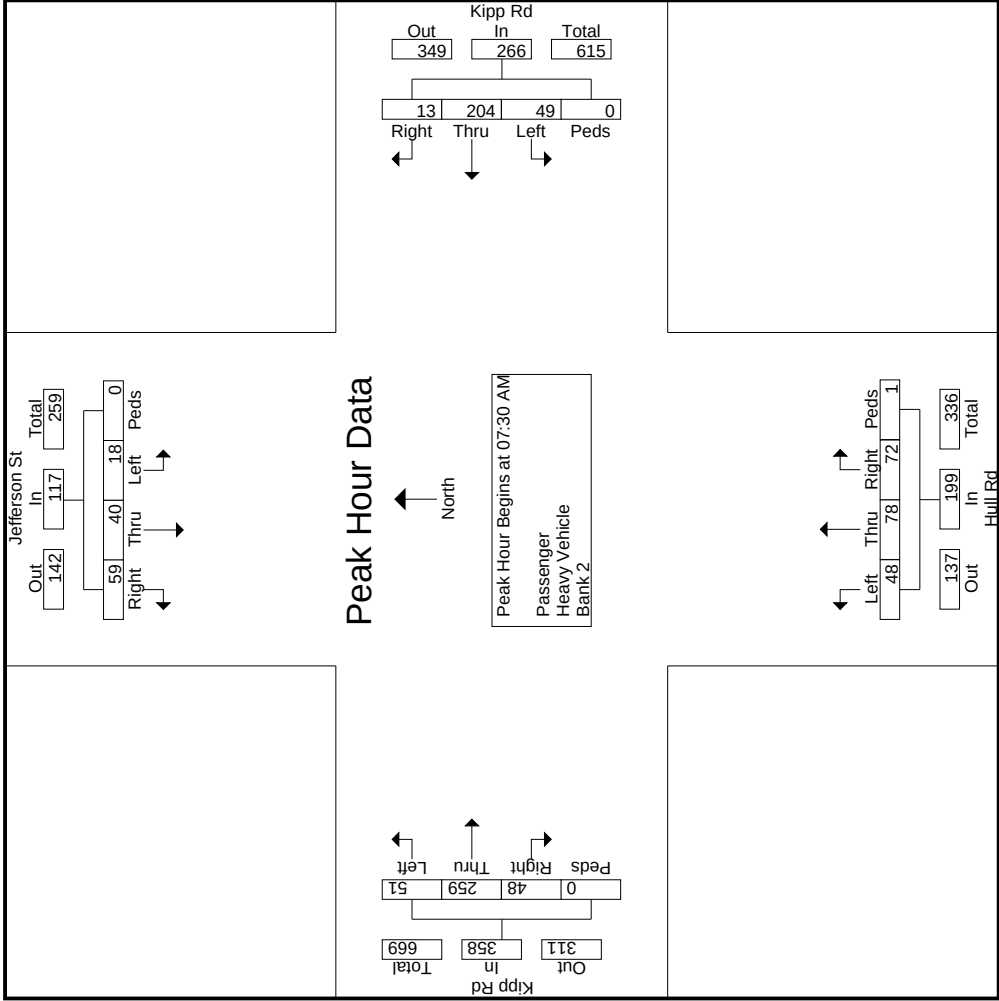
Peak Hour Analysis From 07:30 AM to 08:15 AM - Peak 1 of 1

Peak Hour for Entire Intersection Begins at 07:30 AM

PO Box 100
Saranac, MI 48881
517-627-6028

Location: Kipp Rd @ Jefferson St/Hull Rd
City/County: City of Mason
Weather: Cool
Counted By: DS

File Name : Kipp at Jefferson - AM
Site Code : 00112917
Start Date : 11/29/2017
Page No : 2



Traffic Engineering Associates, Inc.

PO Box 100, Saranac, MI 48881

517-627-6028

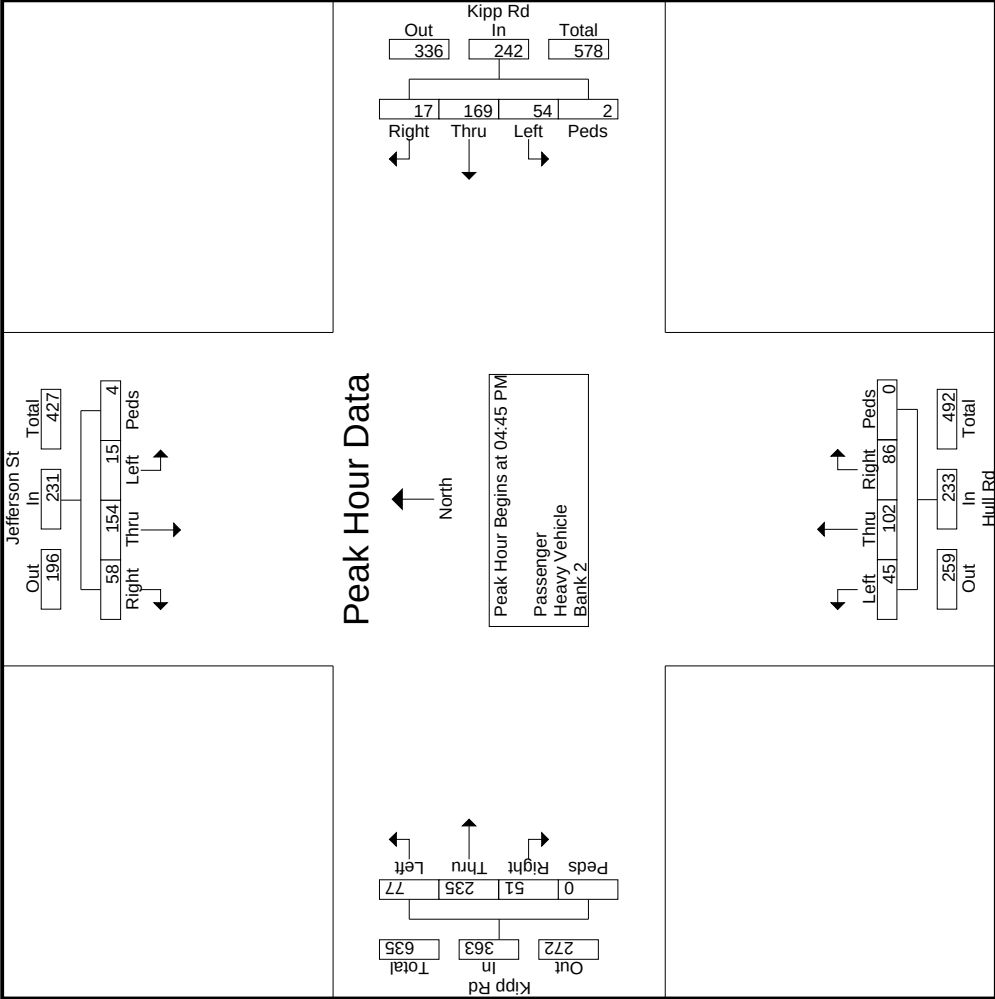
Location: Kipp Rd @ Jefferson St/Hull Rd
City/County: City of Mason
Weather: Cool
Counted By: DS

File Name : Kipp at Jefferson - PM
Site Code : 00112917
Start Date : 11/29/2017
Page No : 1

Groups Printed- Passenger - Heavy Vehicle - Bank 2

Start Time	Jefferson St From North					Kipp Rd From East					Hull Rd From South					Kipp Rd From West				
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total
	From North					From East					From South					From West				
04:00 PM	2	38	22	0	62	16	42	3	0	61	22	34	15	0	71	19	39	15	0	73
04:15 PM	6	38	16	0	60	12	31	5	0	48	17	26	11	0	54	21	41	13	0	75
04:30 PM	1	33	17	2	53	15	30	4	0	49	19	32	19	0	70	12	47	11	0	70
04:45 PM	5	33	10	0	48	15	35	4	0	54	12	20	24	0	56	23	60	12	0	95
Total	14	142	65	2	223	58	138	16	0	212	70	112	69	0	251	75	187	51	0	313
05:00 PM	3	40	13	0	56	13	47	6	0	66	12	33	14	0	59	17	52	14	0	83
05:15 PM	3	40	14	2	59	18	49	5	1	73	14	23	28	0	65	15	67	18	0	100
05:30 PM	4	41	21	2	68	8	38	2	1	49	7	26	20	0	53	22	56	7	0	85
05:45 PM	2	30	11	0	43	6	34	1	0	41	8	34	23	0	65	18	45	10	0	73
Total	12	151	59	4	226	45	168	14	2	229	41	116	85	0	242	72	220	49	0	341
Grand Total	26	293	124	6	449	103	306	30	2	441	111	228	154	0	493	147	407	100	0	654
Apprch %	5.8	65.3	27.6	1.3		23.4	69.4	6.8	0.5		22.5	46.2	31.2	0		22.5	62.2	15.3	0	
Total %	1.3	14.4	6.1	0.3	22	5.1	15	1.5	0.1	21.6	5.4	11.2	7.6	0	24.2	7.2	20	4.9	0	32.1
Passenger	26	292	123	6	447	103	290	30	2	425	107	226	154	0	487	147	386	97	0	630
% Passenger	100	99.7	99.2	100	99.6	100	94.8	100	100	96.4	96.4	99.1	100	0	98.8	100	94.8	97	0	96.3
Heavy Vehicle	0	1	1	0	2	0	16	0	0	16	4	2	0	0	6	0	21	3	0	24
% Heavy Vehicle	0	0.3	0.8	0	0.4	0	5.2	0	0	3.6	3.6	0.9	0	0	1.2	0	5.2	3	0	3.7
Bank 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bank 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	Jefferson St From North					Kipp Rd From East					Hull Rd From South					Kipp Rd From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:45 PM																					
04:45 PM	5	33	10	0	48	15	35	4	0	54	12	20	24	0	56	23	60	12	0	95	253
05:00 PM	3	40	13	0	56	13	47	6	0	66	12	33	14	0	59	17	52	14	0	83	264
05:15 PM	3	40	14	2	59	18	49	5	1	73	14	23	28	0	65	15	67	18	0	100	297
05:30 PM	4	41	21	2	68	8	38	2	1	49	7	26	20	0	53	22	56	7	0	85	255
Total Volume	15	154	58	4	231	54	169	17	2	242	45	102	86	0	233	77	235	51	0	363	1069
% App. Total	6.5	66.7	25.1	1.7		22.3	69.8	7	0.8		19.3	43.8	36.9	0		21.2	64.7	14	0		
PHF	.750	.939	.690	.500	.849	.750	.862	.708	.500	.829	.804	.773	.768	.000	.896	.837	.877	.708	.000		.908



Location: Kipp Rd at Jewett Rd
City/County: City of Mason
Weather: Cool
Counted By: TH

File Name : Kipp at Jewett - AM
Site Code : 11301705
Start Date : 11/30/2017
Page No : 1

Groups Printed- Passenger - Heavy Vehicle - Bank 2

Grouped Traffic Data: Passenger, Heavy Vehicle, Bank 2																															
From North						Kipp Rd						Jewett Rd						Kipp Rd													
Start Time	Left		Thru		Right		Peds		App. Total		Left		Thru		Right		Peds		App. Total		Left		Thru		Right		Peds		App. Total		Int. Total
07:00 AM	0	0	0	0	0	0	0	0	0	10	0	0	0	6	0	0	41	1	0	42	58										
07:15 AM	0	0	0	0	0	0	0	0	0	18	1	0	14	0	15	0	84	0	0	84	117										
07:30 AM	0	0	0	0	0	0	0	0	0	28	0	0	14	0	14	0	40	0	0	40	82										
07:45 AM	0	0	0	0	0	0	0	0	0	14	0	0	7	0	7	0	21	1	0	22	43										
Total	0	0	0	0	0	0	0	0	0	70	1	0	41	0	42	0	186	2	0	188	300										
08:00 AM	0	0	0	0	0	0	0	0	0	11	1	0	10	0	11	0	24	0	0	24	46										
08:15 AM	0	0	0	0	0	0	0	0	0	14	0	0	5	0	5	0	22	1	0	23	42										
08:30 AM	0	0	0	0	0	0	0	0	0	18	0	0	8	0	8	0	19	0	0	19	45										
08:45 AM	0	0	0	0	0	0	0	0	0	23	0	0	1	0	1	0	21	0	0	21	45										
Total	0	0	0	0	0	0	0	0	0	66	1	0	24	0	25	0	86	1	0	87	178										
Grand Total	0	0	0	0	0	0	0	0	0	136	2	0	65	0	67	0	272	3	0	275	478										
Approch %	0	0	0	0	0	0	0	0	0	0	25.7	74.3	0	97	0	98.9	1.1	0	0	0	0										
Total %	0	0	0	0	0	0	0	0	0	28.5	0.4	0	13.6	0	14	0	56.9	0.6	0	57.5	0										
Passenger	0	0	0	0	0	0	0	0	0	120	2	0	58	0	60	0	263	3	0	266	446										
% Passenger	0	0	0	0	0	0	0	0	0	88.2	100	0	89.2	0	89.6	0	96.7	100	0	96.7	93.3										
Heavy Vehicle	0	0	0	0	0	0	0	0	0	16	0	0	7	0	7	0	9	0	0	9	32										
% Heavy Vehicle	0	0	0	0	0	0	0	0	0	11.8	0	0	10.8	0	11.4	0	3.3	0	0	3.3	7.7										
Bank 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0										
% Bank 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0										

	From North					Kipp Rd From East					Jewett Rd From South					Kipp Rd From West						
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total	
Peak Hour Analysis From 07:30 AM to 08:15 AM - Peak 1 of 1																						
Peak Hour for Entire Intersection Begins at 07:30 AM																						
07:30 AM	0	0	0	0	0	6	22			28			14				40				82	
07:45 AM	0	0	0	0	0	2	12	0	0	14	0	0	7	0	7	0	21	1	0	0	43	
08:00 AM	0	0	0	0	0	3	8	0	0	11	1	0	10	0	11	0	24	0	0	0	46	
08:15 AM	0	0	0	0	0	3	11	0	0	14	0	0	5	0	5	0	22	1	0	0	42	
Total Volume	0	0	0	0	0	14	53	0	0	67	1	0	36	0	37	0	107	2	0	0	213	
% App. Total	0	0	0	0	0	20.9	79.1	0	0		2.7	0	97.3	0		0	98.2	1.8	0			
PHF	.000	.000	.000	.000	.000	.583	.602	.000	.000	.598	.250	.000	.643	.000	.661	.000	.669	.500	.000	.000	.681	.649

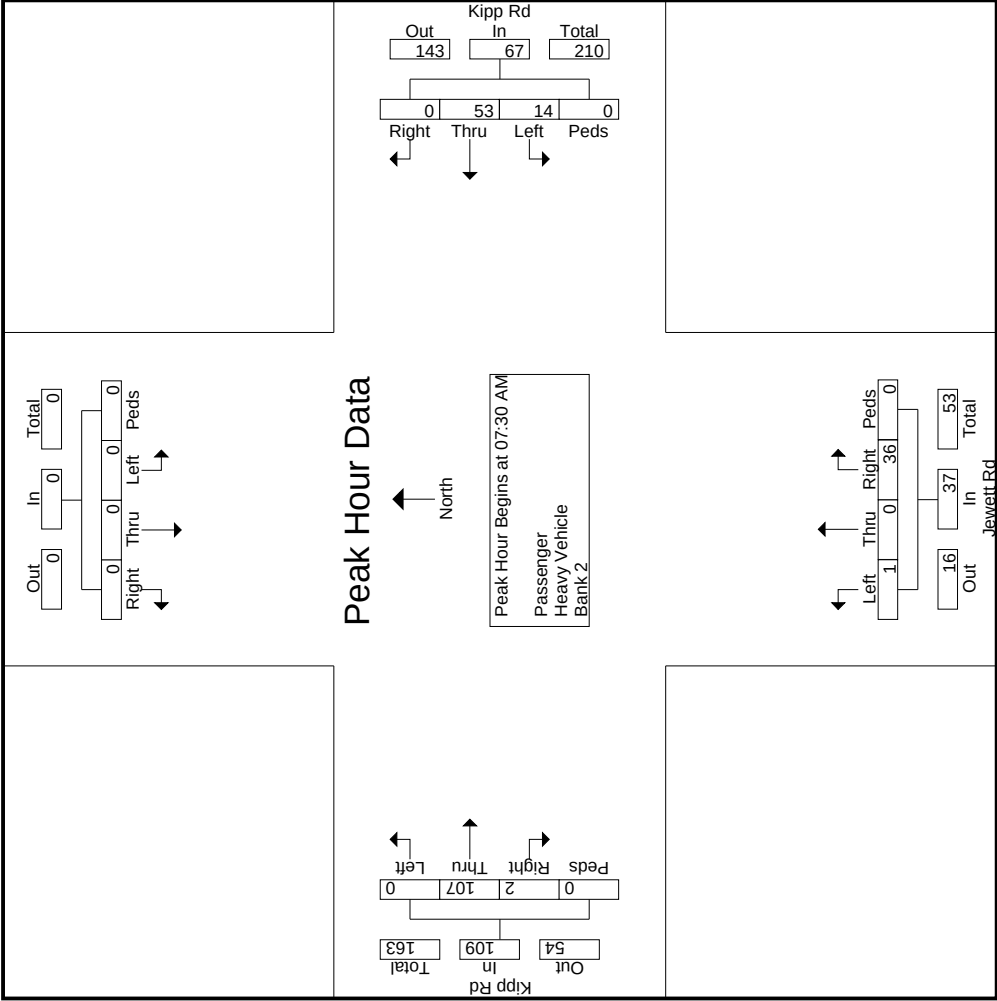
Peak Hour Analysis From 07:30 AM to 08:15 AM - Peak 1 of 1

Peak Hour for Entire Intersection Begins at 07:30 AM

PO Box 100
Saranac, MI 48881
517-627-6028

Location: Kipp Rd at Jewett Rd
City/County: City of Mason
Weather: Cool
Counted By: TH

File Name : Kipp at Jewett - AM
Site Code : 11301705
Start Date : 11/30/2017
Page No : 2



Location: Kipp Rd at Jewett Rd
City/County: City of Mason
Weather: Cool
Counted By: TH

File Name : Kipp at Jewett - PM
Site Code : 11301705
Start Date : 11/30/2017
Page No : 1

Groups Printed- Passenger - Heavy Vehicle - Bank 2

	From North					Kipp Rd From East					Jewett Rd From South					Kipp Rd From West						
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total	
04:45 PM	0	0	0	0	0	8	31	0	0	39	0	0	4	0	4	0	16	0	0	0	16	59
Total	0	0	0	0	0	8	31	0	0	39	0	0	4	0	4	0	16	0	0	0	16	59
05:00 PM	0	1	0	0	1	8	39	0	0	47	0	0	12	0	12	0	15	0	0	0	15	75
05:15 PM	0	0	0	0	0	2	45	0	0	47	1	0	2	0	3	0	23	0	0	0	23	73
05:30 PM	0	0	0	0	0	10	41	0	0	51	0	0	4	0	4	0	17	0	0	0	17	72
05:45 PM	0	0	0	0	0	3	32	0	0	35	0	0	5	0	5	0	22	0	0	0	22	62
Total	0	1	0	0	1	23	157	0	0	180	1	0	23	0	24	0	77	0	0	0	77	282
Grand Total	0	1	0	0	1	31	188	0	0	219	1	0	27	0	28	0	93	0	0	0	93	341
Approch %	0	100	0	0	0	14.2	85.8	0	0	64.2	3.6	0	96.4	0	8.2	0	100	0	0	0	100	0
Total %	0	0.3	0	0	0.3	9.1	55.1	0	0	64.2	0.3	0	7.9	0	8.2	0	27.3	0	0	0	27.3	0
Passenger	0	1	0	0	1	31	186	0	0	217	1	0	24	0	25	0	88	0	0	0	88	331
% Passenger	0	100	0	0	100	100	98.9	0	0	99.1	100	0	88.9	0	89.3	0	94.6	0	0	0	94.6	97.1
Heavy Vehicle	0	0	0	0	0	0	2	0	0	2	0	0	3	0	3	0	5	0	0	0	5	10
% Heavy Vehicle																						
Bank 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bank 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

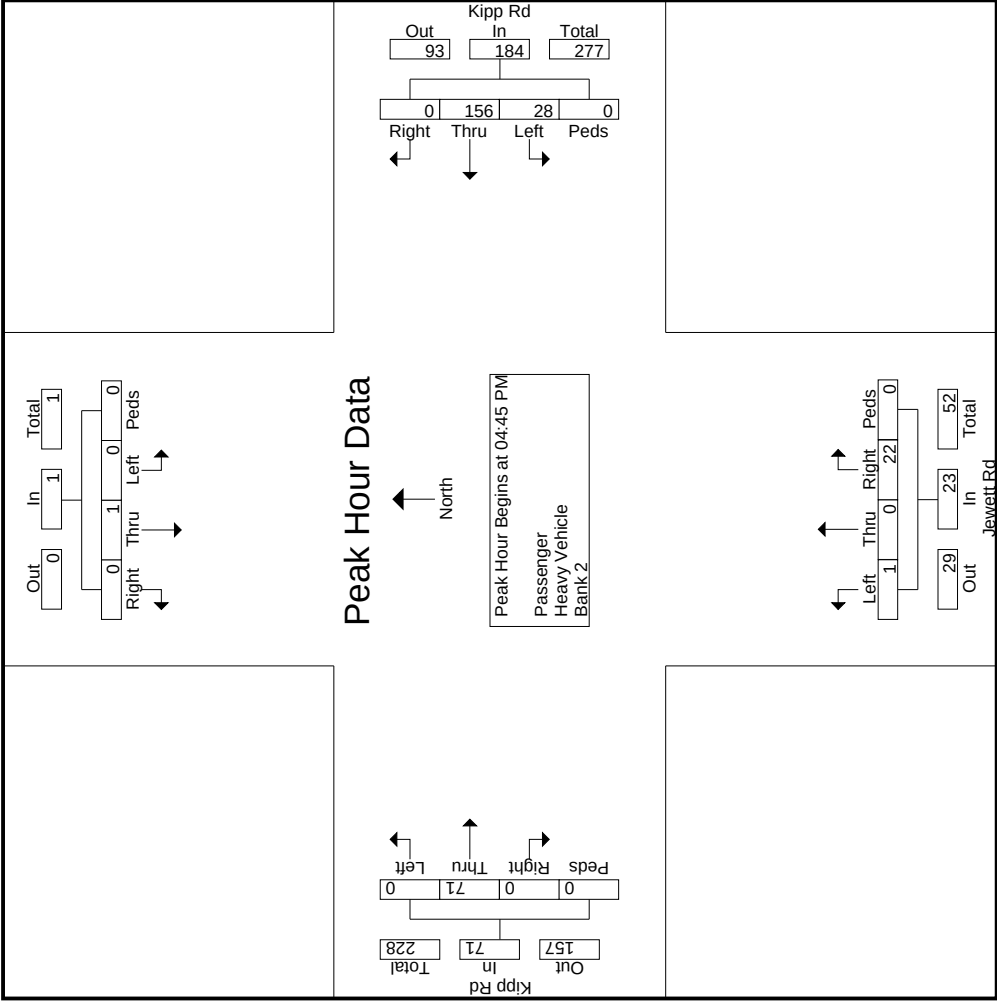
	From North					Kipp Rd From East					Jewett Rd From South					Kipp Rd From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:45 PM to 05:30 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:45 PM																					
04:45 PM	0	0	0	0	0	8	31	0	0	39	0	0	4	0	4	0	16	0	0	16	59
05:00 PM	0	1			1								12		12					75	
05:15 PM	0	0	0	0	0	2	45	0	0	47	1	0	2	0	3	0	23	0	0	23	73
05:30 PM	0	0	0	0	0	10	41	0	0	51	0	0	4	0	4	0	17	0	0	17	72
Total Volume	0	1	0	0	1	28	156	0	0	184	1	0	22	0	23	0	71	0	0	71	279
% App. Total	0	100	0	0		15.2	84.8	0	0		4.3	0	95.7	0		0	100	0	0		
PHF	.000	.250	.000	.000	.250	.700	.867	.000	.000	.902	.250	.000	.458	.000	.479	.000	.772	.000	.000	.772	.930

Peak Hour Analysis From 04:45 PM to 05:30 PM - Peak 1 of 1
Peak Hour for Entire Intersection Begins at 04:45 PM

PO Box 100
Saranac, MI 48881
517-627-6028

Location: Kipp Rd at Jewett Rd
City/County: City of Mason
Weather: Cool
Counted By: TH

File Name : Kipp at Jewett - PM
Site Code : 11301705
Start Date : 11/30/2017
Page No : 2



Location: Kipp Rd at US-127 NB Ramps

City/County: City of Mason

Weather: Cool

Counted By: DS

File Name : Kipp at NB 127 Ramp - AM

Site Code : 00112817

Start Date : 11/28/2017

Page No : 1

Groups Printed- Passenger - Heavy Vehicle - Bank 2

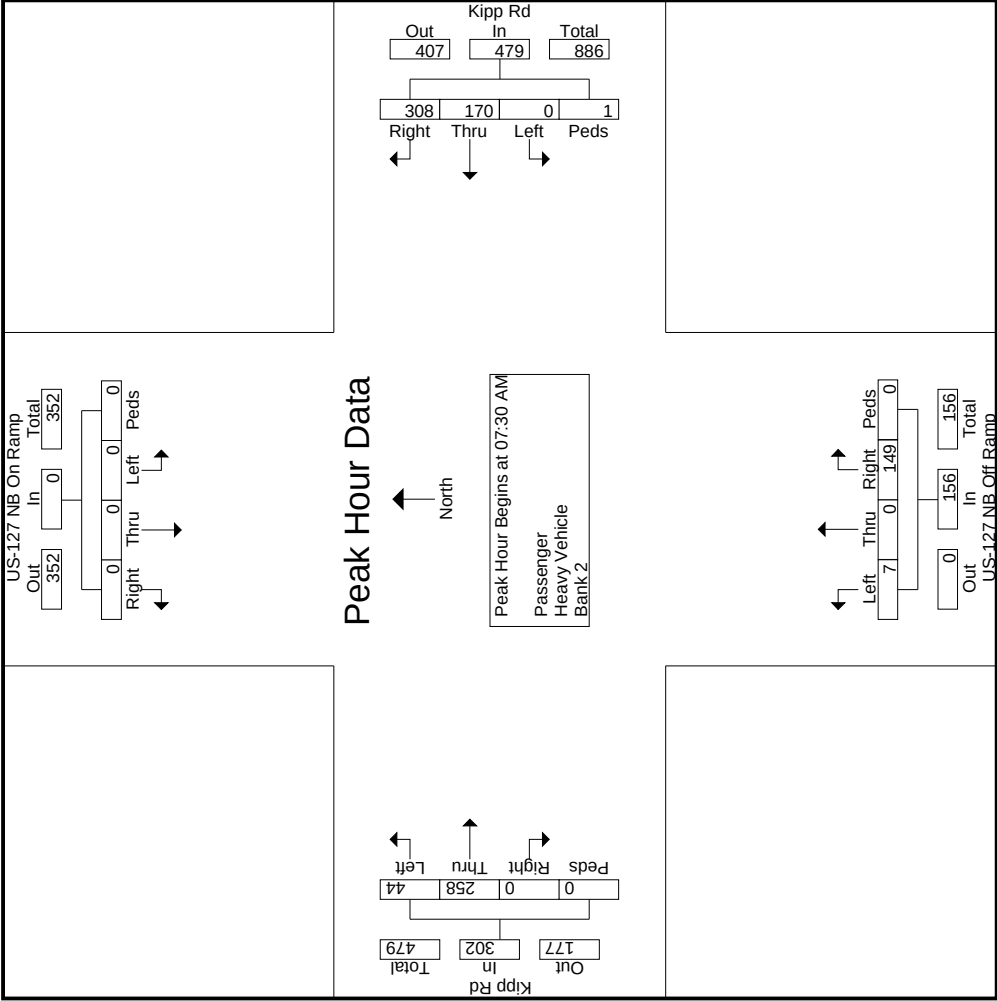
Start Time	US-127 NB On Ramp From North						Kipp Rd From East						US-127 NB Off Ramp From South						Kipp Rd From West					
	Left	Thru	Right	Peds	App. Total		Left	Thru	Right	Peds	App. Total		Left	Thru	Right	Peds	App. Total		Left	Thru	Right	Peds	App. Total	Int. Total
07:00 AM	0	0	0	0	0		0	29	75	0	104		0	0	27	0	27		10	96	0	0	106	237
07:15 AM	0	0	0	0	0		0	54	93	0	147		2	0	33	0	35		21	141	0	0	162	344
07:30 AM	0	0	0	0	0		0	65	100	0	165		3	0	40	0	43		15	88	0	0	103	311
07:45 AM	0	0	0	0	0		0	34	78	0	112		3	0	47	0	50		9	78	0	0	87	249
Total	0	0	0	0	0		0	182	346	0	528		8	0	147	0	155		55	403	0	0	458	1141
08:00 AM	0	0	0	0	0		0	38	73	0	111		0	0	38	0	38		13	54	0	0	67	216
08:15 AM	0	0	0	0	0		0	33	57	1	91		1	0	24	0	25		7	38	0	0	45	161
08:30 AM	0	0	0	0	0		0	27	55	0	82		0	0	23	0	23		9	46	0	0	55	160
08:45 AM	0	0	0	0	0		0	22	40	2	64		0	0	32	0	32		10	54	0	0	64	160
Total	0	0	0	0	0		0	120	225	3	348		1	0	117	0	118		39	192	0	0	231	697
Grand Total	0	0	0	0	0		0	302	571	3	876		9	0	264	0	273		94	595	0	0	689	1838
Approch %	0	0	0	0	0		0	34.5	65.2	0.3			3.3	0	96.7	0			13.6	86.4	0	0		
Total %	0	0	0	0	0		0	16.4	31.1	0.2	47.7		0.5	0	14.4	0	14.9		5.1	32.4	0	0	37.5	
Passenger	0	0	0	0	0		0	282	552	3	837		9	0	247	0	256		94	565	0	0	659	1752
% Passenger	0	0	0	0	0		0	93.4	96.7	100	95.5		100	0	93.6	0	93.8		100	95	0	0	95.6	95.3
Heavy Vehicle	0	0	0	0	0		0	20	19	0	39		0	0	17	0	17		0	30	0	0	30	86
% Heavy Vehicle																								
Bank 2	0	0	0	0	0		0	0	0	0	0		0	0	0	0	0		0	0	0	0	0	0
% Bank 2	0	0	0	0	0		0	0	0	0	0		0	0	0	0	0		0	0	0	0	0	0

Start Time	US-127 NB On Ramp From North						Kipp Rd From East						US-127 NB Off Ramp From South						Kipp Rd From West					
	Left	Thru	Right	Peds	App. Total		Left	Thru	Right	Peds	App. Total		Left	Thru	Right	Peds	App. Total		Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:30 AM to 08:15 AM - Peak 1 of 1																								
Peak Hour for Entire Intersection Begins at 07:30 AM																								
07:30 AM	0	0	0	0	0		0	65	100		165		3	0	47	0	50		15	88	0	0	103	311
07:45 AM	0	0	0	0	0		0	34	78	0	112		3	0	38	0	38		9	78	0	0	87	249
08:00 AM	0	0	0	0	0		0	38	73	0	111		0	0	24	0	25		13	54	0	0	67	216
08:15 AM	0	0	0	0	0		0	33	57	1	91		1	0	24	0	25		7	38	0	0	45	161
Total Volume	0	0	0	0	0		0	170	308	1	479		7	0	149	0	156		44	258	0	0	302	937
% App. Total	0	0	0	0	0		0	35.5	64.3	0.2			4.5	0	95.5	0			14.6	85.4	0	0		
PHF	.000	.000	.000	.000	.000		.000	.654	.770	.250	.726		.583	.000	.793	.000	.780		.733	.733	.000	.000	.733	.753

PO Box 100
Saranac, MI 48881
517-627-6028

Location: Kipp Rd at US-127 NB Ramps
City/County: City of Mason
Weather: Cool
Counted By: DS

File Name : Kipp at NB 127 Ramp - AM
Site Code : 00112817
Start Date : 11/28/2017
Page No : 2



Traffic Engineering Associates, Inc.

PO Box 100, Saranac, MI 48881

517-627-6028

Location: Kipp Rd at US-127 NB Ramps
City/County: City of Mason
Weather: Cool
Counted By: DS

File Name : Kipp at NB 127 Ramp - PM
Site Code : 00112817
Start Date : 11/28/2017
Page No : 1

Groups Printed- Passenger - Heavy Vehicle - Bank 2

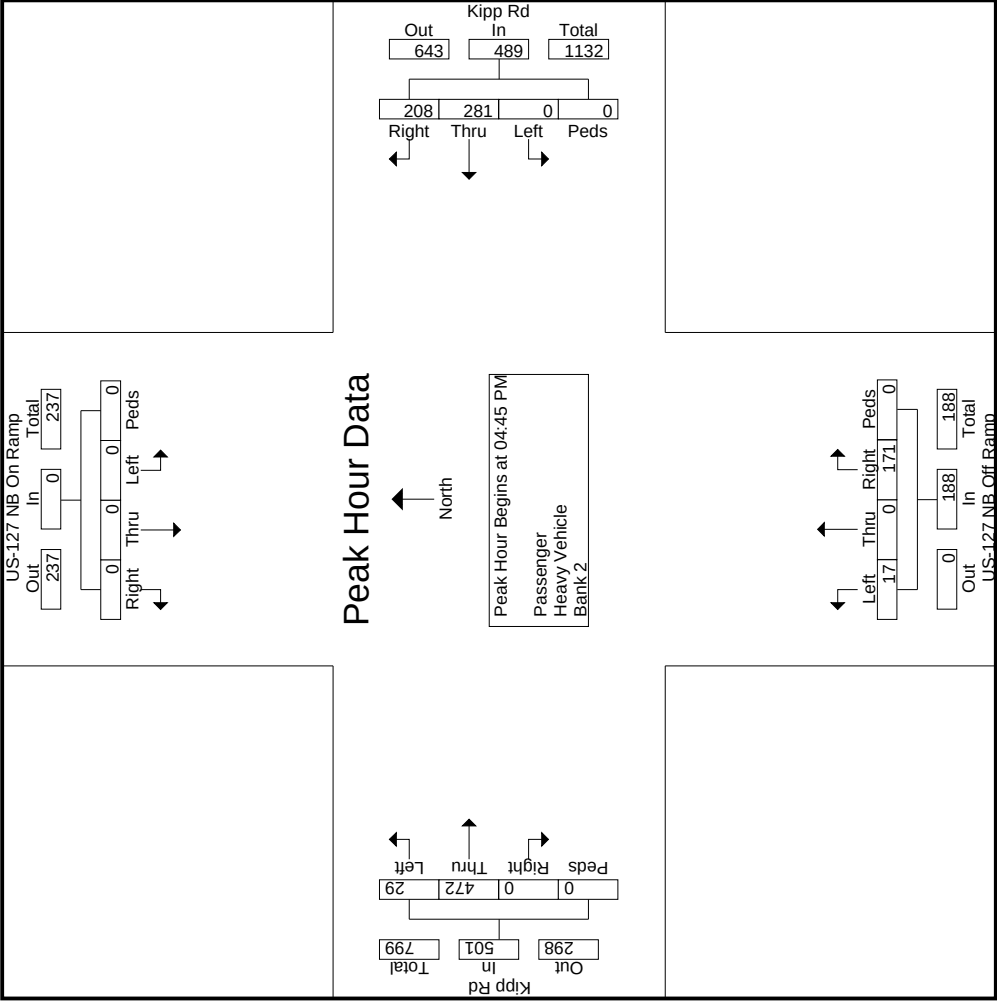
Start Time	US-127 NB On Ramp						Kipp Rd						US-127 NB Off Ramp						Kipp Rd					
	From North						From East						From South						From West					
	Left	Thru	Right	Peds	App. Total		Left	Thru	Right	Peds	App. Total		Left	Thru	Right	Peds	App. Total		Left	Thru	Right	Peds	App. Total	Int. Total
04:00 PM	0	0	0	0	0		0	77	50	0	127		2	0	33	0	35		6	111	0	0	117	279
04:15 PM	0	0	0	0	0		0	63	52	2	117		5	0	27	0	32		3	108	0	0	111	260
04:30 PM	0	0	0	0	0		0	70	55	0	125		0	0	34	1	35		4	96	0	0	100	260
04:45 PM	0	0	0	0	0		0	62	52	0	114		9	0	42	0	51		8	113	0	0	121	286
Total	0	0	0	0	0		0	272	209	2	483		16	0	136	1	153		21	428	0	0	449	1085
05:00 PM	0	0	0	0	0		0	81	68	0	149		2	0	42	0	44		9	99	0	0	108	301
05:15 PM	0	0	0	0	0		0	72	44	0	116		5	0	33	0	38		5	146	0	0	151	305
05:30 PM	0	0	0	0	0		0	66	44	0	110		1	0	54	0	55		7	114	0	0	121	286
05:45 PM	0	0	0	0	0		0	57	38	0	95		2	0	43	0	45		5	82	0	0	87	227
Total	0	0	0	0	0		0	276	194	0	470		10	0	172	0	182		26	441	0	0	467	1119
Grand Total	0	0	0	0	0		0	548	403	2	953		26	0	308	1	335		47	869	0	0	916	2204
Apprch %	0	0	0	0	0		0	57.5	42.3	0.2			7.8	0	91.9	0.3			5.1	94.9	0	0		
Total %	0	0	0	0	0		0	24.9	18.3	0.1	43.2		1.2	0	14	0	15.2		2.1	39.4	0	0	41.6	
Passenger	0	0	0	0	0		0	537	390	2	929		25	0	296	1	322		45	860	0	0	905	2156
% Passenger	0	0	0	0	0		0	98	96.8	100	97.5		96.2	0	96.1	100	96.1		95.7	99	0	0	98.8	97.8
Heavy Vehicle	0	0	0	0	0		0	11	13	0	24		1	0	12	0	13		2	9	0	0	11	48
% Heavy Vehicle	0	0	0	0	0		0	2	3.2	0	2.5		3.8	0	3.9	0	3.9		4.3	1	0	0	1.2	2.2
Bank 2	0	0	0	0	0		0	0	0	0	0		0	0	0	0	0		0	0	0	0	0	0
% Bank 2	0	0	0	0	0		0	0	0	0	0		0	0	0	0	0		0	0	0	0	0	0

Start Time	US-127 NB On Ramp						Kipp Rd						US-127 NB Off Ramp						Kipp Rd					
	From North						From East						From South						From West					
	Left	Thru	Right	Peds	App. Total		Left	Thru	Right	Peds	App. Total		Left	Thru	Right	Peds	App. Total		Left	Thru	Right	Peds	App. Total	Int. Total
04:45 PM	0	0	0	0	0		0	62	52	0	114		9	0	42	0	51		8	113	0	0	121	286
05:00 PM	0	0	0	0	0		0	81	68	0	149		2	0	42	0	44		9	99	0	0	108	301
05:15 PM	0	0	0	0	0		0	72	44	0	116		5	0	33	0	38		5	146	0	0	151	305
05:30 PM	0	0	0	0	0		0	66	44	0	110		1	0	54	0	55		7	114	0	0	121	286
Total Volume	0	0	0	0	0		0	281	208	0	489		17	0	171	0	188		29	472	0	0	501	1178
% App. Total	0	0	0	0	0		0	57.5	42.5	0			9	0	91	0			5.8	94.2	0	0		
PHF	.000	.000	.000	.000	.000		.000	.867	.765	.000	.820		.472	.000	.792	.000	.855		.806	.808	.000	.000	.829	.966

Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Entire Intersection Begins at 04:45 PM

Location: Kipp Rd at US-127 NB Ramps
City/County: City of Mason
Weather: Cool
Counted By: DS

File Name : Kipp at NB 127 Ramp - PM
Site Code : 00112817
Start Date : 11/28/2017
Page No : 2



Location: Kipp Rd at US-127 SB Ramps
City/County: City of Mason
Weather: Cool
Counted By: TH

File Name : Kipp at SB 127 Ramp - AM
Site Code : 11281701
Start Date : 11/28/2017
Page No : 1

Groups Printed- Passenger - Heavy Vehicle - Bank 2

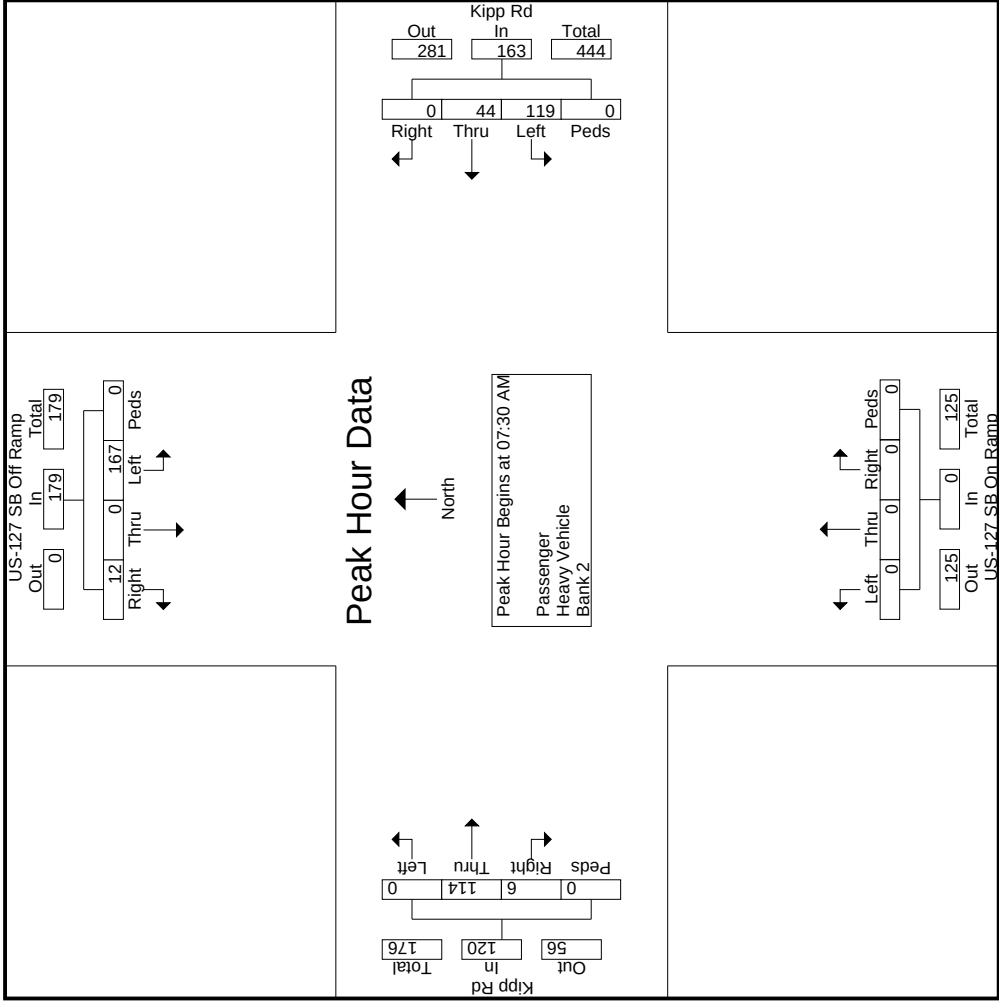
US-127 SB Off Ramp From North										Kipp Rd From East					US-127 SB On Ramp From South					Kipp Rd From West				
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total			
07:00 AM	65	0	1	0	66	23	6	0	0	29	0	0	0	0	0	0	52	1	0	53	148			
07:15 AM	64	0	4	0	68	40	16	0	0	56	0	0	0	0	0	0	96	9	0	105	229			
07:30 AM	50	0	5	0	55	42	19	0	0	61	0	0	0	0	0	0	39	1	0	40	156			
07:45 AM	58	0	1	0	59	23	10	0	0	33	0	0	0	0	0	0	28	4	0	32	124			
Total	237	0	11	0	248	128	51	0	0	179	0	0	0	0	0	0	215	15	0	230	657			
08:00 AM	32	0	1	0	33	30	7	0	0	37	0	0	0	0	0	0	28	0	0	28	98			
08:15 AM	27	0	5	0	32	24	8	0	0	32	0	0	0	0	0	0	19	1	0	20	84			
08:30 AM	37	1	3	0	41	18	8	0	0	26	0	0	0	0	0	0	23	1	0	24	91			
08:45 AM	34	0	4	0	38	16	6	0	0	22	0	0	0	0	0	0	21	2	0	23	83			
Total	130	1	13	0	144	88	29	0	0	117	0	0	0	0	0	0	91	4	0	95	356			
Grand Total	367	1	24	0	392	216	80	0	0	296	0	0	0	0	0	0	306	19	0	325	1013			
Approch %	93.6	0.3	6.1	0		73	27	0	0		0	0	0	0		0	94.2	5.8	0					
Total %	36.2	0.1	2.4	0	38.7	21.3	7.9	0	0	29.2	0	0	0	0	0	0	30.2	1.9	0	32.1				
Passenger	335	0	22	0	357	194	73	0	0	267	0	0	0	0	0	0	292	19	0	311	935			
% Passenger	91.3	0	91.7	0	91.1	89.8	91.2	0	0	90.2	0	0	0	0	0	0	95.4	100	0	95.7	92.3			
Heavy Vehicle	32	1	2	0	35	22	7	0	0	29	0	0	0	0	0	0	14	0	0	14	78			
% Heavy Vehicle																								
Bank 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
% Bank 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			

US-127 SB Off Ramp From North						Kipp Rd From East						US-127 SB On Ramp From South						Kipp Rd From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total		
Peak Hour Analysis From 07:30 AM to 08:15 AM - Peak 1 of 1																							
Peak Hour for Entire Intersection Begins at 07:30 AM																							
07:30 AM	50	0	5			42	19			61							39			40	156		
07:45 AM	58	0	1	0	59	23	10	0	0	33	0	0	0	0	0	0	28	4	0	32	124		
08:00 AM	32	0	1	0	33	30	7	0	0	37	0	0	0	0	0	0	28	0	0	28	98		
08:15 AM	27	0	5	0	32	24	8	0	0	32	0	0	0	0	0	0	19	1	0	20	84		
Total Volume	167	0	12	0	179	119	44	0	0	163	0	0	0	0	0	0	114	6	0	120	462		
% App. Total	93.3	0	6.7	0		73	27	0	0		0	0	0	0		0	95	5	0				
PHF	.720	.000	.600	.000	.758	.708	.579	.000	.000	.668	.000	.000	.000	.000	.000	.000	.731	.375	.000	.750	.740		

PO Box 100
Saranac, MI 48881
517-627-6028

Location: Kipp Rd at US-127 SB Ramps
City/County: City of Mason
Weather: Cool
Counted By: TH

File Name : Kipp at SB 127 Ramp - AM
Site Code : 11281701
Start Date : 11/28/2017
Page No : 2



Traffic Engineering Associates, Inc.

PO Box 100, Saranac, MI 48881

517-627-6028

Location: Kipp Rd at US-127 SB Ramps

City/County: City of Mason

Weather: Cool

Counted By: TH

File Name : Kipp at SB 127 Ramp - PM

Site Code : 11281701

Start Date : 11/28/2017

Page No : 1

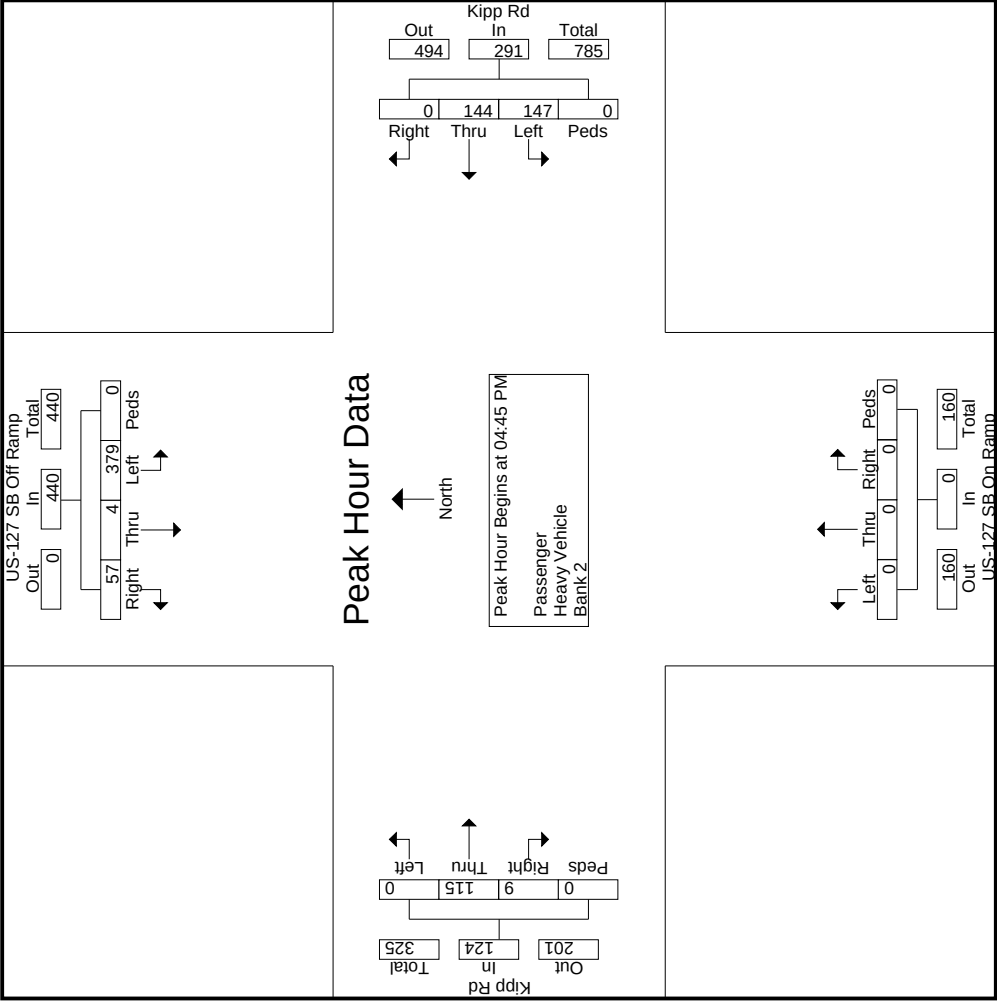
Groups Printed- Passenger - Heavy Vehicle - Bank 2

	US-127 SB Off Ramp From North					Kipp Rd From East					US-127 SB On Ramp From South					Kipp Rd From West						
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total	
04:00 PM	79	0	10	0	89	38	45	0	0	83	0	0	0	0	0	0	26	0	0	0	26	198
04:15 PM	87	0	19	0	106	32	32	0	0	64	0	0	0	0	0	0	30	2	0	0	32	202
04:30 PM	75	2	9	0	86	34	31	0	0	65	0	0	0	0	0	0	25	2	0	0	27	178
04:45 PM	78	0	20	0	98	37	35	0	0	72	0	0	0	0	0	0	32	4	0	0	36	206
Total	319	2	58	0	379	141	143	0	0	284	0	0	0	0	0	0	113	8	0	0	121	784
05:00 PM	97	1	14	0	112	38	41	0	0	79	0	0	0	0	0	0	25	4	0	0	29	220
05:15 PM	120	2	17	0	139	38	35	0	0	73	0	0	0	0	0	0	36	1	0	0	37	249
05:30 PM	84	1	6	0	91	34	33	0	0	67	0	0	0	0	0	0	22	0	0	0	22	180
05:45 PM	58	0	8	0	66	32	32	0	0	64	0	0	0	0	0	0	30	1	0	0	31	161
Total	359	4	45	0	408	142	141	0	0	283	0	0	0	0	0	0	113	6	0	0	119	810
Grand Total	678	6	103	0	787	283	284	0	0	567	0	0	0	0	0	0	226	14	0	0	240	1594
Apprch %	86.1	0.8	13.1	0		49.9	50.1	0	0		0	0	0	0	0	0	94.2	5.8	0	0		
Total %	42.5	0.4	6.5	0	49.4	17.8	17.8	0	0	35.6	0	0	0	0	0	0	14.2	0.9	0	0	15.1	
Passenger	665	4	102	0	771	270	274	0	0	544	0	0	0	0	0	0	218	14	0	0	232	1547
% Passenger	98.1	66.7	99	0	98	95.4	96.5	0	0	95.9	0	0	0	0	0	0	96.5	100	0	0	96.7	97.1
Heavy Vehicle	13	2	1	0	16	13	10	0	0	23	0	0	0	0	0	0	8	0	0	0	8	47
% Heavy Vehicle	1.9	33.3	1	0	2	4.6	3.5	0	0	4.1	0	0	0	0	0	0	3.5	0	0	0	3.3	2.9
Bank 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bank 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	US-127 SB Off Ramp From North					Kipp Rd From East					US-127 SB On Ramp From South					Kipp Rd From West						
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																						
Peak Hour for Entire Intersection Begins at 04:45 PM																						
04:45 PM	78	0	20	0	98	37	35	0	0	72	0	0	0	0	0	0	32	4	0	0	36	206
05:00 PM	97	1	14	0	112	38	41	0	0	79	0	0	0	0	0	0	25	4	0	0	29	220
05:15 PM	120	2	17	0	139	38	35	0	0	73	0	0	0	0	0	0	36	1	0	0	37	249
05:30 PM	84	1	6	0	91	34	33	0	0	67	0	0	0	0	0	0	22	0	0	0	22	180
Total Volume	379	4	57	0	440	147	144	0	0	291	0	0	0	0	0	0	115	9	0	0	124	855
% App. Total	86.1	0.9	13	0		50.5	49.5	0	0		0	0	0	0	0	0	92.7	7.3	0	0		
PHF	.790	.500	.713	.000	.791	.967	.878	.000	.000	.921	.000	.000	.000	.000	.000	.000	.799	.563	.000	.000	.838	.858

Location: Kipp Rd at US-127 SB Ramps
City/County: City of Mason
Weather: Cool
Counted By: TH

File Name : Kipp at SB 127 Ramp - PM
Site Code : 11281701
Start Date : 11/28/2017
Page No : 2





Volume Count Report

LOCATION INFO	
Location ID	12020
Type	LINK
Funct'l Class	-
Located On	KIPP RD
From Road	JEWETT RD
To Road	TUTTLE RD
Direction	2-WAY
County	Ingham
Community	Vevay Twp
MPO ID	
HPMS ID	
Agency	Ingham County

COUNT DATA INFO	
Count Status	Accepted
Start Date	Mon 5/16/2005
End Date	Tue 5/17/2005
Start Time	8:00:00 AM
End Time	8:00:00 AM
Direction	
Notes	
Station	B1
Study	
Speed Limit	
Description	
Sensor Type	

INTERVAL:60-MIN	
Time	Hourly Count
0:00-1:00	11
1:00-2:00	12
2:00-3:00	1
3:00-4:00	6
4:00-5:00	7
5:00-6:00	30
6:00-7:00	85
7:00-8:00 	318
 8:00-9:00	203
9:00-10:00	166
10:00-11:00	152
11:00-12:00	175
12:00-13:00	202
13:00-14:00	160
14:00-15:00	218
15:00-16:00	260
16:00-17:00	274
17:00-18:00	330
18:00-19:00	232
19:00-20:00	184
20:00-21:00	142
21:00-22:00	102
22:00-23:00	64
23:00-24:00	30
Total	3,364
AM Peak	07:00-08:00 318
PM Peak	17:00-18:00 330

TRAFFIC SIGNAL TIMING PERMIT

APPROACH		PHASE	1	2	3	4	5	6	7	8	TIMING INSTALLED
MINIMUM GREEN											REMARKS
PASSAGE											
MAXIMUM NO. 1											
MAXIMUM NO. 2											
YELLOW CHANGE											
RED CLEARANCE											
WALK											
PEDESTRIAN CLEARANCE											
EXTENDED PED. CLEARANCE											
REST IN WALK											
INITIALIZATION											
NON-ACT RESPONSE											
VEHICLE RECALL											
PEDESTRIAN RECALL											
NON-LOCK MEMORY											
DUAL ENTRY											
		CYCLE							O1	O2	O3
DIAL		SPLIT									
DIAL		SPLIT									
DIAL		SPLIT									
DIAL		SPLIT									
DIAL		SPLIT									
DIAL		SPLIT									
DIAL		SPLIT									
		MODE									
PREPARED BY: DATE:											
FLASH HOURS: to DAILY ☐ NONE ☐											
NIGHT FLASH: FR =											
CONFLICT FLASH: FR =											
CONTROLLER TYPE: ☐ EPAC ☐ PRE-EMPT ☐ ☐ Other: ☐ COUNTDOWN PEDS ☐											
LOCATION:											
CITY/TWP:											
COUNTY :											
MILE POINT CONTROL SECTION-SPOT #											
Job # (If Applicable):											

OVERLAPS						
Overlap Phase	Load Bays	Phases Overlapped	T.G. (s)	Y (s)	R (s)	-GY +GRN
=						
=						
=						
=						

PHASE	1	2	3	4	5	6	7	8
1								
2								
3								
4								
5								
6								
7								
8								

ADVANCED TIMING PARAMETERS FORM

[illegible]

PREEMPTION INFORMATION FORM

[illegible]

TRAFFIC SIGNAL TIMING PERMIT

APPROACH		PHASE	1	2	3	4	5	6	7	8	TIMING INSTALLED
MINIMUM GREEN											REMARKS
PASSAGE											
MAXIMUM NO. 1											
MAXIMUM NO. 2											
YELLOW CHANGE											
RED CLEARANCE											
WALK											
PEDESTRIAN CLEARANCE											
EXTENDED PED. CLEARANCE											
REST IN WALK											
INITIALIZATION											
NON-ACT RESPONSE											
VEHICLE RECALL											
PEDESTRIAN RECALL											
NON-LOCK MEMORY											
DUAL ENTRY											
		CYCLE							O1	O2	O3
DIAL		SPLIT									
DIAL		SPLIT									
DIAL		SPLIT									
DIAL		SPLIT									
DIAL		SPLIT									
DIAL		SPLIT									
DIAL		SPLIT									
		MODE									
PREPARED BY: DATE:											
FLASH HOURS: to DAILY ☐ NONE ☐											
NIGHT FLASH: FR =											
CONFLICT FLASH: FR =											
CONTROLLER TYPE: ☐ EPAC ☐ PRE-EMPT ☐ ☐ Other: ☐ COUNTDOWN PEDS ☐											
LOCATION:											
CITY/TWP:											
COUNTY :											
MILE POINT CONTROL SECTION-SPOT #											
Job # (If Applicable):											

OVERLAPS						
Overlap Phase	Load Bays	Phases Overlapped	T.G. (s)	Y (s)	R (s)	-GY +GRN
=						
=						
=						
=						

PHASE	1	2	3	4	5	6	7	8

ADVANCED TIMING PARAMETERS FORM

SYSTEM INFORMATION	LEFT-TURN PHASING								RING AND BARRIER STRUCTURE											
Controller Type: ☐ EPAC ☐ Other: System Type: ☐ Closed Loop ☐ Stand By ☐ Group 1 ☐ Group 2 Address: ☐ TBC ☐ TBC/GPS ☐ None ☐ Other: If TBC, Synch by: ☐ TOD ☐ Event Interconnect Type: ☐ Hardwire ☐ Fiber-Optic ☐ Radio ☐ Phone Drop ☐ None ☐ Other: If Phone Drop, Phone # Controller Status: ☐ Master ☐ Slave ☐ Isolated ☐ TBC If Slave, Master Location: Master Spot # :	Phase # / Description		Permissive-Protected		Protected-Only				B1		B2		B3		B4					
			Lead	Lag	Split	Lead	Lag	R1												
				☐	☐	☐	☐	R2												
				☐	☐	☐	☐	R3												
				☐	☐	☐	☐	R4												
				☐	☐	☐	☐													
VEHICULAR AND PEDESTRIAN DETECTION																				
		Vehicular Detection						Pedestrian Detection												
Approach		Movements and Call Delay (s)						Push-Button Crossing Locations												
		Left		Thru		Right		Loop		Video		Other								
		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐				
		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐				
		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐				
		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐				
		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐				
		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐				
ADDITIONAL DIAL SPLIT DATA																				
		PHASE		1	2	3	4	5	6	7	8	O1	O2	O3						
DIAL	SPLIT	CYCLE													Operation Mode					
DIAL	SPLIT	CYCLE													Coordination Mode					
DIAL	SPLIT	CYCLE													Maximum Mode					
DIAL	SPLIT	CYCLE													Correction Mode					
DIAL	SPLIT	CYCLE													Offset Mode					
DIAL	SPLIT	CYCLE													Force Mode					
DIAL	SPLIT	CYCLE													Max Dwell					
DIAL	SPLIT	CYCLE													Yield Period					
ADDITIONAL OVERLAP DATA																				
								Load	Phases Overlapped		T.G. (s)	Y (s)	R (s)	-G/Y	+GRN					
								=												
								=												
								=												
								=												
								PREPARED BY:				DATE:				LOCATION:				
								☐ MDOT ☐ County ☐ City ☐ Consultant												
								CONTROL SECTION-SPOT #												

PREEMPTION INFORMATION FORM

Preemption Description:																	Preempt System Data									
Preempt # =	Time (s)	Phases	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Ring MIN GRN/WLK (s)	1	2	3	4			
SEL Ped Ci		Vehicle	Track																							
SEL Yellow			Dwell																							
SEL Red Ci			Cycle																							
TRACK Green		Ped	Exit																							
TRACK Ped Ci			Track																							
TRACK Yellow			Dwell																							
TRACK Red CL		Cycle																								
DWELL Green		Overlap Vehicle	Overlap	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P		PE/FL	PE1/2	PE2/3	PE3/4	PE4/5	PE5/6
RET Ped Ci			Track																							
RET Yellow			Dwell																							
RET Red Ci		Cycle																								
Preemption Description:																	Preempt System Data									
Preempt # =	Time (s)	Phases	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Ring MIN GRN/WLK (s)	1	2	3	4			
SEL Ped Ci		Vehicle	Track																							
SEL Yellow			Dwell																							
SEL Red Ci			Cycle																							
TRACK Green		Ped	Exit																							
TRACK Ped Ci			Track																							
TRACK Yellow			Dwell																							
TRACK Red CL		Cycle																								
DWELL Green		Overlap Vehicle	Overlap	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P							
RET Ped Ci			Track																							
RET Yellow			Dwell																							
RET Red Ci		Cycle																								
Preemption Description:																	Preempt System Data									
Preempt # =	Time (s)	Phases	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Ring MIN GRN/WLK (s)	1	2	3	4			
SEL Ped Ci		Vehicle	Track																							
SEL Yellow			Dwell																							
SEL Red Ci			Cycle																							
TRACK Green		Ped	Exit																							
TRACK Ped Ci			Track																							
TRACK Yellow			Dwell																							
TRACK Red CL		Cycle																								
DWELL Green		Overlap Vehicle	Overlap	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P							
RET Ped Ci			Track																							
RET Yellow			Dwell																							
RET Red Ci		Cycle																								

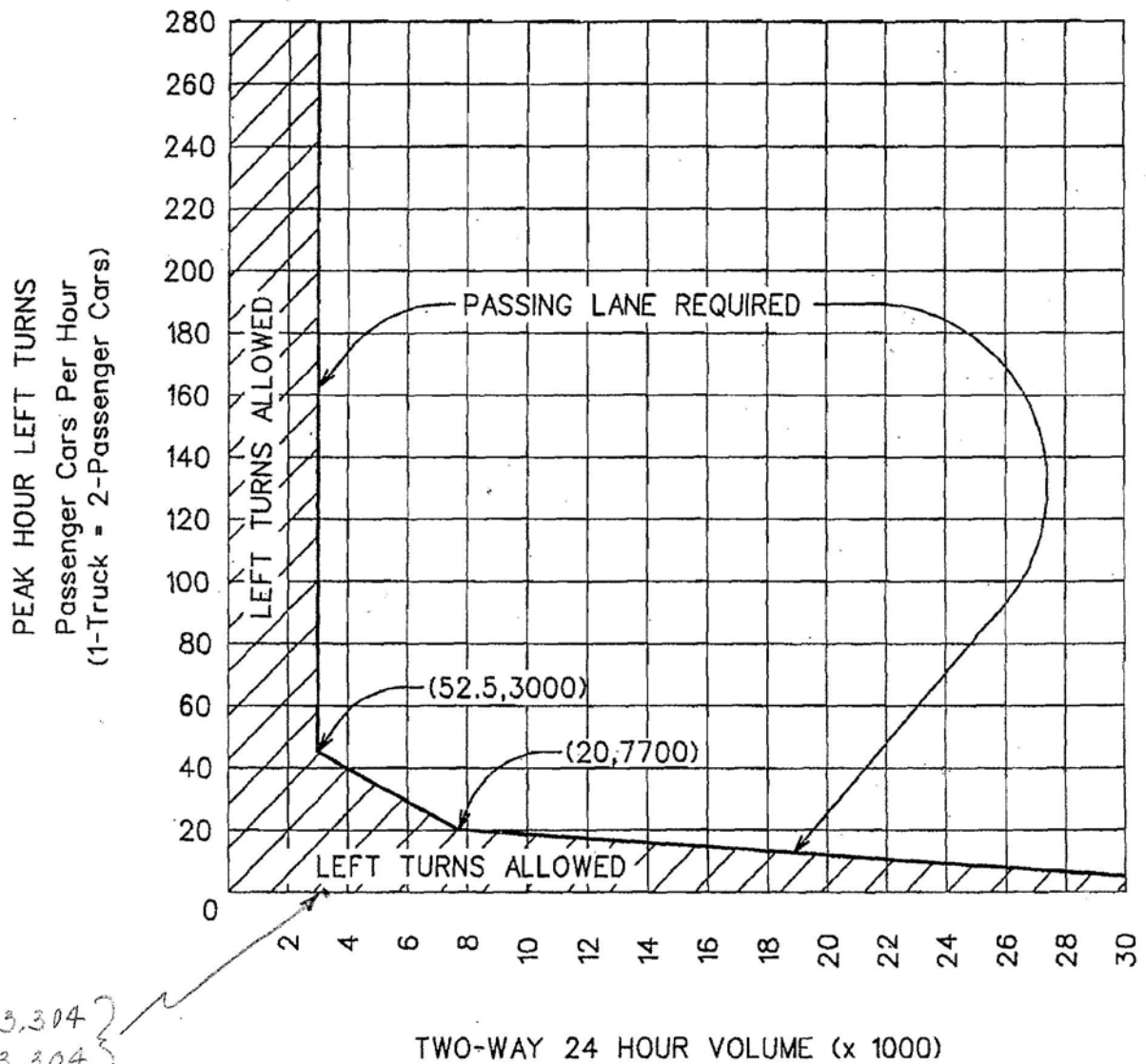
PREPARED BY:

DATE:

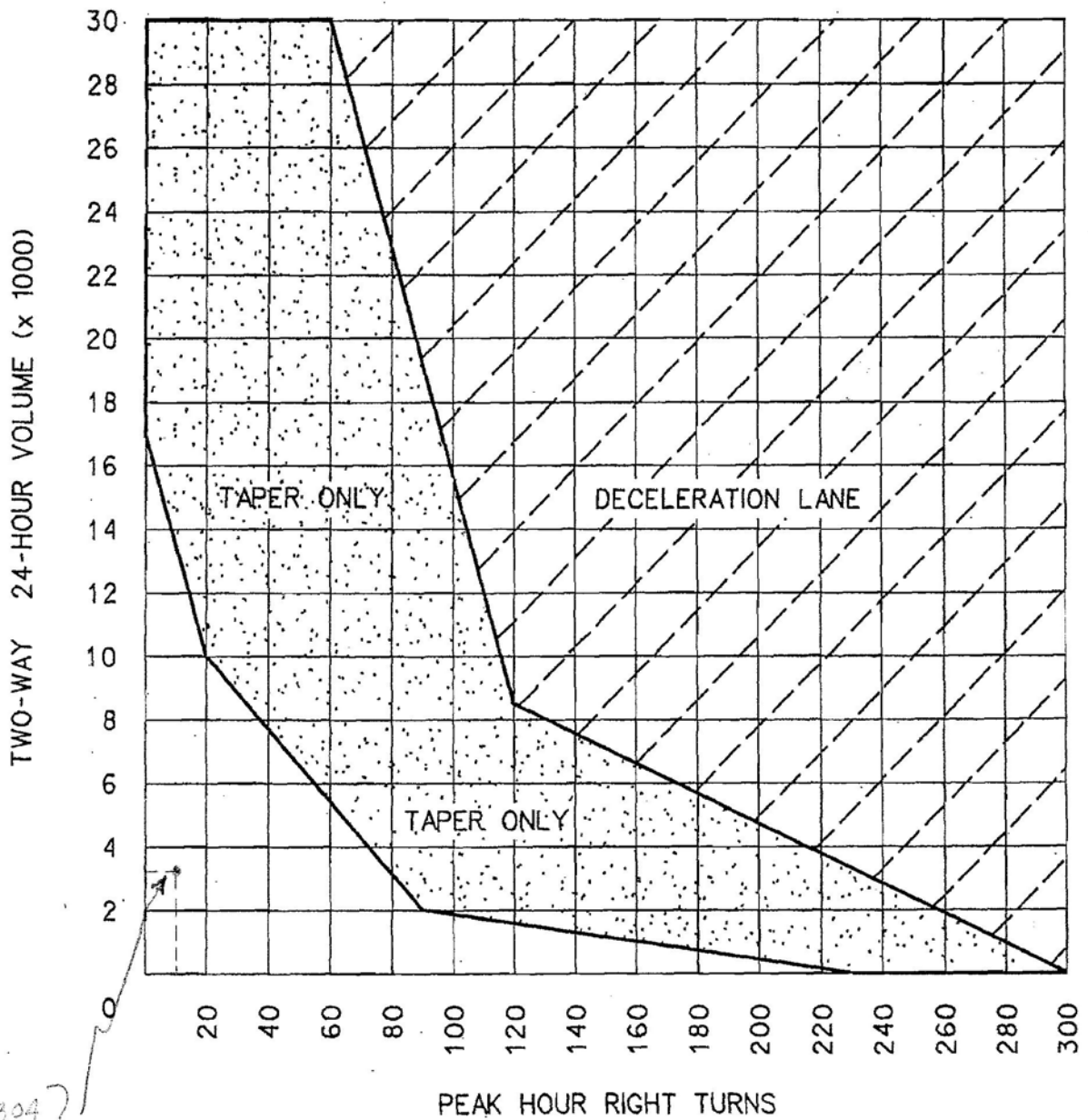
LOCATION:

CONTROL SECTION-SPOT #

Warrants for Left Turn Passing Lane



Warrants for Right Turn
Deceleration Lane or Taper



AM = 17 + 3,304
PM = 13 + 3,304

Lanes, Volumes, Timings
1001: Meijer Dr/Cedar St & Kipp Road

04/13/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	62	296	82	4	223	74	92	37	13	66	35	64
Future Volume (vph)	62	296	82	4	223	74	92	37	13	66	35	64
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		110	0		0	120		0	130		0
Storage Lanes	0		1	0		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	0.95	0.95	1.00	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850		0.963			0.960			0.903	
Flt Protected		0.991			0.999		0.950			0.950		
Satd. Flow (prot)	0	3313	1495	0	3216	0	1597	1614	0	1671	1589	0
Flt Permitted		0.991			0.999		0.684			0.722		
Satd. Flow (perm)	0	3313	1495	0	3216	0	1150	1614	0	1270	1589	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			109		49			14			74	
Link Speed (mph)		45			45			25			35	
Link Distance (ft)		670			525			276			442	
Travel Time (s)		10.2			8.0			7.5			8.6	
Peak Hour Factor	0.82	0.82	0.82	0.81	0.81	0.81	0.95	0.95	0.95	0.87	0.87	0.87
Heavy Vehicles (%)	8%	8%	8%	8%	8%	8%	13%	13%	13%	8%	8%	8%
Adj. Flow (vph)	76	361	100	5	275	91	97	39	14	76	40	74
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	437	100	0	371	0	97	53	0	76	114	0
Turn Type	Split	NA	Prot	Split	NA		Perm	NA		Perm	NA	
Protected Phases	4	4	4	8	8			2			6	
Permitted Phases							2			6		
Detector Phase	4	4	4	8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0		8.0	8.0		8.0	8.0	
Minimum Split (s)	16.0	16.0	16.0	16.0	16.0		14.0	14.0		14.0	14.0	
Total Split (s)	32.0	32.0	32.0	32.0	32.0		26.0	26.0		26.0	26.0	
Total Split (%)	35.6%	35.6%	35.6%	35.6%	35.6%		28.9%	28.9%		28.9%	28.9%	
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5		4.5	4.5		4.5	4.5	
All-Red Time (s)	1.5	1.5	1.5	1.5	1.5		1.5	1.5		1.5	1.5	
Lost Time Adjust (s)		0.0	0.0		0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.0	6.0		6.0		6.0	6.0		6.0	6.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	Max	Max	Max	Max	Max		C-Min	C-Min		C-Min	C-Min	
Act Effct Green (s)		32.9	32.9		26.0		13.1	13.1		13.1	13.1	
Actuated g/C Ratio		0.37	0.37		0.29		0.15	0.15		0.15	0.15	
v/c Ratio		0.36	0.16		0.39		0.58	0.21		0.41	0.39	
Control Delay		22.9	4.9		17.2		48.9	27.1		40.3	17.6	
Queue Delay		0.0	0.0		0.0		0.0	0.0		0.0	0.0	
Total Delay		22.9	4.9		17.2		48.9	27.1		40.3	17.6	
LOS		C	A		B		D	C		D	B	
Approach Delay		19.5			17.2			41.2			26.7	
Approach LOS		B			B			D			C	
Queue Length 50th (ft)		93	0		42		52	20		40	20	

Lanes, Volumes, Timings
1001: Meijer Dr/Cedar St & Kipp Road

04/13/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)		133	24		57		96	49		74	60	
Internal Link Dist (ft)		590			445			196			362	
Turn Bay Length (ft)			110				120			130		
Base Capacity (vph)		1211	615		963		255	369		282	410	
Starvation Cap Reductn		0	0		0		0	0		0	0	
Spillback Cap Reductn		0	0		0		0	0		0	0	
Storage Cap Reductn		0	0		0		0	0		0	0	
Reduced v/c Ratio		0.36	0.16		0.39		0.38	0.14		0.27	0.28	

Intersection Summary

Area Type: Other

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 2 (2%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 50

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.58

Intersection Signal Delay: 22.5

Intersection LOS: C

Intersection Capacity Utilization 45.4%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 1001: Meijer Dr/Cedar St & Kipp Road

 Ø2 (R)	 Ø4	 Ø8
26 s	32 s	32 s
 Ø6 (R)		
26 s		

Lanes, Volumes, Timings
1002: Hull Rd/Jefferson St & Kipp Road

04/13/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	51	259	48	49	204	13	48	78	72	18	40	59
Future Volume (vph)	51	259	48	49	204	13	48	78	72	18	40	59
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	350		0	200		0
Storage Lanes	0		0	0		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	0.95	0.95	0.95	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.980			0.992			0.928			0.910	
Flt Protected		0.993			0.991		0.950			0.950		
Satd. Flow (prot)	0	3314	0	0	3348	0	1770	1729	0	1770	1695	0
Flt Permitted		0.993			0.991		0.679			0.486		
Satd. Flow (perm)	0	3314	0	0	3348	0	1265	1729	0	905	1695	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		19			6			50			73	
Link Speed (mph)		45			45			55			35	
Link Distance (ft)		525			809			391			539	
Travel Time (s)		8.0			12.3			4.8			10.5	
Peak Hour Factor	0.68	0.68	0.68	0.89	0.89	0.89	0.79	0.79	0.79	0.81	0.81	0.81
Heavy Vehicles (%)	6%	6%	6%	6%	6%	6%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	75	381	71	55	229	15	61	99	91	22	49	73
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	527	0	0	299	0	61	190	0	22	122	0
Turn Type	Split	NA		Split	NA		Perm	NA		Perm	NA	
Protected Phases	4	4		8	8			2			6	
Permitted Phases							2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		8.0	8.0		8.0	8.0	
Minimum Split (s)	16.0	16.0		16.0	16.0		14.0	14.0		14.0	14.0	
Total Split (s)	30.0	30.0		30.0	30.0		30.0	30.0		30.0	30.0	
Total Split (%)	33.3%	33.3%		33.3%	33.3%		33.3%	33.3%		33.3%	33.3%	
Yellow Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
All-Red Time (s)	1.5	1.5		1.5	1.5		1.5	1.5		1.5	1.5	
Lost Time Adjust (s)		0.0			0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.0			6.0		6.0	6.0		6.0	6.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	Max	Max		Max	Max		C-Min	C-Min		C-Min	C-Min	
Act Effct Green (s)		35.0			24.0		13.0	13.0		13.0	13.0	
Actuated g/C Ratio		0.39			0.27		0.14	0.14		0.14	0.14	
v/c Ratio		0.41			0.33		0.34	0.65		0.17	0.40	
Control Delay		6.3			27.3		38.0	36.5		34.6	18.9	
Queue Delay		0.0			0.0		0.0	0.0		0.0	0.0	
Total Delay		6.3			27.3		38.0	36.5		34.6	18.9	
LOS		A			C		D	D		C	B	
Approach Delay		6.3			27.3			36.8			21.3	
Approach LOS		A			C			D			C	
Queue Length 50th (ft)		41			70		32	76		11	25	

Lanes, Volumes, Timings
1002: Hull Rd/Jefferson St & Kipp Road

04/13/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)		42			105		56	111		28	58	
Internal Link Dist (ft)		445			729			311			459	
Turn Bay Length (ft)							350			200		
Base Capacity (vph)		1299			897		337	497		241	505	
Starvation Cap Reductn		0			0		0	0		0	0	
Spillback Cap Reductn		0			0		0	0		0	0	
Storage Cap Reductn		0			0		0	0		0	0	
Reduced v/c Ratio		0.41			0.33		0.18	0.38		0.09	0.24	

Intersection Summary

Area Type: Other

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 7 (8%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 50

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.65

Intersection Signal Delay: 19.5

Intersection LOS: B

Intersection Capacity Utilization 48.5%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 1002: Hull Rd/Jefferson St & Kipp Road

 Ø2 (R)	 Ø4	 Ø8
30 s	30 s	30 s
 Ø6 (R)		
30 s		

Intersection

Int Delay, s/veh 2.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	107	2	14	53	1	36
Future Vol, veh/h	107	2	14	53	1	36
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	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	68	68	60	60	66	66
Heavy Vehicles, %	3	3	12	12	10	10
Mvmt Flow	157	3	23	88	2	55

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	160
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.22
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.308
Pot Cap-1 Maneuver	-	-	1360
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	1360
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.6	9.5
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	859	-	-	1360	-
HCM Lane V/C Ratio	0.065	-	-	0.017	-
HCM Control Delay (s)	9.5	-	-	7.7	0
HCM Lane LOS	A	-	-	A	A
HCM 95th %tile Q(veh)	0.2	-	-	0.1	-

Intersection

Int Delay, s/veh 10.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↱		↱	↱					↱		↱
Traffic Vol, veh/h	0	114	6	119	44	0	0	0	0	167	0	12
Future Vol, veh/h	0	114	6	119	44	0	0	0	0	167	0	12
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	150	-	-	-	-	-	105	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	-	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	75	75	75	67	67	67	92	92	92	76	76	76
Heavy Vehicles, %	4	4	4	10	10	10	2	2	2	9	9	9
Mvmt Flow	0	152	8	178	66	0	0	0	0	220	0	16

Major/Minor	Major1			Major2			Minor2		
Conflicting Flow All	-	0	0	160	0	0	577	-	66
Stage 1	-	-	-	-	-	-	421	-	-
Stage 2	-	-	-	-	-	-	156	-	-
Critical Hdwy	-	-	-	4.2	-	-	6.49	-	6.29
Critical Hdwy Stg 1	-	-	-	-	-	-	5.49	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	5.49	-	-
Follow-up Hdwy	-	-	-	2.29	-	-	3.581	-	3.381
Pot Cap-1 Maneuver	0	-	-	1372	-	0	467	0	979
Stage 1	0	-	-	-	-	0	647	0	-
Stage 2	0	-	-	-	-	0	856	0	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	-	1372	-	-	406	0	979
Mov Cap-2 Maneuver	-	-	-	-	-	-	406	0	-
Stage 1	-	-	-	-	-	-	563	0	-
Stage 2	-	-	-	-	-	-	856	0	-

Approach	EB	WB	SB
HCM Control Delay, s	0	5.9	22.8
HCM LOS			C

Minor Lane/Major Mvmt	EBT	EBR	WBL	WBT	SBLn1	SBLn2
Capacity (veh/h)	-	-	1372	-	406	979
HCM Lane V/C Ratio	-	-	0.129	-	0.541	0.016
HCM Control Delay (s)	-	-	8	-	23.8	8.7
HCM Lane LOS	-	-	A	-	C	A
HCM 95th %tile Q(veh)	-	-	0.4	-	3.1	0

Intersection

Int Delay, s/veh 2.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	44	258	0	0	170	308	7	0	149	0	0	0
Future Vol, veh/h	44	258	0	0	170	308	7	0	149	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	150	-	-	-	-	0	150	-	0	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	-	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	73	73	73	72	72	72	78	78	78	92	92	92
Heavy Vehicles, %	4	4	4	4	4	4	6	6	6	2	2	2
Mvmt Flow	60	353	0	0	236	428	9	0	191	0	0	0

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	236	0	-
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.14	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.236	-	-
Pot Cap-1 Maneuver	1319	-	0
Stage 1	-	0	0
Stage 2	-	0	0
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	1319	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	1.1	0	12.4
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	WBT	WBR
Capacity (veh/h)	376	682	1319	-	-	-
HCM Lane V/C Ratio	0.024	0.28	0.046	-	-	-
HCM Control Delay (s)	14.8	12.3	7.9	-	-	-
HCM Lane LOS	B	B	A	-	-	-
HCM 95th %tile Q(veh)	0.1	1.1	0.1	-	-	-

Lanes, Volumes, Timings
1001: Meijer Dr/Cedar St & Kipp Road

04/13/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	99	265	271	6	206	62	130	121	21	81	124	92
Future Volume (vph)	99	265	271	6	206	62	130	121	21	81	124	92
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		110	0		0	120		0	130		0
Storage Lanes	0		1	0		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	0.95	0.95	1.00	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850		0.966			0.977			0.936	
Flt Protected		0.987			0.999		0.950			0.950		
Satd. Flow (prot)	0	3426	1553	0	3287	0	1770	1820	0	1752	1727	0
Flt Permitted		0.987			0.999		0.400			0.636		
Satd. Flow (perm)	0	3426	1553	0	3287	0	745	1820	0	1173	1727	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			285		42			9			38	
Link Speed (mph)		45			45			25			35	
Link Distance (ft)		670			525			276			442	
Travel Time (s)		10.2			8.0			7.5			8.6	
Peak Hour Factor	0.95	0.95	0.95	0.88	0.88	0.88	0.93	0.93	0.93	0.83	0.83	0.83
Heavy Vehicles (%)	4%	4%	4%	6%	6%	6%	2%	2%	2%	3%	3%	3%
Adj. Flow (vph)	104	279	285	7	234	70	140	130	23	98	149	111
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	383	285	0	311	0	140	153	0	98	260	0
Turn Type	Split	NA	Prot	Split	NA		Perm	NA		Perm	NA	
Protected Phases	4	4	4	8	8			2			6	
Permitted Phases							2			6		
Detector Phase	4	4	4	8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0		8.0	8.0		8.0	8.0	
Minimum Split (s)	16.0	16.0	16.0	16.0	16.0		14.0	14.0		14.0	14.0	
Total Split (s)	32.0	32.0	32.0	32.0	32.0		26.0	26.0		26.0	26.0	
Total Split (%)	35.6%	35.6%	35.6%	35.6%	35.6%		28.9%	28.9%		28.9%	28.9%	
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5		4.5	4.5		4.5	4.5	
All-Red Time (s)	1.5	1.5	1.5	1.5	1.5		1.5	1.5		1.5	1.5	
Lost Time Adjust (s)		0.0	0.0		0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.0	6.0		6.0		6.0	6.0		6.0	6.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	Max	Max	Max	Max	Max		C-Min	C-Min		C-Min	C-Min	
Act Effct Green (s)		27.6	27.6		26.0		18.4	18.4		18.4	18.4	
Actuated g/C Ratio		0.31	0.31		0.29		0.20	0.20		0.20	0.20	
v/c Ratio		0.36	0.42		0.32		0.92	0.40		0.41	0.68	
Control Delay		26.2	5.3		17.8		92.4	32.0		36.1	37.4	
Queue Delay		0.0	0.0		0.0		0.0	0.0		0.0	0.0	
Total Delay		26.2	5.3		17.8		92.4	32.0		36.1	37.4	
LOS		C	A		B		F	C		D	D	
Approach Delay		17.3			17.8			60.9			37.0	
Approach LOS		B			B			E			D	
Queue Length 50th (ft)		91	0		40		77	70		48	114	

Lanes, Volumes, Timings
1001: Meijer Dr/Cedar St & Kipp Road

04/13/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)		132	57		58		#184	126		87	175	
Internal Link Dist (ft)		590			445			196			362	
Turn Bay Length (ft)			110				120			130		
Base Capacity (vph)		1051	674		979		165	411		260	413	
Starvation Cap Reductn		0	0		0		0	0		0	0	
Spillback Cap Reductn		0	0		0		0	0		0	0	
Storage Cap Reductn		0	0		0		0	0		0	0	
Reduced v/c Ratio		0.36	0.42		0.32		0.85	0.37		0.38	0.63	

Intersection Summary

Area Type: Other

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 2 (2%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 50

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.92

Intersection Signal Delay: 29.6

Intersection LOS: C

Intersection Capacity Utilization 57.9%

ICU Level of Service B

Analysis Period (min) 15

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 1001: Meijer Dr/Cedar St & Kipp Road

		
Ø2 (R)	Ø4	Ø8
26 s	32 s	32 s
		
Ø6 (R)		
26 s		

Lanes, Volumes, Timings
1002: Hull Rd/Jefferson St & Kipp Road

04/13/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔↔			↔↔		↗	↘		↗	↘	
Traffic Volume (vph)	77	235	51	54	169	17	45	102	86	15	154	58
Future Volume (vph)	77	235	51	54	169	17	45	102	86	15	154	58
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	350		0	200		0
Storage Lanes	0		0	0		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	0.95	0.95	0.95	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.979			0.990			0.931			0.959	
Flt Protected		0.989			0.989		0.950			0.950		
Satd. Flow (prot)	0	3361	0	0	3399	0	1787	1751	0	1805	1822	0
Flt Permitted		0.989			0.989		0.394			0.489		
Satd. Flow (perm)	0	3361	0	0	3399	0	741	1751	0	929	1822	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		20			8			46			20	
Link Speed (mph)		45			45			55			35	
Link Distance (ft)		525			809			391			539	
Travel Time (s)		8.0			12.3			4.8			10.5	
Peak Hour Factor	0.91	0.91	0.91	0.83	0.83	0.83	0.90	0.90	0.90	0.85	0.85	0.85
Heavy Vehicles (%)	4%	4%	4%	4%	4%	4%	1%	1%	1%	0%	0%	0%
Adj. Flow (vph)	85	258	56	65	204	20	50	113	96	18	181	68
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	399	0	0	289	0	50	209	0	18	249	0
Turn Type	Split	NA		Split	NA		Perm	NA		Perm	NA	
Protected Phases	4	4		8	8			2			6	
Permitted Phases							2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		8.0	8.0		8.0	8.0	
Minimum Split (s)	16.0	16.0		16.0	16.0		14.0	14.0		14.0	14.0	
Total Split (s)	30.0	30.0		30.0	30.0		30.0	30.0		30.0	30.0	
Total Split (%)	33.3%	33.3%		33.3%	33.3%		33.3%	33.3%		33.3%	33.3%	
Yellow Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
All-Red Time (s)	1.5	1.5		1.5	1.5		1.5	1.5		1.5	1.5	
Lost Time Adjust (s)		0.0			0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.0			6.0		6.0	6.0		6.0	6.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	Max	Max		Max	Max		C-Min	C-Min		C-Min	C-Min	
Act Effct Green (s)		31.4			24.0		16.6	16.6		16.6	16.6	
Actuated g/C Ratio		0.35			0.27		0.18	0.18		0.18	0.18	
v/c Ratio		0.34			0.32		0.36	0.58		0.11	0.71	
Control Delay		6.4			26.8		38.1	31.6		29.3	42.0	
Queue Delay		0.0			0.0		0.0	0.0		0.0	0.0	
Total Delay		6.4			26.8		38.1	31.6		29.3	42.0	
LOS		A			C		D	C		C	D	
Approach Delay		6.4			26.8			32.9			41.2	
Approach LOS		A			C			C			D	
Queue Length 50th (ft)		36			67		25	84		9	123	

Lanes, Volumes, Timings
1002: Hull Rd/Jefferson St & Kipp Road

04/13/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)		52			93		56	142		24	173	
Internal Link Dist (ft)		445			729			311			459	
Turn Bay Length (ft)							350			200		
Base Capacity (vph)		1184			912		197	500		247	500	
Starvation Cap Reductn		0			0		0	0		0	0	
Spillback Cap Reductn		0			0		0	0		0	0	
Storage Cap Reductn		0			0		0	0		0	0	
Reduced v/c Ratio		0.34			0.32		0.25	0.42		0.07	0.50	

Intersection Summary

Area Type: Other

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 7 (8%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 50

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.71

Intersection Signal Delay: 24.5

Intersection LOS: C

Intersection Capacity Utilization 57.0%

ICU Level of Service B

Analysis Period (min) 15

Splits and Phases: 1002: Hull Rd/Jefferson St & Kipp Road

 Ø2 (R)	 Ø4	 Ø8
30 s	30 s	30 s
 Ø6 (R)		
30 s		

Intersection

Int Delay, s/veh 1.7

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	71	0	28	156	1	22
Future Vol, veh/h	71	0	28	156	1	22
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	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	77	77	90	90	60	60
Heavy Vehicles, %	4	4	2	2	12	12
Mvmt Flow	92	0	31	173	2	37

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	92
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.12
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.218
Pot Cap-1 Maneuver	-	-	1503
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	1503
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.1	9.1
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	919	-	-	1503	-
HCM Lane V/C Ratio	0.042	-	-	0.021	-
HCM Control Delay (s)	9.1	-	-	7.4	0
HCM Lane LOS	A	-	-	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0.1	-

Intersection

Int Delay, s/veh 67.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↱		↱	↱					↱		↱
Traffic Vol, veh/h	0	115	9	147	144	0	0	0	0	379	0	57
Future Vol, veh/h	0	115	9	147	144	0	0	0	0	379	0	57
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	150	-	-	-	-	-	105	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	-	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	84	84	84	92	92	92	92	92	92	79	79	79
Heavy Vehicles, %	3	3	3	4	4	4	2	2	2	2	2	2
Mvmt Flow	0	137	11	160	157	0	0	0	0	480	0	72

Major/Minor	Major1			Major2			Minor2		
Conflicting Flow All	-	0	0	148	0	0	618	-	157
Stage 1	-	-	-	-	-	-	476	-	-
Stage 2	-	-	-	-	-	-	142	-	-
Critical Hdwy	-	-	-	4.14	-	-	6.42	-	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	5.42	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	5.42	-	-
Follow-up Hdwy	-	-	-	2.236	-	-	3.518	-	3.318
Pot Cap-1 Maneuver	0	-	-	1421	-	0	~ 453	0	889
Stage 1	0	-	-	-	-	0	625	0	-
Stage 2	0	-	-	-	-	0	885	0	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	-	1421	-	-	~ 402	0	889
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 402	0	-
Stage 1	-	-	-	-	-	-	555	0	-
Stage 2	-	-	-	-	-	-	885	0	-

Approach	EB	WB	SB
HCM Control Delay, s	0	4	122.3
HCM LOS			F

Minor Lane/Major Mvmt	EBT	EBR	WBL	WBT	SBLn1	SBLn2
Capacity (veh/h)	-	-	1421	-	402	889
HCM Lane V/C Ratio	-	-	0.112	-	1.193	0.081
HCM Control Delay (s)	-	-	7.9	-	139.3	9.4
HCM Lane LOS	-	-	A	-	F	A
HCM 95th %tile Q(veh)	-	-	0.4	-	19.1	0.3

Notes

~: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection												
Int Delay, s/veh	2.8											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	29	472	0	0	281	208	17	0	171	0	0	0
Future Vol, veh/h	29	472	0	0	281	208	17	0	171	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	150	-	-	-	-	0	150	-	0	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	-	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	83	83	83	82	82	82	86	86	86	92	92	92
Heavy Vehicles, %	1	1	1	3	3	3	4	4	4	2	2	2
Mvmt Flow	35	569	0	0	343	254	20	0	199	0	0	0

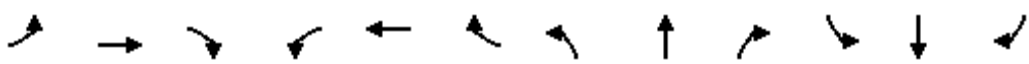
Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	343	0	-	-	0	982
Stage 1	-	-	-	-	-	639
Stage 2	-	-	-	-	-	343
Critical Hdwy	4.11	-	-	-	-	6.44
Critical Hdwy Stg 1	-	-	-	-	-	5.44
Critical Hdwy Stg 2	-	-	-	-	-	5.44
Follow-up Hdwy	2.209	-	-	-	-	3.536
Pot Cap-1 Maneuver	1222	-	0	0	-	274
Stage 1	-	-	0	0	-	522
Stage 2	-	-	0	0	-	714
Platoon blocked, %	-	-	-	-	-	-
Mov Cap-1 Maneuver	1222	-	-	-	-	266
Mov Cap-2 Maneuver	-	-	-	-	-	266
Stage 1	-	-	-	-	-	507
Stage 2	-	-	-	-	-	714

Approach	EB	WB	NB
HCM Control Delay, s	0.5	0	16.5
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	WBT	WBR
Capacity (veh/h)	266	518	1222	-	-	-
HCM Lane V/C Ratio	0.074	0.384	0.029	-	-	-
HCM Control Delay (s)	19.6	16.2	8	-	-	-
HCM Lane LOS	C	C	A	-	-	-
HCM 95th %tile Q(veh)	0.2	1.8	0.1	-	-	-

Lanes, Volumes, Timings
1001: Meijer Dr/Cedar St & Kipp Road

04/13/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	62	296	82	4	223	74	92	37	13	66	35	64
Future Volume (vph)	62	296	82	4	223	74	92	37	13	66	35	64
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		110	0		0	120		0	130		0
Storage Lanes	0		1	0		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	0.95	0.95	1.00	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850		0.963			0.960			0.903	
Flt Protected		0.991			0.999		0.950			0.950		
Satd. Flow (prot)	0	3313	1495	0	3216	0	1597	1614	0	1671	1589	0
Flt Permitted		0.991			0.999		0.684			0.722		
Satd. Flow (perm)	0	3313	1495	0	3216	0	1150	1614	0	1270	1589	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			164		46			14			74	
Link Speed (mph)		45			45			25			35	
Link Distance (ft)		670			525			276			442	
Travel Time (s)		10.2			8.0			7.5			8.6	
Peak Hour Factor	0.82	0.82	0.82	0.81	0.81	0.81	0.95	0.95	0.95	0.87	0.87	0.87
Heavy Vehicles (%)	8%	8%	8%	8%	8%	8%	13%	13%	13%	8%	8%	8%
Adj. Flow (vph)	76	361	100	5	275	91	97	39	14	76	40	74
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	437	100	0	371	0	97	53	0	76	114	0
Turn Type	Split	NA	Prot	Split	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	4	4	4	8	8		5	2		1	6	
Permitted Phases							2			6		
Detector Phase	4	4	4	8	8		5	2		1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0		5.0	8.0		5.0	8.0	
Minimum Split (s)	16.0	16.0	16.0	16.0	16.0		9.5	14.0		9.5	14.0	
Total Split (s)	25.0	25.0	25.0	28.0	28.0		13.0	24.0		13.0	24.0	
Total Split (%)	27.8%	27.8%	27.8%	31.1%	31.1%		14.4%	26.7%		14.4%	26.7%	
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5		3.5	4.5		3.5	4.5	
All-Red Time (s)	1.5	1.5	1.5	1.5	1.5		1.0	1.5		1.0	1.5	
Lost Time Adjust (s)		0.0	0.0		0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.0	6.0		6.0		4.5	6.0		4.5	6.0	
Lead/Lag							Lag	Lead		Lag	Lead	
Lead-Lag Optimize?												
Recall Mode	Max	Max	Max	Max	Max		None	C-Min		None	C-Min	
Act Effct Green (s)		32.4	32.4		22.0		16.0	8.7		17.2	9.3	
Actuated g/C Ratio		0.36	0.36		0.24		0.18	0.10		0.19	0.10	
v/c Ratio		0.37	0.16		0.45		0.42	0.31		0.28	0.50	
Control Delay		23.6	1.3		50.3		34.3	34.6		30.4	23.4	
Queue Delay		0.0	0.0		0.0		0.0	0.0		0.0	0.0	
Total Delay		23.6	1.3		50.3		34.3	34.6		30.4	23.4	
LOS		C	A		D		C	C		C	C	
Approach Delay		19.4			50.3			34.4			26.2	
Approach LOS		B			D			C			C	
Queue Length 50th (ft)		96	0		107		46	21		36	22	

Lanes, Volumes, Timings
1001: Meijer Dr/Cedar St & Kipp Road

04/13/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)		134	1		138		82	55		65	65	
Internal Link Dist (ft)		590			445			196			362	
Turn Bay Length (ft)			110				120			130		
Base Capacity (vph)		1191	642		820		281	334		310	377	
Starvation Cap Reductn		0	0		0		0	0		0	0	
Spillback Cap Reductn		0	0		0		0	0		0	0	
Storage Cap Reductn		0	0		0		0	0		0	0	
Reduced v/c Ratio		0.37	0.16		0.45		0.35	0.16		0.25	0.30	

Intersection Summary

Area Type: Other

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 78 (87%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 60

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.50

Intersection Signal Delay: 31.4

Intersection LOS: C

Intersection Capacity Utilization 45.4%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 1001: Meijer Dr/Cedar St & Kipp Road

 Ø2 (R)	 Ø1	 Ø4	 Ø8
24 s	13 s	25 s	28 s
 Ø6 (R)	 Ø5		
24 s	13 s		

Lanes, Volumes, Timings
1002: Hull Rd/Jefferson St & Kipp Road

04/13/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	51	259	48	49	204	13	48	78	72	18	40	59
Future Volume (vph)	51	259	48	49	204	13	48	78	72	18	40	59
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	350		0	200		0
Storage Lanes	0		0	0		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	0.95	0.95	0.95	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.980			0.992			0.928			0.910	
Flt Protected		0.993			0.991		0.950			0.950		
Satd. Flow (prot)	0	3314	0	0	3348	0	1770	1729	0	1770	1695	0
Flt Permitted		0.993			0.991		0.679			0.486		
Satd. Flow (perm)	0	3314	0	0	3348	0	1265	1729	0	905	1695	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		19			6			50			73	
Link Speed (mph)		45			45			55			35	
Link Distance (ft)		525			809			391			539	
Travel Time (s)		8.0			12.3			4.8			10.5	
Peak Hour Factor	0.68	0.68	0.68	0.89	0.89	0.89	0.79	0.79	0.79	0.81	0.81	0.81
Heavy Vehicles (%)	6%	6%	6%	6%	6%	6%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	75	381	71	55	229	15	61	99	91	22	49	73
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	527	0	0	299	0	61	190	0	22	122	0
Turn Type	Split	NA		Split	NA		Perm	NA		Perm	NA	
Protected Phases	4	4		8	8			2			6	
Permitted Phases							2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		8.0	8.0		8.0	8.0	
Minimum Split (s)	16.0	16.0		16.0	16.0		14.0	14.0		14.0	14.0	
Total Split (s)	30.0	30.0		30.0	30.0		30.0	30.0		30.0	30.0	
Total Split (%)	33.3%	33.3%		33.3%	33.3%		33.3%	33.3%		33.3%	33.3%	
Yellow Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
All-Red Time (s)	1.5	1.5		1.5	1.5		1.5	1.5		1.5	1.5	
Lost Time Adjust (s)		0.0			0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.0			6.0		6.0	6.0		6.0	6.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	Max	Max		Max	Max		C-Min	C-Min		C-Min	C-Min	
Act Effect Green (s)		35.0			24.0		13.0	13.0		13.0	13.0	
Actuated g/C Ratio		0.39			0.27		0.14	0.14		0.14	0.14	
v/c Ratio		0.41			0.33		0.34	0.65		0.17	0.40	
Control Delay		12.9			27.3		38.0	36.5		34.6	18.9	
Queue Delay		0.0			0.0		0.0	0.0		0.0	0.0	
Total Delay		12.9			27.3		38.0	36.5		34.6	18.9	
LOS		B			C		D	D		C	B	
Approach Delay		12.9			27.3			36.8			21.3	
Approach LOS		B			C			D			C	
Queue Length 50th (ft)		133			70		32	76		11	25	

Lanes, Volumes, Timings
1002: Hull Rd/Jefferson St & Kipp Road

04/13/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)		105			105		56	111		28	58	
Internal Link Dist (ft)		445			729			311			459	
Turn Bay Length (ft)							350			200		
Base Capacity (vph)		1299			897		337	497		241	505	
Starvation Cap Reductn		0			0		0	0		0	0	
Spillback Cap Reductn		0			0		0	0		0	0	
Storage Cap Reductn		0			0		0	0		0	0	
Reduced v/c Ratio		0.41			0.33		0.18	0.38		0.09	0.24	

Intersection Summary

Area Type: Other

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 7 (8%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 50

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.65

Intersection Signal Delay: 22.3

Intersection LOS: C

Intersection Capacity Utilization 48.5%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 1002: Hull Rd/Jefferson St & Kipp Road

 Ø2 (R)	 Ø4	 Ø8
30 s	30 s	30 s
 Ø6 (R)		
30 s		

HCM Unsignalized Intersection Capacity Analysis

9000: Jewitt Rd & Kipp Road

03/22/2018

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↰			↱	↰	↱
Traffic Volume (veh/h)	107	2	14	53	1	36
Future Volume (Veh/h)	107	2	14	53	1	36
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.68	0.68	0.60	0.60	0.66	0.66
Hourly flow rate (vph)	157	3	23	88	2	55
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			160		292	158
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			160		292	158
tC, single (s)			4.2		6.5	6.3
tC, 2 stage (s)						
tF (s)			2.3		3.6	3.4
p0 queue free %			98		100	94
cM capacity (veh/h)			1372		666	861
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	160	111	57			
Volume Left	0	23	2			
Volume Right	3	0	55			
cSH	1700	1372	853			
Volume to Capacity	0.09	0.02	0.07			
Queue Length 95th (ft)	0	1	5			
Control Delay (s)	0.0	1.7	9.5			
Lane LOS		A	A			
Approach Delay (s)	0.0	1.7	9.5			
Approach LOS			A			
Intersection Summary						
Average Delay		2.2				
Intersection Capacity Utilization		20.2%	ICU Level of Service		A	
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

9001: US-127 SB On Ramp/US-127 SB Off Ramp & Kipp Road

03/22/2018

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	114	6	119	44	0	0	0	0	167	0	12
Future Volume (Veh/h)	0	114	6	119	44	0	0	0	0	167	0	12
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.75	0.75	0.75	0.67	0.67	0.67	0.92	0.92	0.92	0.76	0.76	0.76
Hourly flow rate (vph)	0	152	8	178	66	0	0	0	0	220	0	16
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	66			160			594	578	156	578	582	66
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	66			160			594	578	156	578	582	66
tC, single (s)	4.1			4.2			7.1	6.5	6.2	7.2	6.6	6.3
tC, 2 stage (s)												
tF (s)	2.2			2.3			3.5	4.0	3.3	3.6	4.1	3.4
p0 queue free %	100			87			100	100	100	41	100	98
cM capacity (veh/h)	1523			1372			369	371	890	375	361	979
Direction, Lane #	EB 1	WB 1	WB 2	SB 1	SB 2							
Volume Total	160	178	66	220	16							
Volume Left	0	178	0	220	0							
Volume Right	8	0	0	0	16							
cSH	1700	1372	1700	375	979							
Volume to Capacity	0.09	0.13	0.04	0.59	0.02							
Queue Length 95th (ft)	0	11	0	90	1							
Control Delay (s)	0.0	8.0	0.0	27.3	8.7							
Lane LOS		A		D	A							
Approach Delay (s)	0.0	5.8		26.1								
Approach LOS				D								
Intersection Summary												
Average Delay	11.8											
Intersection Capacity Utilization	35.7%			ICU Level of Service			A					
Analysis Period (min)	15											

HCM Unsignalized Intersection Capacity Analysis

9002: US-127 NB Off Ramp/US-127 NB On Ramp & Kipp Road

03/22/2018

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	44	258	0	0	170	308	7	0	149	0	0	0
Future Volume (Veh/h)	44	258	0	0	170	308	7	0	149	0	0	0
Sign Control	Free			Free			Stop			Stop		
Grade	0%			0%			0%			0%		
Peak Hour Factor	0.73	0.73	0.73	0.73	0.73	0.73	0.78	0.78	0.78	0.92	0.92	0.92
Hourly flow rate (vph)	60	353	0	0	233	422	9	0	191	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (ft)	670											
pX, platoon unblocked												
vC, conflicting volume	655			353			706	1128	353	897	706	233
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	655			353			706	1128	353	897	706	233
tC, single (s)	4.1			4.1			7.2	6.6	6.3	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.6	4.1	3.4	3.5	4.0	3.3
p0 queue free %	93			100			97	100	72	100	100	100
cM capacity (veh/h)	923			1195			328	188	682	178	337	806
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2						
Volume Total	60	353	233	422	9	191						
Volume Left	60	0	0	0	9	0						
Volume Right	0	0	0	422	0	191						
cSH	923	1700	1700	1700	328	682						
Volume to Capacity	0.07	0.21	0.14	0.25	0.03	0.28						
Queue Length 95th (ft)	5	0	0	0	2	29						
Control Delay (s)	9.2	0.0	0.0	0.0	16.3	12.3						
Lane LOS	A				C	B						
Approach Delay (s)	1.3		0.0		12.5							
Approach LOS					B							
Intersection Summary												
Average Delay	2.4											
Intersection Capacity Utilization	35.7%			ICU Level of Service			A					
Analysis Period (min)	15											

Lanes, Volumes, Timings
1001: Meijer Dr/Cedar St & Kipp Road

04/13/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	99	265	271	6	206	62	130	121	21	81	124	92
Future Volume (vph)	99	265	271	6	206	62	130	121	21	81	124	92
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		110	0		0	120		0	130		0
Storage Lanes	0		1	0		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	0.95	0.95	1.00	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850		0.966			0.977			0.936	
Flt Protected		0.987			0.999		0.950			0.950		
Satd. Flow (prot)	0	3426	1553	0	3287	0	1770	1820	0	1752	1727	0
Flt Permitted		0.987			0.999		0.321			0.616		
Satd. Flow (perm)	0	3426	1553	0	3287	0	598	1820	0	1136	1727	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			285		35			10			42	
Link Speed (mph)		45			45			25			35	
Link Distance (ft)		670			525			276			442	
Travel Time (s)		10.2			8.0			7.5			8.6	
Peak Hour Factor	0.95	0.95	0.95	0.88	0.88	0.88	0.93	0.93	0.93	0.83	0.83	0.83
Heavy Vehicles (%)	4%	4%	4%	6%	6%	6%	2%	2%	2%	3%	3%	3%
Adj. Flow (vph)	104	279	285	7	234	70	140	130	23	98	149	111
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	383	285	0	311	0	140	153	0	98	260	0
Turn Type	Split	NA	Prot	Split	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	4	4	4	8	8		5	2		1	6	
Permitted Phases							2			6		
Detector Phase	4	4	4	8	8		5	2		1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0		5.0	8.0		5.0	8.0	
Minimum Split (s)	16.0	16.0	16.0	16.0	16.0		9.5	14.0		9.5	14.0	
Total Split (s)	26.0	26.0	26.0	20.0	20.0		12.0	32.0		12.0	32.0	
Total Split (%)	28.9%	28.9%	28.9%	22.2%	22.2%		13.3%	35.6%		13.3%	35.6%	
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5		3.5	4.5		3.5	4.5	
All-Red Time (s)	1.5	1.5	1.5	1.5	1.5		1.0	1.5		1.0	1.5	
Lost Time Adjust (s)		0.0	0.0		0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.0	6.0		6.0		4.5	6.0		4.5	6.0	
Lead/Lag							Lag	Lead		Lag	Lead	
Lead-Lag Optimize?												
Recall Mode	Max	Max	Max	Max	Max		None	C-Min		None	C-Min	
Act Effct Green (s)		30.2	30.2		14.0		21.7	14.9		28.2	16.9	
Actuated g/C Ratio		0.34	0.34		0.16		0.24	0.17		0.31	0.19	
v/c Ratio		0.33	0.40		0.58		0.62	0.49		0.23	0.73	
Control Delay		24.8	5.4		26.8		40.3	38.1		22.2	40.0	
Queue Delay		0.0	0.0		0.0		0.0	0.0		0.0	0.0	
Total Delay		24.8	5.4		26.8		40.3	38.1		22.2	40.0	
LOS		C	A		C		D	D		C	D	
Approach Delay		16.5			26.8			39.1			35.1	
Approach LOS		B			C			D			D	
Queue Length 50th (ft)		84	0		42		58	77		40	118	

Lanes, Volumes, Timings
1001: Meijer Dr/Cedar St & Kipp Road

04/13/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)		141	61		63		89	131		60	163	
Internal Link Dist (ft)		590			445			196			362	
Turn Bay Length (ft)			110				120			130		
Base Capacity (vph)		1150	710		540		249	532		434	528	
Starvation Cap Reductn		0	0		0		0	0		0	0	
Spillback Cap Reductn		0	0		0		0	0		0	0	
Storage Cap Reductn		0	0		0		0	0		0	0	
Reduced v/c Ratio		0.33	0.40		0.58		0.56	0.29		0.23	0.49	

Intersection Summary

Area Type: Other

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 60

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.73

Intersection Signal Delay: 26.6

Intersection LOS: C

Intersection Capacity Utilization 56.6%

ICU Level of Service B

Analysis Period (min) 15

Splits and Phases: 1001: Meijer Dr/Cedar St & Kipp Road

 Ø2 (R)	 Ø1	 Ø4	 Ø8
32 s	12 s	26 s	20 s
 Ø6 (R)	 Ø5		
32 s	12 s		

Lanes, Volumes, Timings
1002: Hull Rd/Jefferson St & Kipp Road

04/13/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	77	235	51	54	169	17	45	102	86	15	154	58
Future Volume (vph)	77	235	51	54	169	17	45	102	86	15	154	58
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	350		0	200		0
Storage Lanes	0		0	0		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	0.95	0.95	0.95	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.979			0.990			0.931			0.959	
Flt Protected		0.989			0.989		0.950			0.950		
Satd. Flow (prot)	0	3361	0	0	3399	0	1787	1751	0	1805	1822	0
Flt Permitted		0.989			0.989		0.394			0.489		
Satd. Flow (perm)	0	3361	0	0	3399	0	741	1751	0	929	1822	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		20			8			46			20	
Link Speed (mph)		45			45			55			35	
Link Distance (ft)		525			809			391			539	
Travel Time (s)		8.0			12.3			4.8			10.5	
Peak Hour Factor	0.91	0.91	0.91	0.83	0.83	0.83	0.90	0.90	0.90	0.85	0.85	0.85
Heavy Vehicles (%)	4%	4%	4%	4%	4%	4%	1%	1%	1%	0%	0%	0%
Adj. Flow (vph)	85	258	56	65	204	20	50	113	96	18	181	68
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	399	0	0	289	0	50	209	0	18	249	0
Turn Type	Split	NA		Split	NA		Perm	NA		Perm	NA	
Protected Phases	4	4		8	8			2			6	
Permitted Phases							2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		8.0	8.0		8.0	8.0	
Minimum Split (s)	16.0	16.0		16.0	16.0		14.0	14.0		14.0	14.0	
Total Split (s)	30.0	30.0		30.0	30.0		30.0	30.0		30.0	30.0	
Total Split (%)	33.3%	33.3%		33.3%	33.3%		33.3%	33.3%		33.3%	33.3%	
Yellow Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
All-Red Time (s)	1.5	1.5		1.5	1.5		1.5	1.5		1.5	1.5	
Lost Time Adjust (s)		0.0			0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.0			6.0		6.0	6.0		6.0	6.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	Max	Max		Max	Max		C-Min	C-Min		C-Min	C-Min	
Act Effct Green (s)		31.4			24.0		16.6	16.6		16.6	16.6	
Actuated g/C Ratio		0.35			0.27		0.18	0.18		0.18	0.18	
v/c Ratio		0.34			0.32		0.36	0.58		0.11	0.71	
Control Delay		11.3			26.8		38.1	31.6		29.3	42.0	
Queue Delay		0.0			0.0		0.0	0.0		0.0	0.0	
Total Delay		11.3			26.8		38.1	31.6		29.3	42.0	
LOS		B			C		D	C		C	D	
Approach Delay		11.3			26.8			32.9			41.2	
Approach LOS		B			C			C			D	
Queue Length 50th (ft)		43			67		25	84		9	123	

Lanes, Volumes, Timings
1002: Hull Rd/Jefferson St & Kipp Road

04/13/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)		72			93		56	142		24	173	
Internal Link Dist (ft)		445			729			311			459	
Turn Bay Length (ft)							350			200		
Base Capacity (vph)		1184			912		197	500		247	500	
Starvation Cap Reductn		0			0		0	0		0	0	
Spillback Cap Reductn		0			0		0	0		0	0	
Storage Cap Reductn		0			0		0	0		0	0	
Reduced v/c Ratio		0.34			0.32		0.25	0.42		0.07	0.50	

Intersection Summary

Area Type: Other

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 7 (8%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 50

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.71

Intersection Signal Delay: 26.2

Intersection LOS: C

Intersection Capacity Utilization 57.0%

ICU Level of Service B

Analysis Period (min) 15

Splits and Phases: 1002: Hull Rd/Jefferson St & Kipp Road

 Ø2 (R)	 Ø4	 Ø8
30 s	30 s	30 s
 Ø6 (R)		
30 s		

HCM Unsignalized Intersection Capacity Analysis

9000: Jewitt Rd & Kipp Road

04/09/2018

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱			↱	↘↗	
Traffic Volume (veh/h)	71	0	28	156	1	22
Future Volume (Veh/h)	71	0	28	156	1	22
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.77	0.77	0.90	0.90	0.60	0.60
Hourly flow rate (vph)	92	0	31	173	2	37
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			92		327	92
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			92		327	92
tC, single (s)			4.1		6.5	6.3
tC, 2 stage (s)						
tF (s)			2.2		3.6	3.4
p0 queue free %			98		100	96
cM capacity (veh/h)			1509		636	941
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	92	204	39			
Volume Left	0	31	2			
Volume Right	0	0	37			
cSH	1700	1509	919			
Volume to Capacity	0.05	0.02	0.04			
Queue Length 95th (ft)	0	2	3			
Control Delay (s)	0.0	1.3	9.1			
Lane LOS		A	A			
Approach Delay (s)	0.0	1.3	9.1			
Approach LOS			A			
Intersection Summary						
Average Delay			1.8			
Intersection Capacity Utilization			26.4%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

9001: US-127 SB On Ramp/US-127 SB Off Ramp & Kipp Road

04/09/2018

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	115	9	147	144	0	0	0	0	379	0	57
Future Volume (Veh/h)	0	115	9	147	144	0	0	0	0	379	0	57
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.84	0.84	0.84	0.92	0.92	0.92	0.92	0.92	0.92	0.79	0.79	0.79
Hourly flow rate (vph)	0	137	11	160	157	0	0	0	0	480	0	72
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	157			148			692	620	142	620	625	157
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	157			148			692	620	142	620	625	157
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			89			100	100	100	0	100	92
cM capacity (veh/h)	1417			1421			301	359	905	366	356	889
Direction, Lane #	EB 1	WB 1	WB 2	SB 1	SB 2							
Volume Total	148	160	157	480	72							
Volume Left	0	160	0	480	0							
Volume Right	11	0	0	0	72							
cSH	1700	1421	1700	366	889							
Volume to Capacity	0.09	0.11	0.09	1.31	0.08							
Queue Length 95th (ft)	0	9	0	558	7							
Control Delay (s)	0.0	7.9	0.0	188.3	9.4							
Lane LOS		A		F	A							
Approach Delay (s)	0.0	4.0		165.0								
Approach LOS				F								
Intersection Summary												
Average Delay		90.8										
Intersection Capacity Utilization		45.7%			ICU Level of Service				A			
Analysis Period (min)		15										

HCM Unsignalized Intersection Capacity Analysis

9002: US-127 NB Off Ramp/US-127 NB On Ramp & Kipp Road

04/09/2018

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	29	472	0	0	281	208	17	0	171	0	0	0
Future Volume (Veh/h)	29	472	0	0	281	208	17	0	171	0	0	0
Sign Control	Free			Free			Stop			Stop		
Grade	0%			0%			0%			0%		
Peak Hour Factor	0.83	0.83	0.83	0.82	0.82	0.82	0.86	0.86	0.86	0.92	0.92	0.92
Hourly flow rate (vph)	35	569	0	0	343	254	20	0	199	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (ft)	670											
pX, platoon unblocked	0.95						0.95	0.95		0.95	0.95	0.95
vC, conflicting volume	597			569			982	1236	569	1181	982	343
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	546			569			953	1221	569	1163	953	278
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	96			100			91	100	62	100	100	100
cM capacity (veh/h)	973			998			218	163	518	97	236	720
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2						
Volume Total	35	569	343	254	20	199						
Volume Left	35	0	0	0	20	0						
Volume Right	0	0	0	254	0	199						
cSH	973	1700	1700	1700	218	518						
Volume to Capacity	0.04	0.33	0.20	0.15	0.09	0.38						
Queue Length 95th (ft)	3	0	0	0	7	45						
Control Delay (s)	8.8	0.0	0.0	0.0	23.2	16.2						
Lane LOS	A				C	C						
Approach Delay (s)	0.5		0.0		16.9							
Approach LOS					C							
Intersection Summary												
Average Delay	2.8											
Intersection Capacity Utilization	45.7%			ICU Level of Service			A					
Analysis Period (min)	15											

Lanes, Volumes, Timings
1001: Meijer Dr/Cedar St & Kipp Road

04/13/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	62	296	82	4	223	74	92	37	13	66	35	64
Future Volume (vph)	62	296	82	4	223	74	92	37	13	66	35	64
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		110	0		0	120		0	130		0
Storage Lanes	0		1	0		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	0.95	0.95	1.00	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850		0.963			0.960			0.903	
Flt Protected		0.991			0.999		0.950			0.950		
Satd. Flow (prot)	0	3313	1495	0	3216	0	1597	1614	0	1671	1589	0
Flt Permitted		0.991			0.999		0.683			0.722		
Satd. Flow (perm)	0	3313	1495	0	3216	0	1148	1614	0	1270	1589	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			164		46			14			74	
Link Speed (mph)		45			45			25			35	
Link Distance (ft)		670			525			276			442	
Travel Time (s)		10.2			8.0			7.5			8.6	
Peak Hour Factor	0.82	0.82	0.82	0.81	0.81	0.81	0.95	0.95	0.95	0.87	0.87	0.87
Growth Factor	101%	101%	101%	101%	101%	101%	101%	101%	101%	101%	101%	101%
Heavy Vehicles (%)	8%	8%	8%	8%	8%	8%	13%	13%	13%	8%	8%	8%
Adj. Flow (vph)	76	365	101	5	278	92	98	39	14	77	41	74
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	441	101	0	375	0	98	53	0	77	115	0
Turn Type	Split	NA	Prot	Split	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	4	4	4	8	8		5	2		1	6	
Permitted Phases							2			6		
Detector Phase	4	4	4	8	8		5	2		1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0		5.0	8.0		5.0	8.0	
Minimum Split (s)	16.0	16.0	16.0	16.0	16.0		9.5	14.0		9.5	14.0	
Total Split (s)	25.0	25.0	25.0	28.0	28.0		13.0	24.0		13.0	24.0	
Total Split (%)	27.8%	27.8%	27.8%	31.1%	31.1%		14.4%	26.7%		14.4%	26.7%	
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5		3.5	4.5		3.5	4.5	
All-Red Time (s)	1.5	1.5	1.5	1.5	1.5		1.0	1.5		1.0	1.5	
Lost Time Adjust (s)		0.0	0.0		0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.0	6.0		6.0		4.5	6.0		4.5	6.0	
Lead/Lag							Lag	Lead		Lag	Lead	
Lead-Lag Optimize?												
Recall Mode	Max	Max	Max	Max	Max		None	C-Min		None	C-Min	
Act Effct Green (s)		32.3	32.3		22.0		16.1	8.7		17.3	9.4	
Actuated g/C Ratio		0.36	0.36		0.24		0.18	0.10		0.19	0.10	
v/c Ratio		0.37	0.16		0.46		0.42	0.31		0.28	0.50	
Control Delay		23.7	1.3		50.5		34.3	34.6		30.4	23.6	
Queue Delay		0.0	0.0		0.0		0.0	0.0		0.0	0.0	
Total Delay		23.7	1.3		50.5		34.3	34.6		30.4	23.6	
LOS		C	A		D		C	C		C	C	
Approach Delay		19.5			50.5			34.4			26.3	
Approach LOS		B			D			C			C	

Lanes, Volumes, Timings
1001: Meijer Dr/Cedar St & Kipp Road

04/13/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 50th (ft)		97	0		108		47	21		36	22	
Queue Length 95th (ft)		136	2		140		83	55		65	66	
Internal Link Dist (ft)		590			445			196			362	
Turn Bay Length (ft)			110				120			130		
Base Capacity (vph)		1189	642		820		281	334		310	377	
Starvation Cap Reductn		0	0		0		0	0		0	0	
Spillback Cap Reductn		0	0		0		0	0		0	0	
Storage Cap Reductn		0	0		0		0	0		0	0	
Reduced v/c Ratio		0.37	0.16		0.46		0.35	0.16		0.25	0.31	

Intersection Summary

Area Type: Other

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 78 (87%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 60

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.50

Intersection Signal Delay: 31.6

Intersection LOS: C

Intersection Capacity Utilization 45.6%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 1001: Meijer Dr/Cedar St & Kipp Road

 Ø2 (R)	 Ø1	 Ø4	 Ø8
24 s	13 s	25 s	28 s
 Ø6 (R)	 Ø5		
24 s	13 s		

Lanes, Volumes, Timings
1002: Hull Rd/Jefferson St & Kipp Road

04/13/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔↔			↔↔		↔	↔		↔	↔	
Traffic Volume (vph)	51	259	48	49	204	13	48	78	72	18	40	59
Future Volume (vph)	51	259	48	49	204	13	48	78	72	18	40	59
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	350		0	200		0
Storage Lanes	0		0	0		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	0.95	0.95	0.95	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.980			0.993			0.928			0.910	
Flt Protected		0.993			0.991		0.950			0.950		
Satd. Flow (prot)	0	3314	0	0	3351	0	1770	1729	0	1770	1695	0
Flt Permitted		0.993			0.991		0.677			0.482		
Satd. Flow (perm)	0	3314	0	0	3351	0	1261	1729	0	898	1695	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		19			6			50			74	
Link Speed (mph)		45			45			55			35	
Link Distance (ft)		525			809			391			539	
Travel Time (s)		8.0			12.3			4.8			10.5	
Peak Hour Factor	0.68	0.68	0.68	0.89	0.89	0.89	0.79	0.79	0.79	0.81	0.81	0.81
Growth Factor	101%	101%	101%	101%	101%	101%	101%	101%	101%	101%	101%	101%
Heavy Vehicles (%)	6%	6%	6%	6%	6%	6%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	76	385	71	56	232	15	61	100	92	22	50	74
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	532	0	0	303	0	61	192	0	22	124	0
Turn Type	Split	NA		Split	NA		Perm	NA		Perm	NA	
Protected Phases	4	4		8	8			2			6	
Permitted Phases							2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		8.0	8.0		8.0	8.0	
Minimum Split (s)	16.0	16.0		16.0	16.0		14.0	14.0		14.0	14.0	
Total Split (s)	30.0	30.0		30.0	30.0		30.0	30.0		30.0	30.0	
Total Split (%)	33.3%	33.3%		33.3%	33.3%		33.3%	33.3%		33.3%	33.3%	
Yellow Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
All-Red Time (s)	1.5	1.5		1.5	1.5		1.5	1.5		1.5	1.5	
Lost Time Adjust (s)		0.0			0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.0			6.0		6.0	6.0		6.0	6.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	Max	Max		Max	Max		C-Min	C-Min		C-Min	C-Min	
Act Effect Green (s)		34.9			24.0		13.1	13.1		13.1	13.1	
Actuated g/C Ratio		0.39			0.27		0.15	0.15		0.15	0.15	
v/c Ratio		0.41			0.34		0.33	0.65		0.17	0.40	
Control Delay		12.9			27.3		37.9	36.7		34.5	18.9	
Queue Delay		0.0			0.0		0.0	0.0		0.0	0.0	
Total Delay		12.9			27.3		37.9	36.7		34.5	18.9	
LOS		B			C		D	D		C	B	
Approach Delay		12.9			27.3			37.0			21.2	
Approach LOS		B			C			D			C	

Lanes, Volumes, Timings
1002: Hull Rd/Jefferson St & Kipp Road

04/13/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 50th (ft)		134			71		32	77		11	26	
Queue Length 95th (ft)		105			106		56	113		28	58	
Internal Link Dist (ft)		445			729			311			459	
Turn Bay Length (ft)							350			200		
Base Capacity (vph)		1296			898		336	497		239	506	
Starvation Cap Reductn		0			0		0	0		0	0	
Spillback Cap Reductn		0			0		0	0		0	0	
Storage Cap Reductn		0			0		0	0		0	0	
Reduced v/c Ratio		0.41			0.34		0.18	0.39		0.09	0.25	

Intersection Summary

Area Type: Other

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 7 (8%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 50

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.65

Intersection Signal Delay: 22.3

Intersection LOS: C

Intersection Capacity Utilization 48.7%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 1002: Hull Rd/Jefferson St & Kipp Road

 Ø2 (R)	 Ø4	 Ø8
30 s	30 s	30 s
 Ø6 (R)		
30 s		

Intersection

Int Delay, s/veh 2.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	107	2	14	53	1	36
Future Vol, veh/h	107	2	14	53	1	36
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	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	68	68	60	60	66	66
Heavy Vehicles, %	3	3	12	12	10	10
Mvmt Flow	159	3	24	89	2	55

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	162
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.22
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.308
Pot Cap-1 Maneuver	-	-	1358
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	1358
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.6	9.5
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	858	-	-	1358	-
HCM Lane V/C Ratio	0.066	-	-	0.017	-
HCM Control Delay (s)	9.5	-	-	7.7	0
HCM Lane LOS	A	-	-	A	A
HCM 95th %tile Q(veh)	0.2	-	-	0.1	-

Intersection

Int Delay, s/veh 10.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↱		↱	↱					↱		↱
Traffic Vol, veh/h	0	114	6	119	44	0	0	0	0	167	0	12
Future Vol, veh/h	0	114	6	119	44	0	0	0	0	167	0	12
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	150	-	-	-	-	-	105	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	-	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	75	75	75	67	67	67	92	92	92	76	76	76
Heavy Vehicles, %	4	4	4	10	10	10	2	2	2	9	9	9
Mvmt Flow	0	154	8	179	66	0	0	0	0	222	0	16

Major/Minor	Major1			Major2			Minor2		
Conflicting Flow All	-	0	0	162	0	0	583	-	66
Stage 1	-	-	-	-	-	-	425	-	-
Stage 2	-	-	-	-	-	-	158	-	-
Critical Hdwy	-	-	-	4.2	-	-	6.49	-	6.29
Critical Hdwy Stg 1	-	-	-	-	-	-	5.49	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	5.49	-	-
Follow-up Hdwy	-	-	-	2.29	-	-	3.581	-	3.381
Pot Cap-1 Maneuver	0	-	-	1370	-	0	463	0	979
Stage 1	0	-	-	-	-	0	645	0	-
Stage 2	0	-	-	-	-	0	854	0	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	-	1370	-	-	403	0	979
Mov Cap-2 Maneuver	-	-	-	-	-	-	403	0	-
Stage 1	-	-	-	-	-	-	561	0	-
Stage 2	-	-	-	-	-	-	854	0	-

Approach	EB	WB	SB
HCM Control Delay, s	0	5.9	23.3
HCM LOS			C

Minor Lane/Major Mvmt	EBT	EBR	WBL	WBT	SBLn1	SBLn2
Capacity (veh/h)	-	-	1370	-	403	979
HCM Lane V/C Ratio	-	-	0.131	-	0.551	0.016
HCM Control Delay (s)	-	-	8	-	24.3	8.7
HCM Lane LOS	-	-	A	-	C	A
HCM 95th %tile Q(veh)	-	-	0.5	-	3.2	0.1

Intersection

Int Delay, s/veh 2.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	44	258	0	0	170	308	7	0	149	0	0	0
Future Vol, veh/h	44	258	0	0	170	308	7	0	149	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	150	-	-	-	-	0	150	-	0	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	-	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	73	73	73	72	72	72	78	78	78	92	92	92
Heavy Vehicles, %	4	4	4	4	4	4	6	6	6	2	2	2
Mvmt Flow	61	357	0	0	238	432	9	0	193	0	0	0

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	238	0	-
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.14	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.236	-	-
Pot Cap-1 Maneuver	1317	-	0
Stage 1	-	0	0
Stage 2	-	0	0
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	1317	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	1.1	0	12.5
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	WBT	WBR
Capacity (veh/h)	372	678	1317	-	-	-
HCM Lane V/C Ratio	0.024	0.285	0.046	-	-	-
HCM Control Delay (s)	14.9	12.4	7.9	-	-	-
HCM Lane LOS	B	B	A	-	-	-
HCM 95th %tile Q(veh)	0.1	1.2	0.1	-	-	-

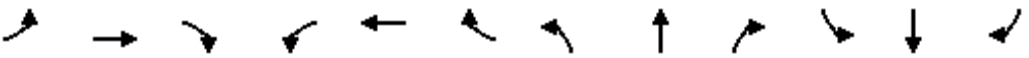
Lanes, Volumes, Timings
1001: Meijer Dr/Cedar St & Kipp Road

04/13/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	99	265	271	6	206	62	130	121	21	81	124	92
Future Volume (vph)	99	265	271	6	206	62	130	121	21	81	124	92
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		110	0		0	120		0	130		0
Storage Lanes	0		1	0		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	0.95	0.95	1.00	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850		0.966			0.978			0.936	
Flt Protected		0.987			0.999		0.950			0.950		
Satd. Flow (prot)	0	3426	1553	0	3287	0	1770	1822	0	1752	1727	0
Flt Permitted		0.987			0.999		0.318			0.615		
Satd. Flow (perm)	0	3426	1553	0	3287	0	592	1822	0	1134	1727	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			288		36			10			42	
Link Speed (mph)		45			45			25			35	
Link Distance (ft)		670			525			276			442	
Travel Time (s)		10.2			8.0			7.5			8.6	
Peak Hour Factor	0.95	0.95	0.95	0.88	0.88	0.88	0.93	0.93	0.93	0.83	0.83	0.83
Growth Factor	101%	101%	101%	101%	101%	101%	101%	101%	101%	101%	101%	101%
Heavy Vehicles (%)	4%	4%	4%	6%	6%	6%	2%	2%	2%	3%	3%	3%
Adj. Flow (vph)	105	282	288	7	236	71	141	131	23	99	151	112
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	387	288	0	314	0	141	154	0	99	263	0
Turn Type	Split	NA	Prot	Split	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	4	4	4	8	8		5	2		1	6	
Permitted Phases							2			6		
Detector Phase	4	4	4	8	8		5	2		1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0		5.0	8.0		5.0	8.0	
Minimum Split (s)	16.0	16.0	16.0	16.0	16.0		9.5	14.0		9.5	14.0	
Total Split (s)	26.0	26.0	26.0	20.0	20.0		12.0	32.0		12.0	32.0	
Total Split (%)	28.9%	28.9%	28.9%	22.2%	22.2%		13.3%	35.6%		13.3%	35.6%	
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5		3.5	4.5		3.5	4.5	
All-Red Time (s)	1.5	1.5	1.5	1.5	1.5		1.0	1.5		1.0	1.5	
Lost Time Adjust (s)		0.0	0.0		0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.0	6.0		6.0		4.5	6.0		4.5	6.0	
Lead/Lag							Lag	Lead		Lag	Lead	
Lead-Lag Optimize?												
Recall Mode	Max	Max	Max	Max	Max		None	C-Min		None	C-Min	
Act Effect Green (s)		30.0	30.0		14.0		21.9	15.0		28.4	17.0	
Actuated g/C Ratio		0.33	0.33		0.16		0.24	0.17		0.32	0.19	
v/c Ratio		0.34	0.41		0.58		0.62	0.49		0.23	0.73	
Control Delay		25.1	5.4		27.0		40.4	38.0		22.1	40.1	
Queue Delay		0.0	0.0		0.0		0.0	0.0		0.0	0.0	
Total Delay		25.1	5.4		27.0		40.4	38.0		22.1	40.1	
LOS		C	A		C		D	D		C	D	
Approach Delay		16.7			27.0			39.1			35.1	
Approach LOS		B			C			D			D	

Lanes, Volumes, Timings
1001: Meijer Dr/Cedar St & Kipp Road

04/13/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 50th (ft)		85	0		43		58	78		40	119	
Queue Length 95th (ft)		143	62		65		89	131		60	165	
Internal Link Dist (ft)		590			445			196			362	
Turn Bay Length (ft)			110				120			130		
Base Capacity (vph)		1142	709		541		250	533		437	528	
Starvation Cap Reductn		0	0		0		0	0		0	0	
Spillback Cap Reductn		0	0		0		0	0		0	0	
Storage Cap Reductn		0	0		0		0	0		0	0	
Reduced v/c Ratio		0.34	0.41		0.58		0.56	0.29		0.23	0.50	

Intersection Summary

Area Type: Other

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 60

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.73

Intersection Signal Delay: 26.7

Intersection LOS: C

Intersection Capacity Utilization 56.9%

ICU Level of Service B

Analysis Period (min) 15

Splits and Phases: 1001: Meijer Dr/Cedar St & Kipp Road

							
32 s		12 s		26 s		20 s	
							
32 s		12 s					

Lanes, Volumes, Timings
1002: Hull Rd/Jefferson St & Kipp Road

04/13/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔↔			↔↔		↔	↔		↔	↔	
Traffic Volume (vph)	77	235	51	54	169	17	45	102	86	15	154	58
Future Volume (vph)	77	235	51	54	169	17	45	102	86	15	154	58
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	350		0	200		0
Storage Lanes	0		0	0		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	0.95	0.95	0.95	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.979			0.989			0.931			0.959	
Flt Protected		0.990			0.989		0.950			0.950		
Satd. Flow (prot)	0	3364	0	0	3395	0	1787	1751	0	1805	1822	0
Flt Permitted		0.990			0.989		0.389			0.486		
Satd. Flow (perm)	0	3364	0	0	3395	0	732	1751	0	923	1822	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		20			9			46			21	
Link Speed (mph)		45			45			55			35	
Link Distance (ft)		525			809			391			539	
Travel Time (s)		8.0			12.3			4.8			10.5	
Peak Hour Factor	0.91	0.91	0.91	0.83	0.83	0.83	0.90	0.90	0.90	0.85	0.85	0.85
Growth Factor	101%	101%	101%	101%	101%	101%	101%	101%	101%	101%	101%	101%
Heavy Vehicles (%)	4%	4%	4%	4%	4%	4%	1%	1%	1%	0%	0%	0%
Adj. Flow (vph)	85	261	57	66	206	21	51	114	97	18	183	69
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	403	0	0	293	0	51	211	0	18	252	0
Turn Type	Split	NA		Split	NA		Perm	NA		Perm	NA	
Protected Phases	4	4		8	8			2			6	
Permitted Phases							2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		8.0	8.0		8.0	8.0	
Minimum Split (s)	16.0	16.0		16.0	16.0		14.0	14.0		14.0	14.0	
Total Split (s)	30.0	30.0		30.0	30.0		30.0	30.0		30.0	30.0	
Total Split (%)	33.3%	33.3%		33.3%	33.3%		33.3%	33.3%		33.3%	33.3%	
Yellow Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
All-Red Time (s)	1.5	1.5		1.5	1.5		1.5	1.5		1.5	1.5	
Lost Time Adjust (s)		0.0			0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.0			6.0		6.0	6.0		6.0	6.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	Max	Max		Max	Max		C-Min	C-Min		C-Min	C-Min	
Act Effect Green (s)		31.3			24.0		16.7	16.7		16.7	16.7	
Actuated g/C Ratio		0.35			0.27		0.19	0.19		0.19	0.19	
v/c Ratio		0.34			0.32		0.38	0.58		0.11	0.71	
Control Delay		11.7			26.8		38.5	31.7		29.3	42.0	
Queue Delay		0.0			0.0		0.0	0.0		0.0	0.0	
Total Delay		11.7			26.8		38.5	31.7		29.3	42.0	
LOS		B			C		D	C		C	D	
Approach Delay		11.7			26.8			33.0			41.1	
Approach LOS		B			C			C			D	

Lanes, Volumes, Timings
1002: Hull Rd/Jefferson St & Kipp Road

04/13/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 50th (ft)		43			67		26	85		9	124	
Queue Length 95th (ft)		75			94		57	144		24	174	
Internal Link Dist (ft)		445			729			311			459	
Turn Bay Length (ft)							350			200		
Base Capacity (vph)		1182			911		195	500		246	501	
Starvation Cap Reductn		0			0		0	0		0	0	
Spillback Cap Reductn		0			0		0	0		0	0	
Storage Cap Reductn		0			0		0	0		0	0	
Reduced v/c Ratio		0.34			0.32		0.26	0.42		0.07	0.50	

Intersection Summary

Area Type: Other

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 7 (8%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 50

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.71

Intersection Signal Delay: 26.3

Intersection LOS: C

Intersection Capacity Utilization 57.2%

ICU Level of Service B

Analysis Period (min) 15

Splits and Phases: 1002: Hull Rd/Jefferson St & Kipp Road

 Ø2 (R)	 Ø4	 Ø8
30 s	30 s	30 s
 Ø6 (R)		
30 s		

Intersection

Int Delay, s/veh 1.7

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	71	0	28	156	1	22
Future Vol, veh/h	71	0	28	156	1	22
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	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	77	77	90	90	60	60
Heavy Vehicles, %	4	4	2	2	12	12
Mvmt Flow	93	0	31	175	2	37

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	93
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.12
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.218
Pot Cap-1 Maneuver	-	-	1501
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	1501
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.1	9.1
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	917	-	-	1501	-
HCM Lane V/C Ratio	0.042	-	-	0.021	-
HCM Control Delay (s)	9.1	-	-	7.5	0
HCM Lane LOS	A	-	-	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0.1	-

Intersection

Int Delay, s/veh 72.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↗		↖	↗					↖		↗
Traffic Vol, veh/h	0	115	9	147	144	0	0	0	0	379	0	57
Future Vol, veh/h	0	115	9	147	144	0	0	0	0	379	0	57
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	150	-	-	-	-	-	105	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	-	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	84	84	84	92	92	92	92	92	92	79	79	79
Heavy Vehicles, %	3	3	3	4	4	4	2	2	2	2	2	2
Mvmt Flow	0	138	11	161	158	0	0	0	0	485	0	73

Major/Minor	Major1			Major2			Minor2		
Conflicting Flow All	-	0	0	149	0	0	625	-	158
Stage 1	-	-	-	-	-	-	481	-	-
Stage 2	-	-	-	-	-	-	144	-	-
Critical Hdwy	-	-	-	4.14	-	-	6.42	-	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	5.42	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	5.42	-	-
Follow-up Hdwy	-	-	-	2.236	-	-	3.518	-	3.318
Pot Cap-1 Maneuver	0	-	-	1420	-	0	~ 449	0	887
Stage 1	0	-	-	-	-	0	622	0	-
Stage 2	0	-	-	-	-	0	883	0	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	-	1420	-	-	~ 398	0	887
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 398	0	-
Stage 1	-	-	-	-	-	-	551	0	-
Stage 2	-	-	-	-	-	-	883	0	-

Approach	EB	WB	SB
HCM Control Delay, s	0	4	130.5
HCM LOS			F

Minor Lane/Major Mvmt	EBT	EBR	WBL	WBT	SBLn1	SBLn2
Capacity (veh/h)	-	-	1420	-	398	887
HCM Lane V/C Ratio	-	-	0.114	-	1.217	0.082
HCM Control Delay (s)	-	-	7.9	-	148.7	9.4
HCM Lane LOS	-	-	A	-	F	A
HCM 95th %tile Q(veh)	-	-	0.4	-	19.9	0.3

Notes

~: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection

Int Delay, s/veh 2.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	29	472	0	0	281	208	17	0	171	0	0	0
Future Vol, veh/h	29	472	0	0	281	208	17	0	171	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	150	-	-	-	-	0	150	-	0	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	-	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	83	83	83	82	82	82	86	86	86	92	92	92
Heavy Vehicles, %	1	1	1	3	3	3	4	4	4	2	2	2
Mvmt Flow	35	574	0	0	346	256	20	0	201	0	0	0

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	346	0	-
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.11	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.209	-	-
Pot Cap-1 Maneuver	1219	-	0
Stage 1	-	0	0
Stage 2	-	0	0
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	1219	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0.5	0	16.7
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	WBT	WBR
Capacity (veh/h)	263	514	1219	-	-	-
HCM Lane V/C Ratio	0.076	0.391	0.029	-	-	-
HCM Control Delay (s)	19.8	16.4	8	-	-	-
HCM Lane LOS	C	C	A	-	-	-
HCM 95th %tile Q(veh)	0.2	1.8	0.1	-	-	-

Lanes, Volumes, Timings
1001: Meijer Dr/Cedar St & Kipp Road

04/13/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕	↗		↕↕		↗	↗		↗	↗	
Traffic Volume (vph)	65	305	83	4	234	75	93	37	13	67	35	67
Future Volume (vph)	65	305	83	4	234	75	93	37	13	67	35	67
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		110	0		0	120		0	130		0
Storage Lanes	0		1	0		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	0.95	0.95	1.00	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850		0.964			0.960			0.901	
Flt Protected		0.991			0.999		0.950			0.950		
Satd. Flow (prot)	0	3313	1495	0	3219	0	1597	1614	0	1671	1585	0
Flt Permitted		0.991			0.999		0.682			0.722		
Satd. Flow (perm)	0	3313	1495	0	3219	0	1147	1614	0	1270	1585	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			164		44			14			77	
Link Speed (mph)		45			45			25			35	
Link Distance (ft)		670			525			276			442	
Travel Time (s)		10.2			8.0			7.5			8.6	
Peak Hour Factor	0.82	0.82	0.82	0.81	0.81	0.81	0.95	0.95	0.95	0.87	0.87	0.87
Heavy Vehicles (%)	8%	8%	8%	8%	8%	8%	13%	13%	13%	8%	8%	8%
Adj. Flow (vph)	79	372	101	5	289	93	98	39	14	77	40	77
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	451	101	0	387	0	98	53	0	77	117	0
Turn Type	Split	NA	Prot	Split	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	4	4	4	8	8		5	2		1	6	
Permitted Phases							2			6		
Detector Phase	4	4	4	8	8		5	2		1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0		5.0	8.0		5.0	8.0	
Minimum Split (s)	16.0	16.0	16.0	16.0	16.0		9.5	14.0		9.5	14.0	
Total Split (s)	25.0	25.0	25.0	28.0	28.0		13.0	24.0		13.0	24.0	
Total Split (%)	27.8%	27.8%	27.8%	31.1%	31.1%		14.4%	26.7%		14.4%	26.7%	
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5		3.5	4.5		3.5	4.5	
All-Red Time (s)	1.5	1.5	1.5	1.5	1.5		1.0	1.5		1.0	1.5	
Lost Time Adjust (s)		0.0	0.0		0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.0	6.0		6.0		4.5	6.0		4.5	6.0	
Lead/Lag							Lag	Lead		Lag	Lead	
Lead-Lag Optimize?												
Recall Mode	Max	Max	Max	Max	Max		None	C-Min		None	C-Min	
Act Effct Green (s)		32.3	32.3		22.0		16.1	8.7		17.3	9.4	
Actuated g/C Ratio		0.36	0.36		0.24		0.18	0.10		0.19	0.10	
v/c Ratio		0.38	0.16		0.47		0.42	0.31		0.28	0.50	
Control Delay		23.8	1.3		50.7		34.3	34.6		30.4	23.1	
Queue Delay		0.0	0.0		0.0		0.0	0.0		0.0	0.0	
Total Delay		23.8	1.3		50.7		34.3	34.6		30.4	23.1	
LOS		C	A		D		C	C		C	C	
Approach Delay		19.7			50.7			34.4			26.0	
Approach LOS		B			D			C			C	
Queue Length 50th (ft)		99	0		113		47	21		36	22	

Lanes, Volumes, Timings
1001: Meijer Dr/Cedar St & Kipp Road

04/13/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)		139	2		144		83	55		65	66	
Internal Link Dist (ft)		590			445			196			362	
Turn Bay Length (ft)			110				120			130		
Base Capacity (vph)		1189	642		820		281	334		310	378	
Starvation Cap Reductn		0	0		0		0	0		0	0	
Spillback Cap Reductn		0	0		0		0	0		0	0	
Storage Cap Reductn		0	0		0		0	0		0	0	
Reduced v/c Ratio		0.38	0.16		0.47		0.35	0.16		0.25	0.31	

Intersection Summary

Area Type: Other

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 78 (87%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 60

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.50

Intersection Signal Delay: 31.7

Intersection LOS: C

Intersection Capacity Utilization 46.1%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 1001: Meijer Dr/Cedar St & Kipp Road

 Ø2 (R)	 Ø1	 Ø4	 Ø8
24 s	13 s	25 s	28 s
 Ø6 (R)	 Ø5		
24 s	13 s		

Lanes, Volumes, Timings
1002: Hull Rd/Jefferson St & Kipp Road

04/13/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕		↗	↘		↗	↘	
Traffic Volume (vph)	53	265	50	49	210	13	51	79	73	18	40	62
Future Volume (vph)	53	265	50	49	210	13	51	79	73	18	40	62
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	350		0	200		0
Storage Lanes	0		0	0		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	0.95	0.95	0.95	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.980			0.993			0.928			0.908	
Flt Protected		0.993			0.991		0.950			0.950		
Satd. Flow (prot)	0	3314	0	0	3351	0	1770	1729	0	1770	1691	0
Flt Permitted		0.993			0.991		0.676			0.482		
Satd. Flow (perm)	0	3314	0	0	3351	0	1259	1729	0	898	1691	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		19			6			50			77	
Link Speed (mph)		45			45			55			35	
Link Distance (ft)		525			809			391			539	
Travel Time (s)		8.0			12.3			4.8			10.5	
Peak Hour Factor	0.68	0.68	0.68	0.89	0.89	0.89	0.79	0.79	0.79	0.81	0.81	0.81
Heavy Vehicles (%)	6%	6%	6%	6%	6%	6%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	78	390	74	55	236	15	65	100	92	22	49	77
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	542	0	0	306	0	65	192	0	22	126	0
Turn Type	Split	NA		Split	NA		Perm	NA		Perm	NA	
Protected Phases	4	4		8	8			2			6	
Permitted Phases							2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		8.0	8.0		8.0	8.0	
Minimum Split (s)	16.0	16.0		16.0	16.0		14.0	14.0		14.0	14.0	
Total Split (s)	30.0	30.0		30.0	30.0		30.0	30.0		30.0	30.0	
Total Split (%)	33.3%	33.3%		33.3%	33.3%		33.3%	33.3%		33.3%	33.3%	
Yellow Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
All-Red Time (s)	1.5	1.5		1.5	1.5		1.5	1.5		1.5	1.5	
Lost Time Adjust (s)		0.0			0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.0			6.0		6.0	6.0		6.0	6.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	Max	Max		Max	Max		C-Min	C-Min		C-Min	C-Min	
Act Effct Green (s)		34.9			24.0		13.1	13.1		13.1	13.1	
Actuated g/C Ratio		0.39			0.27		0.15	0.15		0.15	0.15	
v/c Ratio		0.42			0.34		0.36	0.65		0.17	0.40	
Control Delay		12.9			27.4		38.5	36.7		34.5	18.5	
Queue Delay		0.0			0.0		0.0	0.0		0.0	0.0	
Total Delay		12.9			27.4		38.5	36.7		34.5	18.5	
LOS		B			C		D	D		C	B	
Approach Delay		12.9			27.4			37.1			20.9	
Approach LOS		B			C			D			C	
Queue Length 50th (ft)		137			72		34	77		11	25	

Lanes, Volumes, Timings
1002: Hull Rd/Jefferson St & Kipp Road

04/13/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)		105			107		59	113		28	59	
Internal Link Dist (ft)		445			729			311			459	
Turn Bay Length (ft)							350			200		
Base Capacity (vph)		1296			898		335	497		239	507	
Starvation Cap Reductn		0			0		0	0		0	0	
Spillback Cap Reductn		0			0		0	0		0	0	
Storage Cap Reductn		0			0		0	0		0	0	
Reduced v/c Ratio		0.42			0.34		0.19	0.39		0.09	0.25	

Intersection Summary

Area Type: Other

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 7 (8%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 50

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.65

Intersection Signal Delay: 22.4

Intersection LOS: C

Intersection Capacity Utilization 48.8%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 1002: Hull Rd/Jefferson St & Kipp Road

 Ø2 (R)	 Ø4	 Ø8
30 s	30 s	30 s
 Ø6 (R)		
30 s		

Intersection

Int Delay, s/veh 2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	120	2	14	70	2	36
Future Vol, veh/h	120	2	14	70	2	36
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	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	68	68	60	60	66	66
Heavy Vehicles, %	3	3	12	12	10	10
Mvmt Flow	176	3	23	117	3	55

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	179
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.22
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.308
Pot Cap-1 Maneuver	-	-	1339
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	1339
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.3	9.7
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	830	-	-	1339	-
HCM Lane V/C Ratio	0.069	-	-	0.017	-
HCM Control Delay (s)	9.7	-	-	7.7	0
HCM Lane LOS	A	-	-	A	A
HCM 95th %tile Q(veh)	0.2	-	-	0.1	-

Intersection

Int Delay, s/veh 11

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↱		↱	↱					↱		↱
Traffic Vol, veh/h	0	125	8	120	57	0	0	0	0	169	0	15
Future Vol, veh/h	0	125	8	120	57	0	0	0	0	169	0	15
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	150	-	-	-	-	-	105	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	-	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	75	75	75	67	67	67	92	92	92	76	76	76
Heavy Vehicles, %	4	4	4	10	10	10	2	2	2	9	9	9
Mvmt Flow	0	167	11	179	85	0	0	0	0	222	0	20

Major/Minor	Major1			Major2			Minor2		
Conflicting Flow All	-	0	0	177	0	0	615	-	85
Stage 1	-	-	-	-	-	-	443	-	-
Stage 2	-	-	-	-	-	-	172	-	-
Critical Hdwy	-	-	-	4.2	-	-	6.49	-	6.29
Critical Hdwy Stg 1	-	-	-	-	-	-	5.49	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	5.49	-	-
Follow-up Hdwy	-	-	-	2.29	-	-	3.581	-	3.381
Pot Cap-1 Maneuver	0	-	-	1352	-	0	443	0	955
Stage 1	0	-	-	-	-	0	633	0	-
Stage 2	0	-	-	-	-	0	841	0	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	-	1352	-	-	384	0	955
Mov Cap-2 Maneuver	-	-	-	-	-	-	384	0	-
Stage 1	-	-	-	-	-	-	549	0	-
Stage 2	-	-	-	-	-	-	841	0	-

Approach	EB	WB	SB
HCM Control Delay, s	0	5.5	25.1
HCM LOS			D

Minor Lane/Major Mvmt	EBT	EBR	WBL	WBT	SBLn1	SBLn2
Capacity (veh/h)	-	-	1352	-	384	955
HCM Lane V/C Ratio	-	-	0.132	-	0.579	0.021
HCM Control Delay (s)	-	-	8.1	-	26.5	8.8
HCM Lane LOS	-	-	A	-	D	A
HCM 95th %tile Q(veh)	-	-	0.5	-	3.5	0.1

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	46	267	0	0	184	311	9	0	150	0	0	0
Future Vol, veh/h	46	267	0	0	184	311	9	0	150	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	150	-	-	-	-	0	150	-	0	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	-	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	73	73	73	72	72	72	78	78	78	92	92	92
Heavy Vehicles, %	4	4	4	4	4	4	6	6	6	2	2	2
Mvmt Flow	63	366	0	0	256	432	12	0	192	0	0	0

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	256	0	-	-	-	0	748	-	366
Stage 1	-	-	-	-	-	-	492	-	-
Stage 2	-	-	-	-	-	-	256	-	-
Critical Hdwy	4.14	-	-	-	-	-	6.46	-	6.26
Critical Hdwy Stg 1	-	-	-	-	-	-	5.46	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	5.46	-	-
Follow-up Hdwy	2.236	-	-	-	-	-	3.554	-	3.354
Pot Cap-1 Maneuver	1297	-	0	0	-	-	374	0	670
Stage 1	-	-	0	0	-	-	606	0	-
Stage 2	-	-	0	0	-	-	777	0	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1297	-	-	-	-	-	356	0	670
Mov Cap-2 Maneuver	-	-	-	-	-	-	356	0	-
Stage 1	-	-	-	-	-	-	577	0	-
Stage 2	-	-	-	-	-	-	777	0	-

Approach	EB	WB	NB
HCM Control Delay, s	1.2	0	12.7
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	WBT	WBR
Capacity (veh/h)	356	670	1297	-	-	-
HCM Lane V/C Ratio	0.032	0.287	0.049	-	-	-
HCM Control Delay (s)	15.5	12.5	7.9	-	-	-
HCM Lane LOS	C	B	A	-	-	-
HCM 95th %tile Q(veh)	0.1	1.2	0.2	-	-	-

HCM Unsignalized Intersection Capacity Analysis

9101: Kipp Road & Hotel Driveway

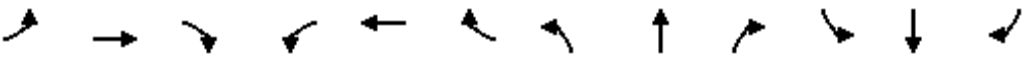
04/13/2018



Movement	WBL	WBR	SBL	SBR	NEL	NER
Lane Configurations	W	R	W	R	W	R
Traffic Volume (veh/h)	38	17	12	1	1	110
Future Volume (Veh/h)	38	17	12	1	1	110
Sign Control	Free		Stop		Free	
Grade	0%		0%		0%	
Peak Hour Factor	0.60	0.60	0.92	0.92	0.68	0.68
Hourly flow rate (vph)	63	28	13	1	1	162
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None				None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			241	77	91	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			241	77	91	
tC, single (s)			6.4	6.2	4.1	
tC, 2 stage (s)						
tF (s)			3.5	3.3	2.2	
p0 queue free %			98	100	100	
cM capacity (veh/h)			747	984	1498	
Direction, Lane #	WB 1	SB 1	NE 1			
Volume Total	91	14	163			
Volume Left	0	13	1			
Volume Right	28	1	0			
cSH	1700	760	1498			
Volume to Capacity	0.05	0.02	0.00			
Queue Length 95th (ft)	0	1	0			
Control Delay (s)	0.0	9.8	0.1			
Lane LOS		A	A			
Approach Delay (s)	0.0	9.8	0.1			
Approach LOS		A				
Intersection Summary						
Average Delay			0.5			
Intersection Capacity Utilization			23.5%	ICU Level of Service		A
Analysis Period (min)			15			

Lanes, Volumes, Timings
1001: Meijer Dr/Cedar St & Kipp Road

04/13/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕	↗		↕↕		↗	↗		↗	↗	
Traffic Volume (vph)	102	274	274	6	214	63	131	122	21	82	125	95
Future Volume (vph)	102	274	274	6	214	63	131	122	21	82	125	95
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		110	0		0	120		0	130		0
Storage Lanes	0		1	0		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	0.95	0.95	1.00	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850		0.966			0.978			0.935	
Flt Protected		0.987			0.999		0.950			0.950		
Satd. Flow (prot)	0	3426	1553	0	3287	0	1770	1822	0	1752	1725	0
Flt Permitted		0.987			0.999		0.304			0.611		
Satd. Flow (perm)	0	3426	1553	0	3287	0	566	1822	0	1127	1725	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			288		39			9			38	
Link Speed (mph)		45			45			25			35	
Link Distance (ft)		670			525			276			442	
Travel Time (s)		10.2			8.0			7.5			8.6	
Peak Hour Factor	0.95	0.95	0.95	0.88	0.88	0.88	0.93	0.93	0.93	0.83	0.83	0.83
Heavy Vehicles (%)	4%	4%	4%	6%	6%	6%	2%	2%	2%	3%	3%	3%
Adj. Flow (vph)	107	288	288	7	243	72	141	131	23	99	151	114
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	395	288	0	322	0	141	154	0	99	265	0
Turn Type	Split	NA	Prot	Split	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	4	4	4	8	8		5	2		1	6	
Permitted Phases							2			6		
Detector Phase	4	4	4	8	8		5	2		1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0		5.0	8.0		5.0	8.0	
Minimum Split (s)	16.0	16.0	16.0	16.0	16.0		9.5	14.0		9.5	14.0	
Total Split (s)	25.0	25.0	25.0	28.0	28.0		13.0	24.0		13.0	24.0	
Total Split (%)	27.8%	27.8%	27.8%	31.1%	31.1%		14.4%	26.7%		14.4%	26.7%	
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5		3.5	4.5		3.5	4.5	
All-Red Time (s)	1.5	1.5	1.5	1.5	1.5		1.0	1.5		1.0	1.5	
Lost Time Adjust (s)		0.0	0.0		0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.0	6.0		6.0		4.5	6.0		4.5	6.0	
Lead/Lag							Lag	Lead		Lag	Lead	
Lead-Lag Optimize?												
Recall Mode	Max	Max	Max	Max	Max		None	C-Min		None	C-Min	
Act Effct Green (s)		22.7	22.7		22.0		22.5	15.1		26.9	15.8	
Actuated g/C Ratio		0.25	0.25		0.24		0.25	0.17		0.30	0.18	
v/c Ratio		0.46	0.47		0.39		0.60	0.49		0.25	0.80	
Control Delay		31.5	6.8		49.6		40.2	38.3		23.6	48.0	
Queue Delay		0.0	0.0		0.0		0.0	0.0		0.0	0.0	
Total Delay		31.5	6.8		49.6		40.2	38.3		23.6	48.0	
LOS		C	A		D		D	D		C	D	
Approach Delay		21.1			49.6			39.2			41.4	
Approach LOS		C			D			D			D	
Queue Length 50th (ft)		102	0		97		57	78		39	122	

Lanes, Volumes, Timings
1001: Meijer Dr/Cedar St & Kipp Road

04/13/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)		153	65		138		99	132		66	184	
Internal Link Dist (ft)		590			445			196			362	
Turn Bay Length (ft)			110				120			130		
Base Capacity (vph)		865	607		832		264	382		415	375	
Starvation Cap Reductn		0	0		0		0	0		0	0	
Spillback Cap Reductn		0	0		0		0	0		0	0	
Storage Cap Reductn		0	0		0		0	0		0	0	
Reduced v/c Ratio		0.46	0.47		0.39		0.53	0.40		0.24	0.71	

Intersection Summary

Area Type: Other

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 78 (87%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 60

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.80

Intersection Signal Delay: 34.3

Intersection LOS: C

Intersection Capacity Utilization 57.3%

ICU Level of Service B

Analysis Period (min) 15

Splits and Phases: 1001: Meijer Dr/Cedar St & Kipp Road

 Ø2 (R)	 Ø1	 Ø4	 Ø8
24 s	13 s	25 s	28 s
 Ø6 (R)	 Ø5		
24 s	13 s		

Lanes, Volumes, Timings
1002: Hull Rd/Jefferson St & Kipp Road

04/13/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	80	239	54	55	173	17	47	103	87	15	156	61
Future Volume (vph)	80	239	54	55	173	17	47	103	87	15	156	61
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	350		0	200		0
Storage Lanes	0		0	0		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	0.95	0.95	0.95	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.978			0.990			0.931			0.958	
Flt Protected		0.989			0.989		0.950			0.950		
Satd. Flow (prot)	0	3357	0	0	3399	0	1787	1751	0	1805	1820	0
Flt Permitted		0.989			0.989		0.385			0.490		
Satd. Flow (perm)	0	3357	0	0	3399	0	724	1751	0	931	1820	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		20			8			46			21	
Link Speed (mph)		45			45			55			35	
Link Distance (ft)		525			809			391			539	
Travel Time (s)		8.0			12.3			4.8			10.5	
Peak Hour Factor	0.91	0.91	0.91	0.83	0.83	0.83	0.90	0.90	0.90	0.85	0.85	0.85
Heavy Vehicles (%)	4%	4%	4%	4%	4%	4%	1%	1%	1%	0%	0%	0%
Adj. Flow (vph)	88	263	59	66	208	20	52	114	97	18	184	72
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	410	0	0	294	0	52	211	0	18	256	0
Turn Type	Split	NA		Split	NA		Perm	NA		Perm	NA	
Protected Phases	4	4		8	8			2			6	
Permitted Phases							2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		8.0	8.0		8.0	8.0	
Minimum Split (s)	16.0	16.0		16.0	16.0		14.0	14.0		14.0	14.0	
Total Split (s)	30.0	30.0		30.0	30.0		30.0	30.0		30.0	30.0	
Total Split (%)	33.3%	33.3%		33.3%	33.3%		33.3%	33.3%		33.3%	33.3%	
Yellow Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
All-Red Time (s)	1.5	1.5		1.5	1.5		1.5	1.5		1.5	1.5	
Lost Time Adjust (s)		0.0			0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.0			6.0		6.0	6.0		6.0	6.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	Max	Max		Max	Max		C-Min	C-Min		C-Min	C-Min	
Act Effct Green (s)		31.0			24.0		17.0	17.0		17.0	17.0	
Actuated g/C Ratio		0.34			0.27		0.19	0.19		0.19	0.19	
v/c Ratio		0.35			0.32		0.38	0.57		0.10	0.71	
Control Delay		11.2			26.9		38.6	31.2		29.0	42.0	
Queue Delay		0.0			0.0		0.0	0.0		0.0	0.0	
Total Delay		11.2			26.9		38.6	31.2		29.0	42.0	
LOS		B			C		D	C		C	D	
Approach Delay		11.2			26.9			32.7			41.1	
Approach LOS		B			C			C			D	
Queue Length 50th (ft)		36			68		26	85		9	126	

Lanes, Volumes, Timings
1002: Hull Rd/Jefferson St & Kipp Road

04/13/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)		98			95		57	143		24	177	
Internal Link Dist (ft)		445			729			311			459	
Turn Bay Length (ft)							350			200		
Base Capacity (vph)		1170			912		193	500		248	500	
Starvation Cap Reductn		0			0		0	0		0	0	
Spillback Cap Reductn		0			0		0	0		0	0	
Storage Cap Reductn		0			0		0	0		0	0	
Reduced v/c Ratio		0.35			0.32		0.27	0.42		0.07	0.51	

Intersection Summary

Area Type: Other

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 7 (8%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 50

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.71

Intersection Signal Delay: 26.1

Intersection LOS: C

Intersection Capacity Utilization 57.6%

ICU Level of Service B

Analysis Period (min) 15

Splits and Phases: 1002: Hull Rd/Jefferson St & Kipp Road

 Ø2 (R)	 Ø4	 Ø8
30 s	30 s	30 s
 Ø6 (R)		
30 s		

Intersection

Int Delay, s/veh 1.6

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	85	0	28	171	1	22
Future Vol, veh/h	85	0	28	171	1	22
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	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	77	77	90	90	60	60
Heavy Vehicles, %	4	4	2	2	12	12
Mvmt Flow	110	0	31	190	2	37

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	110
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.12
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.218
Pot Cap-1 Maneuver	-	-	1480
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	1480
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.1	9.2
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	897	-	-	1480	-
HCM Lane V/C Ratio	0.043	-	-	0.021	-
HCM Control Delay (s)	9.2	-	-	7.5	0
HCM Lane LOS	A	-	-	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0.1	-

Intersection

Int Delay, s/veh 77.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↱		↱	↱					↱		↱
Traffic Vol, veh/h	0	125	13	148	154	0	0	0	0	383	0	62
Future Vol, veh/h	0	125	13	148	154	0	0	0	0	383	0	62
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	150	-	-	-	-	-	105	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	-	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	84	84	84	92	92	92	92	92	92	79	79	79
Heavy Vehicles, %	3	3	3	4	4	4	2	2	2	2	2	2
Mvmt Flow	0	149	15	161	167	0	0	0	0	485	0	78

Major/Minor	Major1			Major2			Minor2		
Conflicting Flow All	-	0	0	164	0	0	646	-	167
Stage 1	-	-	-	-	-	-	489	-	-
Stage 2	-	-	-	-	-	-	157	-	-
Critical Hdwy	-	-	-	4.14	-	-	6.42	-	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	5.42	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	5.42	-	-
Follow-up Hdwy	-	-	-	2.236	-	-	3.518	-	3.318
Pot Cap-1 Maneuver	0	-	-	1402	-	0	~ 436	0	877
Stage 1	0	-	-	-	-	0	616	0	-
Stage 2	0	-	-	-	-	0	871	0	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	-	1402	-	-	~ 386	0	877
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 386	0	-
Stage 1	-	-	-	-	-	-	545	0	-
Stage 2	-	-	-	-	-	-	871	0	-

Approach	EB	WB	SB
HCM Control Delay, s	0	3.9	143
HCM LOS			F

Minor Lane/Major Mvmt	EBT	EBR	WBL	WBT	SBLn1	SBLn2
Capacity (veh/h)	-	-	1402	-	386	877
HCM Lane V/C Ratio	-	-	0.115	-	1.256	0.089
HCM Control Delay (s)	-	-	7.9	-	164.6	9.5
HCM Lane LOS	-	-	A	-	F	A
HCM 95th %tile Q(veh)	-	-	0.4	-	21	0.3

Notes

~: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection												
Int Delay, s/veh	2.8											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	30	485	0	0	292	210	18	0	173	0	0	0
Future Vol, veh/h	30	485	0	0	292	210	18	0	173	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	150	-	-	-	-	0	150	-	0	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	-	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	83	83	83	82	82	82	86	86	86	92	92	92
Heavy Vehicles, %	1	1	1	3	3	3	4	4	4	2	2	2
Mvmt Flow	36	584	0	0	356	256	21	0	201	0	0	0

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	356	0	-	-	0	1013
Stage 1	-	-	-	-	-	657
Stage 2	-	-	-	-	-	356
Critical Hdwy	4.11	-	-	-	-	6.44
Critical Hdwy Stg 1	-	-	-	-	-	5.44
Critical Hdwy Stg 2	-	-	-	-	-	5.44
Follow-up Hdwy	2.209	-	-	-	-	3.536
Pot Cap-1 Maneuver	1208	-	0	0	-	262
Stage 1	-	-	0	0	-	512
Stage 2	-	-	0	0	-	704
Platoon blocked, %	-	-	-	-	-	-
Mov Cap-1 Maneuver	1208	-	-	-	-	254
Mov Cap-2 Maneuver	-	-	-	-	-	254
Stage 1	-	-	-	-	-	497
Stage 2	-	-	-	-	-	704

Approach	EB	WB	NB
HCM Control Delay, s	0.5	0	17
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	WBT	WBR
Capacity (veh/h)	254	508	1208	-	-	-
HCM Lane V/C Ratio	0.082	0.396	0.03	-	-	-
HCM Control Delay (s)	20.4	16.7	8.1	-	-	-
HCM Lane LOS	C	C	A	-	-	-
HCM 95th %tile Q(veh)	0.3	1.9	0.1	-	-	-

HCM Unsignalized Intersection Capacity Analysis

9101: Kipp Road & Hotel Driveway

04/13/2018



Movement	WBL	WBR	SBL	SBR	NEL	NER
Lane Configurations	W		W		W	
Traffic Volume (veh/h)	159	13	13	1	1	72
Future Volume (Veh/h)	159	13	13	1	1	72
Sign Control	Free		Stop		Free	
Grade	0%		0%		0%	
Peak Hour Factor	0.90	0.90	0.92	0.92	0.77	0.77
Hourly flow rate (vph)	177	14	14	1	1	94
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None				None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			280	184	191	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			280	184	191	
tC, single (s)			6.4	6.2	4.1	
tC, 2 stage (s)						
tF (s)			3.5	3.3	2.2	
p0 queue free %			98	100	100	
cM capacity (veh/h)			709	858	1371	
Direction, Lane #	WB 1	SB 1	NE 1			
Volume Total	191	15	95			
Volume Left	0	14	1			
Volume Right	14	1	0			
cSH	1700	718	1371			
Volume to Capacity	0.11	0.02	0.00			
Queue Length 95th (ft)	0	2	0			
Control Delay (s)	0.0	10.1	0.1			
Lane LOS		B	A			
Approach Delay (s)	0.0	10.1	0.1			
Approach LOS		B				
Intersection Summary						
Average Delay			0.5			
Intersection Capacity Utilization			27.4%	ICU Level of Service		A
Analysis Period (min)			15			