PROPOSED AGENDA

CHARTER TOWNSHIP OF BRIGHTON
PLANNING COMMISSION
4363 BUNO ROAD
BRIGHTON, MI 48114

OCTOBER 24, 2016
SPECIAL MEETING
7:00 P.M.
(810) 229.0562

A. CALL TO ORDER
B. PLEDGE OF ALLEGIANCE
C. ROLL CALL
D. CALL TO THE PUBLIC
E. AGENDA
F. MINUTES

1. **SEPTEMBER 12, 2016 REGULAR MEETING**

G. BUSINESS

1. **CONDITIONAL REZONING #16/01: ENCORE VILLAGE; ADDRESSES: 11065 AND 10675 E. GRAND RIVER; APPLICANT AND OWNER: MANCHESTER BRIGHTON; TAX ID#'S: 12-32-400-001 AND 12-33-400-010; ZONING: OS**

H. REPORTS AND CORRESPONDENCE
I. CALL TO THE PUBLIC
J. ADJOURNMENT

The Charter Township of Brighton will provide the necessary reasonable auxiliary aids and services, such as signers for the hearing impaired and audiotapes of printed materials being considered at the meeting to individuals with disabilities at the meeting upon 10 days' notice to the Charter Township of Brighton, Attn: Township Manager. Individuals should contact the Charter Township of Brighton by writing or contacting the following: Kelly Mathews, 4363 Buno Road, Brighton, MI 48114. Telephone: 810-229-0562 or e-mail at……planner@brightontwp.com.

PROPOSED MINUTES

CHARTER TOWNSHIP OF BRIGHTON
PLANNING COMMISSION
4363 BUNO ROAD
BRIGHTON, MI 48114

SEPTEMBER 12, 2016
REGULAR MEETING
7:00 P.M.
(810) 229.0562

Chairman S. Holden called the meeting to order at 7:00 P.M. The Pledge of Allegiance was said.
Present: S. Holden, M. Slaton, J. Stinedurf, G. Mitsopoulos, G. Unruh, D. Schifko
Absent: L. Herzinger

CALL TO THE PUBLIC
Bob Potocki, 8420 Woodland Shore Dr. - Handed out comments dated 9/12/16; ZBA fee is too high; need certification of accuracy and completeness for applications; public safety regarding traffic impact studies - need independent studies conducted; unratified zoning ordinance; sewer questions in regards to Encore Village.

Mike Palmer, 10382 Grand River - Concerned about the usage of the sewer plant - only using 40% capacity; need to keep master plan in mind when approving applications; MSP Post was built without sewer and water; Township Hall does not have sewer and water; could divert storm water run-off from projects into sewer plant to utilize some excess capacity; don't fast track developments without sewer.

Jim Sarna, 8266 Woodland Shore Dr. - Sandila Estates was not required to connect into sewer; new developments need to connect into the sewer system.

AGENDA
G. Mitsopoulos moved and G. Unruh seconded **to approve the agenda as presented.**
Motion carried.

MINUTES
G. Mitsopoulos moved and J. Stinedurf seconded **to approve the minutes of the August 22, 2016 regular meeting as presented.**
Motion carried.

PUBLIC HEARING FOR SPECIAL LAND USES SLU#16/02 FOR KROGER'S; ADDRESS: 9968 E. GRAND RIVER AVENUE and 5771 BORDERLINE; APPLICANT AND OWNER: THE KROGER COMPANY OF MICHIGAN; TAX ID #'S: 12-32-300-061 AND 062; ZONING B-2 (GENERAL BUSINESS)
Applicant Representatives Tom Ross (Kroger's) and Alan Boyer (LSG Engineers & Surveyors) were in attendance. Mr. Boyer explained the request for the special land use permit which includes a retail building in excess of 30,000 sq. ft., a drive-thru pharmacy, and outdoor sales. K. Mathews, Township Planner, overviewed her special land use permit review letter dated August 26, 2016. J. Rushlow, Township Engineer, overviewed the portions of his site plan letter dated September 1, 2016 relative to the special land use permits. J. Rushlow also stated that the traffic study methodology was acceptable and summarized the recommendations from the study and his letter dated August 1, 2016 regarding the TIS.

PUBLIC HEARING
The public hearing opened at 7:25 p.m.
M. Palmer, 10382 Grand River - Asked about the wall along the eastern side of the property.
The public hearing closed at 7:30 p.m.

The Planning Commission asked the applicant what the outdoor sales would be (each of the four (4) seasons would have various items for sale on the sidewalk). It was explained that the special land use permit did not include tents in the parking lot. It was explained that those are permitted separately as a

temporary use. The Planning Commission discussed traffic in detail including asking the traffic consultant if the traffic study included projected traffic from other developments such as the UM Hospital and Encore Village. Julie Kroll, Fleis & Vanderbrink, explained the way they take traffic counts and that this study for Kroger's was done prior to Encore Village.

Planning Commission also discussed that during construction the contractor will use the two (2) accesses to the site other than Victor Drive as much as possible.

G. Mitsopoulos moved and D. Schifko seconded **to approve the Special Land Use Permit SLU # 16/02 for Kroger's; Address: 9968 E. Grand River Avenue and 5771 Borderline; Tax ID #'s: 12-32-300-061 and 062; Zoning B-2 (General Business) for retail in excess of 30,000 sq. ft., drive-thru pharmacy, and outdoor sales contingent upon meeting the requirements of the Township Planner and Township Engineer.**
Motion carried.

PRELIMINARY SITE PLAN SP # 16/05 FOR KROGER'S; ADDRESS: 9968 E. GRAND RIVER AVENUE AND 5771 BORDERLINE; APPLICANT AND OWNER: THE KROGER COMPANY OF MICHIGAN; TAX ID #'S: 12-32-300-061 AND 062; ZONING B-2 (GENERAL BUSINESS)
The Planning Commission read the September 8, 2016 LCRC traffic impact study (TIS) comments and recommendations into the record. Julie Kroll, Fleis & Vanderbrink, referenced recent conversation with Mike Goryl, Livingston County Road Commission (LCRC) traffic engineer, noting a dedicated right turn lane will be constructed if needed and stated that due to MDOT's project the traffic may be inflated and that once the MDOT project is completed they will have a better understanding of the traffic. She stated that if improvements are needed, they will be constructed. J. Rushlow reviewed his September 1, 2016 letter and stated that of the two (2) outstanding items Item #1, a truck turning plan, had been provided and Item #2, proposed landscaping, the plantings are too close to the LCWA water main easement and the matter needs to be discussed with LCWA. K. Mathews reviewed her September 6, 2016 site plan letter.

Planning Commission discussion included the impact of cumulative traffic for the area and that it needs to be considered (i.e. Kroger's traffic, the additional traffic generated by Encore Village and other projects in the area). The proposed percentage of brick on the front elevation 64% v. 75% requirement was also discussed and it was noted that the addition continues with the use of existing materials for the building and that the Planning Commission has the discretion to allow materials other than the strict percentages in the Zoning Ordinance. The Fire Department letter dated August 24, 2016 and the Livingston County Drain Commissioner (LCDC) e-mail dated September 7, 2016 were acknowledged.

G. Mitsopoulos moved and D. Schifko seconded **to approve the Preliminary Site Plan SP # 16/05 for Kroger's; Address: 9968 E. Grand River Avenue and 5771 Borderline; Tax ID #'s 12-32-300-061 and 062; contingent upon meeting the requirements of the Township Planner, Township Engineer, LCWA, LCRC, LCDC and any other agency requirements and that the requirements for a dedicated right turn lane will be constructed if required by the LCRC.**
Motion carried.

PUBLIC HEARING FOR CONDITIONAL REZONING RZ # 16/01 FOR ENCORE VILLAGE; ADDRESSES: 11001 AND 10675 E. GRAND RIVER; TAX ID #'S 12-32-400-001 AND 12-33-400-010; APPLICANT AND OWNER: MANCHESTER BRIGHTON; ZONING: OS (OFFICE SERVICE)
Applicants Jim George, Joe George, and Michael Furnari were in attendance. Additionally, Applicant Representatives Brent LaVanway (Boss Engineering), Alex Bogarts (Alexander V. Bogaerts + Associates P.C.), Jeff King (King and McGregor) and Julie Kroll, (Fleis and Vanderbrink) were in attendance. B. LaVanway made a presentation outlining the project and stated that the project being proposed is due to a market study that was completed which included the Township, Livingston County, and national information regarding seniors and active living communities; referenced the previous zoning on the property was RM-1 before being rezoned to OS for Providence Hospital; and stated that he feels the RM-1 zoning classification is a good transition between the business uses to the west and the multi-family to the east. He noted the project would be built in three (3) phases: the multi-story; west Encore Village, and

then east Encore Village. A conditional zoning is proposed so the Township knows the details of the site early in the process i.e. number of units, road layout, etc. The benefits of the project include sidewalk and walking paths, the three (3) story building will be for seniors which is needed in the area and a large amount of wooded and wetland area will be preserved. The units are one-story ranch style units and each side of the project has a clubhouse and pool.

Alex Bogaerts, Alexander V. Bogaerts & Associates, PC, explained that the design for the site is for all units to have views of the lakes and that the size of the units are 1,441 s.f. interior units and 1,486 s.f. end units, all have two (2) car garages, two-bedrooms with den, and a great room/open plan with brick and siding and there are three (3) styles to choose from. Additionally, the club houses and the (3) story building have the same architecture. He stated that the three (3) story building will be a full-service facility for aging in place. He stated many aging in place projects have been done around the country and are very successful.

K. Mathews overviewed the rezoning and preliminary site plan processes. J. Rushlow, Township Engineer, reviewed his September 8, 2016 letter and stated that some of the setbacks to the wetlands are less than the minimum twenty-five (25) ft. and that there are four (4) entrances to the project and that it has not been identified whether the proposal is for private roads. He said there is plenty of parking within the site but additional ADA spaces are needed for the three (3) story building due to the type of units. He stated that there are sidewalks proposed on both sides of the property except for one small section where it is not feasible to construct. He overviewed his August 30, 2016 TIS letter and stated that the TIS needs to be updated for the three (3) story v. the originally planned one story building and that additional information is needed on the grading for the site; it is conceptual at this point but some finish grades for buildings were provided. He stated that the Township has the sewer capacity and that information is needed from FIB in regards to water capacity. The LCDC letter dated September 2, 2016, and the Fire Department letters dated August 15, 2016 and August 19, 2016 were acknowledged. The e-mail from John Harris dated September 6, 2016 was also acknowledged.

PUBLIC HEARING
The public hearing opened at 9:20 p.m.

Kim Logie-Bates, 5508 Woodland Shore Drive - Stated she submitted an e-mail dated 9/11/16 with 16 questions and wanted to know about the utilities for the site; that the TIS states failed levels for traffic on Grand River; will MDOT/LCRC approve traffic improvements suggested in the study; requested clarification on the usage of Woodruff Lake; setbacks from the natural features of the site; what will drain off the site into Woodruff and Pickerel Lakes from the site; concerns about leased v. owner occupied units; concerned that with lease units the property values will decrease; concerned with the number of trees being taken down between Woodruff and Pickerel Lakes.

Dawn Bates, 5508 Woodland Shore Drive - Wants to see the marketing study mentioned by the developer to see if there is a need for these units.

Dana Casey, 5573 Woodland Shore Drive - E-mail dated 9/12/16 stating that the 5/19/14 Master Plan natural features goal is to enhance quality of life and the preservation of natural features: how is this development protecting the natural features?

Mike Palmer, 10382 E. Grand River - Lives across the street on Fonda Lake and stated when Grand River was widened from two (2) to five (5) lanes that the storm grates that were put in by the LCRC have much drainage from the road going into the lakes and he is concerned about this development adding additional drainage into the lakes. He stated the storm run-off from this site could be diverted into the sewer plant and that would utilize some of the excess 60% capacity in the plant. He said that with 555 units 1,800 cars would be going in and out.

Jim Sarna, 8266 Woodland Shore Drive - Stated that the average number of cars per home is currently 3.3 multiplied by 555 units is 1831.5 cars in and out of the development every day.

Gino Pulice, 4705 Hawkview Ct. - In favor of this development; it's a need in Brighton and if this is not

approved, a development will come in under the OS zoning which would have a much greater effect on the area.

Sue Kelly, 4121 Marsh Trail - Stated that the conceptual plan is unclear relative to the clear-cutting of all three (3) phases at once which is a problem if the development doesn't move forward. She would suggest clear-cutting one phase at a time; she is opposed to a 25 ft. wetland setback v. 100 ft. natural features setback; the natural features study is not complete; wants to see the market study because other senior developments such as Independence Village in the City currently have high vacancies.

Resident concerned about the traffic and natural features setback; need to preserve the 100 ft. setback to the natural features; concerned about the market study; wants to see that these units are needed; she said we need more development for families and children; if you talk to realtors moderate to high end homes for families are needed; said residential is better than office but this project is too dense/too massive.

Christine Weisenberger, 11486 Casa Loma - Not opposed to development but the traffic in the entire area needs to be considered such as Legacy Park in Green Oak; concerns about lease v. own; project is too dense; she would like a rezoning to single family which would allow seniors but be less dense.

Dave Wylie, 5907 High Pointe Ct - He said the 4th access point to the development which serves 10 units is too close to their development and it is only 2 lanes on Grand River at this point; the visibility out of their steep driveway is too difficult.

Michael Weisenberger, 11486 Casa Loma - He inquired where he could get the PowerPoint and other materials presented.

E-mail dated 9/10/16 from Kelley Behrendt - Opposed due to traffic.

E-mail dated 9/12/16 from Diane Fleming – Opposed; traffic concerns; leased units v. owner occupied.

E-mail dated 9/12/16 from Bob Potocki - Traffic concerns.

The public hearing closed at 9:50 p.m.

The Planning Commission discussed traffic at length and the need to include all proposed development in the area. The need to not clear-cut all three (3) at one time was discussed. The price point for the leases was discussed and that the price point and size of units would be attractive mainly to empty nesters. It was stated that OS zoning would be much more detrimental to the natural features of the site than residential. It was stated that the leases would be one to three (3) years, no subleasing would be allowed, and are suited for persons not wanting maintenance. J. Rushlow stated that the storm water cannot by law go into the sewer plant because that would be a violation of the DEQ permit and would actually increase costs by treating good water. It was stated that only visual access to Woodruff Lake was provided and that only underbrush around Woodruff Lake would be cleared but the tree buffer would remain. It was suggested that all improvements as suggested in the TIS will be required but we are waiting on Mike Goryl, LCRC traffic engineer's comments. The 100 ft. v. 25 ft. natural feature buffers were discussed and the fifty (50) ft. buffer to the wetlands was sufficient to protect the integrity of wetlands according to Jeff King, King and McGregor. Additionally, he stated that the steep slopes make it difficult to maintain such a large setback but dense vegetation is being left along the shoreline; no beaches are being created; just the one existing beach.

D. Schifko moved and G. Unruh seconded **to table Conditional Rezoning RZ # 16/01 for Encore Village; Addresses: 11001 and 10675 E. Grand River; Tax ID #'s 12-32-400-001 and 12-33-400-010; Applicant and Owner: Manchester Brighton; Zoning: OS (Office Service) to allow the Applicant to provide the additional information required by the Township Planner, Township Engineer, and other entities.**
Motion carried.

REPORTS AND CORRESPONDENCE

B. Vick - Stated that residents can sign up for e-mail/text notifications via the website.

CALL TO THE PUBLIC
Christine Christensen - Inquired if they would be noticed for the next meeting.

ADJOURNMENT
G. Unruh moved and J. Stinedurf seconded **to adjourn.**
Motion carried.

The meeting adjourned at 10:35 P.M.

Respectfully submitted,

Steve Holden, Chairperson	Gary Unruh, Secretary
Kelly Mathews, Recording Secretary	Ann M. Bollin, CMC, CMMC, Clerk

BOSS ENGINEERING
ENGINEERS • SURVEYORS • PLANNERS
LANDSCAPE ARCHITECTS

3121 E. Grand River Ave. Howell, MI 48843
(517) 546-4836 Fax: (517) 548-1670 E-mail: be@bosseng.com

LETTER OF TRANSMITTAL

DATE	JOB NO.
10/20/16	16-060

ATTENTION: Kelly Mathews

RE: Encore Village Conditional Rezoning

TO
Kelly Mathews
4363 Buno Rd
Brighton, MI 4814

WE ARE SENDING YOU ☒ Attached ☐ Under separate cover via _____ the following items:

☐ Shop drawings ☐ Prints ☑ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☐ _____

COPIES	DATE	NO.	DESCRIPTION
10	10-20-16		Updated Conditional Rezoning Encore Village Plan Set
10	10-20-16		Conditional Rezoning Response Letter
10	10-20-16		Updated Traffic Study by Fleis & Vandenbrink
10	10-20-16		Natural Features Evaluation by King MacGregor
10	10-20-16		Updated Conditional Conceptual Zoning Agreement

THESE ARE TRANSMITTED as checked below:

☑ For approval ☐ Approved as submitted ☐ Resubmit _____ copies for approval
☐ For your use ☐ Approved as noted ☐ Submit _____ copies for distribution
☐ As requested ☐ Returned for corrections ☐ Return _____ corrected prints
☐ For review and comment ☐ _____
☐ FOR BIDS DUE _____ 20 _____ ☐ PRINTS RETURNED AFTER LOAN TO US

REMARKS

Please call with any questions you may have.

RECEIVED
OCT 20 2016
BRIGHTON TOWNSHIP

COPY TO _____

SIGNED: _____

If enclosures are not as noted, kindly notify us at once.

BOSS Engineering
3121 E. Grand River Howell, MI 48843
517.546.4836 fax 517.548.1670
www.bosseng.com

October 5, 2016

RECEIVED
OCT 0 6 2016
BRIGHTON TOWNSHIP

Mrs. Kelly Mathews, Charter Township of Brighton Planner
4363 Buno Rd
Brighton, MI 48114

Re: Conditional Rezoning for Encore Village, Township Review
Boss File 16-060

Dear Mrs. Mathews,

We have received the following review letters: the Township Planner for the Encore Village Conditional Rezoning Review dated September 1st, 2016, the Township Engineer for Encore Village Conditional Rezoning Review dated August 26th, 2016, and the Brighton Area Fire Authority Site Plan Review dated August 19th, 2016 and offer the following comments.

Township Planner Comments

General

1. Information to be provided in market study which is in the process of being refined.
2. Acknowledged
3. Acknowledged
4. Acknowledged
5. Acknowledged
6. See below for responses
    a. Acknowledged
    b. Acknowledged
    c. Acknowledged
    d. Acknowledged
        i. Will coordinate with OHM and LCRC during site plan and construction plan phases.
        ii. Acknowledged
        iii. Acknowledged

Content of Conditional Conceptual Zoning Agreement (CCZA)

a. Acknowledged
b. Acknowledged
c. Language has been added to the CCZA.
d. Acknowledged
e. Acknowledged
f. Acknowledged
g. Legal description has been added to the CCZA.
h. Acknowledged
i. Acknowledged

Site Plan Discussion

a. **Existing Site Conditions**
    i. Acknowledged
    ii. Acknowledged
    iii. Acknowledged

iv. Acknowledged
v. Acknowledged
vi. Acknowledged
vii. This item will be addressed during site plan and construction plan phases.

b. Proposed Development Features

i. Street names will be provided during the site plan phase.
ii. Acknowledged
iii. Further detail regarding landscaping and trees will be provided during site plan phase. Additional dimensions have been added to the parking lots to show aisle width and space dimensions. Barrier free spaces have also been added (See sheet 5, 5A, & 5B).
iv. Acknowledged
v. Note #4 has been added regarding conservation easement to Site Plan page (Sheet 5). A Natural Features Protection Narrative has been added to Sheet 7 explaining preservation methods. Details of protection methods including silt fence and protection fence have also been added to the Construction Details page (Sheet 9).
vi. Acknowledged
vii. Acknowledged
viii. Acknowledged
ix. Acknowledged
x. Information regarding building material percentages will be provided during the site plan phase.
xi. A new traffic study has been conducted per the Planning Commission and Township Engineer comments which is included in submittal.

c. Tabulations

i. Acknowledged
ii. Acknowledged.
iii. Acknowledged
iv. Leasing information will be included in the marketing study which is in the process of being refined.
v. This information is included in the CCZA on page 3.

Township Engineer Comments

General

1. This item will be addressed during the site plan and construction plan phases.
2. Boundaries and property dimensions are now shown on the Existing Conditions and Demolition page (Sheet 2).
3. Information on adjacent properties including address, tax id, and zoning are now shown on the Existing Conditions and Demolition sheet.
4. A Natural Features Protection Narrative has been added to the Overall Grading page (Sheet 7) explaining some of the preservation methods that will be used to protect natural features on site (details for protection fence and silt fence are shown on Sheet 9).
5. Additional dimensions have been added on the Dimensioned Site Plan sheets (both West sheet 5A and East sheet 5B) showing distance between buildings and property lines.
6. This development will be under single ownership and all internal vehicular travel corridors are to be considered access drives and not roads therefore, ownership will be private access drives (Sheet 9). Public and Private road standards are not applicable.
7. Traffic consultant has performed an updated traffic study and is included in the submittal.

8. Easement notes have been added to the bottom of notes on the overall utility plan (Sheet 8) outlining what the easement widths will be for the respective utilities they apply to.

Brighton Area Fire Authority Comments

Encore Village Multi-Family Residential

1. Water main sizing information and gate valve locations will be addressed in site plan and construction plan phases.
2. Hydrant spacing has been adjusted to locations determined per meeting between Capt. Rick Boisvert and Boss Engineering on 9-16-16.
3. Acknowledged
4. Building address information and further detail will be provided during site plan phase.
5. Fire lane designation and sign detail will be provided during site plan phase. It is also acknowledged that access drives shall be provided and maintained during construction and are capable of supporting fire apparatus weight requirements.
6. Acknowledged.
7. Acknowledged
8. Acknowledged
9. Dead end access drive requirements will be addressed during site plan phase.
10. Cul-de-sac at Buildings 78-80 have been changed to have an inside turn radius of 30' and outside turn radius of 60'.
11. Residential knox boxes will be addressed during the site plan phase.
12. Owners name and address along with other consultants contact information has been provided on the cover sheet (Sheet 1).

First and Main Assisted Living (Note*: no longer referred to as First & Main)

13. Water main sizing information and gate valve locations will be addressed in site plan and construction plan phases.
14. Fire protection lead sizing information and gate valve location and connections will be addressed during site plan phase.
15. Hydrant spacing has been adjusted to locations determined per meeting between Capt. Rick Boisvert and Boss Engineering on 9-16-16.
16. Acknowledged
    a. Acknowledged
    b. Acknowledged
17. Acknowledged
18. Building address information will be addressed in the site plan phase.
19. Fire lane designation and sign detail will be provided during site plan phase. It is also acknowledged that access drives shall be provided and maintained during construction and are capable of supporting fire apparatus weight requirements.
20. Acknowledged
21. Acknowledged
22. Acknowledged
23. Contact information has been provided on the Cover Sheet (Sheet 1).

Feel free to contact us should you have any questions, or if you are in need of any additional information.

Regards,

BOSS ENGINEERING COMPANY

Brent LaVanway, P.E
Vice President
Director of Engineering

Cameron Horvath
Project Landscape Architect

CC: G:\16-060\docs\Combined Rezoning Response Letter.doc

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BRIGHTON TOWNSHIP

CONDITIONAL CONCEPTUAL ZONING AGREEMENT

THIS CONDITIONAL CONCEPTUAL ZONING AGREEMENT (the "Agreement"), is entered into by and between **Manchester Brighton, LLC**, a Michigan limited liability company, whose address is 1700 West Big Beaver, Suite 120, Troy, MI 48084 ("Developer"), and the **Charter Township of Brighton,** a Michigan municipal corporation whose address is 4363 Buno Road, Brighton, MI 48114 ("Township").

RECITALS:

I. Developer is the owner of land (the "Property") located within the Township located on the south side of Interstate 96, the north side of Grand River and west of Pleasant Valley Road, as more particularly described in **Exhibit 1** hereto.

II. The Property consists of approximately 147 acres and is presently zoned OS-Office Service.

III. Developer petitioned for a rezoning of the Property as a Conditional Rezoning request pursuant to Article 23 of the Township's Zoning Ordinance and Section 3405 of the Michigan Zoning Enabling Act, found at MCL 125.3405, requesting a rezoning of the Property from OS-Office Service to RM-1, Residential Multiple Family and identified as Application for Rezoning 16/01, filed July 28, 2016, for a proposed multiple family development to be known as "Encore Village" (the "Project").

IV. Based upon and subject to the Conditions proposed by Developer, the Township's Planning Commission recommended to the Township Board approval of the rezoning request at its regular meeting held on _____, 2016, and the Township Board approved the rezoning request at its regular meeting held on _____, 2016.

V. In proposing the rezoning with conditions to the Township, Developer has expressed as a firm and unalterable intent that Developer will develop the Property in strict conformance with the conditions of rezoning as set forth herein and the Concept Site Plan dated _____, 2016, attached hereto as **Exhibit 2** (the "Concept Plan"), each and every one of which being material:

A. The Property shall be developed with a maximum of 393 multifamily residential units in buildings of various sizes as depicted on the Concept Plan, but no single building shall contain more than six (6) residential units.

In addition, the southwest corner of the Property consisting of approximately 8 acres may be developed as an assisted living facility comprising no more than 162 beds. It is recognized that the Concept Plan has not yet been fully engineered and, the Planning Commission, as part of final site plan review, shall take into consideration the more detailed planning and engineering undertaken for the Property.

B. Developer acknowledges that the Property shall be developed in accordance with all applicable ordinances, laws and regulations, and consistent with the offered conditions set forth herein, and the right to develop shall be subject to and in accordance with all applications, reviews, approvals, permits and authorizations required.

C. The proposed development and Conditional Rezoning Request by the Developer enumerated herein, was not required by the Township, rather it was offered voluntarily by the Developer and the offered conditions, intended acts and forbearances are deemed necessary by Developer in order to preserve the character of the area, promote public safety and welfare, preserve and protect of environmental features, and without which Developer would not desire to develop or use the Property.

D. Developer has not alleged or demonstrated that the existing zoning is invalid for any reason, rather the proposed conditional rezoning of the Property with the conditions offered was determined by Developer, and confirmed by the Township, to be consistent with the surrounding land uses and the goals of preserving the character of the area, promoting public safety and welfare, preserving and protecting environmental features, and to satisfying a housing need in the Community.

E. The Township has relied on Developer's representations that it will act in strict conformance with the conditions of rezoning as set forth herein and the Concept Plan in Exhibit 2, as attached, so that the development of the Property will preserve the character of the area, promote public safety and welfare, and preserve and protect the environmental features.

NOW, THEREFORE, IT IS AGREED AS FOLLOWS:

1. Developer agrees that if the Property is developed under the RM-1, Residential Multiple Family District, the development shall be in accordance with the Conditional Rezoning Request, and in accordance with the offered conditions set forth below, the Concept Plan attached as Exhibit 2, and with all applicable ordinances, laws and regulations.

2. Developer agrees that the right to develop shall be subject to and in accordance with all applications, reviews, approvals, permits and authorizations required, including site plan and engineering plan reviews.

3. Developer agrees to forbear from acting in a manner inconsistent with the offered conditions set forth in this Agreement and the Concept Plan attached as Exhibit 2, and all revisions and documents submitted and made a part of the record of approval.

4. If the Property is developed under the RM-1 District, the Property shall be developed in a manner consistent with the following conditions of rezoning:

   a. The number or multiple family residential units shall be limited to 393 units in buildings containing no more than six (6) units per building.

   b. The development shall include two clubhouses with pools.

   c. The development shall preserve the natural features surrounding Pickerel and Woodruff Lakes as shown on the Concept Plan and include the following passive and active recreational features---viewing points for the two lakes, walking paths and nature viewing opportunities.

   d. The development shall provide, but limit, access to Pickerel and Woodruff Lakes as shown on the Concept Plan.

   e. Each residential unit shall be provided with an exterior patio or deck.

   f. Yard setbacks for each multiple family building shall comply with the following:

      1. Front Yard Setback – not less than thirty feet (30').
      2. Side Yard Setback between buildings – not less than twenty feet (20') in total.
      3. Rear Yard Setback – not less than thirty feet (30').
      4. Perimeter Setback from Property Line to Buildings—not less than thirty feet (30').
      5. Natural Features Setback—not less than twenty-five feet (25').

   g. The development shall provide for Open Space Preservation consisting of approximately 75 acres comprising preserved woodlands, wetlands and lake areas as depicted on the Concept Plan.

   h. The assisted living component of the development shall consist of no more than 162 beds and may be three (3) stories in height consistent with the RM-1 zoning district The assisted living may include a combination of one or more of independent living, assisted living, critical care, rehabilitation and memory care units. It is understood and agreed that the assisted living and multiple family developments may be developed separately, whether by parcel split or as a separate condominium unit, by different entities and may be under different ownership provided that appropriate easements for utilities, ingress/egress and use and maintenance of common elements be provided through condominium

documents or covenants and restrictions approved by the Township in the exercise of reasonable discretion in connection with final site plan approvals for the development. In the event that Developer elects not to construct the assisted living component of the development, the Developer shall be permitted to develop the assisted living portion of the Property for additional multiple family residential consistent with the development parameters specified for the multiple family development set forth herein, including without limitation, density, setback and open space restrictions, etc. In such case, Developer shall submit to the Township for administrative review and approval a revised development plan consistent with the terms and conditions of this Agreement.

i. The general quality of exterior construction of the multiple family residential buildings and the type and nature of the materials used on the buildings shall be generally consistent with the architectural elevations included with the Concept Plan, unless otherwise approved by the Planning Commission as part of final site plan approval.

5. Subject to Developer obtaining all other required state and local permits and approvals for the development of the Property and compliance with Township final site plan, landscaping and engineering requirements, the Township agrees that Developer shall be permitted to develop the Property in accordance with the above-stated use and development conditions of rezoning. In the event that modifications to the Concept Plan are: (a) required or requested by other reviewing governmental agencies having jurisdiction over the development or any portion thereof; (b) reasonably required as a result of final engineering and/or design considerations as confirmed by the Township's professional engineers or other appropriate Township consultants; and/or (c) made to address design, marketing or other conditions, such as to reduce the number of units or vary street layouts, such modifications do not require Township Board approval or amendment of this Agreement, provided that no such modification shall involve a greater number of residential units or assisted living beds or any reduction to set-back or requirements or any reduction in open space and proposed development amenities as set forth in this Agreement and the Concept Plan attached hereto. Any of the above modifications shall be provided to the Township for administrative review and approval, and such review and approval shall not be unreasonably withheld or delayed.

6. The Township has not required the use and development conditions of rezoning. The Conditional Rezoning request was voluntarily offered by Developer in order to provide an enhanced use and value of the Property, to provide additional development options for the Property, to preserve the character of the area, promote public safety and welfare, and preserve and protect the environmental features.

7. All of the conditions represent actions, improvements and/or forbearances that are a direct benefit to the Property and/or to the development of the Property. The burden of the conditions on Developer is roughly proportionate to the burdens created by the development, and are a benefit which will accrue to the Property as a result of the conditions.

8. The rezoning shall take effect upon approval of the final site plan and all conditions of such plan being met. To the extent any provision of this Agreement directly conflicts with any existing or future zoning or other ordinance of the Township, the provisions of this Agreement shall control and Developer shall be deemed to have been granted all variances necessary to conform the terms hereof to the Township's ordinances and the uses authorized herein shall be deemed conforming uses.

9. In the event that the Developer, or any respective successors, assigns and/or transferees, thereafter attempts to proceed with development of the Property in a manner which is in any material respect in violation of the use and development conditions of rezoning as set forth in this Agreement, the Exhibits hereto or the Concept Plan depicted in Exhibit 3, the Township may, following notice and a reasonable opportunity to cure, take action using the procedure prescribed by law for the rezoning of property, return the zoning of the Property to the OS-Office Service District and Developer nor any respective successors, assigns and/or transferees, shall have any vested rights in the RM-1 District, and shall be estopped from objecting to a rezoning to the OS classification.

10. If the development as agreed to in this Agreement is not constructed, and the Property is rezoned back to the OS classification, this provision shall not prohibit a future owner of the Property from thereafter objecting to the reasonableness of the OS classification as applied to the Property, provided such objection shall not be based upon the allegation of a down zoning or other claim based upon the validity of this Agreement.

11. The action of the Township in entering into this Agreement as to Conditions of Rezoning is based upon the understanding that many of the land use and environmental objectives of the Township are reflected in the design of the development as proposed and the Township is thus achieving its police power objectives and has not, by this Agreement, bargained away or otherwise compromised any of its police power objectives. Further, this Agreement shall not permit any activity, use or condition that would otherwise violate any requirement or standard that is otherwise applicable in the new zoning district.

12. After consulting with its legal counsel, Developer understands and agrees that this Agreement is authorized by all applicable state and federal laws and respective constitutions, that it shall be irrevocably estopped from taking a contrary position in the future, and that the Township shall be entitled to injunctive relief to prohibit any actions by Developer that are inconsistent with the strict terms of this Agreement.

13. This Agreement shall be binding upon and inure to the benefit of the parties to this Agreement and their respective heirs, successors, assigns and transferees, and this Agreement shall be recorded by Developer at its expense with the office of the Livingston County Register of Deeds.

14. This Agreement may be signed in counterparts.

IN WITNESS WHEREOF, each party has caused this Agreement to be duly executed and delivered in its name and on behalf its behalf by an authorized representative, as of the date written below.

PROPERTY OWNER/DEVELOPER:

Manchester Brighton, LLC,
a Michigan limited liability company,

By: _____

Its: _____

Date: _____

TOWNSHIP:

Charter Township of Brighton,
a Michigan municipal corporation

By: _____

Its: Township Supervisor

Date: _____

By: _____

Its: Township Clerk

Date: _____

DRAFT

3333706_1

EXHIBIT 1

LEGAL DESCRIPTION

DRAFT

EXHIBIT 2

CONCEPTUAL SITE PLAN dated _____ 2016

4845-1768-9653.2
112920\000002

DRAFT

PROPERTY DESCRIPTION

PART OF THE SOUTHEAST QUATER AND SOUTHWEST QUATER OF SECTION 33, TOWN 2 NORTH, RANGE 6 EAST, BRIGHTON TOWNSHIP AND PART OF THE NORTHEAST QUATER OF SECTION 4, TOWN 1 NORTH, RANGE 6 EAST, GREEN OAK TOWNSHIP, LIVINGSTON COUNTY, MICHIGAN, MORE PARTICULARY DESCRIBED AS FOLLOWS: BEGINNING AT THE SOUTHEAST CORNER OF SAID SECTION 33; THENCE ALONG THE SOUTH LINE OF SAID SECTION 33, SOUTH 86 DEGREES 40 MINUTES 21 SECONDS WEST, 22.36 FEET TO THE NORTHEAST CORNER OF SECTION 4, TOWN 1 NORTH, RANGE 6 EAST; THENCE SOUTH 03 DEGREES 01 MINUTES 07 SECONDS EAST 50.03 FEET; THENCE ALONG THE NORTHERLY LINE OF GRAND RIVER AVENUE (100 FOOT WIDE RIGHT OF WAY), NORTH 85 DEGREES 09 MINUTES 55 SECONDS WEST 602.02 FEET; THENCE CONTINUING ALONG SAID NORTH LINE, WESTERLY ON AN ARC LEFT, HAVING A LENGTH OF 890.23 FEET, A RADIUS OF 4347.80 FEET, A CENTRAL ANGLE OFF 11 DEGREES 43 MINUTES 54 SECONDS AND A LONG CHORD WHICH BEARS SOUTH 88 DEGREES 58 MINUTES 05 SECONDS WEST 888.68 FEET; THENCE CONTINUING ALONG SAID NORTH LINE, SOUTH 83 DEGREES 06 MINUTES 05 SECONDS WEST 359.94 FEET; THENCE CONTINUING ALONG SAID NORTH LINE, WESTERLY ON AN ARC TO THE RIGHT, HAVING A LENGTH OF 839.17 FEET, A RADIUS OF 1750.12 FEET; A CENTRAL ANGLE OF 27 DEGREES 28 MINUTES 23 SECONDS, AND A LONG CHORD WHICH BEARS NORTH 83 DEGREES 10 MINUTES 24 SECONDS WEST, 831.16 FEET; THENCE CONTINUING ALONG SAID NORTH LINE, NORTH 69 DEGREES 26 MINUTES 55 SECONDS WEST 821.91 FEET; THENCE NORTH 07 DEGREES 41 MINUTES 46 SECONDS EAST, 366.69 FEET; THENCE NORTH 03 DEGREES 07 MINUTES 49 SECONDS WEST, 1260.64 FEET; THENCE ALONG THE SOUTHERLY LINE OF LIMITED ACCESS HIGHWAY I-96, SOUTH 88 DEGREES 14 MINUTES 38 SECONDS EAST, 1924.66 FEET; THENCE CONTINUING ALONG SOUTHERLY LINE OF SAID I-96, EASTERLY ON AN ARC LEFT, HAVING A LENGTH OF 977.07 FEET, A RADIUS OF 11609.18 FEET, A CENTRAL ANGLE OF 04 DEGREES 49 MINUTES 20 SECONDS, AND A LONG CHORD WHICH BEARS NORTH 89 DEGREES 20 MINUTES 42 SECONDS EAST, 976.78 FEET; THENCE CONTINUING ALONG THE SOUTHERLY LINE OF SAID I-96, NORTH 86 DEGREES 56 MINUTES 02 SECONDS EAST 40 FEET TO TRAVERSE POINT A; THENCE CONTINUING ALONG THE SOUTHERLY LINE OF SAID I-96, NORTH 86 DEGREES 56 MINUTES 02 SECONDS EAST, 439.72; THENCE ALONG THE EAST LINE OF SAID SECTION 33 SOUTH 02 DEGREES 59 MINUTES 07 SECONDS EAST, 1355.49 FEET TO TRAVERSE POINT B, BEING THE ENDPOINT OF A MEANDERING TRAVERSE LINE BEGINNING AT AFOREMENTIONED TRAVERSE POINT A, AND HAVING THE FOLLOWING 2 COURSES: 1) SOUTH 01 DEGREES 03 MINUTES 42 SECONDS EAST, 595.20 FEET, 2) SOUTH 34 DEGREES 09 MINUTES 12 SECONDS EAST, 888.22 FEET; THENCE CONTINUING ALONG THE EAST LINE OF SAID SECTION 33, SOUTH 02 DEGREES 59 MINUTES 07 SECONDS EAST, 574.69 FEET TO THE POINT OF BEGINNING.

King & MacGregor
Environmental
Inc.

September 30, 2016

Sent Via Email

Ms. Kelly Mathews
Planner
Charter Township of Brighton
4363 Buno Road
Brighton, MI 48114

RECEIVED
OCT 2 0 2016
BRIGHTON TOWNSHIP

Re: Proposed Encore Village
Natural Features Setback Evaluation

Dear Ms. Mathews:

On behalf of Manchester Brighton, LLC, and in conjunction with Boss Engineering, enclosed please find our Natural Features Setback Evaluation as requested by the Planning Commission during their meeting of September 12, 2016.

Thank you for your review of this report and for your on-going attention to this project. Please contact me at your earliest convenience if you should have any questions regarding its contents or our conclusions.

Sincerely,

King & MacGregor Environmental, Inc.
Jeffery A. King

Enclosures

cc: Michael Furnari (Manchester Brighton, LLC)
Brent LaVanway (Boss Engineering)

2520 Woodmeadow SE
Grand Rapids, MI 49546
Phone: 616/957-1231
Fax: 616/957-2198

43050 Ford Road, Suite 130
Canton, MI 48187
Phone: 734/354-0594
Fax: 734/354-0593

email: kme@king-macgregor.com

Natural Features Setback Evaluation
Encore Village

A proposed development in
Brighton Township, Livingston County, Michigan

September 30, 2016

Prepared by:
King & MacGregor Environmental, Inc.
43050 Ford Road, Suite 130
Canton, Michigan 48187
(734) 354-0594

KME No. 15268

SUMMARY

This evaluation was conducted by King & MacGregor Environmental, Inc. on behalf of Manchester Brighton, LLC at the request of Brighton Township as part of a pending site plan application. It is intended to document the existing vegetative character of the on-site Natural Features Setback areas, discusses the potential effectiveness of those setback areas to serve as a buffer between the proposed development and the regulated Natural Features to be preserved on the property, and suggests measures that could be taken to improve the effectiveness of these setback areas to serve as such a buffer.

INTRODUCTION

Manchester Brighton, LLC has proposed a multi-family residential and assisted living development ("Encore Village") on an approximately 147-acre parcel on the north side of Grand River Avenue and approximately one mile west of Pleasant Valley Road in Brighton Township, Livingston County. This parcel is generally undeveloped and contains Pickerel Lake, associated lacustrine (lakeshore) wetlands, three isolated palustrine (surface and groundwater fed) wetlands and a portion of Woodruff Lake and its associated lacustrine and palustrine wetlands. With the exception of the northwest and southeast corner of the property, the majority of the property is within a Natural Features Overlay District as defined by the Brighton Township Zoning Ordinance, which includes regulations for applying "Natural Features Setbacks" to proposed site plans. As it relates to this property, on-site features that meet the definition of "Natural Features" under the Zoning Ordinance include Pickerel Lake, Woodruff Lake and the identified wetlands. For the purposes of this evaluation, we have included the wetlands associated with Woodruff Lake that are excluded from the Natural Features Overlay District. As Pickerel Lake has a surface water connection to Woodruff Lake and, eventually, the Huron River, activities that preserve the quality of Pickerel Lake and on-site wetlands are anticipated to also preserve the quality of Woodruff Lake and the regional aquatic resources.

Article 10 of the Brighton Township Zoning Ordinance describes several functions and values of Natural Features Setbacks, which buffer the regulated Natural Features from the potential effects of the proposed development based on the development's anticipated use, density, traffic generation, storm water runoff, noise, lighting, and other potential development impacts. From this description, we developed the following criteria for evaluating the character of the on-site Natural Features Setback Areas on the Encore Village site:

- Presence/absence of trees and shrubs and the quality thereof;
- Presence/absence of herbaceous vegetation and the quality thereof;
- Stability of soils; and
- Likelihood of existing vegetation to thrive after construction.

To carry out this effort, we have performed several on-site evaluations of the Natural Features Setback Areas identified on a site plan dated July 22, 2016 as produced by Boss Engineering with the most recent evaluation taking place on September 15, 2016. During this most recent site evaluation, the entire Natural Features Setback Areas were walked, vegetation and soil character were noted and representative photographs were taken. The results of this evaluation are reported herein.

FINDINGS

For purposes of this report, we have grouped the on-site Natural Features Setback Areas into six categories, with these categories defined by the character of existing vegetation and stability of the soils. The categories are as follows:

1. Mature Hardwoods
2. Immature Hardwoods
3. Immature Hardwoods, Eroding
4. Pine-Dominated Woods
5. Scrub
6. Previously-Maintained Landscape

The approximate delineation of the on-site Natural Features Setback Areas into these categories, and the distance between the Natural Features and the proposed buildings, roads, and parking lots, are shown in the appended figures. These categories are described in further detail as follows:

1. Mature Hardwoods

The setback areas with mature hardwoods are vegetated with established native trees such as red oak (*Quercus rubra*), white oak (*Quercus alba*), shagbark hickory (*Carya ovata*), pignut hickory (*Carya glabra*), sugar maple (*Acer saccharum*), and black cherry (*Prunus serotina*). These trees create a dense canopy and naturally limit shrub and herbaceous cover to those species adapted to lower-light conditions such as saplings of the canopy trees, Virginia creeper (*Parthenocissus quinquefolia*) and Pennsylvania sedge (*Carex pensylvanica*).

Mature hardwoods create an effective buffer for the on-site regulated Nature Features by creating a visual buffer between the natural resource and the development, reducing direct runoff to the regulated Natural Features by intercepting rainfall with the tree canopy and increasing infiltration into the thick, un-compacted surface organic soil layer, and by protecting the regulated Natural Features from encroachment through the physical barrier created by the trees and shrubs. In general, mature hardwoods are not effective as a natural buffer from the sheet flow of storm water discharge, as they naturally lack a dense layer of herbaceous vegetation that would be most resistant to erosion from flowing water.

Measures that can be taken during site development and construction to maintain the effectiveness of this setback in buffering the regulated Natural Features include limiting grading adjacent to the setback that could undermine the stability of the mature trees to the extent feasible, designing a storm water management system that minimizes runoff from the developed portions of the property from sheet-flowing through the setback and creating erosive gullies, and managing the clearing and construction phase of the development to control unnecessary removal of mature trees.

Mature hardwoods occur in the northern portion of the eastern half of the parcel, adjacent to proposed Buildings 12-25. The proposed distance between the regulated Natural Features and the proposed buildings in this area is between 25 feet and 196 feet, with an average distance of approximately 70 feet.

Mature Hardwoods setback area near proposed Building 17.

Mature Hardwoods setback area near proposed Building 24.

2. Immature Hardwoods

The setback areas with immature hardwoods are vegetated with young native trees such as white oak, cherry, red oak, and black cherry. These trees create a partial canopy and therefore dense shrub and herbaceous vegetation dominates the setback area understory. Common

shrub and vine species occurring in this portion of the site include gray dogwood (*Cornus racemosa*), multiflora rose (*Rosa multiflora*), Asian bittersweet (*Celastrus orbiculatus*), Virginia creeper, autumn olive (*Elaeagnus umbellata*) and privet (*Ligustrum sp.).* Common herbaceous vegetation occurring in this portion of the site includes Queen Anne's lace (*Daucus carota*), garlic mustard (*Alliaria petiolata*) and lily of the valley (*Convallaria majalis*).

Immature hardwoods are an effective buffer for the regulated Natural Features by creating a visual buffer between those regulated Natural Features and the development, reducing direct runoff to the regulated Natural Features by intercepting rainfall with the tree canopy, and protecting the regulated Natural Features from encroachment by the physical barrier created by the trees and shrubs. While more effective than mature hardwoods as a buffer, immature hardwoods are also not particularly effective as a natural buffer from the sheet flow of storm water discharge, as they naturally lack a dense layer of herbaceous vegetation that would be most resistant to erosion from flowing water.

As with Mature Hardwoods, measures that can be taken during site development and construction to maintain the effectiveness of this setback in buffering the regulated Natural Features include limiting grading adjacent to the setback that could undermine the stability of the maturing trees to the extent feasible, designing a storm water management system that minimizes runoff from the developed portions of the property from sheet-flowing through the setback and creating erosive gullies, and managing the clearing and construction phase of this development to control unnecessary removal of maturing trees.

Immature hardwoods exist in the southeast corner of the site adjacent to proposed Buildings 8, 9, 29 and 79-80, the southern shoreline of Pickerel Lake, and in the western portion of the site adjacent to proposed Buildings 43-47. The proposed distance between the regulated Natural Features and the proposed buildings in this area is between 26 and 117 feet, with an average distance of approximately 58 feet.

Immature Hardwoods setback area near proposed Building 29

Immature Hardwoods setback area near proposed Building 45.

Immature Hardwoods setback area near proposed Building 79.

3. Immature Hardwoods, Eroding

The setback areas with immature hardwoods and eroding soils are vegetated with young trees such as American elm (*Ulmus americana*), black cherry, and Norway maple (*Acer platanoides*).

These trees create a partial canopy and therefore shrubs are present in the understory. Common shrub and vine species include multiflora rose, Asian bittersweet, Virginia creeper, autumn olive and privet. This category differs from the "Immature Hardwoods" category in that within these areas there are numerous gullies with active erosion. Some of these areas are broad with little or no herbaceous vegetation to hold the soil, and others areas are gullies that channelize surface water runoff.

The effectiveness and limitations of this category as a buffer are similar to the Immature Hardwoods" category but with added limitation regarding the unstable nature of the soils. Work to increase the cover by shrub and herbaceous plants would stabilize the soil and increase the effectiveness of this vegetative type as a buffer. In addition to seeding and planting, this work may also require regrading at the top of the slope to redirect surface water runoff that appears to be the source of the existing erosion.

Immature hardwoods, eroding, exist along the southwest shore of Pickerel Lake, adjacent to the proposed parking lot and Clubhouse. The proposed distance between the regulated Natural Features and the proposed buildings in this area is between 79 and 92 feet, with an average distance of approximately 85 feet.

Immature Hardwoods, Eroding setback area near proposed Clubhouse on western portion of site.

Immature Hardwoods, Eroding setback area near proposed Building 43.

4. Pine-Dominated Woods

The setback areas with pine-dominated woods are distinguished by a dense stand of white pine (*Pinus strobus*) and red pine (*Pinus resinosa*) that creates a dense canopy and suppresses significant shrub and herbaceous vegetation growth.

Pine-dominated woods are an effective buffer for the on-site regulated Natural Features by creating a visual buffer between the regulated Natural Features and the development, reducing direct runoff to the regulated Natural Features by intercepting rainfall with the tree canopy, and protecting the regulated Natural Features from encroachment by the physical barrier created by the trees. As with Mature Hardwoods, pine-dominated hardwoods are not effective as a natural buffer from the sheet flow of storm water discharge, as they also naturally lack a dense layer of herbaceous vegetation that would be most resistant to erosion from flowing water.

As with Mature Hardwoods and Immature Hardwoods, measures that can be taken during site development and construction to maintain the effectiveness of this setback in buffering the regulated resources include limiting grading adjacent to the setback that could undermine the stability of the mature trees to the extent feasible, designing a storm water management system that minimizes runoff from the developed portions of the property from sheet-flowing through the setback and creating erosive gullies, and managing the clearing and construction phase of this development to control unnecessary removal of mature trees.

Pine-dominated woods exist as a pocket in the southeast corner of the property adjacent to proposed Building 80. The proposed distance between the regulated natural features and the proposed buildings in this area is 90 feet.

Pine-Dominated Woods setback area near proposed Building 80.

5. Scrub

The setback areas with scrub vegetation have only scattered immature trees such as black cherry and American elm. These immature trees do not create much of a canopy; therefore the vegetation in the understory is dominated by dense shrub and vine vegetation. Common shrub and/or vine species include Asian bittersweet, multiflora rose, autumn olive, Virginia creeper, and privet.

Scrub vegetation is an effective buffer for the on-site regulated Natural Features by reducing direct runoff to the regulated Natural Features by intercepting rainfall with the shrub canopy and protecting the regulated Natural Features from encroachment by the physical barrier created by the shrubs and vines. Scrub vegetation is also effective as a buffer in that it creates a significant a physical barrier between the regulated Natural Features and the development, even though these areas tend to be dominated by non-native and invasive plants that reduce overall plant diversity.

Measures that can be taken during site development and construction to maintain the effectiveness of this setback in buffering the regulated Natural Features include limiting grading adjacent to the setback that could undermine the stability of the shrubs to the extent feasible, designing a storm water management system that minimizes runoff from the developed portions of the property from sheet-flowing through the setback and creating erosive gullies, and managing the clearing and construction phase of the development to control unnecessary removal of vegetation.

Scrub vegetation areas exist along the eastern property boundary adjacent to proposed Buildings 10 and 11 and along the northeast shore of Pickerel Lake adjacent to proposed Building 48. The proposed distance between the regulated natural features and the proposed

buildings in these areas is between 33 and 123 feet, with an average distance of approximately 60 feet.

Scrub vegetation setback area near proposed Building 10.

Scrub vegetation setback area near proposed Building 48

6. Previously-Maintained Landscape

The setback areas with Previously-Maintained Landscape are now dominated by grasses and forbs (weeds) and appear to have been maintained as lawn areas over the past several decades. These areas generally lack trees and shrubs.

Previously-Maintained Landscapes are an effective buffer for the on-site regulated Natural Features by being highly resilient to erosion from storm water runoff and by filtering out suspended particles from storm water runoff. Maintained landscapes however, do not create a visual or physical buffer between the regulated Natural Features and the development.

Measures that can be taken during site development and construction to increase the effectiveness of this setback, except in the area of a proposed lake access community area, include planting native trees, shrubs, and establishing a native herbaceous flora to the extent feasible.

Maintained landscape areas exist along the southeast shore of Pickerel Lake, adjacent to a proposed clubhouse and parking lot, and in the northeastern property boundary adjacent to proposed Buildings 47 and 48. The proposed distance between the regulated Natural Features and the proposed buildings in this area is between 53 and 110 feet, with an average distance of approximately 82 feet.

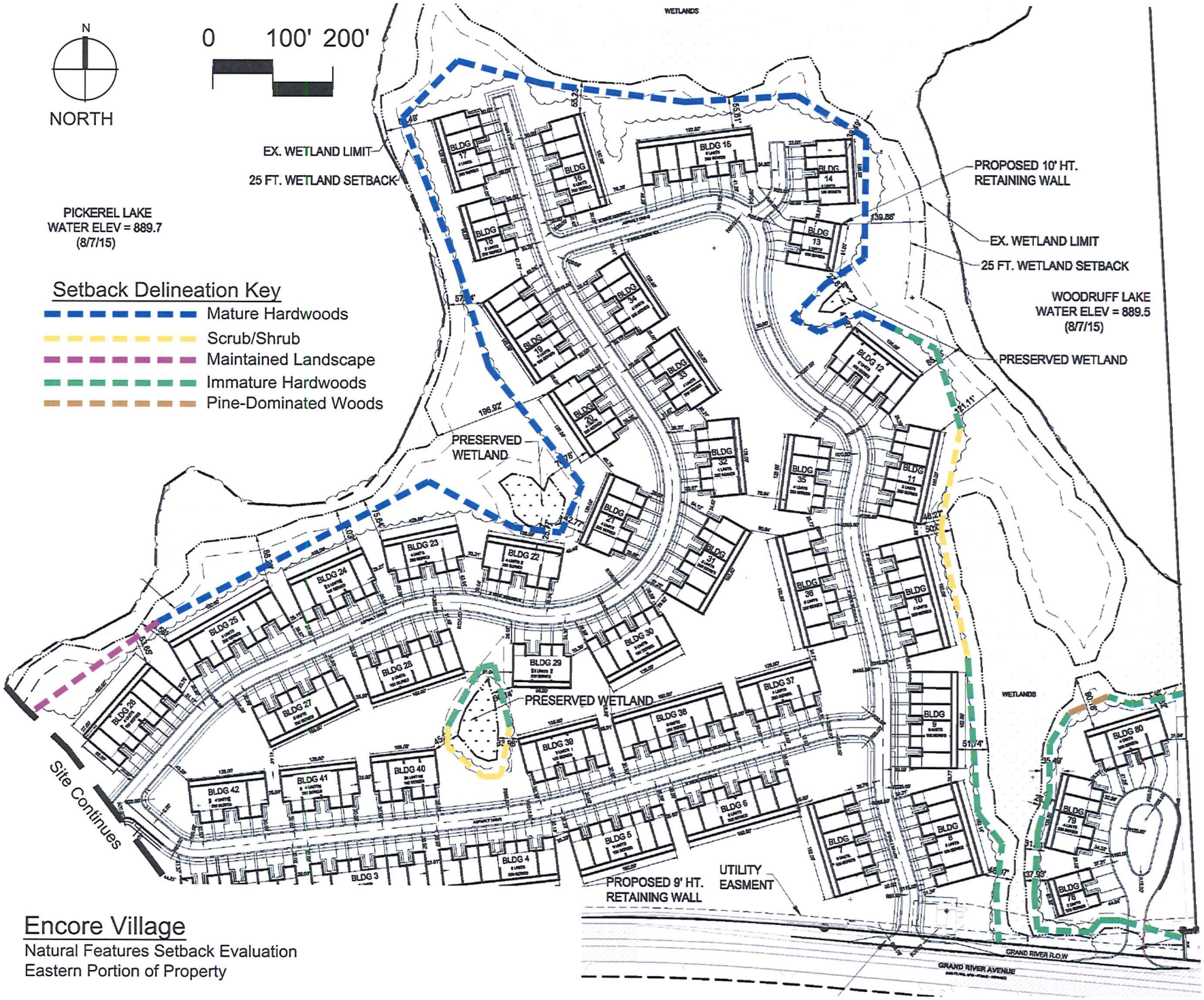
Previously-Maintained Landscape setback area near proposed Building 47.

CONCLUSIONS AND RECOMMENDATIONS

A variety of vegetative types and communities occur within the Natural Features Setback Areas on the property, with each of these vegetative communities having unique characteristics that in total help make them, an effective buffer between the proposed development and the regulated Natural Features, almost all of which are to be preserved on the property. The various Natural Features Setback categories extend an average from 58 to 90 feet from the Natural Features.

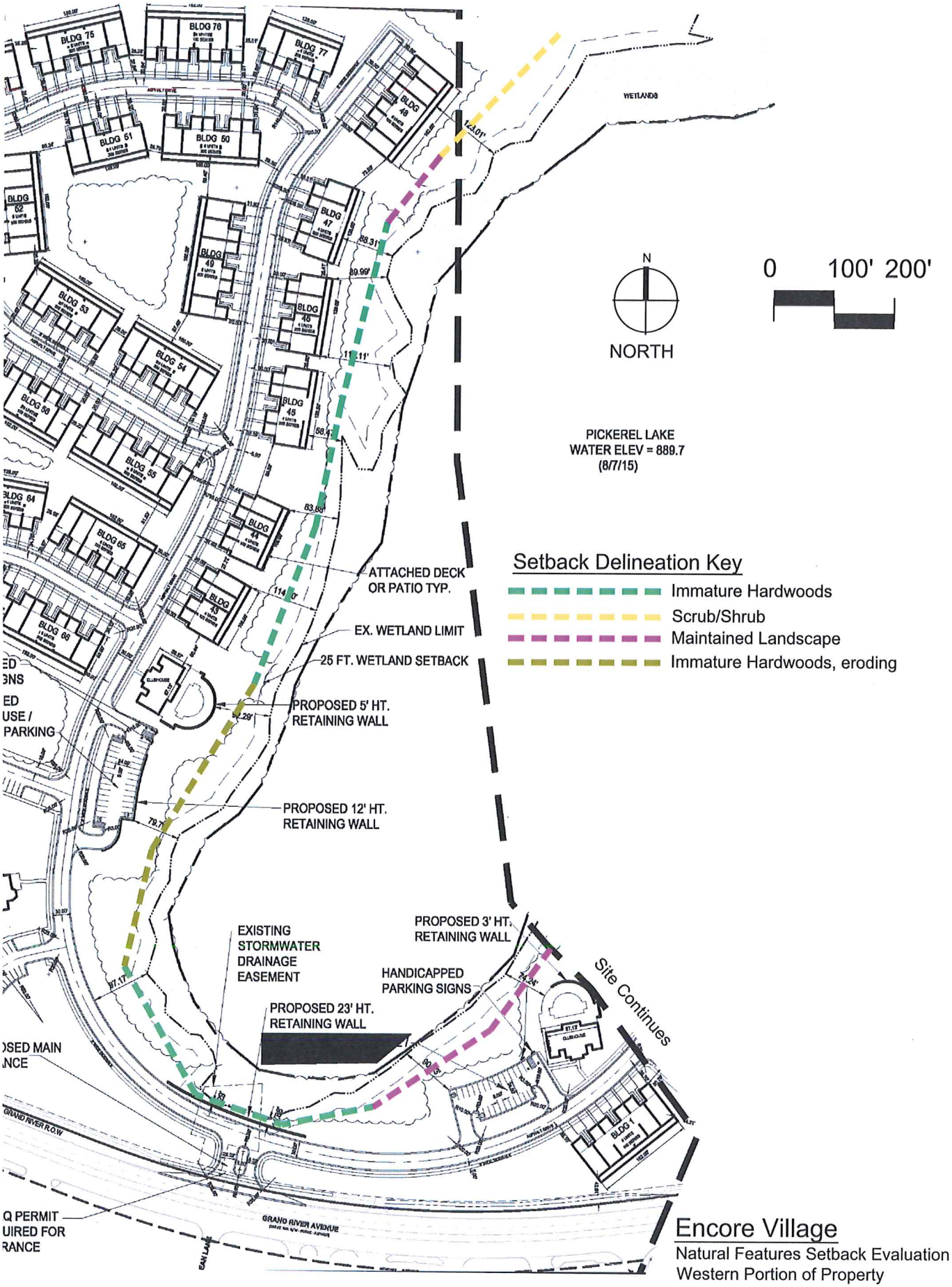
Design and construction management considerations will maintain and/or increase the effectiveness of any specific area to serve as buffers. A common consideration is to limit proposed grading adjacent to the setback area to the extent feasible. Construction measures that could be employed to accomplish this goal could be the use of walkout basements and retaining walls to match existing and proposed grades, rather than the creation of extensive side slopes. There were also two vegetative communities observed (referred to as "Immature Woods, Eroding" and "Maintained Landscape") where the effectiveness of those areas as a buffer could be improved through the installation of supplemental vegetation and erosion control blanket where needed.

The quality of stormwater entering Pickerel Lake and ultimately Woodruff Lake through the watercourse connection is of significant importance during and after construction. The developer will be required to comply with the Michigan Department of Environmental Quality requirements for stormwater pretreatment prior to discharge of stormwater to Pickerel Lake. Additionally the plan will be reviewed for stormwater compliance by the Township Engineering Consultant and the Livingston County Drain Commissioner's office.



Encore Village

Natural Features Setback Evaluation
Eastern Portion of Property



Encore Village

Natural Features Setback Evaluation
Western Portion of Property

FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

October 4, 2016

VIA EMAIL

Mr. Michael Furnari
Manchester Brighton, LLC
1700 W. Big Beaver, Suite 120
Troy, MI 48084

RE: Proposed Encore Village Residential Community
Brighton Township, Michigan
Traffic Impact Study

Dear Mr. Furnari:

Included herein is the revised Traffic Impact Study (TIS) completed by Fleis & VandenBrink (F&V) for the proposed Encore Village, a Multi-Family residential development in Brighton Township, Michigan. The previous TIS dated July 19, 2016 was prepared by F&V, and subsequent to the completion of this study the site development plan was modified. The TIS was revised to incorporate the impact of the changes to the site plan and also includes additional analyses at the request of the Brighton Township Planning Commission and the Livingston County Road Commission (LCRC). The TIS revisions are summarized below.

Trip Generation

- The TIS was revised to reflect the most current version of the site plan which includes: 393 apartment units and a 162 bed assisted living facility. The impact of these changes is negligible as summarized in the table below.

Land Use	ITE Code	Amount	Units	Average Daily Traffic	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
July 2016 TIS										
Apartments	220	411	D.U.	2,614	41	164	205	159	85	244
Assisted Living	254	104	Beds	277	10	5	15	10	13	23
TOTAL				2,891	51	169	220	169	98	267
October 2016 TIS										
Apartments	220	393	D.U.	2,505	39	157	196	152	82	234
Assisted Living	254	162	Beds	431	15	8	23	16	20	36
TOTAL				2,936	54	165	219	168	102	270
CHANGE IN NEW TRIPS				**45**	**3**	**-4**	**-1**	**-1**	**4**	**3**

27725 Stansbury Boulevard, Suite 150
Farmington Hills, MI 48334
P: 248.536.0080
F: 248.536.0079
www.fveng.com

- The proposed development includes 393 apartment units that will be targeted towards "empty nesters" and active adults which best matches the ITE description for land use code 252 (Senior Adult Housing – Attached); however, as they will not be age restricted, ITE land use code 220 (Apartments) was utilized in this study. For comparison purposed, the trip generation for each land use is summarized below. The results show that the Apartments land use results in more than two times the number of peak hour site-generated vehicle trips as compared to using the senior adult housing land use. The actual trips generated by the proposed development are expected to be closer the Senior Adult Housing land use code.

Land Use	ITE Code	Amount	Units	Average Daily Traffic	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
Apartments	220	393	D.U.	2,505	39	157	196	152	82	234
Senior Adult Housing - Attached	252	393	D.U.	1,192	27	51	78	52	44	96
DIFFERENCE				**1,313**	**12**	**106**	**118**	**100**	**38**	**138**

Analysis

- The Pleasant Valley & I-96 WB Off-Ramp intersection was added to the study at the request of the LCRC and MDOT. The results of the analysis show that in this intersection currently operates acceptably during the peak periods and is expected to continue operating acceptably with the addition of the proposed development.

- The revised TIS includes the trip generation from the Kroger supermarket expansion as summarized in TIS completed by F&V dated August 12, 2016.

- The SimTraffic approach delays are shown in the LOS summary tables at the request of the LCRC.

Results and Recommendations

- There are no changes to the recommended improvements with the revised TIS.
- The proposed development will increase traffic volumes at the intersection of Grand River Avenue with Old US-23 / Whitmore Lake Road by approximately 3% during both the AM and PM peak periods; and, at the intersection of Grand River Avenue with Pleasant Valley Road by approximately 10% during the AM peak period and 8% during the PM peak period.
- The study evaluated the full buildout of the development. The development is proposed in phases and the full impact of the site development will not be experienced until site buildout.

In summary, the study recommendations included herein, provide mitigations for consideration and for future planning purposes. As noted by LCRC, the traffic volumes at the study intersections can vary daily depending on the operations of I-96 and US 23, and with the ongoing construction (including the I-96 / US 23 interchange and the upcoming US 23 dynamic lanes project) through the area it may take several years for traffic to "normalize" through the area.

Therefore, it is difficult to recommend future improvements based on data that may be different in several years. As the development progresses, the study intersections should be monitored to determine if the mitigation measures included herein are necessary. Since LCRC has jurisdiction over the roadways included in the analysis, further discussion is recommended to determine the requirement of off-site roadway improvements for the development.

If you have any questions, please contact our office.

Sincerely,

FLEIS & VANDENBRINK

Julie M. Kroll

Julie M. Kroll, PE, PTOE
Sr. Project Manager

Attachment

JMK:jmk

FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

MEMO

VIA EMAIL

To:	**Mr. Michael Furnari** **Manchester Brighton, LLC**
From:	**Michael J. Labadie, PE** **Julie M. Kroll, PE, PTOE** **Steven J. Russo, E.I.T.** **Fleis & VandenBrink**
Date:	**October 4, 2016**
Re:	**Encore Village** **Brighton Township, Michigan** **Traffic Impact Study**

Introduction

This memorandum presents the results of a Traffic Impact Study (TIS) for the proposed Encore Village Multi-Family residential development in Brighton Township, Michigan. The project site is located on the north side of Grand River Avenue, approximately one mile east of Old US-23 and is currently undeveloped. The multi-family residential development is proposed to include 393 apartment units and 162 bed assisted living facility. Site access for the site will be provided via four site access driveways to Grand River Avenue. Grand River Avenue and all other study roadways are under the jurisdiction of the Livingston County Road Commission (LCRC).

Based on the standards set forth in the Brighton Township Zoning Ordinance, a TIS is required to evaluate traffic impacts of the proposed development. This TIS has been completed to identify the impacts (if any) of the proposed development on the following study intersections:

- Grand River Avenue & Old US-23 / Whitmore Lake Road,
- Grand River Avenue & Pleasant Valley Road,
- Old US-23 & Spencer Road West,
- Pleasant Valley Road & WB I-96 Off-Ramp / Culver Road, and
- The proposed site access points.

The scope of the study was developed based on Fleis & VandenBrink's (F&V) knowledge of the study area, understanding of the development program, accepted traffic engineering practice, and the methodologies published by the Institute of Transportation Engineers. Additionally, F&V solicited input regarding the proposed scope of work from the Livingston County Road Commission (LCRC) and the Township's traffic consultant, OHM. The study analyses were completed using Synchro and SimTraffic, Version 9 traffic analysis software.

Data Collection

Existing weekday traffic volume data were collected by F&V subconsultant Traffic Data Collection, Inc. (TDC) on March 22, 2016 and September 20, 2016. Vehicular turning movement counts were collected during the weekday AM (7:00 AM to 9:00 AM) and PM (4:00 PM to 6:00 PM) peak periods at all study intersections. This data was used as a baseline to establish existing traffic conditions without the proposed development. Additionally, F&V collected an inventory of existing lane use and traffic controls and obtained existing traffic signal timing information from LCRC. The applicable data referenced in this memorandum are attached.

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Existing Conditions

Existing peak hour vehicle delays and Levels of Service (LOS) were calculated at the study intersections using Synchro (Version 9) traffic analysis software. This analysis was based on the existing lane use and traffic control shown on the attached Figure 1, the existing peak hour traffic volumes shown on the attached Figure 2, and the methodologies presented in the *Highway Capacity Manual 2010* (HCM). Typically, LOS D is considered acceptable, with LOS A representing minimal delay, and LOS F indicating failing conditions. Additionally, SimTraffic network simulations were reviewed to evaluate network operations and vehicle queues. The existing conditions results are attached and summarized in Table 1 below.

Table 1: Existing Intersection Operations

			AM Peak			PM Peak		
Intersection	Control	Approach	HCM Delay (s/veh)	SimTraffic Delay (s/veh)	HCM LOS	HCM Delay (s/veh)	SimTraffic Delay (s/veh)	HCM LOS
1. Grand River Avenue	Signalized	EB	28.0	33.5	C	55.9	51.5	E
& Old US-23 /		WB	27.8	32.2	C	59.4	76.1	E
Whitmore Lake Road		NB	24.7	28.2	C	47.4	59.9	D
		SB	27.8	33.1	C	51.0	52.8	D
		Overall	**27.0**	**31.9**	**C**	**54.2**	**61.7**	**D**
2. Old US-23	Signalized	EB	25.1	19.4	C	25.8	23.0	C
& Spencer Road West		NB	6.3	10.9	A	9.1	15.0	A
		SB	15.6	13.5	B	14.1	15.6	B
		Overall	**16.6**	**14.8**	**B**	**15.6**	**17.6**	**B**
3. Grand River Avenue	STOP	EB LT	8.3	5.0	A	11.2	10.4	B
& Pleasant Valley Road	(Minor)	WB LT	8.7	1.2	A	7.9	2.6	A
		NB	0.0	0.0	A	593.6	52.6	F
		SB	21.3	7.0	C	29.3	18.2	D
4. Pleasant Valley Road	STOP	EB	14.3	5.2	B	12.4	3.4	B
& WB I-96 Off-Ramp /	(Minor)	WB	12.8	7.0	B	16.9	9.7	C
Culver Road		NB LT	8.4	2.0	A	8.7	3.6	A
		SB		Free			Free	

The results of the existing conditions analysis indicate that all study intersection approaches and movements currently operate acceptably at a LOS D or better during the AM and PM peak periods with the exception of the following:

- The STOP controlled southbound left turn movement from Pleasant Valley Road onto eastbound Grand River Avenue which currently operates at a LOS F during both peak periods.
- The eastbound and westbound approaches, northbound through movement, and southbound left turn movement at the intersection of Grand River Avenue & Old US-23 / Whitmore Lake Road which currently operate at a LOS E during the PM peak period.
- The STOP controlled northbound Bar None Drive approach aligned with Pleasant Valley Road which currently operates at a LOS F during the PM peak period.

Review of network simulations indicates acceptable traffic operations during the AM peak period. During the PM peak period, long vehicle queues are observed for several approaches and movements at the intersection of Grand River Avenue & Old US-23 / Whitmore Lake Road. In particular, a long vehicle queue is observed for the westbound left turn movement which frequently exceeds available storage length and spills back into the through travel lanes along Grand River Avenue.

At the intersection of Grand River Avenue & Pleasant Valley Road / Bar None Drive, brief periods of long vehicle queues are observed for the southbound right turn movement and eastbound left turn movement during the peak 30 minute period which occupy available storage length; however, these queues dissipate and are not present throughout the duration of the peak period.

Existing Improvements

In order to provide an acceptable LOS D or better for all study intersection approaches and movements, improvements to the study network were investigated. At the intersection of Grand River Avenue & Old US-23 / Whitmore Lake Road, traffic signal cycle length and timing changes were reviewed and it was determined that these changes do not sufficiently reduce vehicle delays. Subsequently, geometric improvements were evaluated and the results of this analysis indicate that right turn lanes should be constructed on the eastbound and westbound Grand River approaches and corresponding right turn overlap signal phases should be provided.

At the intersection of Grand River Avenue & Pleasant Valley Road / Bar None Drive, a signal warrant analysis was performed based on the guidelines set forth in the *Michigan Manual on Uniform Traffic Control Devices (MMUTCD).* The MMUTCD outlines nine factors used in warranting the use of traffic signal control. As F&V only collected four hours of traffic volume data, Warrant 2 (4-Hour) was evaluated for this study.

The MMUTCD states *"The site-specific traffic characteristics should dictate whether an approach is considered as one lane or two lanes."* Based on existing traffic volume data, the right turn movement is the predominant movement for the southbound approach accounting for approximately 90% of approach traffic. Therefore, the minor street approach was considered a one lane approach when applied against the signal warrants, while all major street approaches were considered as two lane approaches.

Additionally, the MMUTCD states *"The study should consider the effects of the right-turn vehicles from the minor street approaches."* This is to account for vehicles which would be able to turn right on red under signalization. Based on traffic volume data and engineering judgment a 50% right turn reduction factor was applied for the Pleasant Valley Road approach to account for the "right turn on red" phenomena.

The results of the signal warrant analysis indicate that the approach volumes fall above the applicable curve for four hours with the application of the 70% factor. Therefore, ***Warrant 2 is met*** and LCRC should consider the installation of a traffic signal at the intersection. With the recommended improvements all study intersection approaches and movements will operate acceptably as shown in Table 2.

Table 2: Existing Intersection Operations with Improvements

			AM Peak			PM Peak		
Intersection	Control	Approach	HCM Delay (s/veh)	SimTraffic Delay (s/veh)	HCM LOS	HCM Delay (s/veh)	SimTraffic Delay (s/veh)	HCM LOS
1. Grand River Avenue & Old US-23 / Whitmore Lake Road	Signalized	EB	22.1	26.5	C	35.2	41.9	C
		WB	24.7	28.2	C	33.7	41.7	C
		NB	24.6	27.7	C	34.1	44.3	C
		SB	27.3	36.3	C	35.7	43.2	D
		Overall	**24.7**	**30.2**	**C**	**34.5**	**42.6**	**C**
3. Grand River Avenue & Pleasant Valley	Signalized	EB	6.4	6.5	A	14.7	12.0	B
		WB	16.5	5.1	B	19.8	10.2	B
		NB	0.0	0.0	A	28.8	30.0	C
		SB	17.6	12.0	B	22.7	14.9	C
		Overall	**9.7**	**7.5**	**A**	**18.4**	**12.1**	**B**

Although these improvements are needed to improve existing traffic operations today, no improvements to the study network are currently planned. Therefore, the remainder of this study evaluates traffic operations with the existing infrastructure.

Background Conditions

In order to determine the applicable growth rate for the existing traffic volumes to the project build-out year of 2020, historical traffic data were referenced from LCRC. Most recent traffic data from LCRC indicate that between 2009 and 2013 overall traffic volumes in the area have decreased or remained stagnant. However, as no new traffic counts have been collected in the study area within the last three years, population forecasts for Brighton Township were also reviewed from the Southeast Michigan Council of Governments (SEMCOG). SEMCOG population forecasts for Brighton Township indicate an annual population growth rate of 0.75% which was utilized in this study for the analysis of background conditions ***without the proposed development.***

In addition to background growth, it is important to account for traffic that will be generated by approved developments within the vicinity of the study area that have yet to be constructed or are currently under construction. Through conversations with LCRC and the Brighton Township Planning Department, a Kroger Supermarket expansion was identified as the only background development.

The Kroger supermarket site is located on the southwest corner of the Grand River Avenue & Old US-23 / Whitmore Lake Road intersection and includes a 40,872 square feet (SF) expansion of the existing Kroger store into adjacent retail space. The PM peak hour vehicle trips that would be generated by the Kroger expansion and assignments to the study road network were obtained from the TIS completed by F&V dated August 12, 2016.

As the Kroger TIS did not include analysis of the AM peak hour, a trip generation forecast was completed based on the rates and equations published by ITE in the *Trip Generation, 9th Edition* to calculate the AM peak hour site-generated trips. These trips were then assigned to the study road network based on the trip distribution methodology outlined in the Kroger TIS.

Background Operations

Background peak hour vehicle delays and LOS were calculated based on the existing lane use and traffic control shown on the attached Figure 1, the background traffic volumes shown on the attached Figure 3, and the methodologies presented in the HCM. The results of the analysis of background conditions analysis are attached and summarized in Table 3.

The results of the background conditions analysis indicate that all study intersection approaches and movements will continue to operate in a manner similar to existing conditions during the AM peak hour. Vehicle delays and LOS as shown in Table 3 will be similar to existing conditions and minor increases will not be discernable. Review of network simulations also indicates traffic operations which are similar to existing conditions.

During the PM peak hour, the signalized intersection of Grand River Avenue & Old US-23 / Whitmore Lake Road will be reduced to an overall LOS E with an increase in delay of 5.4 seconds per vehicle. Review of network simulations at this intersection indicate long vehicle queues for several approaches and movements throughout the duration of the peak period.

At the intersection of Grand River Avenue & Pleasant Valley Road / Bar None Drive, brief periods of long vehicle queues are observed for the southbound right turn movement and eastbound left turn movement during the peak 30 minute period which exceed available storage lengths.

Table 3: Background Intersection Operations

Intersection	Control	Approach	AM Peak HCM Delay (s/veh)	AM Peak SimTraffic Delay (s/veh)	AM Peak HCM LOS	PM Peak HCM Delay (s/veh)	PM Peak SimTraffic Delay (s/veh)	PM Peak HCM LOS
1. Grand River Avenue	Signalized	EB	29.1	33.5	C	64.1	87.3	E
& Old US-23 /		WB	28.7	32.3	C	77.3	167.9	E
Whitmore Lake Road		NB	24.9	27.7	C	51.2	67.7	D
		SB	28.4	36.3	C	54.0	49.7	D
		Overall	**27.7**	**32.9**	**C**	**63.7**	**101.6**	**E**
2. Old US-23	Signalized	EB	25.0	19.4	C	25.9	23.2	C
& Spencer Road West		NB	6.6	11.6	A	9.4	14.2	A
		SB	15.7	13.6	B	14.3	17.2	B
		Overall	**16.7**	**15.0**	**B**	**15.7**	**17.8**	**B**
3. Grand River Avenue	STOP	EB LT	8.3	5.2	A	11.9	11.0	B
& Pleasant Valley Road	(Minor)	WB LT	8.7	1.2	A	7.9	2.9	A
		NB	0.0	0.0	A	1202.1	87.1	F
		SB	23.9	6.9	C	37.2	20.1	E
4. Pleasant Valley Road	STOP	EB	14.9	5.5	B	12.8	3.4	B
& WB I-96 Off-Ramp /	(Minor)	WB	13.3	6.9	B	19.5	11.4	C
Culver Road		NB LT	8.5	2.0	A	8.9	3.3	A
		SB		Free			Free	

Site Trip Generation and Assignment

The development plans are proposed to include 393 apartment units and a 162 bed assisted living facility. The apartment units will be targeted towards "empty nesters" and active adults which best matches the ITE description for land use code 252 (Senior Adult Housing – Attached); however, as they will not be age restricted, ITE land use code 220 (Apartments) was utilized in this study to provide a conservative approach. A trip generation comparison of each land use is summarized in Table 4 and indicates utilization of the Apartments land use results in more than two times the number of peak hour site-generated vehicle trips as compared to using the senior adult housing land use.

Table 4: Apartments Site Trip Generation Comparison

Land Use	ITE Code	Amount	Units	Average Daily Traffic	AM Peak Hour In	AM Peak Hour Out	AM Peak Hour Total	PM Peak Hour In	PM Peak Hour Out	PM Peak Hour Total
Apartments	220	393	D.U.	2,505	39	157	196	152	82	234
Senior Adult Housing - Attached	252	393	D.U.	1,192	27	51	78	52	44	96
DIFFERENCE				**1,313**	**12**	**106**	**118**	**100**	**38**	**138**

A comparison of the trip generation potential of the subject parcel was also forecast for existing permitted uses under the existing Office Service (OS) zoning and the proposed development project. The number of weekday, AM, and PM peak hour vehicle trips that would be generated was forecast based on data published by ITE in *Trip Generation, 9th Edition* and the *Trip Generation Handbook, 3rd Edition*.

In order to determine the maximum site trip generation potential under the existing zoning conditions, the principal uses permitted under the OS zoning classification were matched to the land use categories described by ITE in *Trip Generation, 9th Edition*. Review of the ITE land use descriptions indicates that the General Office Building (710) use best match the uses defined by Ordinance.

The maximum allowable density for the site was determined based on information provided by Boss Engineering which indicates that approximately 1,292,208 SF of office space can feasibly be accommodated on the site. The trip generation forecasts are summarized in Table 5 and indicate the proposed development would result in a significant decrease in daily and peak hour trip generation as compared to the uses permitted under existing zoning.

Table 5: Zoning Site Trip Generation Comparison

Land Use	ITE Code	Amount	Units	Average Daily Traffic	AM Peak Hour In	AM Peak Hour Out	AM Peak Hour Total	PM Peak Hour In	PM Peak Hour Out	PM Peak Hour Total
EXISTING ZONING (OS)										
Office	710	1,292,208	SF	9,179	1,304	178	1,482	259	1,267	1,526
PROPOSED DEVELOPMENT										
Apartments	220	393	D.U.	2,505	39	157	196	152	82	234
Assisted Living	254	162	Beds	431	15	8	23	16	20	36
TOTAL				2,936	54	165	219	168	102	270
CHANGE IN NEW TRIPS FOR SITE				**-6,243**	**-1,250**	**-13**	**-1,263**	**-91**	**-1,165**	**-1,256**

The vehicle trips that would be generated by the proposed development were assigned to the study road network based on existing peak hour traffic patterns, the proposed site plan, and the methodologies published by ITE. This methodology indicates that new trips will return to their direction of origin. Vehicle trips to /from the north on Pleasant Valley Road were distributed through the I-96 interchange based on existing turning movement patterns. The site trip distribution model outlined in Table 6 was applied to assign the future traffic volumes.

Table 6: Site Trip Distribution

To	via	AM	PM
North	Pleasant Valley Road	30%	27%
	Old US-23	5%	7%
South	Whitmore Lake Road	12%	11%
East	Grand River Avenue	35%	28%
West	Grand River Avenue	16%	24%
	Spencer Road	2%	3%
		100%	100%

The site-generated vehicle trips were assigned to the study road network based on this trip distribution pattern and is shown on the attached Figure 4. The site-generated trips were added to the background traffic volumes to calculate the future peak hour traffic volumes shown on the attached Figure 5.

Future Conditions

Future peak hour vehicle delays and LOS ***with the proposed development*** were calculated based on the existing lane use and traffic control, the proposed site access plan, the future traffic volumes, and the methodologies presented in the HCM. Additionally, SimTraffic simulations were utilized to evaluate network operations and vehicle queues. The results of the future conditions analysis are attached and shown in Table 7.

Table 7: Future Intersection Operations

Intersection	Control	Approach	AM Peak HCM Delay (s/veh)	AM Peak SimTraffic Delay (s/veh)	AM Peak HCM LOS	PM Peak HCM Delay (s/veh)	PM Peak SimTraffic Delay (s/veh)	PM Peak HCM LOS
1. Grand River Avenue	Signalized	EB	29.4	34.6	C	66.4	78.3	E
& Old US-23 /		WB	30.0	32.2	C	89.5	164.6	F
Whitmore Lake Road		NB	25.0	28.4	C	50.5	48.1	D
		SB	28.7	34.6	C	59.3	73.7	E
		Overall	**28.2**	**32.8**	**C**	**69.2**	**99.7**	**E**
2. Old US-23	Signalized	EB	25.0	19.0	C	25.8	22.8	C
& Spencer Road West		NB	6.7	11.9	A	9.5	15.2	A
		SB	15.7	13.4	B	14.4	17.4	B
		Overall	**16.6**	**14.8**	**B**	**15.8**	**18.2**	**B**
3. Grand River Avenue	STOP	EB LT	8.6	5.3	A	13.0	15.5	B
& Pleasant Valley Road	(Minor)	WB LT	9.0	1.4	A	8.0	3.2	A
		NB	0.0	0.0	A	4766.0	180.0	F
		SB	37.5	9.1	E	60.8	114.1	F
4. Pleasant Valley Road	STOP	EB	15.3	5.5	C	13.5	3.8	B
& WB I-96 Off-Ramp /	(Minor)	WB	14.0	7.4	B	23.7	13.2	C
Culver Road		NB LT	8.5	2.1	A	9.0	3.4	A
		SB		Free			Free	
5. Grand River Avenue	STOP	EB LT	8.2	2.2	A	10.3	2.2	B
& Assisted Living Drive	(Minor)	WB		Free			Free	
		SB	12.5	7.1	B	17.7	9.5	C
6. Grand River Avenue	STOP	EB LT	8.1	0.7	A	10.6	0.8	B
& W. Residential Site Drive	(Minor)	WB		Free			Free	
		SB	13.7	7.1	B	18.9	9.4	C
7. Grand River Avenue	STOP	EB LT	8.1	2.6	A	10.9	2.5	B
& Middle Residential Site	(Minor)	WB		Free			Free	
Drive		SB	14.5	17.1	B	26.7	20.0	D
8. Grand River Avenue	STOP	EB LT	0.0	1.5	A	10.5	1.3	B
& E. Residential Site Drive	(Minor)	WB		Free			Free	
		SB	15.9	9.5	C	21.1	16.0	C

The results of the future conditions analysis indicate that all study intersection approaches and movements will continue to operate acceptably during the peak periods with the exception of the following:

- The STOP controlled southbound Pleasant Valley Road approach at Grand River Avenue which will operate at a LOS E and F during the AM and PM peak periods, respectively.
- The signalized intersection of Grand River Avenue & Old US-23 / Whitmore Lake Road which will continue to operate at an overall LOS E during the PM peak hour with several approaches and movements operating at a LOS E or F.

- The STOP controlled northbound Bar None Drive approach aligned with Pleasant Valley Road which will continue to operate at a LOS F during the PM peak period.

Review of network simulations indicates acceptable traffic operations during the AM peak hour. During the PM peak hour long vehicle queues are observed at several study intersections. At the intersection of Grand River Avenue & Pleasant Valley Road / Bar None Drive, brief periods of long vehicle queues are observed for the southbound right turn movement and eastbound left turn movement which exceed available storage lengths. At the intersection of Grand River Avenue & Old US-23 / Whitmore Lake Road, long vehicle queues are observed for several approaches and movements throughout the duration of the peak hour. At the WB I-96 off-ramp to Pleasant Valley Road, a long vehicle queue is observed for the westbound I-96 off-ramp left turn movement during the peak ten minute period; however, the queue dissipates and does not extend back to the westbound I-96 mainline.

At the proposed site access points to Grand River Avenue, all approaches and movements will operate acceptably at a LOS D or better during both peak periods. Additionally, review of network simulations indicates acceptable driveway operations and significant vehicle queues are not observed.

Future Improvements

In order to mitigate future traffic operations to be similar to background conditions, an analysis of future conditions with the improvements recommended under existing conditions was completed. The results of this analysis indicate that all study intersection approaches would operate acceptably at a LOS D or better during both peak periods, as shown in Table 8. Review of network simulations also indicates acceptable traffic operations and vehicle queues are observed to be acceptably processed.

Table 8: Future Intersection Operations with Improvements

			AM Peak			PM Peak		
Intersection	Control	Approach	HCM Delay (s/veh)	SimTraffic Delay (s/veh)	HCM LOS	HCM Delay (s/veh)	SimTraffic Delay (s/veh)	HCM LOS
1. Grand River Avenue & Old US-23 / Whitmore Lake Road	Signalized	EB	22.3	26.4	C	40.9	45.0	D
		WB	26.6	30.8	C	40.3	45.6	D
		NB	24.9	28.5	C	41.5	64.5	D
		SB	28.4	38.1	C	43.7	47.8	D
		Overall	**25.4**	**31.3**	**C**	**41.4**	**50.0**	**D**
3. Grand River Avenue & Pleasant Valley Road	Signalized	EB	7.5	7.3	A	20.2	13.7	B
		WB	17.1	7.0	B	23.3	12.8	C
		NB	0.0	0.0	A	28.8	33.7	C
		SB	17.7	13.0	B	28.2	18.7	C
		Overall	**10.4**	**8.5**	**B**	**23.1**	**14.6**	**C**

It is important to note that these improvements are not required entirely as a result of the proposed development. Currently, these intersections have multiple approaches and movements that operate at a LOS E or F during the PM peak hour. The proposed development will increase traffic volumes at the intersection of Grand River Avenue with Old US-23 / Whitmore Lake Road and Pleasant Valley Road by approximately 3% and 8%, respectively, during the PM peak hour as compared to background conditions.

Turn Lane Warrants

MDOT warrants for right turn deceleration lanes were evaluated for the proposed site access points to Grand River Avenue. The results of the turn lane warrant evaluation indicate that a right turn taper only is recommended at the W. Residential Site Drive and full width right turn lane is recommended at the Middle Residential Site Drive. At the Assisted Living Site Drive and E. Residential Site Drive no right turn treatment is required.

Conclusions

The conclusions of this Traffic Impact Study are as follows:

1. At the intersections of Grand River Avenue with Old US-23 / Whitmore Lake Road and Pleasant Valley Road, several approaches and movements currently operate at a LOS E or F during the PM peak period.
2. With the recommended existing improvements below, all study intersection approaches and movements will operate acceptably at a LOS D or better *(Note: these improvements are not currently planned; therefore, background and future conditions were evaluated with the existing infrastructure.)*
    a. Construct right turn lanes on the EB and WB approaches at the intersection of Grand River Avenue & Old US-23 / Whitmore Lake Road.
    b. Signalize the intersection of Grand River Avenue & Pleasant Valley Road / Bar None Drive.
3. Background conditions were evaluated which includes a traffic growth rate of 0.75% per year to the project buildout year of 2020 and traffic generated by the proposed Kroger expansion.
4. Under background traffic conditions ***without the proposed development,*** traffic operations will operate in a manner similar to existing conditions with minor increases in vehicle delays and LOS.
5. The proposed development project would result in a significant decrease in daily and peak hour trips on the adjacent road network as compared to existing permitted site uses.
6. The analysis of future conditions ***with the proposed development*** indicates that several approaches and movements at the intersections of Grand River Avenue with Old US-23 / Whitmore Lake Road and Pleasant Valley Road will continue to operate at a LOS E or F.
7. With the recommended existing improvements, all approaches at the study intersections will operate acceptably at a LOS D or better under future conditions.
8. All movements and approaches at the proposed site access points to Grand River Avenue will operate acceptably at a LOS D or better during both peak periods.
9. A right turn taper only is recommended at the proposed W. Residential Site Drive to Grand River Avenue while a full width right turn lane is recommended at the Middle Apartment Site Driveway.
10. The proposed development will increase traffic volumes at the intersection of Grand River Avenue with Old US-23 / Whitmore Lake Road by approximately 3% during both the AM and PM peak periods; and, at the intersection of Grand River Avenue with Pleasant Valley Road by approximately 10% during the AM peak period and 8% during the PM peak period.

Any questions related to this memorandum, study, analyses, and results should be addressed to Fleis & VandenBrink.

Attached: Figures 1 – 5
Traffic Volume Data
SEMCOG Data
Synchro Results
Signal Warrants
Turn Lane Warrants

SJR:mjl

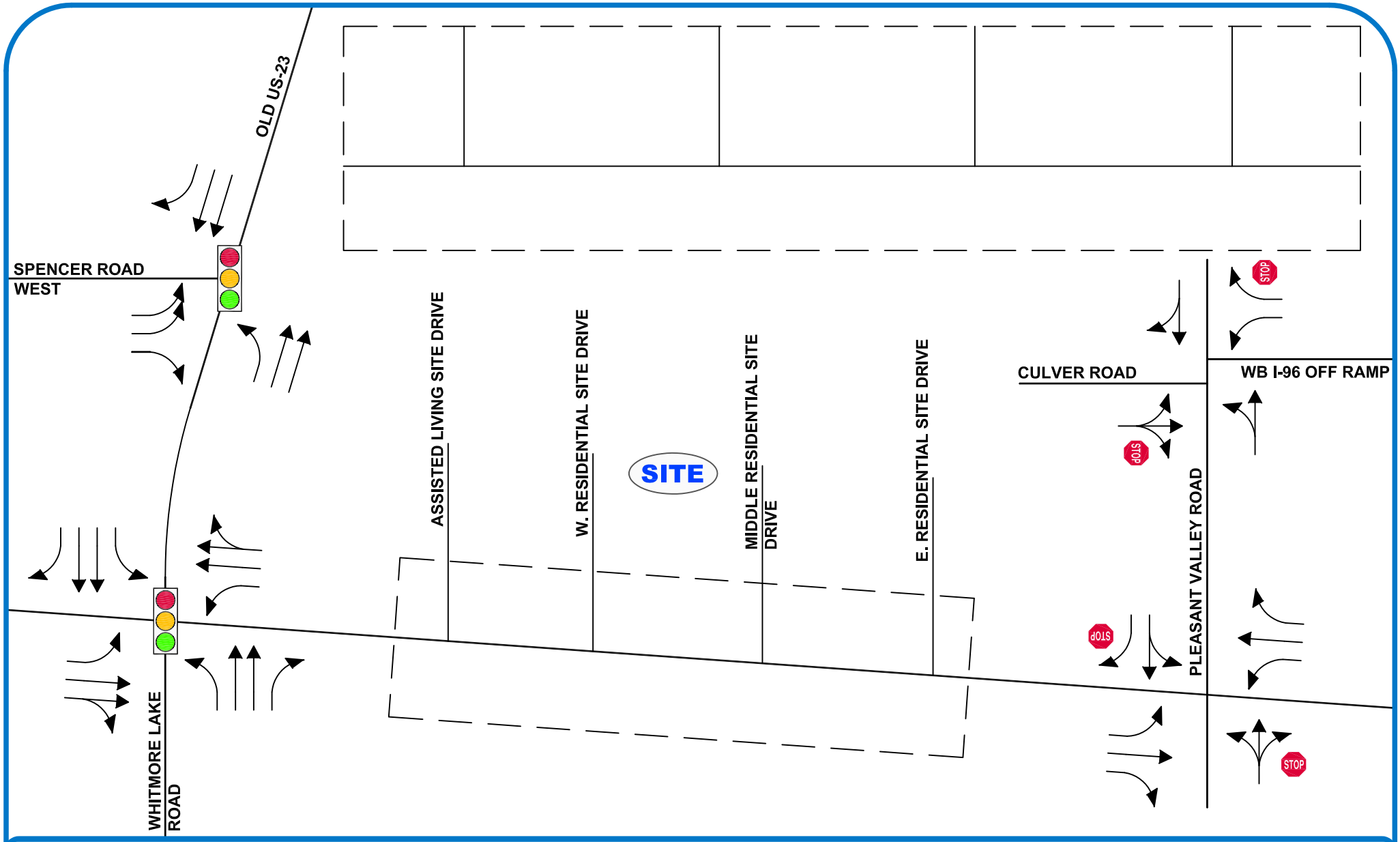


FIGURE 1
LANE USE AND TRAFFIC CONTROL

ENCORE VILLAGE TIS - BRIGHTON TOWNSHIP, MI

LEGEND

- SIGNALIZED INTERSECTION
- UNSIGNALIZED INTERSECTION
- ROADS
- LANE USE

NORTH

SCALE: NOT TO SCALE

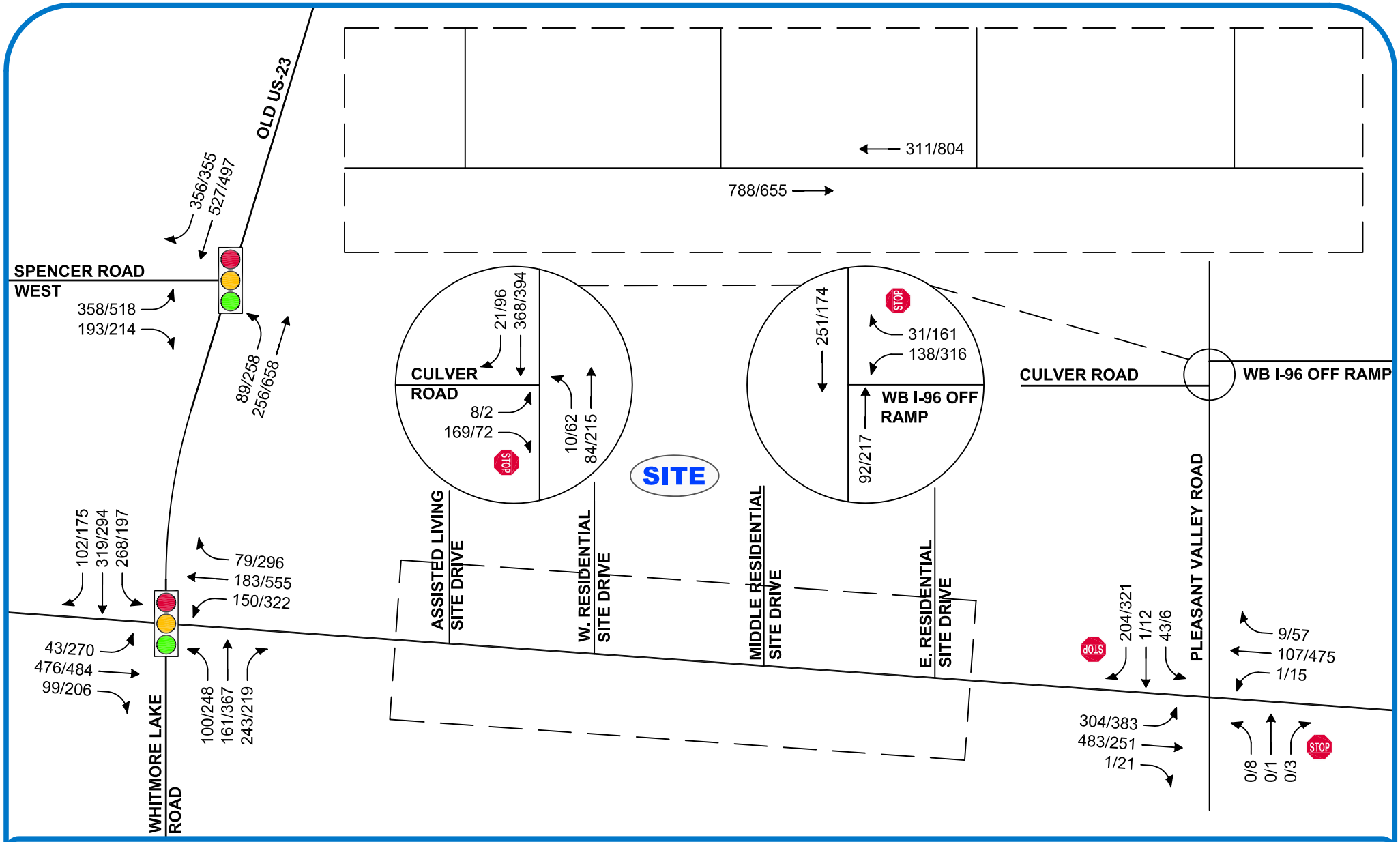


FIGURE 2
EXISTING TRAFFIC VOLUMES

ENCORE VILLAGE TIS - BRIGHTON TOWNSHIP, MI

LEGEND

- SIGNALIZED INTERSECTION
- UNSIGNALIZED INTERSECTION
- TRAFFIC VOLUMES (AM/PM)
- ROADS

NORTH

SCALE: NOT TO SCALE

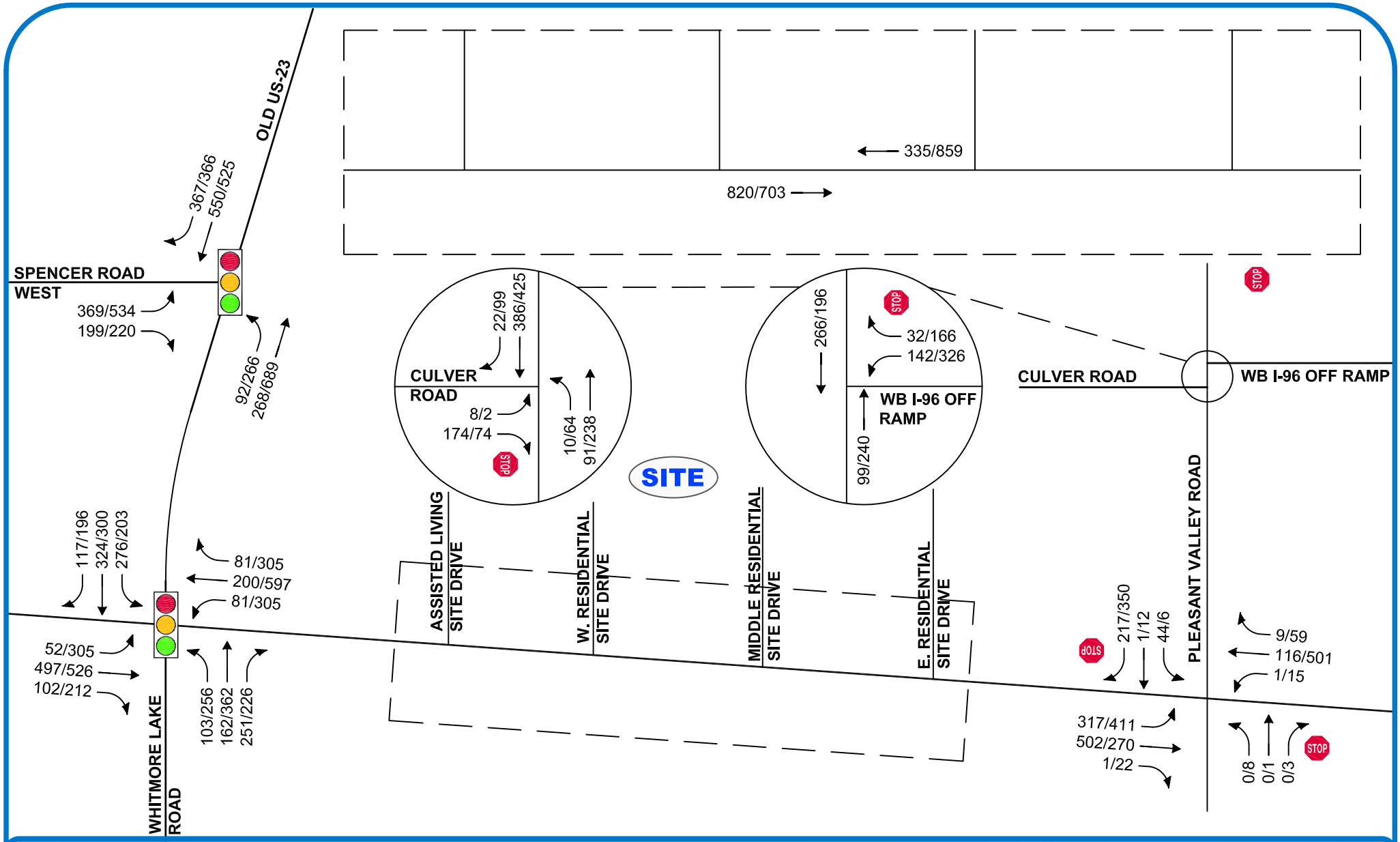


FIGURE 3
BACKGROUND TRAFFIC VOLUMES

ENCORE VILLAGE TIS - BRIGHTON TOWNSHIP, MI

LEGEND

- SIGNALIZED INTERSECTION
- UNSIGNALIZED INTERSECTION
- TRAFFIC VOLUMES (AM/PM)
- ROADS

NORTH

SCALE: NOT TO SCALE

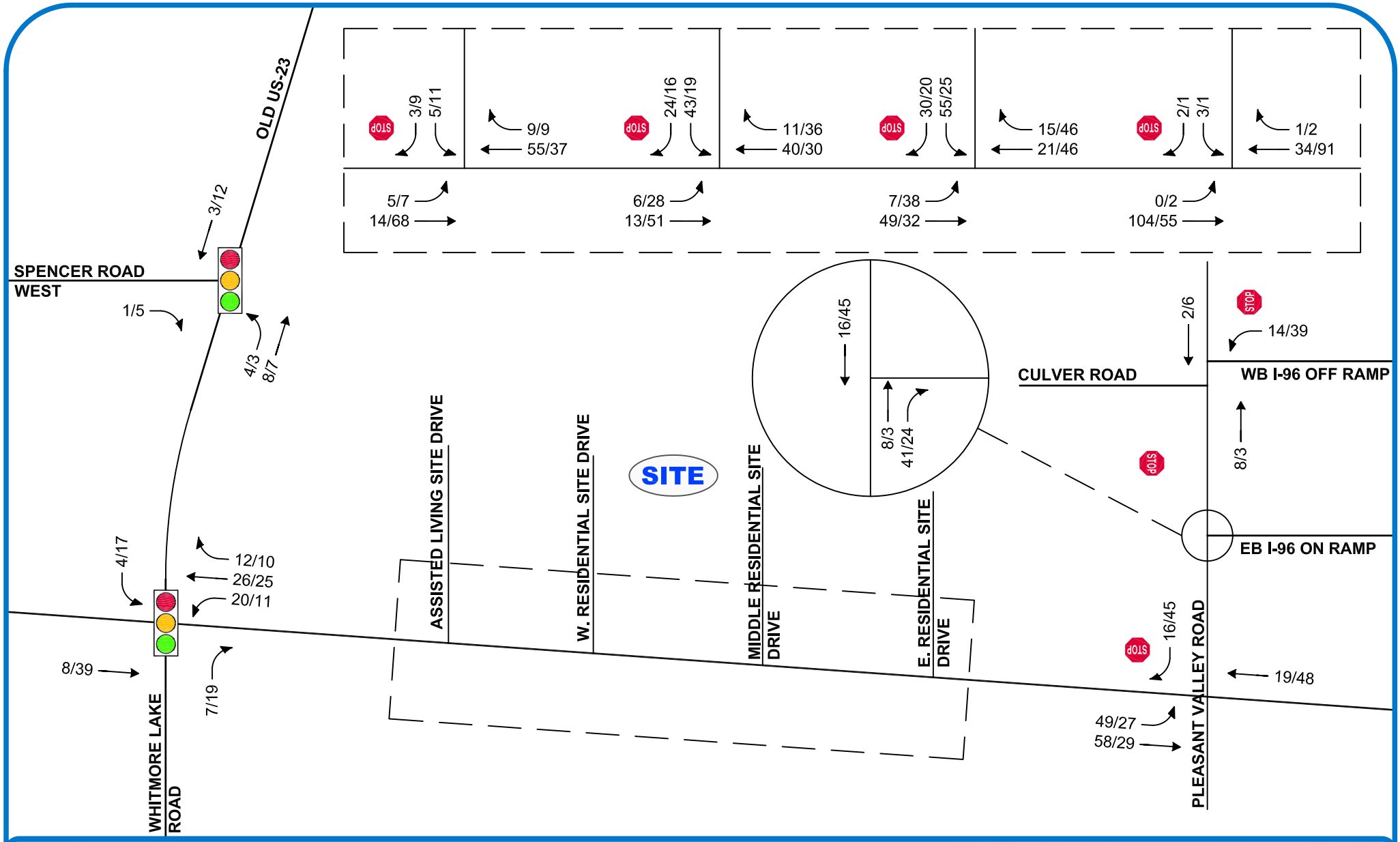


FIGURE 4
SITE-GENERATED TRAFFIC VOLUMES

ENCORE VILLAGE TIS - BRIGHTON TOWNSHIP, MI

LEGEND

- SIGNALIZED INTERSECTION
- UNSIGNALIZED INTERSECTION
- TRAFFIC VOLUMES (AM/PM)
- ROADS

NORTH

SCALE: NOT TO SCALE

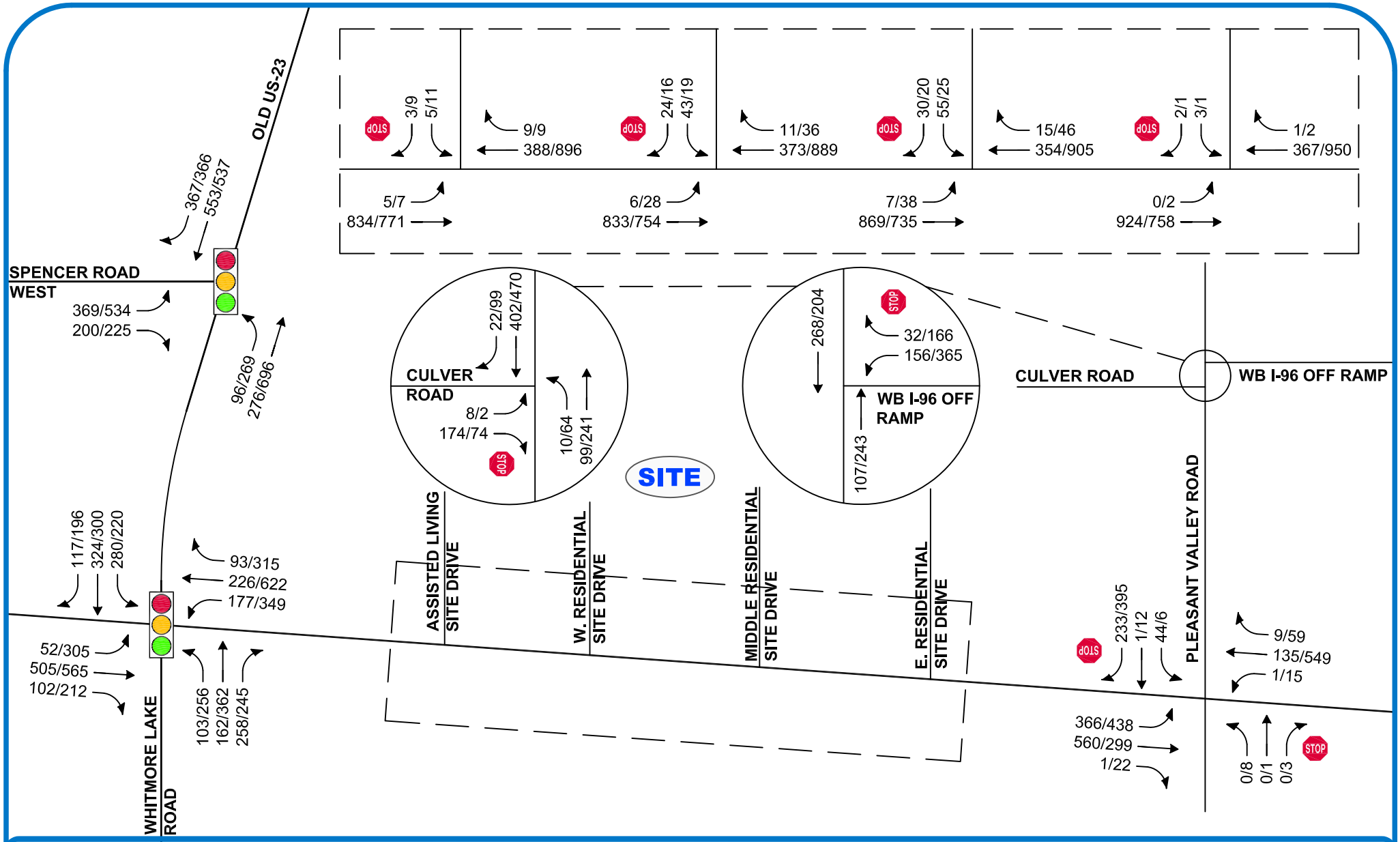


FIGURE 5
FUTURE TRAFFIC VOLUMES

ENCORE VILLAGE TIS - BRIGHTON TOWNSHIP, MI

LEGEND

- SIGNALIZED INTERSECTION
- UNSIGNALIZED INTERSECTION
- TRAFFIC VOLUMES (AM/PM)
- ROADS

NORTH

SCALE: NOT TO SCALE

Traffic Data Collection (TDC)

tdccounts.com

Phone: (586) 786-5407

Traffic Study Performed For:

Fleis & VandenBrink

Project: Brighton Twp. Traffic Study
Type: 4 Hr. Video Turning Movement Count
Weather: Pt. Sunny, Dry Temp 40's
Count By: Miovision Video VCU 1US

File Name : TMC_1 US23&SpencerW_3-22-16
Site Code : TMC_1
Start Date : 3/22/2016
Page No : 1

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

	Old US-23 Hwy. Southbound					Westbound					Old US-23 Hwy. Northbound					West Spencer Road Eastbound					
Start Time	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	132	120	0	0	252	0	0	0	0	0	0	27	15	0	42	35	0	59	0	94	388
07:15 AM	52	141	0	0	193	0	0	0	0	0	0	27	12	0	39	36	0	70	0	106	338
07:30 AM	47	103	0	0	150	0	0	0	0	0	0	54	20	0	74	59	0	74	0	133	357
07:45 AM	65	123	0	0	188	0	0	0	0	0	0	64	17	0	81	63	0	95	0	158	427
Total	296	487	0	0	783	0	0	0	0	0	0	172	64	0	236	193	0	298	0	491	1510
08:00 AM	70	135	0	0	205	0	0	0	0	0	0	52	20	0	72	36	0	70	0	106	383
08:15 AM	78	99	0	0	177	0	0	0	0	0	0	57	25	0	82	47	0	96	0	143	402
08:30 AM	111	133	0	0	244	0	0	0	0	0	0	87	20	0	107	51	0	108	0	159	510
08:45 AM	97	160	0	0	257	0	0	0	0	0	0	60	24	0	84	59	0	84	0	143	484
Total	356	527	0	0	883	0	0	0	0	0	0	256	89	0	345	193	0	358	0	551	1779
**** BREAK ****																					
04:00 PM	93	145	0	0	238	0	0	0	0	0	0	136	54	0	190	45	0	101	0	146	574
04:15 PM	83	121	0	0	204	0	0	0	0	0	0	150	45	0	195	62	0	99	0	161	560
04:30 PM	95	94	0	0	189	0	0	0	0	0	0	153	76	0	229	44	0	99	0	143	561
04:45 PM	72	109	0	0	181	0	0	0	0	0	0	150	54	0	204	59	0	123	0	182	567
Total	343	469	0	0	812	0	0	0	0	0	0	589	229	0	818	210	0	422	0	632	2262
05:00 PM	97	135	0	0	232	0	0	0	0	0	0	179	76	0	255	55	0	138	0	193	680
05:15 PM	89	125	0	0	214	0	0	0	0	0	0	156	72	0	228	54	0	115	0	169	611
05:30 PM	97	128	0	0	225	0	0	0	0	0	0	173	56	0	229	46	0	142	0	188	642
05:45 PM	62	122	0	0	184	0	0	0	0	0	0	137	43	0	180	52	0	110	0	162	526
Total	345	510	0	0	855	0	0	0	0	0	0	645	247	0	892	207	0	505	0	712	2459
Grand Total	1340	1993	0	0	3333	0	0	0	0	0	0	1662	629	0	2291	803	0	1583	0	2386	8010
Apprch %	40.2	59.8	0	0		0	0	0	0		0	72.5	27.5	0		33.7	0	66.3	0		
Total %	16.7	24.9	0	0	41.6	0	0	0	0	0	0	20.7	7.9	0	28.6	10	0	19.8	0	29.8	
Pass Cars	1322	1930	0	0	3252	0	0	0	0	0	0	1632	608	0	2240	783	0	1551	0	2334	7826
% Pass Cars	98.7	96.8	0	0	97.6	0	0	0	0	0	0	98.2	96.7	0	97.8	97.5	0	98	0	97.8	97.7
Single Units	15	60	0	0	75	0	0	0	0	0	0	29	18	0	47	13	0	26	0	39	161
% Single Units	1.1	3	0	0	2.3	0	0	0	0	0	0	1.7	2.9	0	2.1	1.6	0	1.6	0	1.6	2
Heavy Trucks	3	3	0	0	6	0	0	0	0	0	0	1	3	0	4	7	0	6	0	13	23
% Heavy Trucks	0.2	0.2	0	0	0.2	0	0	0	0	0	0	0.1	0.5	0	0.2	0.9	0	0.4	0	0.5	0.3
Ped	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Ped	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Comments: 4 hour video traffic study conducted during typical weekday (Tuesday) from 7:00-9:00 AM morning & 4:00-6:00 PM afternoon peak hours, while school was in session. Signalized skewed intersection no ped. signals. EB has dual left turn lanes. Video SCU camera was located within SW intersection quadrant.

Traffic Data Collection (TDC)

tdccounts.com

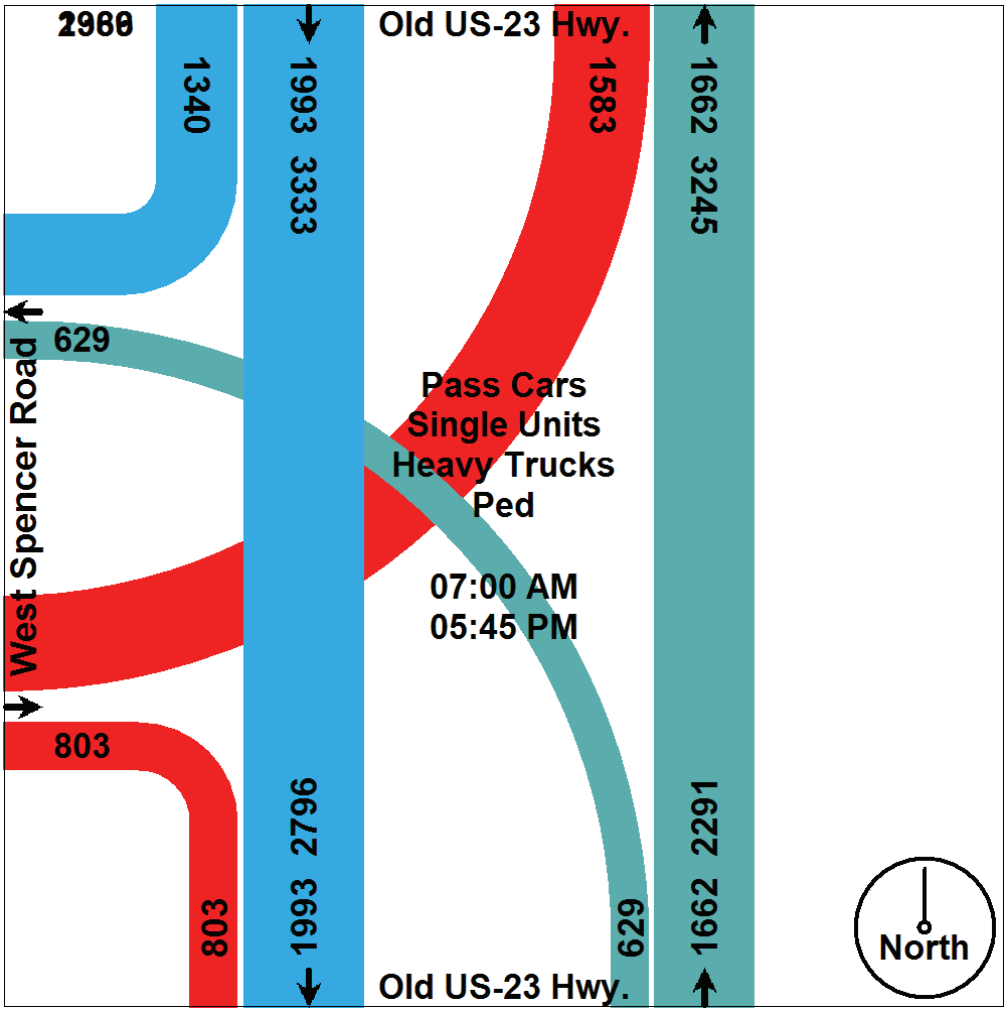
Phone: (586) 786-5407

Traffic Study Performed For:

Fleis & VandenBrink

Project: Brighton Twp. Traffic Study
Type: 4 Hr. Video Turning Movement Count
Weather: Pt. Sunny, Dry Temp 40's
Count By: Miovision Video VCU 1US

File Name : TMC_1 US23&SpencerW_3-22-16
Site Code : TMC_1
Start Date : 3/22/2016
Page No : 2



Traffic Data Collection (TDC)

tdccounts.com

Phone: (586) 786-5407

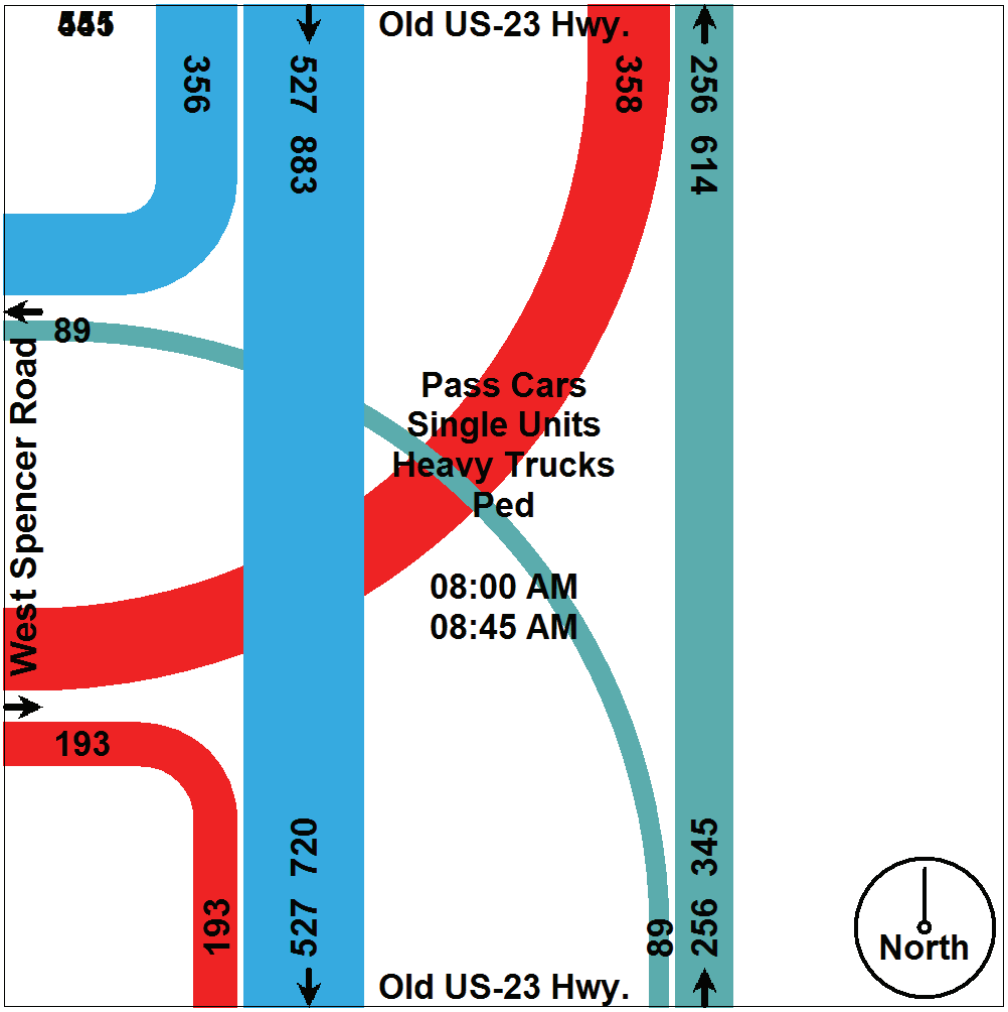
Traffic Study Performed For:

Fleis & VandenBrink

Project: Brighton Twp. Traffic Study
Type: 4 Hr. Video Turning Movement Count
Weather: Pt. Sunny, Dry Temp 40's
Count By: Miovision Video VCU 1US

File Name : TMC_1 US23&SpencerW_3-22-16
Site Code : TMC_1
Start Date : 3/22/2016
Page No : 3

	Old US-23 Hwy. Southbound				Westbound				Old US-23 Hwy. Northbound				West Spencer Road Eastbound				
Start Time	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 12:30 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 08:00 AM																	
08:00 AM	70	135	0	205	0	0	0	0	0	52	20	72	36	0	70	106	383
08:15 AM	78	99	0	177	0	0	0	0	0	57	**25**	82	47	0	96	143	402
08:30 AM	**111**	133	0	244	0	0	0	0	0	**87**	20	**107**	51	0	**108**	**159**	**510**
08:45 AM	97	**160**	0	**257**	0	0	0	0	0	60	24	84	**59**	0	84	143	484
Total Volume	356	527	0	883	0	0	0	0	0	256	89	345	193	0	358	551	1779
% App. Total	40.3	59.7	0		0	0	0		0	74.2	25.8		35	0	65		
PHF	.802	.823	.000	.859	.000	.000	.000	.000	.000	.736	.890	.806	.818	.000	.829	.866	.872
Pass Cars	347	494	0	841	0	0	0	0	0	246	84	330	186	0	339	525	1696
% Pass Cars	97.5	93.7	0	95.2	0	0	0	0	0	96.1	94.4	95.7	96.4	0	94.7	95.3	95.3
Single Units	8	33	0	41	0	0	0	0	0	10	4	14	3	0	14	17	72
% Single Units	2.2	6.3	0	4.6	0	0	0	0	0	3.9	4.5	4.1	1.6	0	3.9	3.1	4.0
Heavy Trucks	1	0	0	1	0	0	0	0	0	0	1	1	4	0	5	9	11
% Heavy Trucks	0.3	0	0	0.1	0	0	0	0	0	0	1.1	0.3	2.1	0	1.4	1.6	0.6
Ped	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Ped	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



Traffic Data Collection (TDC)

tdccounts.com

Phone: (586) 786-5407

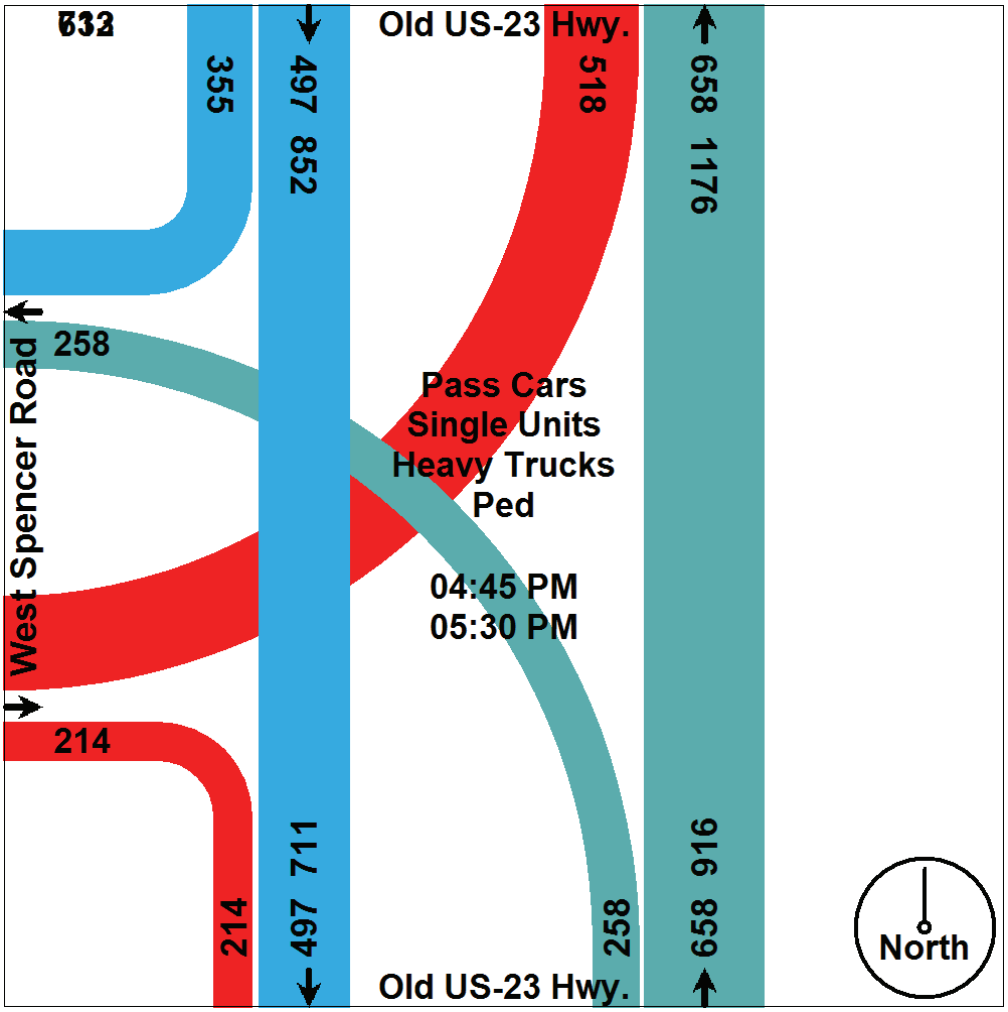
Traffic Study Performed For:

Fleis & VandenBrink

Project: Brighton Twp. Traffic Study
Type: 4 Hr. Video Turning Movement Count
Weather: Pt. Sunny, Dry Temp 40's
Count By: Miovision Video VCU 1US

File Name : TMC_1 US23&SpencerW_3-22-16
Site Code : TMC_1
Start Date : 3/22/2016
Page No : 4

	Old US-23 Hwy. Southbound				Westbound				Old US-23 Hwy. Northbound				West Spencer Road Eastbound				
Start Time	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 12:45 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:45 PM																	
04:45 PM	72	109	0	181	0	0	0	0	0	150	54	204	**59**	0	123	182	567
05:00 PM	**97**	**135**	0	**232**	0	0	0	0	0	**179**	**76**	**255**	55	0	138	**193**	**680**
05:15 PM	89	125	0	214	0	0	0	0	0	156	72	228	54	0	115	169	611
05:30 PM	97	128	0	225	0	0	0	0	0	173	56	229	46	0	**142**	188	642
Total Volume	355	497	0	852	0	0	0	0	0	658	258	916	214	0	518	732	2500
% App. Total	41.7	58.3	0		0	0	0		0	71.8	28.2		29.2	0	70.8		
PHF	.915	.920	.000	.918	.000	.000	.000	.000	.000	.919	.849	.898	.907	.000	.912	.948	.919
Pass Cars	353	496	0	849	0	0	0	0	0	656	255	911	212	0	517	729	2489
% Pass Cars	99.4	99.8	0	99.6	0	0	0	0	0	99.7	98.8	99.5	99.1	0	99.8	99.6	99.6
Single Units	2	1	0	3	0	0	0	0	0	2	3	5	2	0	1	3	11
% Single Units	0.6	0.2	0	0.4	0	0	0	0	0	0.3	1.2	0.5	0.9	0	0.2	0.4	0.4
Heavy Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Heavy Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ped	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Ped	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



Traffic Data Collection (TDC)

tdccounts.com

Phone: (586) 786-5407

Traffic Study Performed For:

Fleis & VandenBrink

Project: Brighton Twp. Traffic Study
Type: 4 Hr. Video Turning Movement Count
Weather: Pt. Sunny, Dry Temp 40's
Count By: Miovision Video VCU 5RA&4G2

File Name : TMC_2 US23&GrandRiver_3-22-16
Site Code : TMC_2
Start Date : 3/22/2016
Page No : 1

Groups Printed- Pass Cars - Single Units - Heavy Trucks

	Old US-23 Hwy. Southbound					Grand River Road Westbound					Old US-23 Hwy. Northbound					Grand River Road Eastbound					
Start Time	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	11	96	59	0	166	18	48	28	0	94	43	14	13	0	70	29	105	10	0	144	474
07:15 AM	17	93	71	0	181	10	41	52	0	103	46	26	15	0	87	24	121	8	0	153	524
07:30 AM	14	76	76	0	166	28	30	41	0	99	66	49	21	0	136	21	124	8	0	153	554
07:45 AM	39	73	73	0	185	18	62	30	0	110	85	52	32	0	169	35	123	15	0	173	637
Total	81	338	279	0	698	74	181	151	0	406	240	141	81	0	462	109	473	41	0	623	2189
08:00 AM	32	77	48	0	157	23	50	27	0	100	46	34	32	0	112	19	108	12	0	139	508
08:15 AM	34	66	49	0	149	24	53	25	0	102	57	44	24	0	125	27	97	16	0	140	516
08:30 AM	36	64	55	0	155	32	63	27	0	122	30	52	21	0	103	16	100	21	0	137	517
08:45 AM	49	89	57	0	195	23	64	30	0	117	56	35	45	0	136	29	108	12	0	149	597
Total	151	296	209	0	656	102	230	109	0	441	189	165	122	0	476	91	413	61	0	565	2138
**** BREAK ****																					
04:00 PM	46	87	44	0	177	46	99	78	0	223	47	95	49	0	191	53	117	54	0	224	815
04:15 PM	49	72	54	0	175	63	121	72	0	256	63	73	59	0	195	46	136	64	0	246	872
04:30 PM	32	71	58	0	161	86	114	79	0	279	70	78	59	0	207	51	104	66	0	221	868
04:45 PM	50	67	46	0	163	57	143	77	0	277	50	97	53	0	200	50	106	65	0	221	861
Total	177	297	202	0	676	252	477	306	0	1035	230	343	220	0	793	200	463	249	0	912	3416
05:00 PM	36	82	43	0	161	101	149	80	0	330	60	77	64	0	201	62	142	76	0	280	972
05:15 PM	55	69	61	0	185	71	128	84	0	283	63	104	66	0	233	45	113	51	0	209	910
05:30 PM	34	76	47	0	157	67	135	81	0	283	46	89	65	0	200	49	123	78	0	250	890
05:45 PM	39	101	54	0	194	47	103	54	0	204	47	72	33	0	152	50	80	52	0	182	732
Total	164	328	205	0	697	286	515	299	0	1100	216	342	228	0	786	206	458	257	0	921	3504
Grand Total	573	1259	895	0	2727	714	1403	865	0	2982	875	991	651	0	2517	606	1807	608	0	3021	11247
Apprch %	21	46.2	32.8	0		23.9	47	29	0		34.8	39.4	25.9	0		20.1	59.8	20.1	0		
Total %	5.1	11.2	8	0	24.2	6.3	12.5	7.7	0	26.5	7.8	8.8	5.8	0	22.4	5.4	16.1	5.4	0	26.9	
Pass Cars	541	1234	874	0	2649	699	1372	856	0	2927	863	977	631	0	2471	592	1776	597	0	2965	11012
% Pass Cars	94.4	98	97.7	0	97.1	97.9	97.8	99	0	98.2	98.6	98.6	96.9	0	98.2	97.7	98.3	98.2	0	98.1	97.9
Single Units	29	22	18	0	69	14	22	6	0	42	7	12	14	0	33	10	24	8	0	42	186
% Single Units	5.1	1.7	2	0	2.5	2	1.6	0.7	0	1.4	0.8	1.2	2.2	0	1.3	1.7	1.3	1.3	0	1.4	1.7
Heavy Trucks	3	3	3	0	9	1	9	3	0	13	5	2	6	0	13	4	7	3	0	14	49
% Heavy Trucks	0.5	0.2	0.3	0	0.3	0.1	0.6	0.3	0	0.4	0.6	0.2	0.9	0	0.5	0.7	0.4	0.5	0	0.5	0.4

Comments: 4 hour video traffic study conducted during typical weekday (Tuesday) from 7:00-9:00 AM morning & 4:00-6:00 PM afternoon peak hours, while school was in session. Signalized, intersection no ped. signals. Video SCU cameras were located within NW & SE intersection quadrants.

Traffic Data Collection (TDC)

tdccounts.com

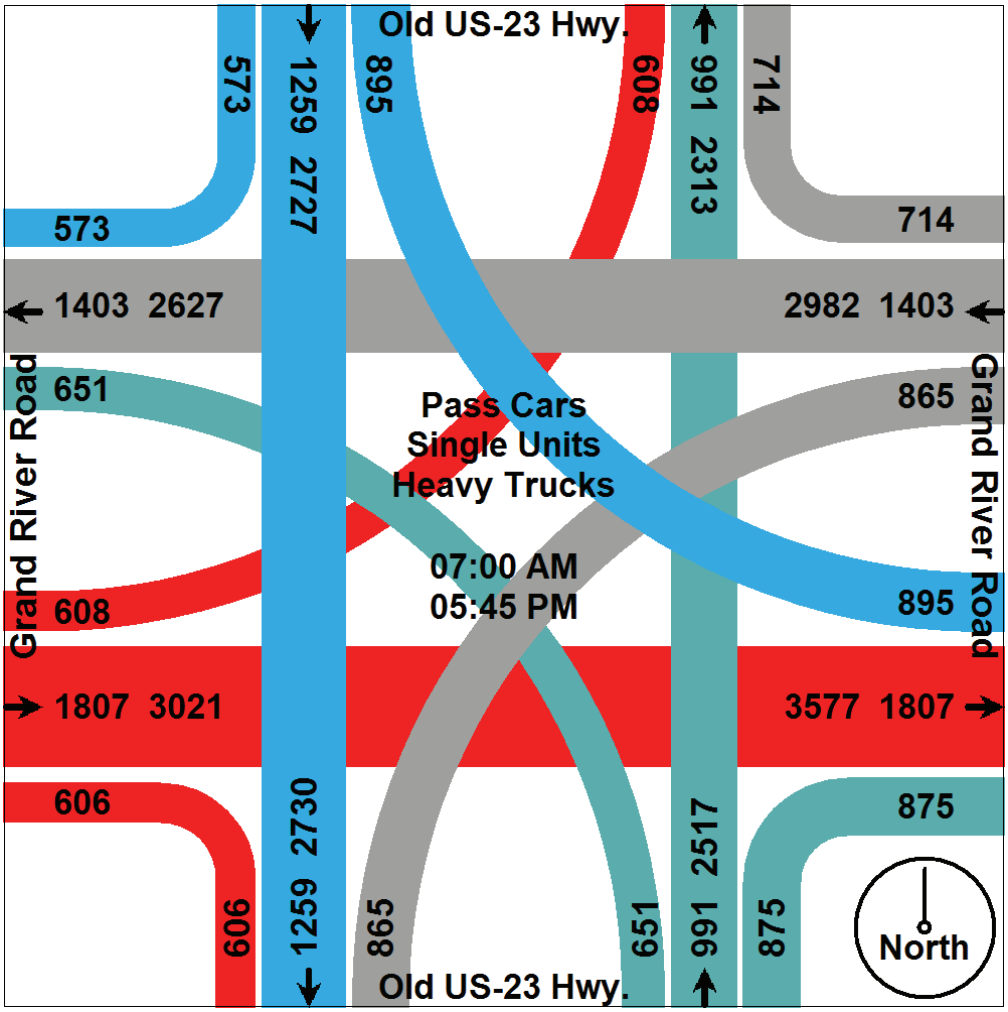
Phone: (586) 786-5407

Traffic Study Performed For:

Fleis & VandenBrink

Project: Brighton Twp. Traffic Study
Type: 4 Hr. Video Turning Movement Count
Weather: Pt. Sunny, Dry Temp 40's
Count By: Miovision Video VCU 5RA&4G2

File Name : TMC_2 US23&GrandRiver_3-22-16
Site Code : TMC_2
Start Date : 3/22/2016
Page No : 2



Traffic Data Collection (TDC)

tdccounts.com

Phone: (586) 786-5407

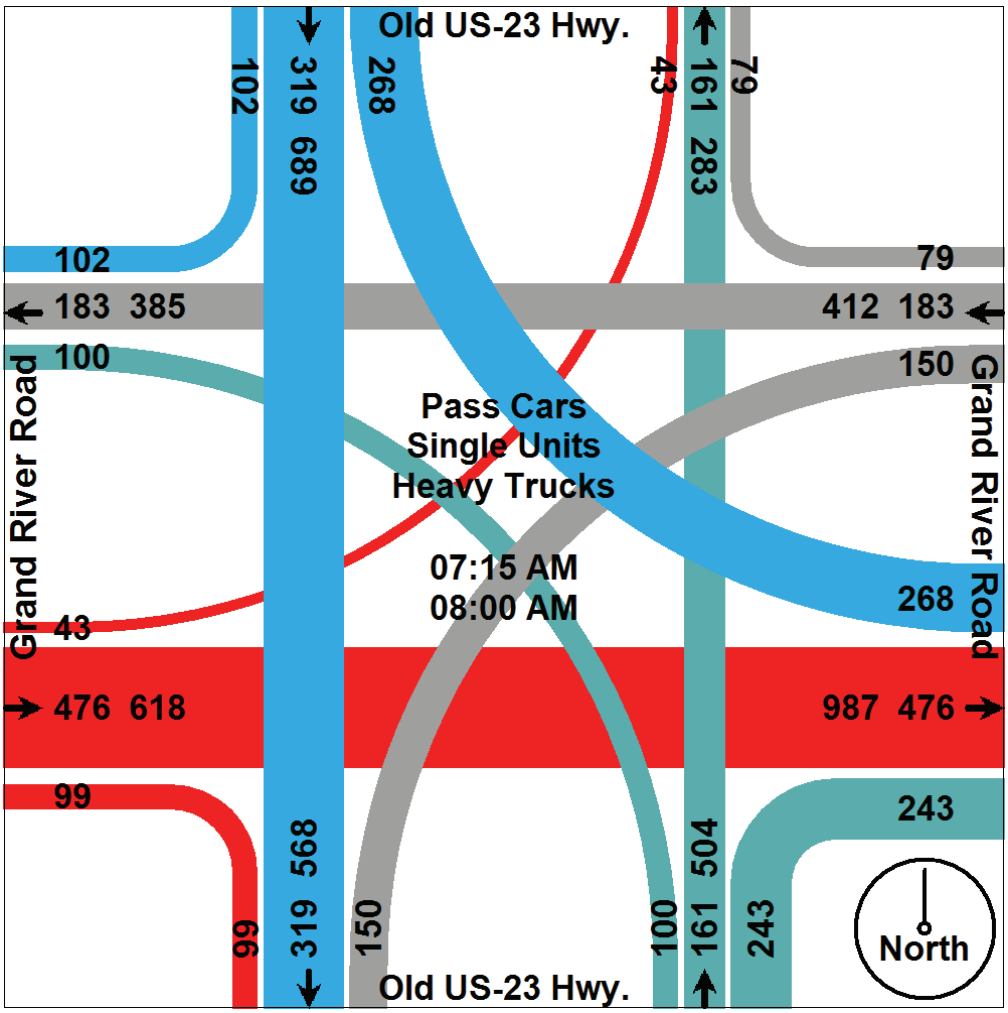
Traffic Study Performed For:

Fleis & VandenBrink

Project: Brighton Twp. Traffic Study
Type: 4 Hr. Video Turning Movement Count
Weather: Pt. Sunny, Dry Temp 40's
Count By: Miovision Video VCU 5RA&4G2

File Name : TMC_2 US23&GrandRiver_3-22-16
Site Code : TMC_2
Start Date : 3/22/2016
Page No : 3

	Old US-23 Hwy. Southbound				Grand River Road Westbound				Old US-23 Hwy. Northbound				Grand River Road Eastbound				
Start Time	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 12:30 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:15 AM																	
07:15 AM	17	**93**	71	181	10	41	**52**	103	46	26	15	87	24	121	8	153	524
07:30 AM	14	76	**76**	166	**28**	30	41	99	66	49	21	136	21	**124**	8	153	554
07:45 AM	**39**	73	73	**185**	18	**62**	30	**110**	**85**	**52**	**32**	**169**	**35**	123	**15**	**173**	**637**
08:00 AM	32	77	48	157	23	50	27	100	46	34	32	112	19	108	12	139	508
Total Volume	102	319	268	689	79	183	150	412	243	161	100	504	99	476	43	618	2223
% App. Total	14.8	46.3	38.9		19.2	44.4	36.4		48.2	31.9	19.8		16	77	7		
PHF	.654	.858	.882	.931	.705	.738	.721	.936	.715	.774	.781	.746	.707	.960	.717	.893	.872
Pass Cars	100	307	262	669	73	173	148	394	237	158	96	491	93	468	40	601	2155
% Pass Cars	98.0	96.2	97.8	97.1	92.4	94.5	98.7	95.6	97.5	98.1	96.0	97.4	93.9	98.3	93.0	97.2	96.9
Single Units	2	11	5	18	5	9	1	15	3	3	3	9	4	7	3	14	56
% Single Units	2.0	3.4	1.9	2.6	6.3	4.9	0.7	3.6	1.2	1.9	3.0	1.8	4.0	1.5	7.0	2.3	2.5
Heavy Trucks	0	1	1	2	1	1	1	3	3	0	1	4	2	1	0	3	12
% Heavy Trucks	0	0.3	0.4	0.3	1.3	0.5	0.7	0.7	1.2	0	1.0	0.8	2.0	0.2	0	0.5	0.5



Traffic Data Collection (TDC)

tdccounts.com

Phone: (586) 786-5407

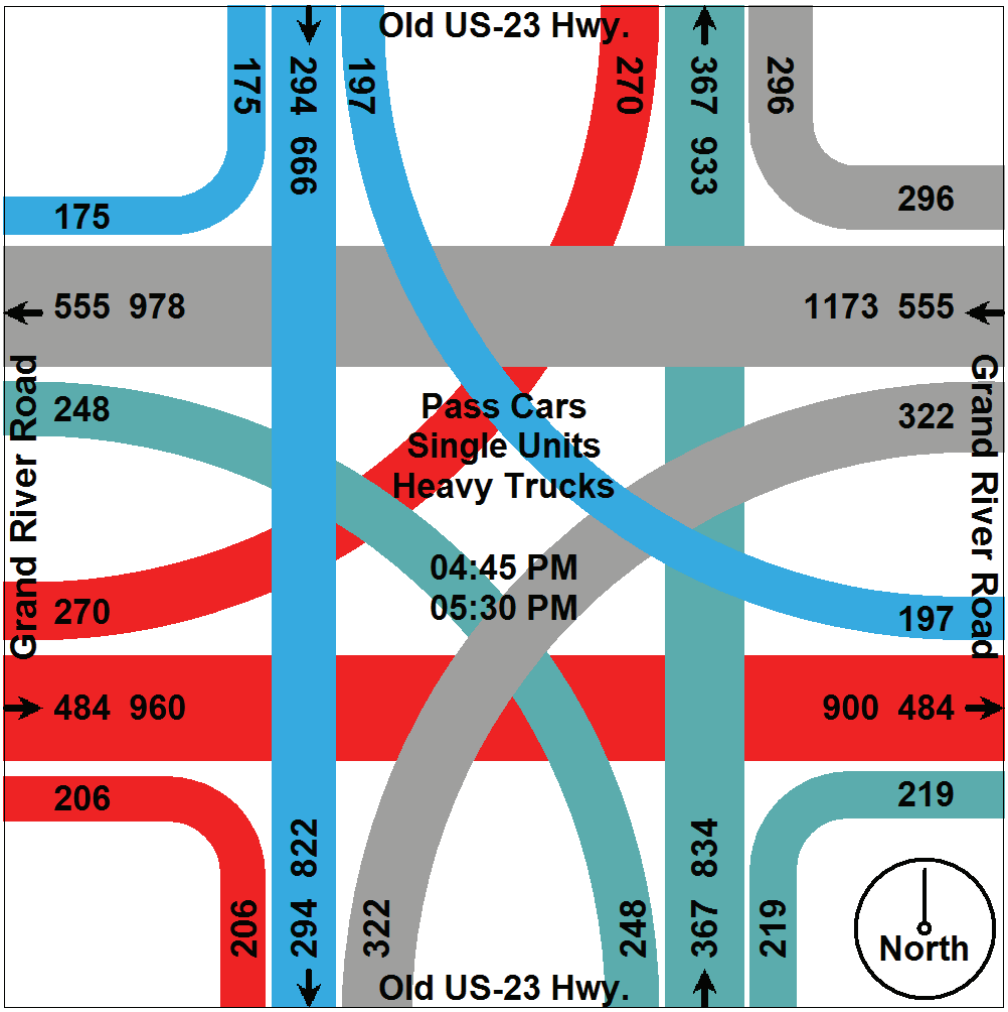
Traffic Study Performed For:

Fleis & VandenBrink

Project: Brighton Twp. Traffic Study
Type: 4 Hr. Video Turning Movement Count
Weather: Pt. Sunny, Dry Temp 40's
Count By: Miovision Video VCU 5RA&4G2

File Name : TMC_2 US23&GrandRiver_3-22-16
Site Code : TMC_2
Start Date : 3/22/2016
Page No : 4

	Old US-23 Hwy. Southbound				Grand River Road Westbound				Old US-23 Hwy. Northbound				Grand River Road Eastbound				
Start Time	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 12:45 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:45 PM																	
04:45 PM	50	67	46	163	57	143	77	277	50	97	53	200	50	106	65	221	861
05:00 PM	36	**82**	43	161	**101**	**149**	80	**330**	60	77	64	201	**62**	**142**	76	**280**	**972**
05:15 PM	**55**	69	**61**	**185**	71	128	**84**	283	**63**	**104**	**66**	**233**	45	113	51	209	910
05:30 PM	34	76	47	157	67	135	81	283	46	89	65	200	49	123	**78**	250	890
Total Volume	175	294	197	666	296	555	322	1173	219	367	248	834	206	484	270	960	3633
% App. Total	26.3	44.1	29.6		25.2	47.3	27.5		26.3	44	29.7		21.5	50.4	28.1		
PHF	.795	.896	.807	.900	.733	.931	.958	.889	.869	.882	.939	.895	.831	.852	.865	.857	.934
Pass Cars	174	294	194	662	294	547	321	1162	218	366	244	828	205	481	269	955	3607
% Pass Cars	99.4	100	98.5	99.4	99.3	98.6	99.7	99.1	99.5	99.7	98.4	99.3	99.5	99.4	99.6	99.5	99.3
Single Units	1	0	3	4	2	4	1	7	0	1	2	3	1	3	1	5	19
% Single Units	0.6	0	1.5	0.6	0.7	0.7	0.3	0.6	0	0.3	0.8	0.4	0.5	0.6	0.4	0.5	0.5
Heavy Trucks	0	0	0	0	0	4	0	4	1	0	2	3	0	0	0	0	7
% Heavy Trucks	0	0	0	0	0	0.7	0	0.3	0.5	0	0.8	0.4	0	0	0	0	0.2



Traffic Data Collection (TDC)

tdccounts.com

Phone: (586) 786-5407

Traffic Study Performed For:

Fleis & VandenBrink

Project: Brighton Twp. Traffic Study
Type: 4 Hr. Video Turning Movement Count
Weather: Pt. Sunny, Dry Temp 40's
Count By: Miovision Video VCU 4PU

File Name : TMC_3 GrandRiver&PleasantValley_3-22-16
Site Code : TMC_3
Start Date : 3/22/2016
Page No : 1

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

	Pleasant Valley Road Southbound					Grand River Road Westbound					Bar None Restaurant Northbound					Grand River Road Eastbound					
Start Time	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	48	0	9	0	57	3	24	0	0	27	0	0	0	0	0	0	97	62	0	159	243
07:15 AM	50	0	10	0	60	3	17	0	0	20	0	0	0	0	0	0	144	85	0	229	309
07:30 AM	45	0	13	0	58	3	31	0	0	34	0	0	0	0	0	0	128	76	0	204	296
07:45 AM	57	0	8	0	65	2	32	0	0	34	0	0	0	0	0	1	119	78	0	198	297
Total	200	0	40	0	240	11	104	0	0	115	0	0	0	0	0	1	488	301	0	790	1145
08:00 AM	52	1	12	0	65	1	27	1	0	29	0	0	0	0	0	0	92	65	0	157	251
08:15 AM	43	0	9	0	52	3	35	0	0	38	0	0	0	0	0	0	84	63	0	147	237
08:30 AM	47	0	5	0	52	1	31	2	0	34	0	0	0	0	0	0	50	70	0	120	206
08:45 AM	58	0	9	0	67	0	38	0	0	38	0	0	0	0	0	2	53	75	0	130	235
Total	200	1	35	0	236	5	131	3	0	139	0	0	0	0	0	2	279	273	0	554	929
**** BREAK ****																					
04:00 PM	75	2	5	0	82	11	79	2	0	92	1	0	2	0	3	3	54	76	0	133	310
04:15 PM	73	1	3	0	77	10	113	2	0	125	0	0	0	0	0	4	61	70	0	135	337
04:30 PM	90	2	0	0	92	16	133	2	0	151	0	1	4	0	5	7	72	90	0	169	417
04:45 PM	80	3	4	0	87	9	103	3	0	115	1	0	3	0	4	4	44	92	0	140	346
Total	318	8	12	0	338	46	428	9	0	483	2	1	9	0	12	18	231	328	0	577	1410
05:00 PM	75	4	0	0	79	25	127	8	0	160	1	0	1	0	2	2	79	108	0	189	430
05:15 PM	76	3	2	0	81	7	112	2	0	121	1	0	0	0	1	8	56	93	0	157	360
05:30 PM	83	1	1	0	85	17	118	3	0	138	3	0	5	0	8	2	56	99	0	157	388
05:45 PM	96	2	2	0	100	8	71	1	0	80	2	1	1	0	4	3	52	69	0	124	308
Total	330	10	5	0	345	57	428	14	0	499	7	1	7	0	15	15	243	369	0	627	1486
Grand Total	1048	19	92	0	1159	119	1091	26	0	1236	9	2	16	0	27	36	1241	1271	0	2548	4970
Apprch %	90.4	1.6	7.9	0		9.6	88.3	2.1	0		33.3	7.4	59.3	0		1.4	48.7	49.9	0		
Total %	21.1	0.4	1.9	0	23.3	2.4	22	0.5	0	24.9	0.2	0	0.3	0	0.5	0.7	25	25.6	0	51.3	
Pass Cars	1030	19	91	0	1140	118	1061	25	0	1204	9	2	15	0	26	35	1209	1251	0	2495	4865
% Pass Cars	98.3	100	98.9	0	98.4	99.2	97.3	96.2	0	97.4	100	100	93.8	0	96.3	97.2	97.4	98.4	0	97.9	97.9
Single Units	13	0	1	0	14	1	25	1	0	27	0	0	1	0	1	1	24	14	0	39	81
% Single Units	1.2	0	1.1	0	1.2	0.8	2.3	3.8	0	2.2	0	0	6.2	0	3.7	2.8	1.9	1.1	0	1.5	1.6
Heavy Trucks	5	0	0	0	5	0	5	0	0	5	0	0	0	0	0	0	8	6	0	14	24
% Heavy Trucks	0.5	0	0	0	0.4	0	0.5	0	0	0.4	0	0	0	0	0	0	0.6	0.5	0	0.5	0.5
Ped	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Ped	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Comments: 4 hour video traffic study conducted during typical weekday (Tuesday) from 7:00-9:00 AM morning & 4:00-6:00 PM afternoon peak hours, while school was in session. Non-signalized, intersection. Video SCU camera was located within SE intersection quadrant.

Traffic Data Collection (TDC)

tdccounts.com

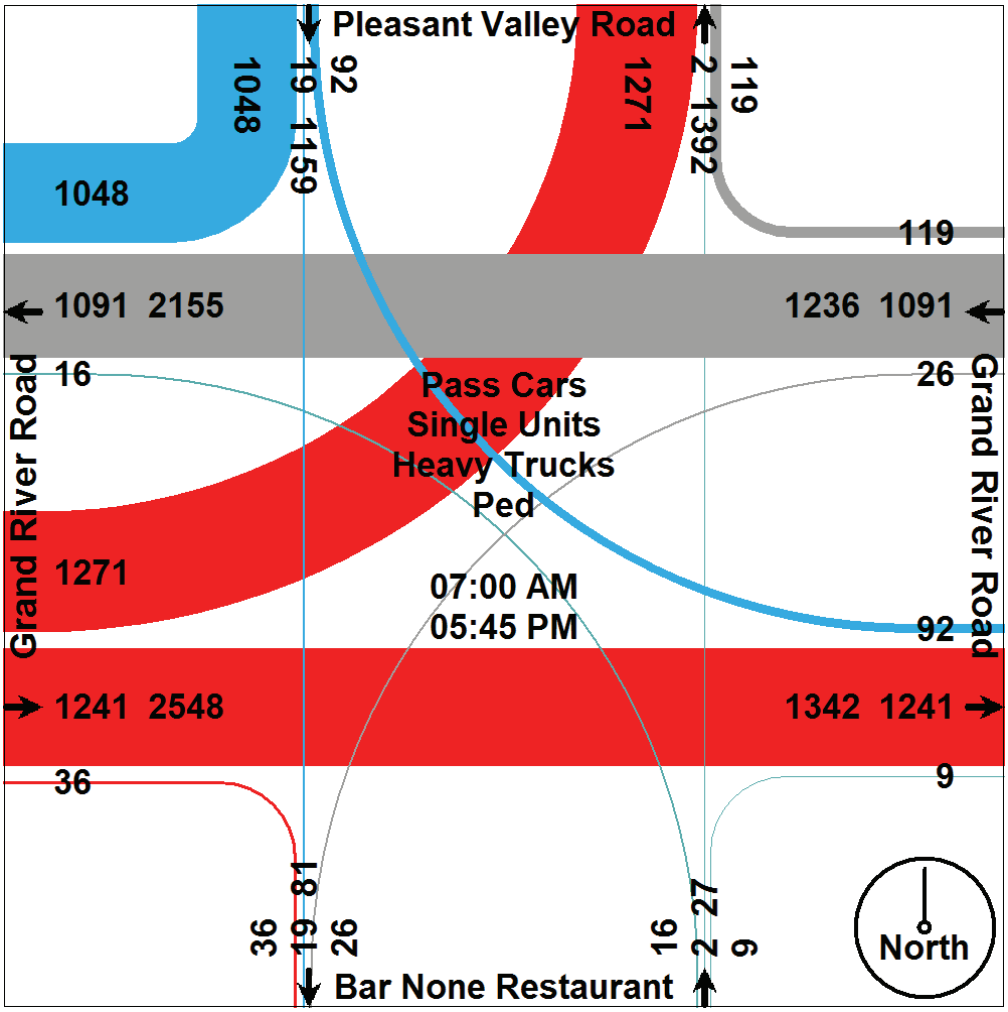
Phone: (586) 786-5407

Traffic Study Performed For:

Fleis & VandenBrink

Project: Brighton Twp. Traffic Study
Type: 4 Hr. Video Turning Movement Count
Weather: Pt. Sunny, Dry Temp 40's
Count By: Miovision Video VCU 4PU

File Name : TMC_3 GrandRiver&PleasantValley_3-22-16
Site Code : TMC_3
Start Date : 3/22/2016
Page No : 2



Traffic Data Collection (TDC)

tdccounts.com

Phone: (586) 786-5407

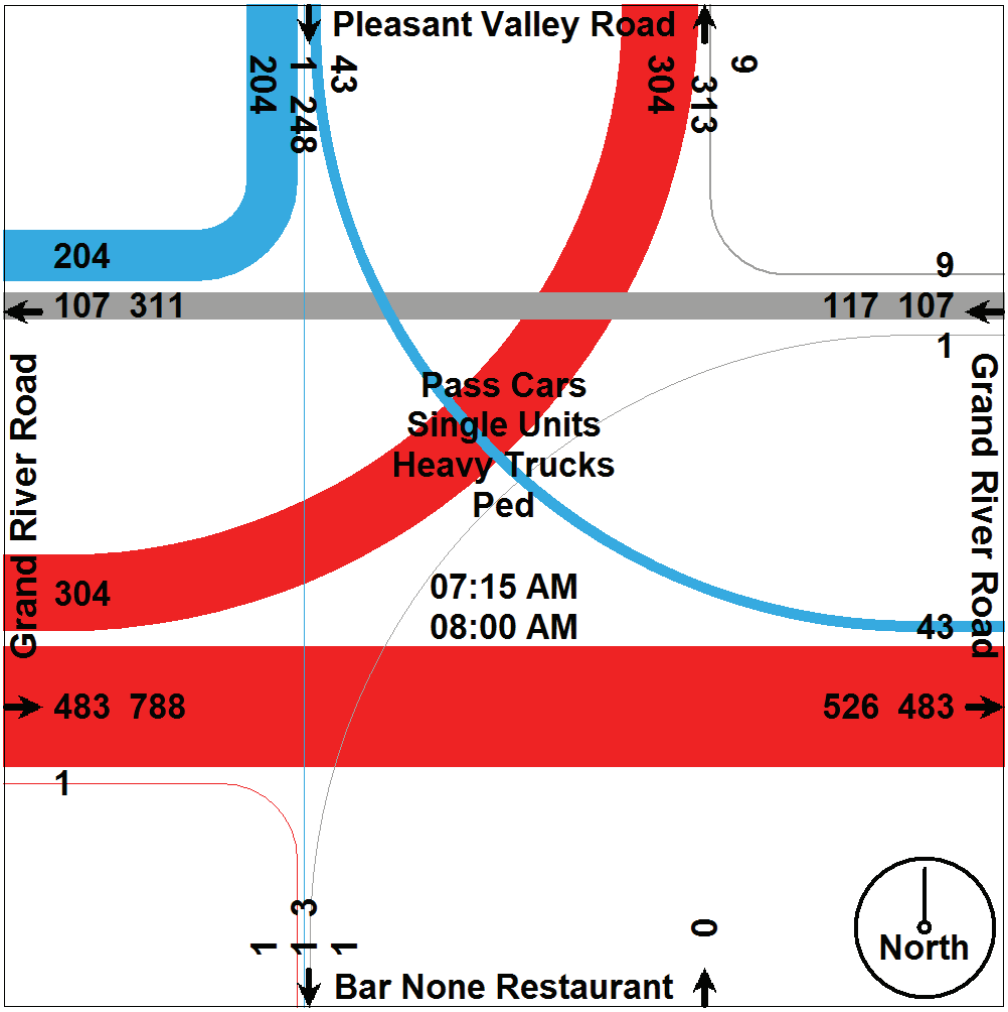
Traffic Study Performed For:

Fleis & VandenBrink

Project: Brighton Twp. Traffic Study
Type: 4 Hr. Video Turning Movement Count
Weather: Pt. Sunny, Dry Temp 40's
Count By: Miovision Video VCU 4PU

File Name : TMC_3 GrandRiver&PleasantValley_3-22-16
Site Code : TMC_3
Start Date : 3/22/2016
Page No : 3

	Pleasant Valley Road Southbound				Grand River Road Westbound				Bar None Restaurant Northbound				Grand River Road Eastbound				
Start Time	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 12:30 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:15 AM																	
07:15 AM	50	0	10	60	**3**	17	0	20	0	0	0	0	0	**144**	**85**	**229**	**309**
07:30 AM	45	0	**13**	58	3	31	0	**34**	0	0	0	0	0	128	76	204	296
07:45 AM	**57**	0	8	**65**	2	**32**	0	34	0	0	0	0	**1**	119	78	198	297
08:00 AM	52	**1**	12	65	1	27	**1**	29	0	0	0	0	0	92	65	157	251
Total Volume	204	1	43	248	9	107	1	117	0	0	0	0	1	483	304	788	1153
% App. Total	82.3	0.4	17.3		7.7	91.5	0.9		0	0	0		0.1	61.3	38.6		
PHF	.895	.250	.827	.954	.750	.836	.250	.860	.000	.000	.000	.000	.250	.839	.894	.860	.933
Pass Cars	197	1	42	240	9	100	0	109	0	0	0	0	1	468	299	768	1117
% Pass Cars	96.6	100	97.7	96.8	100	93.5	0	93.2	0	0	0	0	100	96.9	98.4	97.5	96.9
Single Units	5	0	1	6	0	6	1	7	0	0	0	0	0	11	5	16	29
% Single Units	2.5	0	2.3	2.4	0	5.6	100	6.0	0	0	0	0	0	2.3	1.6	2.0	2.5
Heavy Trucks	2	0	0	2	0	1	0	1	0	0	0	0	0	4	0	4	7
% Heavy Trucks	1.0	0	0	0.8	0	0.9	0	0.9	0	0	0	0	0	0.8	0	0.5	0.6
Ped	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Ped	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



Traffic Data Collection (TDC)

tdccounts.com

Phone: (586) 786-5407

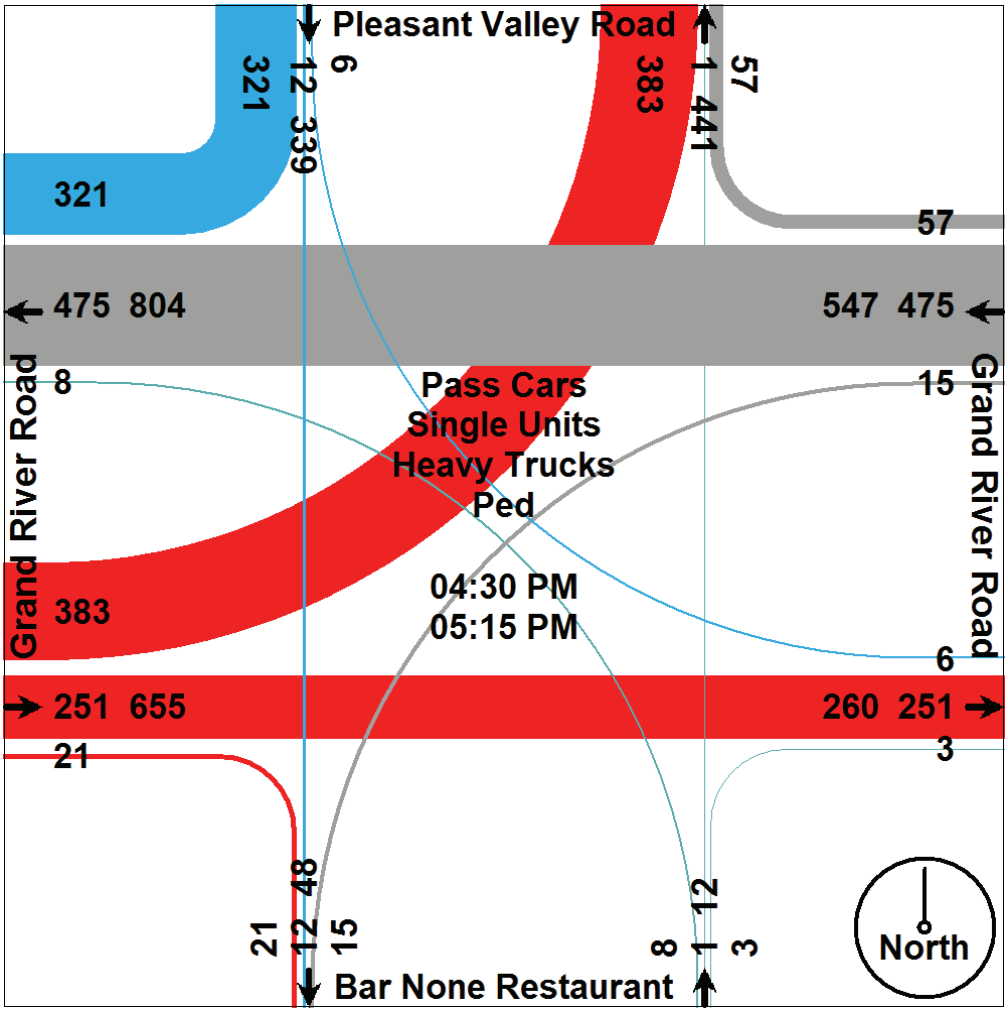
Traffic Study Performed For:

Fleis & VandenBrink

Project: Brighton Twp. Traffic Study
Type: 4 Hr. Video Turning Movement Count
Weather: Pt. Sunny, Dry Temp 40's
Count By: Miovision Video VCU 4PU

File Name : TMC_3 GrandRiver&PleasantValley_3-22-16
Site Code : TMC_3
Start Date : 3/22/2016
Page No : 4

	Pleasant Valley Road Southbound				Grand River Road Westbound				Bar None Restaurant Northbound				Grand River Road Eastbound				
Start Time	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 12:45 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:30 PM																	
04:30 PM	**90**	2	0	**92**	16	**133**	2	151	0	**1**	**4**	**5**	7	72	90	169	417
04:45 PM	80	3	**4**	87	9	103	3	115	**1**	0	3	4	4	44	92	140	346
05:00 PM	75	**4**	0	79	**25**	127	**8**	**160**	1	0	1	2	2	**79**	**108**	**189**	**430**
05:15 PM	76	3	2	81	7	112	2	121	1	0	0	1	**8**	56	93	157	360
Total Volume	321	12	6	339	57	475	15	547	3	1	8	12	21	251	383	655	1553
% App. Total	94.7	3.5	1.8		10.4	86.8	2.7		25	8.3	66.7		3.2	38.3	58.5		
PHF	.892	.750	.375	.921	.570	.893	.469	.855	.750	.250	.500	.600	.656	.794	.887	.866	.903
Pass Cars	318	12	6	336	57	466	15	538	3	1	7	11	20	243	379	642	1527
% Pass Cars	99.1	100	100	99.1	100	98.1	100	98.4	100	100	87.5	91.7	95.2	96.8	99.0	98.0	98.3
Single Units	2	0	0	2	0	8	0	8	0	0	1	1	1	7	3	11	22
% Single Units	0.6	0	0	0.6	0	1.7	0	1.5	0	0	12.5	8.3	4.8	2.8	0.8	1.7	1.4
Heavy Trucks	1	0	0	1	0	1	0	1	0	0	0	0	0	1	1	2	4
% Heavy Trucks	0.3	0	0	0.3	0	0.2	0	0.2	0	0	0	0	0	0.4	0.3	0.3	0.3
Ped	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Ped	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



Traffic Data Collection (TDC)

tdccounts.com

Phone: (586) 786-5407

Traffic Study Performed For:

Fleis & VandenBrink

Project: Brighton Traffic Study
Type: 4 Hr. Video Turning Movement Count
Weather: Pt. Sunny Temp 80's
Count By: Miovision Video VCU 1TM

File Name : TMC_1 I-96 WBOffRamp & PleasantValley_9-20-16
Site Code : TMC_1
Start Date : 9/20/2016
Page No : 1

Groups Printed- Pass Cars - Single Units - Heavy Trucks

	Pleasant Valley Road Southbound					I-96 WB Off Ramp Westbound					Pleasant Valley Road Northbound					Culver Road Eastbound					
Start Time	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	1	73	0	0	74	7	2	20	0	29	0	17	2	0	19	49	0	2	0	51	173
07:15 AM	1	60	0	0	61	5	9	21	0	35	0	23	3	0	26	41	0	4	0	45	167
07:30 AM	1	60	0	0	61	4	7	46	0	57	0	17	4	0	21	37	0	2	0	39	178
07:45 AM	0	55	0	0	55	15	0	33	0	48	0	27	1	0	28	42	0	0	0	42	173
Total	3	248	0	0	251	31	18	120	0	169	0	84	10	0	94	169	0	8	0	177	691
08:00 AM	0	40	0	0	40	11	7	38	0	56	0	15	1	0	16	39	0	0	0	39	151
08:15 AM	2	59	0	0	61	7	5	29	0	41	0	22	3	0	25	26	0	4	0	30	157
08:30 AM	1	64	0	0	65	13	7	28	0	48	0	24	4	0	28	38	0	4	0	42	183
08:45 AM	4	60	0	0	64	10	8	34	0	52	0	12	4	0	16	23	1	2	0	26	158
Total	7	223	0	0	230	41	27	129	0	197	0	73	12	0	85	126	1	10	0	137	649
**** BREAK ****																					
04:00 PM	5	42	0	0	47	38	20	52	0	110	0	38	7	0	45	19	0	2	0	21	223
04:15 PM	1	37	0	0	38	29	26	59	0	114	0	44	7	0	51	21	0	1	0	22	225
04:30 PM	0	35	0	0	35	41	23	66	0	130	0	48	11	0	59	17	0	1	0	18	242
04:45 PM	1	33	0	0	34	30	21	60	0	111	0	47	17	0	64	18	0	1	0	19	228
Total	7	147	0	0	154	138	90	237	0	465	0	177	42	0	219	75	0	5	0	80	918
05:00 PM	1	31	0	0	32	41	20	52	0	113	0	57	19	0	76	20	0	0	0	20	241
05:15 PM	9	41	0	0	50	38	24	60	0	122	0	58	16	0	74	19	0	0	0	19	265
05:30 PM	4	37	0	0	41	43	17	52	0	112	0	53	20	0	73	17	0	1	0	18	244
05:45 PM	5	46	0	0	51	39	16	75	0	130	0	47	7	0	54	16	0	1	0	17	252
Total	19	155	0	0	174	161	77	239	0	477	0	215	62	0	277	72	0	2	0	74	1002
Grand Total	36	773	0	0	809	371	212	725	0	1308	0	549	126	0	675	442	1	25	0	468	3260
Apprch %	4.4	95.6	0	0		28.4	16.2	55.4	0		0	81.3	18.7	0		94.4	0.2	5.3	0		
Total %	1.1	23.7	0	0	24.8	11.4	6.5	22.2	0	40.1	0	16.8	3.9	0	20.7	13.6	0	0.8	0	14.4	
Pass Cars	33	760	0	0	793	366	212	706	0	1284	0	542	124	0	666	440	1	24	0	465	3208
% Pass Cars	91.7	98.3	0	0	98	98.7	100	97.4	0	98.2	0	98.7	98.4	0	98.7	99.5	100	96	0	99.4	98.4
Single Units	3	11	0	0	14	4	0	15	0	19	0	5	2	0	7	2	0	1	0	3	43
% Single Units	8.3	1.4	0	0	1.7	1.1	0	2.1	0	1.5	0	0.9	1.6	0	1	0.5	0	4	0	0.6	1.3
Heavy Trucks	0	2	0	0	2	1	0	4	0	5	0	2	0	0	2	0	0	0	0	0	9
% Heavy Trucks	0	0.3	0	0	0.2	0.3	0	0.6	0	0.4	0	0.4	0	0	0.3	0	0	0	0	0	0.3

Comments: 4 hour video traffic study conducted during typical weekday (Tuesday) from 7:00-9:00 AM & 4:00-6:00 PM afternoon peak hours, while school was in session. Non-signalized intersection, I-96 WB Off Ramp & Culver Road are offestting intersections at Pleasant Valley Road. Video SCU camera was located within NW intersection quadrant.

Traffic Data Collection (TDC)

tdccounts.com

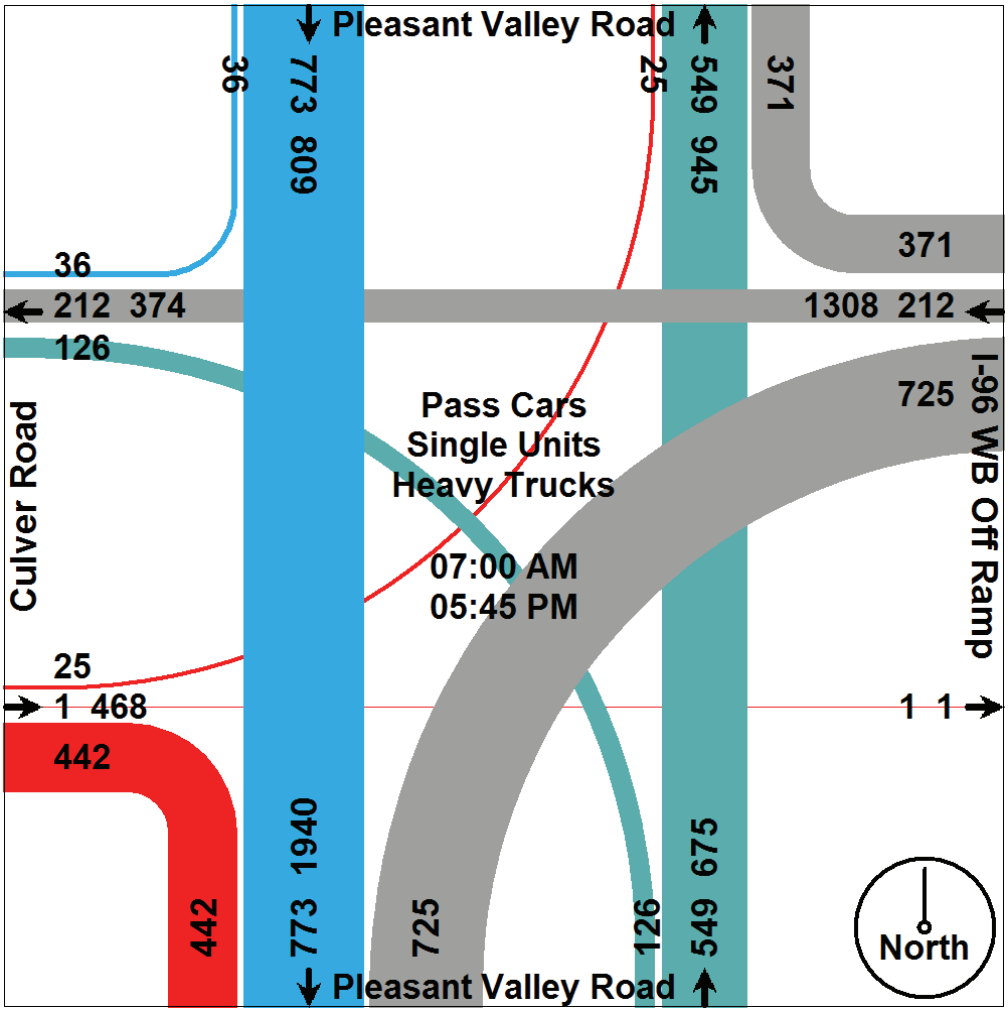
Phone: (586) 786-5407

Traffic Study Performed For:

Fleis & VandenBrink

Project: Brighton Traffic Study
Type: 4 Hr. Video Turning Movement Count
Weather: Pt. Sunny Temp 80's
Count By: Miovision Video VCU 1TM

File Name : TMC_1 I-96 WBOffRamp & PleasantValley_9-20-16
Site Code : TMC_1
Start Date : 9/20/2016
Page No : 2



Traffic Data Collection (TDC)

tdccounts.com

Phone: (586) 786-5407

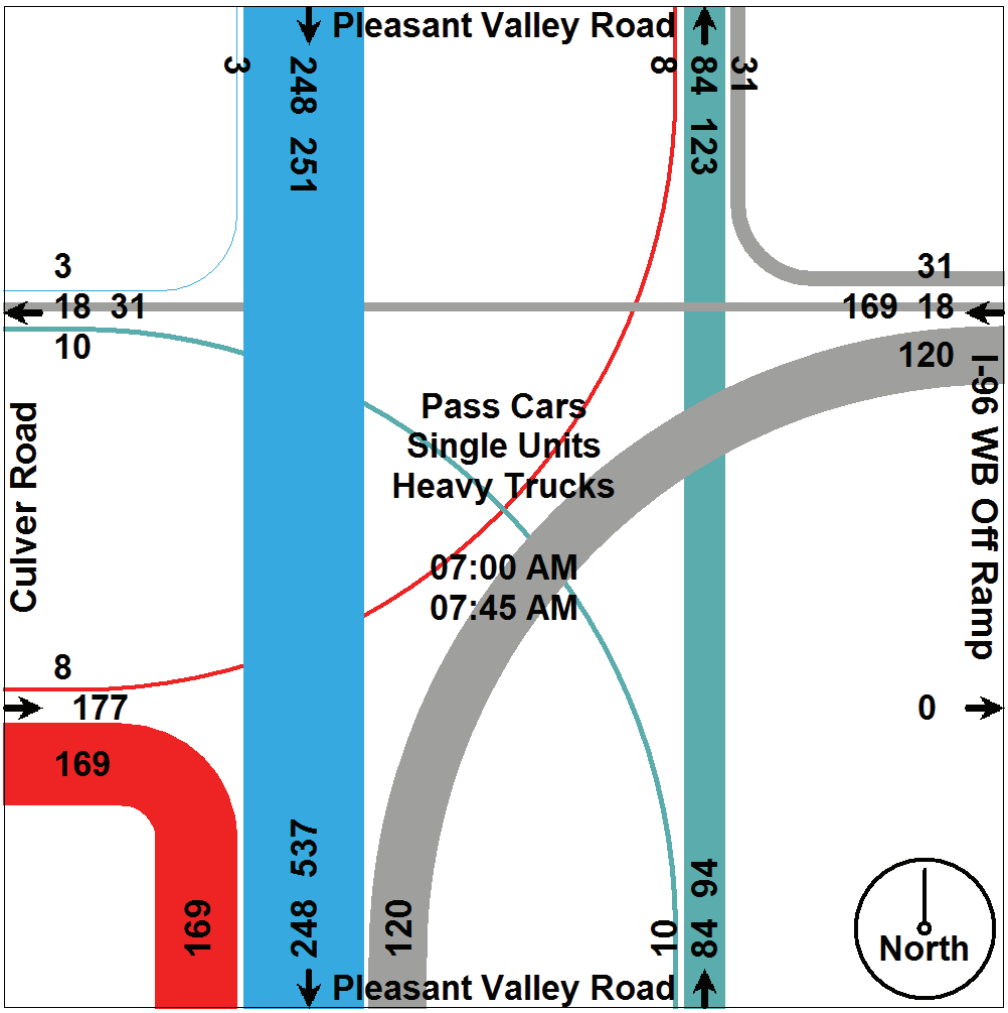
Traffic Study Performed For:

Fleis & VandenBrink

Project: Brighton Traffic Study
Type: 4 Hr. Video Turning Movement Count
Weather: Pt. Sunny Temp 80's
Count By: Miovision Video VCU 1TM

File Name : TMC_1 I-96 WBOffRamp & PleasantValley_9-20-16
Site Code : TMC_1
Start Date : 9/20/2016
Page No : 3

	Pleasant Valley Road Southbound				I-96 WB Off Ramp Westbound				Pleasant Valley Road Northbound				Culver Road Eastbound				
Start Time	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 12:30 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:00 AM																	
07:00 AM	**1**	**73**	0	**74**	7	2	20	29	0	17	2	19	**49**	0	2	**51**	173
07:15 AM	1	60	0	61	5	**9**	21	35	0	23	3	26	41	0	**4**	45	167
07:30 AM	1	60	0	61	4	7	**46**	**57**	0	17	**4**	21	37	0	2	39	**178**
07:45 AM	0	55	0	55	**15**	0	33	48	0	**27**	1	**28**	42	0	0	42	173
Total Volume	3	248	0	251	31	18	120	169	0	84	10	94	169	0	8	177	691
% App. Total	1.2	98.8	0		18.3	10.7	71		0	89.4	10.6		95.5	0	4.5		
PHF	.750	.849	.000	.848	.517	.500	.652	.741	.000	.778	.625	.839	.862	.000	.500	.868	.971
Pass Cars	2	246	0	248	31	18	113	162	0	82	8	90	168	0	7	175	675
% Pass Cars	66.7	99.2	0	98.8	100	100	94.2	95.9	0	97.6	80.0	95.7	99.4	0	87.5	98.9	97.7
Single Units	1	2	0	3	0	0	7	7	0	0	2	2	1	0	1	2	14
% Single Units	33.3	0.8	0	1.2	0	0	5.8	4.1	0	0	20.0	2.1	0.6	0	12.5	1.1	2.0
Heavy Trucks	0	0	0	0	0	0	0	0	0	2	0	2	0	0	0	0	2
% Heavy Trucks	0	0	0	0	0	0	0	0	0	2.4	0	2.1	0	0	0	0	0.3



Traffic Data Collection (TDC)

tdccounts.com

Phone: (586) 786-5407

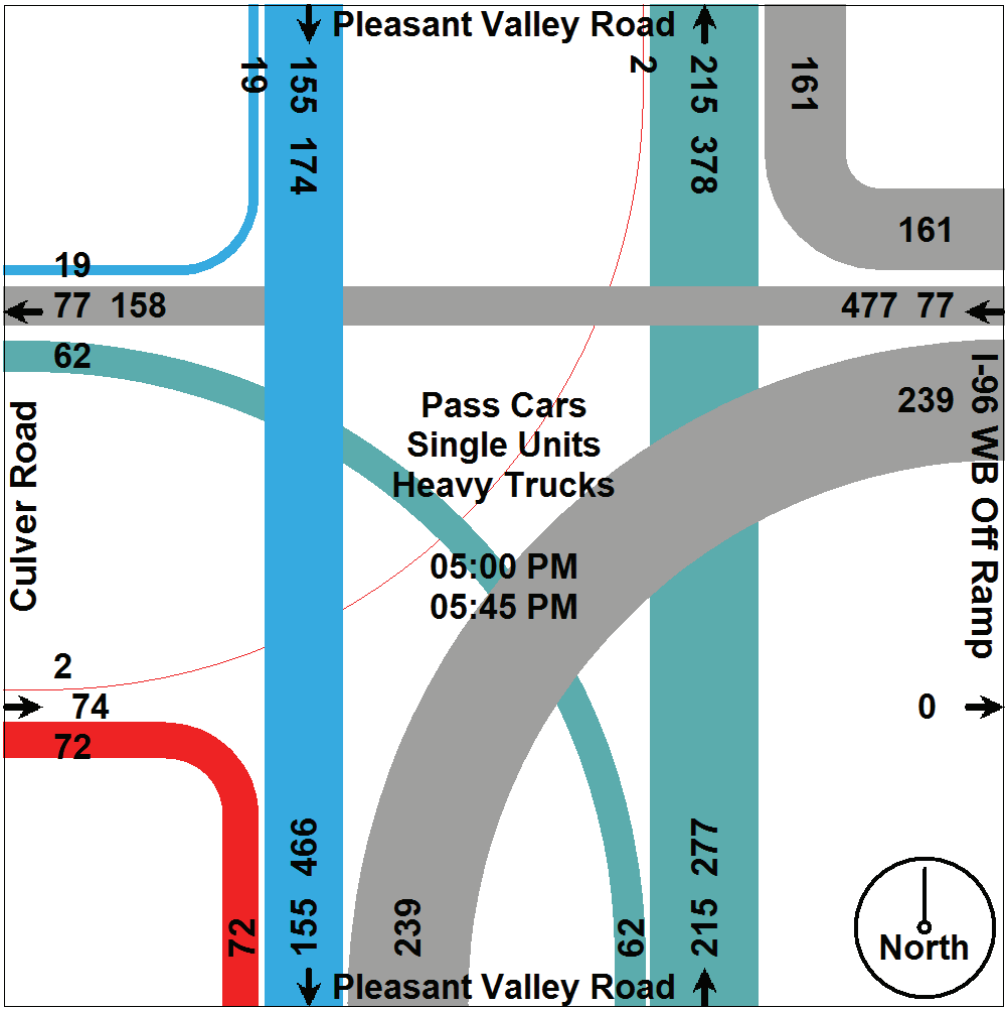
Traffic Study Performed For:

Fleis & VandenBrink

Project: Brighton Traffic Study
Type: 4 Hr. Video Turning Movement Count
Weather: Pt. Sunny Temp 80's
Count By: Miovision Video VCU 1TM

File Name : TMC_1 I-96 WBOffRamp & PleasantValley_9-20-16
Site Code : TMC_1
Start Date : 9/20/2016
Page No : 4

	Pleasant Valley Road Southbound				I-96 WB Off Ramp Westbound				Pleasant Valley Road Northbound				Culver Road Eastbound				
Start Time	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 12:45 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 05:00 PM																	
05:00 PM	1	31	0	32	41	20	52	113	0	57	19	**76**	**20**	0	0	**20**	241
05:15 PM	**9**	41	0	50	38	**24**	60	122	0	**58**	16	74	19	0	0	19	**265**
05:30 PM	4	37	0	41	**43**	17	52	112	0	53	**20**	73	17	0	**1**	18	244
05:45 PM	5	**46**	0	**51**	39	16	**75**	**130**	0	47	7	54	16	0	1	17	252
Total Volume	19	155	0	174	161	77	239	477	0	215	62	277	72	0	2	74	1002
% App. Total	10.9	89.1	0		33.8	16.1	50.1		0	77.6	22.4		97.3	0	2.7		
PHF	.528	.842	.000	.853	.936	.802	.797	.917	.000	.927	.775	.911	.900	.000	.500	.925	.945
Pass Cars	19	149	0	168	161	77	237	475	0	214	62	276	72	0	2	74	993
% Pass Cars	100	96.1	0	96.6	100	100	99.2	99.6	0	99.5	100	99.6	100	0	100	100	99.1
Single Units	0	4	0	4	0	0	0	0	0	1	0	1	0	0	0	0	5
% Single Units	0	2.6	0	2.3	0	0	0	0	0	0.5	0	0.4	0	0	0	0	0.5
Heavy Trucks	0	2	0	2	0	0	2	2	0	0	0	0	0	0	0	0	4
% Heavy Trucks	0	1.3	0	1.1	0	0	0.8	0.4	0	0	0	0	0	0	0	0	0.4



MDOT - Bureau of Transportation Planning
15 Minute Count Report

County	Livingston	**Station**	226	**CS #**	47064	**CS MP**	2.11
Route Desc	I-96 ON RAMP			**PR #**	935204	**PR MP**	0.08
Station Desc	FROM PLEASANT VALLEY RD - BRIGHTON TWP			**City**	None		
Direction	East			**Year**	2015		

06/29/2015 Monday

0015	0030	0045	0100	0115	0130	0145	0200	0215	0230	0245	0300	0315	0330	0345	0400	0415	0430	0445	0500	0515	0530	0545	0600	Daily Total
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**2454**
0615	**0630**	**0645**	**0700**	**0715**	**0730**	**0745**	**0800**	**0815**	**0830**	**0845**	**0900**	**0915**	**0930**	**0945**	**1000**	**1015**	**1030**	**1045**	**1100**	**1115**	**1130**	**1145**	**1200**	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	62	65	57	57	
1215	**1230**	**1245**	**1300**	**1315**	**1330**	**1345**	**1400**	**1415**	**1430**	**1445**	**1500**	**1515**	**1530**	**1545**	**1600**	**1615**	**1630**	**1645**	**1700**	**1715**	**1730**	**1745**	**1800**	
77	78	63	63	72	70	53	53	52	51	55	70	77	71	72	71	64	70	60	39	88	83	65	48	

1815	1830	1845	1900	1915	1930	1945	2000	2015	2030	2045	2100	2115	2130	2145	2200	2215	2230	2245	2300	2315	2330	2345	2400	24 Hour Total
66	45	50	43	41	36	35	37	42	28	29	19	27	22	23	20	13	26	9	10	7	12	3	5	**4959**

AM High Hour 11:15 - 12:00 **AM High Vol** 241 **PM High Hour** 15:15 - 16:00 **PM High Vol** 291

06/30/2015 Tuesday

0015	0030	0045	0100	0115	0130	0145	0200	0215	0230	0245	0300	0315	0330	0345	0400	0415	0430	0445	0500	0515	0530	0545	0600	Daily Total
8	3	4	1	1	0	0	1	4	5	3	0	7	4	6	8	7	12	17	32	39	72	69	78	**5142**
0615	**0630**	**0645**	**0700**	**0715**	**0730**	**0745**	**0800**	**0815**	**0830**	**0845**	**0900**	**0915**	**0930**	**0945**	**1000**	**1015**	**1030**	**1045**	**1100**	**1115**	**1130**	**1145**	**1200**	
130	151	133	121	108	129	133	130	129	126	128	95	85	81	95	62	75	78	70	65	75	72	60	78	
1215	**1230**	**1245**	**1300**	**1315**	**1330**	**1345**	**1400**	**1415**	**1430**	**1445**	**1500**	**1515**	**1530**	**1545**	**1600**	**1615**	**1630**	**1645**	**1700**	**1715**	**1730**	**1745**	**1800**	
55	74	67	66	53	62	51	86	69	56	61	50	58	86	74	70	65	79	61	77	101	102	69	70	

1815	1830	1845	1900	1915	1930	1945	2000	2015	2030	2045	2100	2115	2130	2145	2200	2215	2230	2245	2300	2315	2330	2345	2400	24 Hour Total
58	58	49	32	45	43	36	38	36	44	21	32	35	23	29	16	19	14	18	14	10	7	7	6	**5088**

AM High Hour 06:15 - 07:00 **AM High Vol** 535 **PM High Hour** 17:15 - 18:00 **PM High Vol** 342

07/01/2015 Wednesday

0015	0030	0045	0100	0115	0130	0145	0200	0215	0230	0245	0300	0315	0330	0345	0400	0415	0430	0445	0500	0515	0530	0545	0600	Daily Total
10	3	2	2	3	2	1	3	5	0	1	2	2	6	8	4	6	10	23	24	30	60	74	81	**2451**
0615	**0630**	**0645**	**0700**	**0715**	**0730**	**0745**	**0800**	**0815**	**0830**	**0845**	**0900**	**0915**	**0930**	**0945**	**1000**	**1015**	**1030**	**1045**	**1100**	**1115**	**1130**	**1145**	**1200**	
119	135	133	111	110	125	125	147	119	110	92	92	99	84	89	93	85	72	84	65	0	0	0	0	
1215	**1230**	**1245**	**1300**	**1315**	**1330**	**1345**	**1400**	**1415**	**1430**	**1445**	**1500**	**1515**	**1530**	**1545**	**1600**	**1615**	**1630**	**1645**	**1700**	**1715**	**1730**	**1745**	**1800**	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

1815	1830	1845	1900	1915	1930	1945	2000	2015	2030	2045	2100	2115	2130	2145	2200	2215	2230	2245	2300	2315	2330	2345	2400	24 Hour Total
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**

AM High Hour 07:15 - 08:00 **AM High Vol** 507 **PM High Hour** 12:15 - 13:00 **PM High Vol** 0

These volumes are raw axle counts and are not adjusted for the impact of vehicles with more than 2 axles

SEMCOG | Southeast Michigan Council of Governments

Search...

YOU ARE VIEWING DATA FOR:

Brighton Township

4363 Buno Rd
Brighton, MI 48114-9269
http://www.brightontwp.com/

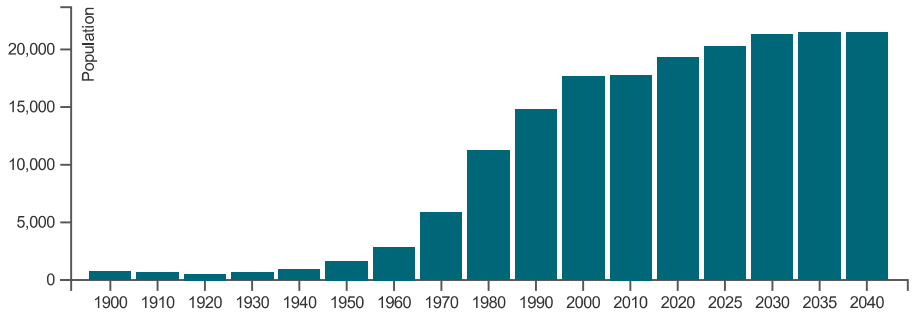
SEMCOG MEMBER

Census 2010 Population: 17,791
Area: 34.6 square miles

Population and Households

Link to American Community Survey (ACS) Profiles: 2010-2014 ▼ **Social** | **Demographic**
Population and Household Estimates for Southeast Michigan, July 2015

Population Forecast



Population and Households

Population and Households	Census 2010	Change 2000-2010	Pct Change 2000-2010	SEMCOG Jul 2015	SEMCOG 2040
Total Population	17,791	118	0.7%	17,888	21,498
Group Quarters Population	111	54	94.7%	111	136
Household Population	17,680	64	0.4%	17,777	21,362
Housing Units	6,765	588	9.5%	7,001	-
Households (Occupied Units)	6,415	465	7.8%	6,697	7,937
Residential Vacancy Rate	5.2%	1.5%	-	4.3%	-
Average Household Size	2.76	-0.20	-	2.65	2.69

Source: **U.S. Census Bureau** and **SEMCOG 2040 Forecast** produced in 2012.

Components of Population Change

Components of Population Change	2000-2005 Avg.	2006-2010 Avg.
Natural Increase (Births - Deaths)	136	54
Births	212	143
Deaths	76	89
Net Migration (Movement In - Movement Out)	-43	-123
Population Change (Natural Increase + Net Migration)	93	-69

Source: **Michigan Department of Community Health** Vital Statistics **U.S. Census Bureau,** and **SEMCOG.**

Level of Service Criteria for Stop Sign Controlled Intersections

The level of service criteria are given in Table 17-2. As used here, control delay is defined as the total elapsed time from the time a vehicle stops at the end of the queue until the vehicle departs from the stop line; this time includes the time required for the vehicle to travel from the last-in-queue position to the first-in-queue position, including deceleration of vehicles from free-flow speed to the speed of vehicles in queue.

The average total delay for any particular minor movement is a function of the service rate or capacity of the approach and the degree of saturation. . . .

Exhibit 17-2. Level of Service Criteria for TWSC Intersections

LEVEL OF SERVICE	AVERAGE CONTROL DELAY (sec/veh)
A	≤ 10
B	> 10 and ≤ 15
C	> 15 and ≤ 25
D	> 25 and ≤ 35
E	> 35 and ≤ 50
F	> 50

Average total delay less than 10 sec/veh is defined as Level of Service (LOS) A. Follow-up times of less than 5 sec have been measured when there is no conflicting traffic for a minor street movement, so control delays of less than 10 sec/veh are appropriate for low flow conditions. To remain consistent with the AWSC intersection analysis procedure described later in this chapter, a total delay of 50 sec/veh is assumed as the break point between LOS E and F.

The proposed level of service criteria for TWSC intersections are somewhat different from the criteria used in Chapter 16 for signalized intersections. The primary reason for this difference is that drivers expect different levels of performance from different kinds of transportation facilities. The expectation is that a signalized intersection is designed to carry higher traffic volumes than an unsignalized intersection. Additionally, several driver behavior considerations combine to make delays at signalized intersections less onerous than at unsignalized intersections. For example, drivers at signalized intersections are able to relax during the red interval, where drivers on the minor approaches to unsignalized intersections must remain attentive to the task of identifying acceptable gaps and vehicle conflicts. Also, there is often much more variability in the amount of delay experienced by individual drivers at unsignalized than signalized intersections. For these reasons, it is considered that the total delay threshold for any given level of service is less for an unsignalized intersection than for a signalized intersection. . . .

LOS F exists when there are insufficient gaps of suitable size to allow a side street demand to cross safely through a major street traffic stream. This level of service is generally evident from extremely long total delays experienced by side street traffic and by queueing on the minor approaches. The method, however, is based on a constant critical gap size - that is, the critical gap remains constant, no matter how long the side street motorist waits. LOS F may also appear in the form of side street vehicles' selecting smaller-than-usual gaps. In such cases, safety may be a problem and some disruption to the major traffic stream may result. It is important to note that LOS F may not always result in long queues but may result in adjustments to normal gap acceptance behavior. The latter is more difficult to observe on the field than queueing, which is more obvious.

Source: Highway Capacity Manual, 2010. Transportation Research Board, National Research Council

Level of Service for Signalized Intersections

Level of service for signalized intersections is defined in terms of delay, which is a measure of driver discomfort and frustration, fuel consumption, and lost travel time. Specifically, level-of-service (LOS) criteria are stated in terms of the average stopped delay per vehicle for a 15-min analysis period. The criteria are given in Exhibit 16-2. Delay may be measured in the field or estimated using procedures presented later in this chapter. Delay is a complex measure and is dependent on a number of variables, including the quality of progression, the cycle length, the green ratio, and the *v/c* ratio for the lane group in question.

LOS A describes operations with very low delay, up to 10 sec per vehicle. This level of service occurs when progression is extremely favorable and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may also contribute to low delay.

LOS B describes operations with delay greater than 10 and up to 20 sec per vehicle. This level generally occurs with good progression, short cycle lengths, or both. More vehicles stop than with LOS A, causing higher levels of average delay.

Exhibit 16-2. Level-of-Service Criteria for Signalized Intersections

LEVEL OF SERVICE	STOPPED DELAY PER VEHICLE (SEC)
A	≤10.0
B	> 10.0 and ≤20.0
C	> 20.0 and ≤ 35.0
D	> 35.0 and ≤ 55.0
E	> 55.0 and ≤ 80.0
F	>80.0

LOS C describes operations with delay greater than 20 and up to 35 sec per vehicle. These higher delays may result from fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level. The number of vehicles stopping is significant at this level, though many still pass through the intersection without stopping.

LOS D describes operations with delay greater than 35 and up to 55 sec per vehicle. At level D, the influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high *v/c* ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.

LOS E describes operations with delay greater than 55 and up to 80 sec per vehicle. This level is considered by many agencies to be the limit of acceptable delay. These high delay values generally indicate poor progression, long cycle lengths, and high *v/c* ratios. Individual cycle failures are frequent occurrences.

LOS F describes operations with delay in excess of 80 sec per vehicle. This level, considered to be unacceptable to most drivers, often occurs with oversaturation, that is, when arrival flow rates exceed the capacity of the intersection. It may also occur at high *v/c* ratios below 1.0 with many individual cycle failures. Poor progression and long cycle lengths may also be major contributing causes to such delay levels.

Source: Highway Capacity Manual, 2010. Transportation Research Board, National Research Council

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	43	476	99	150	183	79	100	161	243	268	319	102
Future Volume (veh/h)	43	476	99	150	183	79	100	161	243	268	319	102
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1942	1942	2000	1923	1923	2000	1942	1942	1942	1942	1942	1942
Adj Flow Rate, veh/h	48	535	111	160	195	84	133	215	324	288	343	110
Adj No. of Lanes	1	2	0	1	2	0	1	1	1	1	1	1
Peak Hour Factor	0.89	0.89	0.89	0.94	0.94	0.94	0.75	0.75	0.75	0.93	0.93	0.93
Percent Heavy Veh, %	3	3	3	4	4	4	3	3	3	3	3	3
Cap, veh/h	474	692	143	253	390	162	255	310	511	404	418	483
Arrive On Green	0.15	0.23	0.23	0.08	0.15	0.15	0.08	0.16	0.16	0.13	0.22	0.22
Sat Flow, veh/h	1849	3046	629	1832	2519	1047	1849	1942	1650	1849	1942	1650
Grp Volume(v), veh/h	48	323	323	160	139	140	133	215	324	288	343	110
Grp Sat Flow(s),veh/h/ln	1849	1845	1831	1832	1827	1738	1849	1942	1650	1849	1942	1650
Q Serve(g_s), s	0.0	10.6	10.7	1.4	4.5	4.8	0.4	6.8	1.2	3.8	10.9	0.0
Cycle Q Clear(g_c), s	0.0	10.6	10.7	1.4	4.5	4.8	0.4	6.8	1.2	3.8	10.9	0.0
Prop In Lane	1.00		0.34	1.00		0.60	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	474	419	416	253	283	269	255	310	511	404	418	483
V/C Ratio(X)	0.10	0.77	0.78	0.63	0.49	0.52	0.52	0.69	0.63	0.71	0.82	0.23
Avail Cap(c_a), veh/h	541	543	539	452	538	512	541	542	707	589	542	588
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	20.1	23.4	23.4	27.6	25.0	25.1	27.5	25.6	19.1	24.6	24.1	17.3
Incr Delay (d2), s/veh	0.1	5.0	5.3	2.6	1.3	1.5	1.7	2.8	1.3	2.3	7.7	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	6.0	6.0	2.8	2.4	2.4	2.3	3.8	5.0	5.0	6.7	1.5
LnGrp Delay(d),s/veh	20.2	28.4	28.7	30.2	26.3	26.6	29.1	28.4	20.5	26.9	31.8	17.5
LnGrp LOS	C	C	C	C	C	C	C	C	C	C	C	B
Approach Vol, veh/h		694			439			672			741	
Approach Delay, s/veh		28.0			27.8			24.7			27.8	
Approach LOS		C			C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	16.2	16.5	11.5	20.4	11.5	21.2	15.1	16.8
Change Period (Y+Rc), s	* 6.5	* 6.5	* 6.5	* 6.5	* 6.5	* 6.5	* 6.5	* 6.5
Max Green Setting (Gmax), s	* 12	* 19	* 15	* 18	* 12	* 19	* 15	* 18
Max Q Clear Time (g_c+I1), s	2.0	6.8	2.4	12.9	3.4	12.7	5.8	8.8
Green Ext Time (p_c), s	0.4	1.1	1.0	1.0	0.3	2.0	0.9	1.6

Intersection Summary	
HCM 2010 Ctrl Delay	27.0
HCM 2010 LOS	C

Notes

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	358	193	89	256	527	356
Future Volume (veh/h)	358	193	89	256	527	356
Number	7	14	5	2	6	16
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1886	1886	1942	1942	1886	1886
Adj Flow Rate, veh/h	411	222	110	316	613	414
Adj No. of Lanes	2	1	1	2	2	1
Peak Hour Factor	0.87	0.87	0.81	0.81	0.86	0.86
Percent Heavy Veh, %	5	5	4	4	5	5
Cap, veh/h	640	741	693	2634	1438	913
Arrive On Green	0.18	0.20	0.26	0.71	0.40	0.39
Sat Flow, veh/h	3484	1603	1850	3788	3677	1603
Grp Volume(v), veh/h	411	222	110	316	613	414
Grp Sat Flow(s),veh/h/ln	1742	1603	1850	1845	1791	1603
Q Serve(g_s), s	8.7	0.0	0.0	2.1	9.9	12.0
Cycle Q Clear(g_c), s	8.7	0.0	0.0	2.1	9.9	12.0
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	640	741	693	2634	1438	913
V/C Ratio(X)	0.64	0.30	0.16	0.12	0.43	0.45
Avail Cap(c_a), veh/h	1076	942	693	2634	1438	913
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	30.2	13.4	13.8	3.6	17.3	10.0
Incr Delay (d2), s/veh	1.1	0.2	0.2	0.1	0.9	1.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.3	4.9	1.6	1.1	5.0	7.9
LnGrp Delay(d),s/veh	31.3	13.6	14.0	3.7	18.2	11.6
LnGrp LOS	C	B	B	A	B	B
Approach Vol, veh/h	633			426	1027	
Approach Delay, s/veh	25.1			6.3	15.6	
Approach LOS	C			A	B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		
Phs Duration (G+Y+Rc), s		61.0		19.0	25.0	36.0		
Change Period (Y+Rc), s		7.2		6.4	7.2	7.2		
Max Green Setting (Gmax), s		43.8		22.6	7.8	28.8		
Max Q Clear Time (g_c+I1), s		4.1		10.7	2.0	14.0		
Green Ext Time (p_c), s		2.5		1.9	1.2	4.7		

Intersection Summary	
HCM 2010 Ctrl Delay	16.6
HCM 2010 LOS	B

Intersection	
Int Delay, s/veh	6.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	304	483	1	1	107	9	0	0	0	43	1	204
Future Vol, veh/h	304	483	1	1	107	9	0	0	0	43	1	204
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	300	-	375	150	-	250	-	-	-	-	-	250
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	86	86	86	86	86	86	92	92	92	95	95	95
Heavy Vehicles, %	3	3	3	7	7	7	2	2	2	3	3	3
Mvmt Flow	353	562	1	1	124	10	0	0	0	45	1	215

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	124	0	0	562	0	0	1396	1396	562	1396	1396	124
Stage 1	-	-	-	-	-	-	1269	1269	-	127	127	-
Stage 2	-	-	-	-	-	-	127	127	-	1269	1269	-
Critical Hdwy	4.13	-	-	4.17	-	-	7.12	6.52	6.22	7.13	6.53	6.23
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.13	5.53	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.13	5.53	-
Follow-up Hdwy	2.227	-	-	2.263	-	-	3.518	4.018	3.318	3.527	4.027	3.327
Pot Cap-1 Maneuver	1457	-	-	985	-	-	119	141	526	118	140	924
Stage 1	-	-	-	-	-	-	206	239	-	874	789	-
Stage 2	-	-	-	-	-	-	877	791	-	206	238	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1457	-	-	985	-	-	74	107	526	96	106	924
Mov Cap-2 Maneuver	-	-	-	-	-	-	74	107	-	96	106	-
Stage 1	-	-	-	-	-	-	156	181	-	662	788	-
Stage 2	-	-	-	-	-	-	672	790	-	156	180	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	3.2	0.1	0	21.3
HCM LOS			A	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	-	1457	-	-	985	-	-	96	924
HCM Lane V/C Ratio	-	0.243	-	-	0.001	-	-	0.482	0.232
HCM Control Delay (s)	0	8.3	-	-	8.7	-	-	73.4	10.1
HCM Lane LOS	A	A	-	-	A	-	-	F	B
HCM 95th %tile Q(veh)	-	1	-	-	0	-	-	2.1	0.9

Intersection	
Int Delay, s/veh	4.6

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	138	31	92	0	0	251
Future Vol, veh/h	138	31	92	0	0	251
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	210	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	74	74	84	84	85	85
Heavy Vehicles, %	4	4	4	4	1	1
Mvmt Flow	186	42	110	0	0	295

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	405	110	0	-	-	-
Stage 1	110	-	-	-	-	-
Stage 2	295	-	-	-	-	-
Critical Hdwy	6.44	6.24	-	-	-	-
Critical Hdwy Stg 1	5.44	-	-	-	-	-
Critical Hdwy Stg 2	5.44	-	-	-	-	-
Follow-up Hdwy	3.536	3.336	-	-	-	-
Pot Cap-1 Maneuver	598	938	-	0	0	-
Stage 1	910	-	-	0	0	-
Stage 2	751	-	-	0	0	-
Platoon blocked, %			-			-
Mov Cap-1 Maneuver	598	938	-	-	-	-
Mov Cap-2 Maneuver	598	-	-	-	-	-
Stage 1	910	-	-	-	-	-
Stage 2	751	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	12.8	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	WBLn1	WBLn2	SBT
Capacity (veh/h)	-	598	938	-
HCM Lane V/C Ratio	-	0.312	0.045	-
HCM Control Delay (s)	-	13.7	9	-
HCM Lane LOS	-	B	A	-
HCM 95th %tile Q(veh)	-	1.3	0.1	-

Intersection	
Int Delay, s/veh	3.8

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	8	169	10	84	368	21
Future Vol, veh/h	8	169	10	84	368	21
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	87	87	84	84	81	81
Heavy Vehicles, %	1	1	4	4	2	2
Mvmt Flow	9	194	12	100	454	26

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	591	467	480	0	-	0
Stage 1	467	-	-	-	-	-
Stage 2	124	-	-	-	-	-
Critical Hdwy	6.41	6.21	4.14	-	-	-
Critical Hdwy Stg 1	5.41	-	-	-	-	-
Critical Hdwy Stg 2	5.41	-	-	-	-	-
Follow-up Hdwy	3.509	3.309	2.236	-	-	-
Pot Cap-1 Maneuver	471	598	1072	-	-	-
Stage 1	633	-	-	-	-	-
Stage 2	904	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	465	598	1072	-	-	-
Mov Cap-2 Maneuver	465	-	-	-	-	-
Stage 1	633	-	-	-	-	-
Stage 2	893	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	14.3	0.9	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1072	-	590	-	-
HCM Lane V/C Ratio	0.011	-	0.345	-	-
HCM Control Delay (s)	8.4	0	14.3	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	1.5	-	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	270	484	206	322	555	296	248	367	219	197	294	175
Future Volume (veh/h)	270	484	206	322	555	296	248	367	219	197	294	175
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1980	1980	2000	1980	1980	2000	1980	1980	1980	1980	1980	1980
Adj Flow Rate, veh/h	314	563	240	362	624	333	276	408	243	219	327	194
Adj No. of Lanes	1	2	0	1	2	0	1	1	1	1	1	1
Peak Hour Factor	0.86	0.86	0.86	0.89	0.89	0.89	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	1	1	1	1	1	1	1	1	1	1	1	1
Cap, veh/h	352	649	276	438	671	358	353	460	646	251	383	633
Arrive On Green	0.15	0.25	0.25	0.18	0.28	0.28	0.14	0.23	0.23	0.10	0.19	0.19
Sat Flow, veh/h	1886	2574	1095	1886	2372	1266	1886	1980	1683	1886	1980	1683
Grp Volume(v), veh/h	314	411	392	362	495	462	276	408	243	219	327	194
Grp Sat Flow(s),veh/h/ln	1886	1881	1787	1886	1881	1757	1886	1980	1683	1886	1980	1683
Q Serve(g_s), s	14.2	23.2	23.2	14.7	28.3	28.3	9.8	22.1	0.0	8.8	17.7	0.0
Cycle Q Clear(g_c), s	14.2	23.2	23.2	14.7	28.3	28.3	9.8	22.1	0.0	8.8	17.7	0.0
Prop In Lane	1.00		0.61	1.00		0.72	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	352	474	450	438	532	497	353	460	646	251	383	633
V/C Ratio(X)	0.89	0.87	0.87	0.83	0.93	0.93	0.78	0.89	0.38	0.87	0.85	0.31
Avail Cap(c_a), veh/h	406	544	517	438	544	508	353	537	712	269	537	764
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	44.4	39.6	39.7	40.9	38.6	38.6	43.6	41.1	24.5	47.6	43.1	24.3
Incr Delay (d2), s/veh	19.6	12.6	13.5	12.3	22.6	23.7	10.7	14.9	0.4	24.5	9.3	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	11.2	13.7	13.1	12.0	18.0	17.0	9.1	13.9	5.4	8.3	10.6	4.2
LnGrp Delay(d),s/veh	64.0	52.3	53.1	53.2	61.2	62.3	54.3	56.0	24.9	72.2	52.4	24.6
LnGrp LOS	E	D	D	D	E	E	D	E	C	E	D	C
Approach Vol, veh/h		1117			1319			927			740	
Approach Delay, s/veh		55.9			59.4			47.4			51.0	
Approach LOS		E			E			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	23.3	37.8	21.7	27.9	26.7	34.4	17.4	32.2
Change Period (Y+Rc), s	* 6.5	* 6.5	* 6.5	* 6.5	* 6.5	* 6.5	* 6.5	* 6.5
Max Green Setting (Gmax), s	* 20	* 32	* 12	* 30	* 20	* 32	* 12	* 30
Max Q Clear Time (g_c+I1), s	16.2	30.3	11.8	19.7	16.7	25.2	10.8	24.1
Green Ext Time (p_c), s	0.6	1.0	0.0	1.8	0.8	2.6	0.1	1.6

Intersection Summary	
HCM 2010 Ctrl Delay	54.2
HCM 2010 LOS	D

Notes

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	518	214	258	658	497	355
Future Volume (veh/h)	518	214	258	658	497	355
Number	7	14	5	2	6	16
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1980	1980	2000	2000	1980	1980
Adj Flow Rate, veh/h	545	225	287	731	540	386
Adj No. of Lanes	2	1	1	2	2	1
Peak Hour Factor	0.95	0.95	0.90	0.90	0.92	0.92
Percent Heavy Veh, %	0	0	1	1	0	0
Cap, veh/h	770	778	685	2610	1510	1004
Arrive On Green	0.21	0.23	0.24	0.69	0.40	0.39
Sat Flow, veh/h	3658	1683	1905	3900	3861	1683
Grp Volume(v), veh/h	545	225	287	731	540	386
Grp Sat Flow(s),veh/h/ln	1829	1683	1905	1900	1881	1683
Q Serve(g_s), s	11.1	0.0	0.0	6.0	8.0	9.6
Cycle Q Clear(g_c), s	11.1	0.0	0.0	6.0	8.0	9.6
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	770	778	685	2610	1510	1004
V/C Ratio(X)	0.71	0.29	0.42	0.28	0.36	0.38
Avail Cap(c_a), veh/h	992	880	685	2610	1510	1004
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	29.3	13.3	18.6	4.9	16.7	8.4
Incr Delay (d2), s/veh	1.6	0.2	0.6	0.3	0.7	1.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.8	5.0	5.0	3.1	4.3	7.1
LnGrp Delay(d),s/veh	30.9	13.5	19.2	5.1	17.4	9.6
LnGrp LOS	C	B	B	A	B	A
Approach Vol, veh/h	770			1018	926	
Approach Delay, s/veh	25.8			9.1	14.1	
Approach LOS	C			A	B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		
Phs Duration (G+Y+Rc), s		58.9		21.1	22.9	36.0		
Change Period (Y+Rc), s		7.2		6.4	7.2	7.2		
Max Green Setting (Gmax), s		46.8		19.6	10.8	28.8		
Max Q Clear Time (g_c+I1), s		8.0		13.1	2.0	11.6		
Green Ext Time (p_c), s		7.1		1.7	3.9	4.3		

Intersection Summary	
HCM 2010 Ctrl Delay	15.6
HCM 2010 LOS	B

Intersection	
Int Delay, s/veh	15.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	383	251	21	15	475	57	8	1	3	6	12	321
Future Vol, veh/h	383	251	21	15	475	57	8	1	3	6	12	321
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	300	-	375	150	-	250	-	-	-	-	-	250
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	87	87	87	86	86	86	60	60	60	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	0	0	0	1	1	1
Mvmt Flow	440	289	24	17	552	66	13	2	5	7	13	349

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	552	0	0	289	0	0	1763	1756	289	1759	1756	552
Stage 1	-	-	-	-	-	-	1169	1169	-	587	587	-
Stage 2	-	-	-	-	-	-	594	587	-	1172	1169	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.1	6.5	6.2	7.11	6.51	6.21
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.11	5.51	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.11	5.51	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.5	4	3.3	3.509	4.009	3.309
Pot Cap-1 Maneuver	1018	-	-	1273	-	-	66	86	755	66	85	535
Stage 1	-	-	-	-	-	-	237	269	-	497	498	-
Stage 2	-	-	-	-	-	-	495	500	-	235	268	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1018	-	-	1273	-	-	~ 12	48	755	42	48	535
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 12	48	-	42	48	-
Stage 1	-	-	-	-	-	-	135	153	-	282	491	-
Stage 2	-	-	-	-	-	-	165	493	-	131	152	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	6.6	0.2	$ 593.6	29.3
HCM LOS			F	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	17	1018	-	-	1273	-	-	46	535
HCM Lane V/C Ratio	1.176	0.432	-	-	0.014	-	-	0.425	0.652
HCM Control Delay (s)	$ 593.6	11.2	-	-	7.9	-	-	132	23.5
HCM Lane LOS	F	B	-	-	A	-	-	F	C
HCM 95th %tile Q(veh)	2.9	2.2	-	-	0	-	-	1.5	4.7

Notes

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

Intersection	
Int Delay, s/veh	9.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	316	161	217	0	0	174
Future Vol, veh/h	316	161	217	0	0	174
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	210	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	91	91	85	85
Heavy Vehicles, %	0	0	0	0	3	3
Mvmt Flow	343	175	238	0	0	205

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	443	238	0	-	-	-
Stage 1	238	-	-	-	-	-
Stage 2	205	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	-	-
Pot Cap-1 Maneuver	576	806	-	0	0	-
Stage 1	806	-	-	0	0	-
Stage 2	834	-	-	0	0	-
Platoon blocked, %			-			-
Mov Cap-1 Maneuver	576	806	-	-	-	-
Mov Cap-2 Maneuver	576	-	-	-	-	-
Stage 1	806	-	-	-	-	-
Stage 2	834	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	16.9	0	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	WBLn1	WBLn2	SBT
Capacity (veh/h)	-	576	806	-
HCM Lane V/C Ratio	-	0.596	0.217	-
HCM Control Delay (s)	-	20.1	10.7	-
HCM Lane LOS	-	C	B	-
HCM 95th %tile Q(veh)	-	3.9	0.8	-

Intersection	
Int Delay, s/veh	1.7

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	2	72	62	215	394	96
Future Vol, veh/h	2	72	62	215	394	96
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	91	91	90	90
Heavy Vehicles, %	0	0	0	0	1	1
Mvmt Flow	2	77	68	236	438	107

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	864	491	544	0	-	0
Stage 1	491	-	-	-	-	-
Stage 2	373	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	327	582	1035	-	-	-
Stage 1	619	-	-	-	-	-
Stage 2	701	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	302	582	1035	-	-	-
Mov Cap-2 Maneuver	302	-	-	-	-	-
Stage 1	619	-	-	-	-	-
Stage 2	648	-	-	-	-	-

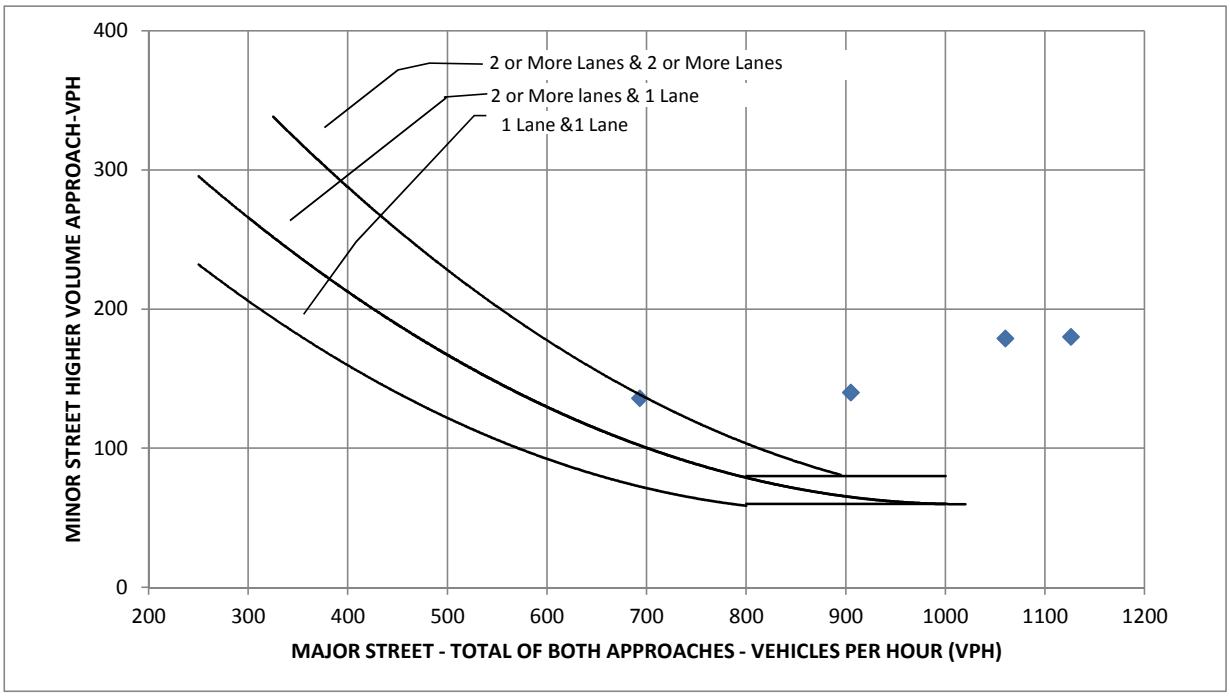
Approach	EB	NB	SB
HCM Control Delay, s	12.4	2	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1035	-	568	-	-
HCM Lane V/C Ratio	0.066	-	0.14	-	-
HCM Control Delay (s)	8.7	0	12.4	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0.2	-	0.5	-	-

Michigan Manual of Uniform Traffic Control Devices
Worksheet for Signal Warrants (Section 4C)
WARRANT 2: Four-Hour Vehicular Volume

Spot Number:	0		
Intersection:	Grand River Avenue @ Pleasant Valley		
Date	3/30/2016	by	F&V

2	: No. of Lanes on Major St.
1	: No. of Lanes on Minor St.
45	: Speed limit or 85th Percentile? (MPH)
NO	: Is the intersection within an Isolated community?
	: What is the of the population isolated community?



How Many Hours Are Met	4
Is Warrant (70%) Met?	YES

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	43	476	99	150	183	79	100	161	243	268	319	102
Future Volume (veh/h)	43	476	99	150	183	79	100	161	243	268	319	102
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1942	1942	1942	1923	1923	1923	1942	1942	1942	1942	1942	1942
Adj Flow Rate, veh/h	48	535	111	160	195	84	133	215	324	288	343	110
Adj No. of Lanes	1	2	1	1	2	1	1	1	1	1	1	1
Peak Hour Factor	0.89	0.89	0.89	0.94	0.94	0.94	0.75	0.75	0.75	0.93	0.93	0.93
Percent Heavy Veh, %	3	3	3	4	4	4	3	3	3	3	3	3
Cap, veh/h	481	783	572	279	581	390	261	312	484	411	419	487
Arrive On Green	0.13	0.21	0.21	0.08	0.16	0.16	0.08	0.16	0.16	0.13	0.22	0.22
Sat Flow, veh/h	1849	3689	1650	1832	3654	1635	1849	1942	1650	1849	1942	1650
Grp Volume(v), veh/h	48	535	111	160	195	84	133	215	324	288	343	110
Grp Sat Flow(s),veh/h/ln	1849	1845	1650	1832	1827	1635	1849	1942	1650	1849	1942	1650
Q Serve(g_s), s	0.0	8.4	0.0	0.5	3.0	0.0	0.3	6.6	2.5	3.5	10.6	0.0
Cycle Q Clear(g_c), s	0.0	8.4	0.0	0.5	3.0	0.0	0.3	6.6	2.5	3.5	10.6	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	481	783	572	279	581	390	261	312	484	411	419	487
V/C Ratio(X)	0.10	0.68	0.19	0.57	0.34	0.22	0.51	0.69	0.67	0.70	0.82	0.23
Avail Cap(c_a), veh/h	573	1319	812	469	1307	714	482	540	678	530	540	590
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	18.8	22.8	14.4	26.6	23.5	19.2	26.7	24.9	19.5	23.8	23.5	16.7
Incr Delay (d2), s/veh	0.1	1.1	0.2	1.8	0.3	0.3	1.5	2.7	1.6	2.9	7.6	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	4.4	1.4	2.7	1.5	1.2	2.3	3.8	4.8	4.9	6.5	1.5
LnGrp Delay(d),s/veh	18.9	23.9	14.6	28.4	23.8	19.5	28.2	27.6	21.1	26.7	31.1	17.0
LnGrp LOS	B	C	B	C	C	B	C	C	C	C	C	B
Approach Vol, veh/h		694			439			672			741	
Approach Delay, s/veh		22.1			24.7			24.6			27.3	
Approach LOS		C			C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	14.8	16.5	11.5	20.1	11.5	19.8	15.0	16.6
Change Period (Y+Rc), s	* 6.5	* 6.5	* 6.5	* 6.5	* 6.5	* 6.5	* 6.5	* 6.5
Max Green Setting (Gmax), s	* 12	* 23	* 13	* 18	* 12	* 23	* 13	* 18
Max Q Clear Time (g_c+I1), s	2.0	5.0	2.3	12.6	2.5	10.4	5.5	8.6
Green Ext Time (p_c), s	0.4	1.2	0.9	1.0	0.4	2.9	0.7	1.5

Intersection Summary	
HCM 2010 Ctrl Delay	24.7
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	304	483	1	1	107	9	0	0	0	43	1	204
Future Volume (veh/h)	304	483	1	1	107	9	0	0	0	43	1	204
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1942	1942	1942	1869	1869	1869	2000	1961	2000	2000	1942	1942
Adj Flow Rate, veh/h	353	562	1	1	124	10	0	0	0	45	1	215
Adj No. of Lanes	1	1	1	1	1	1	0	1	0	0	1	1
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.92	0.92	0.92	0.95	0.95	0.95
Percent Heavy Veh, %	3	3	3	7	7	7	2	2	2	3	3	3
Cap, veh/h	988	1408	1196	292	649	552	0	195	0	238	4	653
Arrive On Green	0.30	0.72	0.72	0.35	0.35	0.35	0.00	0.00	0.00	0.10	0.10	0.10
Sat Flow, veh/h	1849	1942	1650	804	1869	1589	0	1961	0	1367	43	1650
Grp Volume(v), veh/h	353	562	1	1	124	10	0	0	0	46	0	215
Grp Sat Flow(s),veh/h/ln	1849	1942	1650	804	1869	1589	0	1961	0	1410	0	1650
Q Serve(g_s), s	0.0	7.8	0.0	0.1	3.2	0.3	0.0	0.0	0.0	2.1	0.0	0.0
Cycle Q Clear(g_c), s	0.0	7.8	0.0	7.9	3.2	0.3	0.0	0.0	0.0	2.1	0.0	0.0
Prop In Lane	1.00		1.00	1.00		1.00	0.00		0.00	0.98		1.00
Lane Grp Cap(c), veh/h	988	1408	1196	292	649	552	0	195	0	242	0	653
V/C Ratio(X)	0.36	0.40	0.00	0.00	0.19	0.02	0.00	0.00	0.00	0.19	0.00	0.33
Avail Cap(c_a), veh/h	988	1408	1196	292	649	552	0	235	0	271	0	687
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	9.1	3.7	2.7	20.5	16.0	15.0	0.0	0.0	0.0	29.3	0.0	14.7
Incr Delay (d2), s/veh	0.2	0.8	0.0	0.0	0.7	0.1	0.0	0.0	0.0	0.4	0.0	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.1	4.4	0.0	0.0	1.8	0.1	0.0	0.0	0.0	0.9	0.0	2.9
LnGrp Delay(d),s/veh	9.3	4.6	2.7	20.5	16.6	15.1	0.0	0.0	0.0	29.7	0.0	15.0
LnGrp LOS	A	A	A	C	B	B				C		B
Approach Vol, veh/h		916			135			0			261	
Approach Delay, s/veh		6.4			16.5			0.0			17.6	
Approach LOS		A			B						B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		8
Phs Duration (G+Y+Rc), s		56.4		13.6	26.4	30.0		13.6
Change Period (Y+Rc), s		* 5.7		* 6.6	* 5.7	* 5.7		* 6.6
Max Green Setting (Gmax), s		* 49		* 8.4	* 19	* 24		* 8.4
Max Q Clear Time (g_c+I1), s		9.8		4.1	2.0	9.9		0.0
Green Ext Time (p_c), s		4.8		0.3	4.1	0.5		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	9.7
HCM 2010 LOS	A

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	270	484	206	322	555	296	248	367	219	197	294	175
Future Volume (veh/h)	270	484	206	322	555	296	248	367	219	197	294	175
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1980	1980	1980	1980	1980	1980	1980	1980	1980	1980	1980	1980
Adj Flow Rate, veh/h	314	563	240	362	624	333	276	408	243	219	327	194
Adj No. of Lanes	1	2	1	1	2	1	1	1	1	1	1	1
Peak Hour Factor	0.86	0.86	0.86	0.89	0.89	0.89	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	1	1	1	1	1	1	1	1	1	1	1	1
Cap, veh/h	375	772	512	427	848	616	386	485	648	272	402	611
Arrive On Green	0.14	0.21	0.21	0.16	0.23	0.23	0.14	0.24	0.24	0.10	0.20	0.20
Sat Flow, veh/h	1886	3762	1683	1886	3762	1683	1886	1980	1683	1886	1980	1683
Grp Volume(v), veh/h	314	563	240	362	624	333	276	408	243	219	327	194
Grp Sat Flow(s),veh/h/ln	1886	1881	1683	1886	1881	1683	1886	1980	1683	1886	1980	1683
Q Serve(g_s), s	9.1	12.5	1.5	10.5	13.8	1.4	6.5	17.5	0.0	6.0	14.1	0.0
Cycle Q Clear(g_c), s	9.1	12.5	1.5	10.5	13.8	1.4	6.5	17.5	0.0	6.0	14.1	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	375	772	512	427	848	616	386	485	648	272	402	611
V/C Ratio(X)	0.84	0.73	0.47	0.85	0.74	0.54	0.72	0.84	0.38	0.80	0.81	0.32
Avail Cap(c_a), veh/h	522	1242	722	537	1242	792	427	676	810	392	676	844
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	35.1	33.2	25.2	33.7	32.2	22.4	34.1	32.1	19.8	37.8	34.0	20.5
Incr Delay (d2), s/veh	8.3	1.3	0.7	10.0	1.3	0.7	5.0	6.8	0.4	7.7	4.0	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.3	6.6	4.7	9.7	7.3	6.3	6.9	10.4	4.4	5.8	8.2	3.4
LnGrp Delay(d),s/veh	43.4	34.5	25.9	43.7	33.4	23.1	39.1	38.9	20.1	45.5	38.0	20.8
LnGrp LOS	D	C	C	D	C	C	D	D	C	D	D	C
Approach Vol, veh/h		1117			1319			927			740	
Approach Delay, s/veh		35.2			33.7			34.1			35.7	
Approach LOS		D			C			C			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	19.0	26.6	19.1	24.6	20.8	24.8	15.3	28.4
Change Period (Y+Rc), s	* 6.5	* 6.5	* 6.5	* 6.5	* 6.5	* 6.5	* 6.5	* 6.5
Max Green Setting (Gmax), s	* 20	* 30	* 15	* 31	* 20	* 30	* 15	* 31
Max Q Clear Time (g_c+I1), s	11.1	15.8	8.5	16.1	12.5	14.5	8.0	19.5
Green Ext Time (p_c), s	1.5	4.4	0.8	2.0	1.3	3.8	0.9	2.4

Intersection Summary	
HCM 2010 Ctrl Delay	34.5
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	383	251	21	15	475	57	8	1	3	6	12	321
Future Volume (veh/h)	383	251	21	15	475	57	8	1	3	6	12	321
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1961	1961	1961	1961	1961	1961	2000	2000	2000	2000	1980	1980
Adj Flow Rate, veh/h	440	289	24	17	552	66	13	2	5	7	13	349
Adj No. of Lanes	1	1	1	1	1	1	0	1	0	0	1	1
Peak Hour Factor	0.87	0.87	0.87	0.86	0.86	0.86	0.60	0.60	0.60	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	0	0	0	1	1	1
Cap, veh/h	652	1420	1207	497	821	698	152	32	33	105	148	546
Arrive On Green	0.22	0.72	0.72	0.42	0.42	0.42	0.10	0.10	0.10	0.10	0.10	0.10
Sat Flow, veh/h	1867	1961	1667	1062	1961	1667	670	319	330	357	1481	1683
Grp Volume(v), veh/h	440	289	24	17	552	66	20	0	0	20	0	349
Grp Sat Flow(s),veh/h/ln	1867	1961	1667	1062	1961	1667	1318	0	0	1838	0	1683
Q Serve(g_s), s	5.3	3.3	0.3	0.7	15.9	1.7	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	5.3	3.3	0.3	4.1	15.9	1.7	0.7	0.0	0.0	0.6	0.0	0.0
Prop In Lane	1.00		1.00	1.00		1.00	0.65		0.25	0.35		1.00
Lane Grp Cap(c), veh/h	652	1420	1207	497	821	698	217	0	0	253	0	546
V/C Ratio(X)	0.68	0.20	0.02	0.03	0.67	0.09	0.09	0.00	0.00	0.08	0.00	0.64
Avail Cap(c_a), veh/h	652	1420	1207	497	821	698	241	0	0	288	0	580
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	20.0	3.1	2.7	14.1	16.5	12.3	28.7	0.0	0.0	28.6	0.0	20.2
Incr Delay (d2), s/veh	2.8	0.3	0.0	0.1	4.4	0.3	0.2	0.0	0.0	0.1	0.0	2.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.7	1.9	0.1	0.2	9.6	0.8	0.4	0.0	0.0	0.4	0.0	6.0
LnGrp Delay(d),s/veh	22.8	3.4	2.7	14.2	20.8	12.6	28.8	0.0	0.0	28.8	0.0	22.3
LnGrp LOS	C	A	A	B	C	B	C			C		C
Approach Vol, veh/h		753			635			20			369	
Approach Delay, s/veh		14.7			19.8			28.8			22.7	
Approach LOS		B			B			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		8
Phs Duration (G+Y+Rc), s		56.4		13.6	21.4	35.0		13.6
Change Period (Y+Rc), s		* 5.7		* 6.6	* 5.7	* 5.7		* 6.6
Max Green Setting (Gmax), s		* 49		* 8.4	* 14	* 29		* 8.4
Max Q Clear Time (g_c+I1), s		5.3		2.6	7.3	17.9		2.7
Green Ext Time (p_c), s		3.1		0.7	1.8	2.7		0.7

Intersection Summary	
HCM 2010 Ctrl Delay	18.4
HCM 2010 LOS	B

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	52	497	102	157	200	81	103	162	251	276	324	117
Future Volume (veh/h)	52	497	102	157	200	81	103	162	251	276	324	117
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1942	1942	2000	1923	1923	2000	1942	1942	1942	1942	1942	1942
Adj Flow Rate, veh/h	58	558	115	167	213	86	137	216	335	297	348	126
Adj No. of Lanes	1	2	0	1	2	0	1	1	1	1	1	1
Peak Hour Factor	0.89	0.89	0.89	0.94	0.94	0.94	0.75	0.75	0.75	0.93	0.93	0.93
Percent Heavy Veh, %	3	3	3	4	4	4	3	3	3	3	3	3
Cap, veh/h	466	709	146	250	393	154	251	311	522	403	421	484
Arrive On Green	0.16	0.23	0.23	0.08	0.15	0.15	0.08	0.16	0.16	0.13	0.22	0.22
Sat Flow, veh/h	1849	3049	626	1832	2568	1004	1849	1942	1650	1849	1942	1650
Grp Volume(v), veh/h	58	337	336	167	150	149	137	216	335	297	348	126
Grp Sat Flow(s),veh/h/ln	1849	1845	1831	1832	1827	1746	1849	1942	1650	1849	1942	1650
Q Serve(g_s), s	0.0	11.2	11.3	1.7	4.9	5.2	0.6	6.9	1.2	4.3	11.2	0.0
Cycle Q Clear(g_c), s	0.0	11.2	11.3	1.7	4.9	5.2	0.6	6.9	1.2	4.3	11.2	0.0
Prop In Lane	1.00		0.34	1.00		0.58	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	466	429	426	250	279	267	251	311	522	403	421	484
V/C Ratio(X)	0.12	0.79	0.79	0.67	0.54	0.56	0.54	0.70	0.64	0.74	0.83	0.26
Avail Cap(c_a), veh/h	516	536	532	446	531	507	534	534	712	581	534	580
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	21.1	23.6	23.6	28.1	25.6	25.7	27.9	26.0	19.2	25.0	24.4	17.7
Incr Delay (d2), s/veh	0.1	6.0	6.3	3.1	1.6	1.8	1.8	2.8	1.3	2.9	8.3	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.9	6.4	6.4	3.1	2.6	2.6	2.4	3.9	5.1	5.3	7.0	1.8
LnGrp Delay(d),s/veh	21.2	29.6	29.9	31.2	27.2	27.5	29.8	28.8	20.5	27.9	32.7	18.0
LnGrp LOS	C	C	C	C	C	C	C	C	C	C	C	B
Approach Vol, veh/h		731			466			688			771	
Approach Delay, s/veh		29.1			28.7			24.9			28.4	
Approach LOS		C			C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	16.7	16.5	11.5	20.7	11.5	21.7	15.2	17.0
Change Period (Y+Rc), s	* 6.5	* 6.5	* 6.5	* 6.5	* 6.5	* 6.5	* 6.5	* 6.5
Max Green Setting (Gmax), s	* 12	* 19	* 15	* 18	* 12	* 19	* 15	* 18
Max Q Clear Time (g_c+I1), s	2.0	7.2	2.6	13.2	3.7	13.3	6.3	8.9
Green Ext Time (p_c), s	0.4	1.2	1.0	1.0	0.4	1.9	0.9	1.6

Intersection Summary	
HCM 2010 Ctrl Delay	27.7
HCM 2010 LOS	C

Notes

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	369	199	92	268	550	367
Future Volume (veh/h)	369	199	92	268	550	367
Number	7	14	5	2	6	16
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1886	1886	1942	1942	1886	1886
Adj Flow Rate, veh/h	424	229	114	331	640	427
Adj No. of Lanes	2	1	1	2	2	1
Peak Hour Factor	0.87	0.87	0.81	0.81	0.86	0.86
Percent Heavy Veh, %	5	5	4	4	5	5
Cap, veh/h	654	741	678	2620	1438	920
Arrive On Green	0.19	0.20	0.26	0.71	0.40	0.39
Sat Flow, veh/h	3484	1603	1850	3788	3677	1603
Grp Volume(v), veh/h	424	229	114	331	640	427
Grp Sat Flow(s),veh/h/ln	1742	1603	1850	1845	1791	1603
Q Serve(g_s), s	9.0	0.0	0.0	2.3	10.4	12.4
Cycle Q Clear(g_c), s	9.0	0.0	0.0	2.3	10.4	12.4
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	654	741	678	2620	1438	920
V/C Ratio(X)	0.65	0.31	0.17	0.13	0.45	0.46
Avail Cap(c_a), veh/h	1076	935	678	2620	1438	920
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	30.1	13.5	14.7	3.7	17.5	9.9
Incr Delay (d2), s/veh	1.1	0.2	0.2	0.1	1.0	1.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.4	5.1	1.7	1.2	5.4	8.3
LnGrp Delay(d),s/veh	31.1	13.7	14.8	3.8	18.5	11.6
LnGrp LOS	C	B	B	A	B	B
Approach Vol, veh/h	653			445	1067	
Approach Delay, s/veh	25.0			6.6	15.7	
Approach LOS	C			A	B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		
Phs Duration (G+Y+Rc), s		60.7		19.3	24.7	36.0		
Change Period (Y+Rc), s		7.2		6.4	7.2	7.2		
Max Green Setting (Gmax), s		43.8		22.6	7.8	28.8		
Max Q Clear Time (g_c+I1), s		4.3		11.0	2.0	14.4		
Green Ext Time (p_c), s		2.7		1.9	1.2	4.8		

Intersection Summary	
HCM 2010 Ctrl Delay	16.7
HCM 2010 LOS	B

Intersection	
Int Delay, s/veh	7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	317	502	1	1	116	9	0	0	0	44	1	217
Future Vol, veh/h	317	502	1	1	116	9	0	0	0	44	1	217
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	300	-	375	150	-	250	-	-	-	-	-	250
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	86	86	86	86	86	86	92	92	92	95	95	95
Heavy Vehicles, %	3	3	3	7	7	7	2	2	2	3	3	3
Mvmt Flow	369	584	1	1	135	10	0	0	0	46	1	228

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	135	0	0	584	0	0	1459	1458	584	1458	1458	135
Stage 1	-	-	-	-	-	-	1321	1321	-	137	137	-
Stage 2	-	-	-	-	-	-	138	137	-	1321	1321	-
Critical Hdwy	4.13	-	-	4.17	-	-	7.12	6.52	6.22	7.13	6.53	6.23
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.13	5.53	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.13	5.53	-
Follow-up Hdwy	2.227	-	-	2.263	-	-	3.518	4.018	3.318	3.527	4.027	3.327
Pot Cap-1 Maneuver	1443	-	-	966	-	-	107	129	512	107	129	911
Stage 1	-	-	-	-	-	-	193	226	-	864	781	-
Stage 2	-	-	-	-	-	-	865	783	-	192	225	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1443	-	-	966	-	-	64	96	512	86	96	911
Mov Cap-2 Maneuver	-	-	-	-	-	-	64	96	-	86	96	-
Stage 1	-	-	-	-	-	-	144	168	-	643	780	-
Stage 2	-	-	-	-	-	-	647	782	-	143	167	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	3.2	0.1	0	23.9
HCM LOS			A	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	-	1443	-	-	966	-	-	86	911
HCM Lane V/C Ratio	-	0.255	-	-	0.001	-	-	0.551	0.251
HCM Control Delay (s)	0	8.3	-	-	8.7	-	-	89.3	10.3
HCM Lane LOS	A	A	-	-	A	-	-	F	B
HCM 95th %tile Q(veh)	-	1	-	-	0	-	-	2.4	1

Intersection	
Int Delay, s/veh	4.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	142	32	99	0	0	266
Future Vol, veh/h	142	32	99	0	0	266
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	210	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	74	74	84	84	85	85
Heavy Vehicles, %	4	4	4	4	1	1
Mvmt Flow	192	43	118	0	0	313

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	431	118	0	-	-	-
Stage 1	118	-	-	-	-	-
Stage 2	313	-	-	-	-	-
Critical Hdwy	6.44	6.24	-	-	-	-
Critical Hdwy Stg 1	5.44	-	-	-	-	-
Critical Hdwy Stg 2	5.44	-	-	-	-	-
Follow-up Hdwy	3.536	3.336	-	-	-	-
Pot Cap-1 Maneuver	578	928	-	0	0	-
Stage 1	902	-	-	0	0	-
Stage 2	737	-	-	0	0	-
Platoon blocked, %			-			-
Mov Cap-1 Maneuver	578	928	-	-	-	-
Mov Cap-2 Maneuver	578	-	-	-	-	-
Stage 1	902	-	-	-	-	-
Stage 2	737	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	13.3	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	WBLn1	WBLn2	SBT
Capacity (veh/h)	-	578	928	-
HCM Lane V/C Ratio	-	0.332	0.047	-
HCM Control Delay (s)	-	14.3	9.1	-
HCM Lane LOS	-	B	A	-
HCM 95th %tile Q(veh)	-	1.4	0.1	-

Intersection	
Int Delay, s/veh	3.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	8	174	10	91	386	22
Future Vol, veh/h	8	174	10	91	386	22
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	87	87	84	84	81	81
Heavy Vehicles, %	1	1	4	4	2	2
Mvmt Flow	9	200	12	108	477	27

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	622	490	504	0	-	0
Stage 1	490	-	-	-	-	-
Stage 2	132	-	-	-	-	-
Critical Hdwy	6.41	6.21	4.14	-	-	-
Critical Hdwy Stg 1	5.41	-	-	-	-	-
Critical Hdwy Stg 2	5.41	-	-	-	-	-
Follow-up Hdwy	3.509	3.309	2.236	-	-	-
Pot Cap-1 Maneuver	452	580	1050	-	-	-
Stage 1	618	-	-	-	-	-
Stage 2	897	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	447	580	1050	-	-	-
Mov Cap-2 Maneuver	447	-	-	-	-	-
Stage 1	618	-	-	-	-	-
Stage 2	886	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	14.9	0.8	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1050	-	573	-	-
HCM Lane V/C Ratio	0.011	-	0.365	-	-
HCM Control Delay (s)	8.5	0	14.9	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	1.7	-	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	305	526	212	338	597	305	256	362	226	203	300	196
Future Volume (veh/h)	305	526	212	338	597	305	256	362	226	203	300	196
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1980	1980	2000	1980	1980	2000	1980	1980	1980	1980	1980	1980
Adj Flow Rate, veh/h	355	612	247	380	671	343	284	402	251	226	333	218
Adj No. of Lanes	1	2	0	1	2	0	1	1	1	1	1	1
Peak Hour Factor	0.86	0.86	0.86	0.89	0.89	0.89	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	1	1	1	1	1	1	1	1	1	1	1	1
Cap, veh/h	382	679	274	436	667	341	343	449	668	255	386	643
Arrive On Green	0.17	0.26	0.26	0.19	0.28	0.28	0.13	0.23	0.23	0.10	0.20	0.20
Sat Flow, veh/h	1886	2619	1056	1886	2411	1232	1886	1980	1683	1886	1980	1683
Grp Volume(v), veh/h	355	439	420	380	523	491	284	402	251	226	333	218
Grp Sat Flow(s),veh/h/ln	1886	1881	1794	1886	1881	1763	1886	1980	1683	1886	1980	1683
Q Serve(g_s), s	17.6	26.1	26.2	17.3	32.0	32.0	11.3	22.8	0.0	9.8	18.8	0.0
Cycle Q Clear(g_c), s	17.6	26.1	26.2	17.3	32.0	32.0	11.3	22.8	0.0	9.8	18.8	0.0
Prop In Lane	1.00		0.59	1.00		0.70	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	382	488	465	436	520	487	343	449	668	255	386	643
V/C Ratio(X)	0.93	0.90	0.90	0.87	1.01	1.01	0.83	0.89	0.38	0.89	0.86	0.34
Avail Cap(c_a), veh/h	388	520	496	436	520	487	343	513	722	258	513	751
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	45.7	41.4	41.5	43.3	41.9	41.9	46.3	43.4	24.8	49.7	45.1	25.4
Incr Delay (d2), s/veh	28.2	18.1	19.0	17.1	41.1	42.4	15.4	16.6	0.4	28.6	11.1	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	14.1	16.0	15.4	13.8	22.4	21.2	10.2	14.6	5.7	9.1	11.5	5.0
LnGrp Delay(d),s/veh	73.9	59.6	60.4	60.4	83.0	84.3	61.7	60.0	25.1	78.3	56.2	25.7
LnGrp LOS	E	E	E	E	F	F	E	E	C	E	E	C
Approach Vol, veh/h		1214			1394			937			777	
Approach Delay, s/veh		64.1			77.3			51.2			54.0	
Approach LOS		E			E			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	26.1	38.5	22.0	29.1	28.2	36.5	18.3	32.8
Change Period (Y+Rc), s	* 6.5	* 6.5	* 6.5	* 6.5	* 6.5	* 6.5	* 6.5	* 6.5
Max Green Setting (Gmax), s	* 20	* 32	* 12	* 30	* 20	* 32	* 12	* 30
Max Q Clear Time (g_c+I1), s	19.6	34.0	13.3	20.8	19.3	28.2	11.8	24.8
Green Ext Time (p_c), s	0.1	0.0	0.0	1.7	0.2	1.8	0.0	1.5

Intersection Summary	
HCM 2010 Ctrl Delay	63.7
HCM 2010 LOS	E

Notes

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	534	220	266	689	525	366
Future Volume (veh/h)	534	220	266	689	525	366
Number	7	14	5	2	6	16
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1980	1980	2000	2000	1980	1980
Adj Flow Rate, veh/h	562	232	296	766	571	398
Adj No. of Lanes	2	1	1	2	2	1
Peak Hour Factor	0.95	0.95	0.90	0.90	0.92	0.92
Percent Heavy Veh, %	0	0	1	1	0	0
Cap, veh/h	786	778	667	2594	1510	1012
Arrive On Green	0.21	0.23	0.23	0.68	0.40	0.39
Sat Flow, veh/h	3658	1683	1905	3900	3861	1683
Grp Volume(v), veh/h	562	232	296	766	571	398
Grp Sat Flow(s),veh/h/ln	1829	1683	1905	1900	1881	1683
Q Serve(g_s), s	11.4	0.0	0.1	6.4	8.6	9.9
Cycle Q Clear(g_c), s	11.4	0.0	0.1	6.4	8.6	9.9
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	786	778	667	2594	1510	1012
V/C Ratio(X)	0.71	0.30	0.44	0.30	0.38	0.39
Avail Cap(c_a), veh/h	992	873	667	2594	1510	1012
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	29.1	13.4	19.4	5.0	16.9	8.3
Incr Delay (d2), s/veh	1.8	0.2	0.7	0.3	0.7	1.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.0	5.1	5.1	3.4	4.6	7.3
LnGrp Delay(d),s/veh	30.9	13.6	20.1	5.3	17.6	9.5
LnGrp LOS	C	B	C	A	B	A
Approach Vol, veh/h	794			1062	969	
Approach Delay, s/veh	25.9			9.4	14.3	
Approach LOS	C			A	B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		
Phs Duration (G+Y+Rc), s		58.5		21.5	22.5	36.0		
Change Period (Y+Rc), s		7.2		6.4	7.2	7.2		
Max Green Setting (Gmax), s		46.8		19.6	10.8	28.8		
Max Q Clear Time (g_c+I1), s		8.4		13.4	2.1	11.9		
Green Ext Time (p_c), s		7.5		1.7	4.0	4.6		

Intersection Summary	
HCM 2010 Ctrl Delay	15.7
HCM 2010 LOS	B

Intersection	
Int Delay, s/veh	23.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	411	270	22	15	501	59	8	1	3	6	12	350
Future Vol, veh/h	411	270	22	15	501	59	8	1	3	6	12	350
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	300	-	375	150	-	250	-	-	-	-	-	250
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	87	87	87	86	86	86	60	60	60	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	0	0	0	1	1	1
Mvmt Flow	472	310	25	17	583	69	13	2	5	7	13	380

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	583	0	0	310	0	0	1879	1872	310	1876	1872	583
Stage 1	-	-	-	-	-	-	1255	1255	-	617	617	-
Stage 2	-	-	-	-	-	-	624	617	-	1259	1255	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.1	6.5	6.2	7.11	6.51	6.21
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.11	5.51	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.11	5.51	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.5	4	3.3	3.509	4.009	3.309
Pot Cap-1 Maneuver	991	-	-	1250	-	-	55	73	735	55	72	514
Stage 1	-	-	-	-	-	-	212	245	-	479	483	-
Stage 2	-	-	-	-	-	-	477	484	-	210	244	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	991	-	-	1250	-	-	~ 7	38	735	33	37	514
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 7	38	-	33	37	-
Stage 1	-	-	-	-	-	-	111	128	-	251	476	-
Stage 2	-	-	-	-	-	-	119	477	-	108	128	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	7	0.2	$ 1202.1	37.2
HCM LOS			F	E

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	10	991	-	-	1250	-	-	36	514
HCM Lane V/C Ratio	2	0.477	-	-	0.014	-	-	0.543	0.74
HCM Control Delay (s)	$ 1202.1	11.9	-	-	7.9	-	-	189.4	29.4
HCM Lane LOS	F	B	-	-	A	-	-	F	D
HCM 95th %tile Q(veh)	3.4	2.6	-	-	0	-	-	1.9	6.2

Notes

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

Intersection	
Int Delay, s/veh	10.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	326	166	240	0	0	198
Future Vol, veh/h	326	166	240	0	0	198
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	210	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	91	91	85	85
Heavy Vehicles, %	0	0	0	0	3	3
Mvmt Flow	354	180	264	0	0	233

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	497	264	0	-	-	-
Stage 1	264	-	-	-	-	-
Stage 2	233	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	-	-
Pot Cap-1 Maneuver	536	780	-	0	0	-
Stage 1	785	-	-	0	0	-
Stage 2	810	-	-	0	0	-
Platoon blocked, %			-			-
Mov Cap-1 Maneuver	536	780	-	-	-	-
Mov Cap-2 Maneuver	536	-	-	-	-	-
Stage 1	785	-	-	-	-	-
Stage 2	810	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	19.5	0	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	WBLn1	WBLn2	SBT
Capacity (veh/h)	-	536	780	-
HCM Lane V/C Ratio	-	0.661	0.231	-
HCM Control Delay (s)	-	23.9	11	-
HCM Lane LOS	-	C	B	-
HCM 95th %tile Q(veh)	-	4.8	0.9	-

Intersection	
Int Delay, s/veh	1.7

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	2	74	64	238	425	99
Future Vol, veh/h	2	74	64	238	425	99
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	91	91	90	90
Heavy Vehicles, %	0	0	0	0	1	1
Mvmt Flow	2	80	70	262	472	110

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	929	527	582	0	-	0
Stage 1	527	-	-	-	-	-
Stage 2	402	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	300	555	1002	-	-	-
Stage 1	596	-	-	-	-	-
Stage 2	680	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	275	555	1002	-	-	-
Mov Cap-2 Maneuver	275	-	-	-	-	-
Stage 1	596	-	-	-	-	-
Stage 2	624	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	12.8	1.9	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1002	-	541	-	-
HCM Lane V/C Ratio	0.07	-	0.151	-	-
HCM Control Delay (s)	8.9	0	12.8	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0.2	-	0.5	-	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	52	505	102	177	226	93	103	162	258	280	324	117
Future Volume (veh/h)	52	505	102	177	226	93	103	162	258	280	324	117
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1942	1942	2000	1923	1923	2000	1942	1942	1942	1942	1942	1942
Adj Flow Rate, veh/h	58	567	115	188	240	99	137	216	344	301	348	126
Adj No. of Lanes	1	2	0	1	2	0	1	1	1	1	1	1
Peak Hour Factor	0.89	0.89	0.89	0.94	0.94	0.94	0.75	0.75	0.75	0.93	0.93	0.93
Percent Heavy Veh, %	3	3	3	4	4	4	3	3	3	3	3	3
Cap, veh/h	452	717	145	249	388	156	251	311	526	402	421	484
Arrive On Green	0.16	0.23	0.23	0.08	0.15	0.15	0.08	0.16	0.16	0.13	0.22	0.22
Sat Flow, veh/h	1849	3059	619	1832	2549	1021	1849	1942	1650	1849	1942	1650
Grp Volume(v), veh/h	58	341	341	188	170	169	137	216	344	301	348	126
Grp Sat Flow(s),veh/h/ln	1849	1845	1833	1832	1827	1743	1849	1942	1650	1849	1942	1650
Q Serve(g_s), s	0.0	11.4	11.5	2.6	5.7	6.0	0.6	6.9	1.4	4.5	11.2	0.0
Cycle Q Clear(g_c), s	0.0	11.4	11.5	2.6	5.7	6.0	0.6	6.9	1.4	4.5	11.2	0.0
Prop In Lane	1.00		0.34	1.00		0.59	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	452	432	430	249	278	266	251	311	526	402	421	484
V/C Ratio(X)	0.13	0.79	0.79	0.75	0.61	0.64	0.55	0.69	0.65	0.75	0.83	0.26
Avail Cap(c_a), veh/h	497	534	531	445	529	505	533	533	714	579	533	579
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	21.9	23.6	23.6	28.4	26.0	26.1	28.0	26.0	19.2	25.2	24.5	17.7
Incr Delay (d2), s/veh	0.1	6.3	6.6	4.6	2.2	2.5	1.9	2.8	1.4	3.2	8.4	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.9	6.5	6.6	3.6	3.0	3.0	2.5	3.9	5.4	5.5	7.0	1.8
LnGrp Delay(d),s/veh	22.0	29.9	30.2	33.0	28.1	28.6	29.9	28.8	20.6	28.4	32.9	18.0
LnGrp LOS	C	C	C	C	C	C	C	C	C	C	C	B
Approach Vol, veh/h		740			527			697			775	
Approach Delay, s/veh		29.4			30.0			25.0			28.7	
Approach LOS		C			C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	16.9	16.5	11.5	20.7	11.5	21.9	15.2	17.0
Change Period (Y+Rc), s	* 6.5	* 6.5	* 6.5	* 6.5	* 6.5	* 6.5	* 6.5	* 6.5
Max Green Setting (Gmax), s	* 12	* 19	* 15	* 18	* 12	* 19	* 15	* 18
Max Q Clear Time (g_c+I1), s	2.0	8.0	2.6	13.2	4.6	13.5	6.5	8.9
Green Ext Time (p_c), s	0.5	1.3	1.0	1.0	0.4	1.9	0.9	1.6

Intersection Summary	
HCM 2010 Ctrl Delay	28.2
HCM 2010 LOS	C

Notes

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	369	200	96	276	553	367
Future Volume (veh/h)	369	200	96	276	553	367
Number	7	14	5	2	6	16
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1886	1886	1942	1942	1886	1886
Adj Flow Rate, veh/h	424	230	119	341	643	427
Adj No. of Lanes	2	1	1	2	2	1
Peak Hour Factor	0.87	0.87	0.81	0.81	0.86	0.86
Percent Heavy Veh, %	5	5	4	4	5	5
Cap, veh/h	654	741	677	2620	1438	920
Arrive On Green	0.19	0.20	0.26	0.71	0.40	0.39
Sat Flow, veh/h	3484	1603	1850	3788	3677	1603
Grp Volume(v), veh/h	424	230	119	341	643	427
Grp Sat Flow(s),veh/h/ln	1742	1603	1850	1845	1791	1603
Q Serve(g_s), s	9.0	0.0	0.0	2.4	10.5	12.4
Cycle Q Clear(g_c), s	9.0	0.0	0.0	2.4	10.5	12.4
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	654	741	677	2620	1438	920
V/C Ratio(X)	0.65	0.31	0.18	0.13	0.45	0.46
Avail Cap(c_a), veh/h	1076	935	677	2620	1438	920
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	30.1	13.5	14.9	3.7	17.5	9.9
Incr Delay (d2), s/veh	1.1	0.2	0.2	0.1	1.0	1.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.4	5.1	1.9	1.2	5.4	8.3
LnGrp Delay(d),s/veh	31.1	13.7	15.1	3.8	18.5	11.6
LnGrp LOS	C	B	B	A	B	B
Approach Vol, veh/h	654			460	1070	
Approach Delay, s/veh	25.0			6.7	15.7	
Approach LOS	C			A	B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		
Phs Duration (G+Y+Rc), s		60.7		19.3	24.7	36.0		
Change Period (Y+Rc), s		7.2		6.4	7.2	7.2		
Max Green Setting (Gmax), s		43.8		22.6	7.8	28.8		
Max Q Clear Time (g_c+I1), s		4.4		11.0	2.0	14.4		
Green Ext Time (p_c), s		2.8		1.9	1.3	4.8		

Intersection Summary	
HCM 2010 Ctrl Delay	16.6
HCM 2010 LOS	B

Intersection	
Int Delay, s/veh	9.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	366	560	1	1	135	9	0	0	0	44	1	233
Future Vol, veh/h	366	560	1	1	135	9	0	0	0	44	1	233
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	300	-	375	150	-	250	-	-	-	-	-	250
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	86	86	86	86	86	86	92	92	92	95	95	95
Heavy Vehicles, %	3	3	3	7	7	7	2	2	2	3	3	3
Mvmt Flow	426	651	1	1	157	10	0	0	0	46	1	245

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	157	0	0	651	0	0	1662	1661	651	1661	1661	157
Stage 1	-	-	-	-	-	-	1502	1502	-	159	159	-
Stage 2	-	-	-	-	-	-	160	159	-	1502	1502	-
Critical Hdwy	4.13	-	-	4.17	-	-	7.12	6.52	6.22	7.13	6.53	6.23
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.13	5.53	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.13	5.53	-
Follow-up Hdwy	2.227	-	-	2.263	-	-	3.518	4.018	3.318	3.527	4.027	3.327
Pot Cap-1 Maneuver	1417	-	-	912	-	-	77	97	469	77	97	886
Stage 1	-	-	-	-	-	-	152	185	-	841	764	-
Stage 2	-	-	-	-	-	-	842	766	-	151	184	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1417	-	-	912	-	-	42	68	469	59	68	886
Mov Cap-2 Maneuver	-	-	-	-	-	-	42	68	-	59	68	-
Stage 1	-	-	-	-	-	-	106	129	-	588	763	-
Stage 2	-	-	-	-	-	-	607	765	-	106	129	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	3.4	0.1	0	37.5
HCM LOS			A	E

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	-	1417	-	-	912	-	-	59	886
HCM Lane V/C Ratio	-	0.3	-	-	0.001	-	-	0.803	0.277
HCM Control Delay (s)	0	8.6	-	-	9	-	-	176.6	10.6
HCM Lane LOS	A	A	-	-	A	-	-	F	B
HCM 95th %tile Q(veh)	-	1.3	-	-	0	-	-	3.5	1.1

Intersection	
Int Delay, s/veh	5.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	156	32	107	0	0	268
Future Vol, veh/h	156	32	107	0	0	268
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	210	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	74	74	84	84	85	85
Heavy Vehicles, %	4	4	4	4	1	1
Mvmt Flow	211	43	127	0	0	315

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	442	127	0	-	-	-
Stage 1	127	-	-	-	-	-
Stage 2	315	-	-	-	-	-
Critical Hdwy	6.44	6.24	-	-	-	-
Critical Hdwy Stg 1	5.44	-	-	-	-	-
Critical Hdwy Stg 2	5.44	-	-	-	-	-
Follow-up Hdwy	3.536	3.336	-	-	-	-
Pot Cap-1 Maneuver	569	918	-	0	0	-
Stage 1	894	-	-	0	0	-
Stage 2	735	-	-	0	0	-
Platoon blocked, %			-			-
Mov Cap-1 Maneuver	569	918	-	-	-	-
Mov Cap-2 Maneuver	569	-	-	-	-	-
Stage 1	894	-	-	-	-	-
Stage 2	735	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	14	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	WBLn1	WBLn2	SBT
Capacity (veh/h)	-	569	918	-
HCM Lane V/C Ratio	-	0.37	0.047	-
HCM Control Delay (s)	-	15	9.1	-
HCM Lane LOS	-	C	A	-
HCM 95th %tile Q(veh)	-	1.7	0.1	-

Intersection	
Int Delay, s/veh	3.8

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	8	174	10	99	402	22
Future Vol, veh/h	8	174	10	99	402	22
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	87	87	84	84	81	81
Heavy Vehicles, %	1	1	4	4	2	2
Mvmt Flow	9	200	12	118	496	27

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	652	510	523	0	-	0
Stage 1	510	-	-	-	-	-
Stage 2	142	-	-	-	-	-
Critical Hdwy	6.41	6.21	4.14	-	-	-
Critical Hdwy Stg 1	5.41	-	-	-	-	-
Critical Hdwy Stg 2	5.41	-	-	-	-	-
Follow-up Hdwy	3.509	3.309	2.236	-	-	-
Pot Cap-1 Maneuver	434	565	1033	-	-	-
Stage 1	605	-	-	-	-	-
Stage 2	887	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	429	565	1033	-	-	-
Mov Cap-2 Maneuver	429	-	-	-	-	-
Stage 1	605	-	-	-	-	-
Stage 2	876	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	15.3	0.8	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1033	-	557	-	-
HCM Lane V/C Ratio	0.012	-	0.376	-	-
HCM Control Delay (s)	8.5	0	15.3	-	-
HCM Lane LOS	A	A	C	-	-
HCM 95th %tile Q(veh)	0	-	1.7	-	-

Intersection	
Int Delay, s/veh	0.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	5	834	388	9	5	3
Future Vol, veh/h	5	834	388	9	5	3
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	150	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	86	86	93	93	92	92
Heavy Vehicles, %	0	3	4	0	2	2
Mvmt Flow	6	970	417	10	5	3

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	427	0	-	0	919	213
Stage 1	-	-	-	-	422	-
Stage 2	-	-	-	-	497	-
Critical Hdwy	4.1	-	-	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	2.2	-	-	-	3.52	3.32
Pot Cap-1 Maneuver	1143	-	-	-	270	792
Stage 1	-	-	-	-	629	-
Stage 2	-	-	-	-	577	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1143	-	-	-	269	792
Mov Cap-2 Maneuver	-	-	-	-	396	-
Stage 1	-	-	-	-	629	-
Stage 2	-	-	-	-	574	-

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

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1143	-	-	-	487
HCM Lane V/C Ratio	0.005	-	-	-	0.018
HCM Control Delay (s)	8.2	-	-	-	12.5
HCM Lane LOS	A	-	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.1

Intersection	
Int Delay, s/veh	0.7

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	6	833	373	11	43	24
Future Vol, veh/h	6	833	373	11	43	24
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	150	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	86	86	93	93	92	92
Heavy Vehicles, %	0	3	4	0	2	2
Mvmt Flow	7	969	401	12	47	26

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	413	0	-	0	905	206
Stage 1	-	-	-	-	407	-
Stage 2	-	-	-	-	498	-
Critical Hdwy	4.1	-	-	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	2.2	-	-	-	3.52	3.32
Pot Cap-1 Maneuver	1157	-	-	-	276	800
Stage 1	-	-	-	-	641	-
Stage 2	-	-	-	-	576	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1157	-	-	-	274	800
Mov Cap-2 Maneuver	-	-	-	-	400	-
Stage 1	-	-	-	-	641	-
Stage 2	-	-	-	-	573	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	13.7
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1157	-	-	-	487
HCM Lane V/C Ratio	0.006	-	-	-	0.15
HCM Control Delay (s)	8.1	-	-	-	13.7
HCM Lane LOS	A	-	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.5

Intersection	
Int Delay, s/veh	1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	7	869	354	15	55	30
Future Vol, veh/h	7	869	354	15	55	30
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	200	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	86	86	93	93	92	92
Heavy Vehicles, %	0	3	4	0	2	2
Mvmt Flow	8	1010	381	16	60	33

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	397	0	-	0	911	389
Stage 1	-	-	-	-	389	-
Stage 2	-	-	-	-	522	-
Critical Hdwy	4.1	-	-	-	6.63	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.83	-
Follow-up Hdwy	2.2	-	-	-	3.519	3.319
Pot Cap-1 Maneuver	1173	-	-	-	289	658
Stage 1	-	-	-	-	684	-
Stage 2	-	-	-	-	561	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1173	-	-	-	287	658
Mov Cap-2 Maneuver	-	-	-	-	409	-
Stage 1	-	-	-	-	684	-
Stage 2	-	-	-	-	557	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	14.5
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1173	-	-	-	472
HCM Lane V/C Ratio	0.007	-	-	-	0.196
HCM Control Delay (s)	8.1	-	-	-	14.5
HCM Lane LOS	A	-	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.7

Intersection	
Int Delay, s/veh	0.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	0	924	367	1	3	2
Future Vol, veh/h	0	924	367	1	3	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	150	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	86	86	93	93	92	92
Heavy Vehicles, %	0	3	4	0	2	2
Mvmt Flow	0	1074	395	1	3	2

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	396	0	-	0	1469	395
Stage 1	-	-	-	-	395	-
Stage 2	-	-	-	-	1074	-
Critical Hdwy	4.1	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.2	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1174	-	-	-	140	654
Stage 1	-	-	-	-	681	-
Stage 2	-	-	-	-	328	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1174	-	-	-	140	654
Mov Cap-2 Maneuver	-	-	-	-	255	-
Stage 1	-	-	-	-	681	-
Stage 2	-	-	-	-	328	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	15.9
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1174	-	-	-	337
HCM Lane V/C Ratio	-	-	-	-	0.016
HCM Control Delay (s)	0	-	-	-	15.9
HCM Lane LOS	A	-	-	-	C
HCM 95th %tile Q(veh)	0	-	-	-	0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	305	565	212	349	622	315	256	362	245	220	300	196
Future Volume (veh/h)	305	565	212	349	622	315	256	362	245	220	300	196
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1980	1980	2000	1980	1980	2000	1980	1980	1980	1980	1980	1980
Adj Flow Rate, veh/h	355	657	247	392	699	354	284	402	272	244	333	218
Adj No. of Lanes	1	2	0	1	2	0	1	1	1	1	1	1
Peak Hour Factor	0.86	0.86	0.86	0.89	0.89	0.89	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	1	1	1	1	1	1	1	1	1	1	1	1
Cap, veh/h	382	713	268	417	667	338	345	450	668	257	386	629
Arrive On Green	0.17	0.27	0.27	0.18	0.28	0.28	0.14	0.23	0.23	0.10	0.19	0.19
Sat Flow, veh/h	1886	2678	1006	1886	2420	1225	1886	1980	1683	1886	1980	1683
Grp Volume(v), veh/h	355	462	442	392	543	510	284	402	272	244	333	218
Grp Sat Flow(s),veh/h/ln	1886	1881	1803	1886	1881	1764	1886	1980	1683	1886	1980	1683
Q Serve(g_s), s	17.6	27.7	27.7	18.8	32.0	32.0	11.3	22.8	0.0	11.1	18.9	0.0
Cycle Q Clear(g_c), s	17.6	27.7	27.7	18.8	32.0	32.0	11.3	22.8	0.0	11.1	18.9	0.0
Prop In Lane	1.00		0.56	1.00		0.69	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	382	501	480	417	519	486	345	450	668	257	386	629
V/C Ratio(X)	0.93	0.92	0.92	0.94	1.05	1.05	0.82	0.89	0.41	0.95	0.86	0.35
Avail Cap(c_a), veh/h	387	519	497	417	519	486	345	512	721	257	512	736
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	45.8	41.4	41.4	44.9	42.0	42.0	46.3	43.5	25.2	50.2	45.2	26.1
Incr Delay (d2), s/veh	28.4	21.5	22.3	29.4	52.5	54.0	14.7	16.6	0.4	42.3	11.2	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	14.2	17.4	16.7	15.7	24.1	22.8	10.2	14.6	6.3	10.8	11.6	5.0
LnGrp Delay(d),s/veh	74.2	62.9	63.7	74.3	94.5	96.0	60.9	60.1	25.6	92.5	56.4	26.5
LnGrp LOS	E	E	E	E	F	F	E	E	C	F	E	C
Approach Vol, veh/h		1259			1445			958			795	
Approach Delay, s/veh		66.4			89.5			50.5			59.3	
Approach LOS		E			F			D			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	26.2	38.5	22.2	29.1	27.3	37.4	18.5	32.9
Change Period (Y+Rc), s	* 6.5	* 6.5	* 6.5	* 6.5	* 6.5	* 6.5	* 6.5	* 6.5
Max Green Setting (Gmax), s	* 20	* 32	* 12	* 30	* 20	* 32	* 12	* 30
Max Q Clear Time (g_c+I1), s	19.6	34.0	13.3	20.9	20.8	29.7	13.1	24.8
Green Ext Time (p_c), s	0.1	0.0	0.0	1.7	0.0	1.2	0.0	1.5

Intersection Summary	
HCM 2010 Ctrl Delay	69.2
HCM 2010 LOS	E

Notes

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	534	225	269	696	537	366
Future Volume (veh/h)	534	225	269	696	537	366
Number	7	14	5	2	6	16
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1980	1980	2000	2000	1980	1980
Adj Flow Rate, veh/h	562	237	299	773	584	398
Adj No. of Lanes	2	1	1	2	2	1
Peak Hour Factor	0.95	0.95	0.90	0.90	0.92	0.92
Percent Heavy Veh, %	0	0	1	1	0	0
Cap, veh/h	787	778	664	2593	1510	1012
Arrive On Green	0.22	0.23	0.23	0.68	0.40	0.39
Sat Flow, veh/h	3658	1683	1905	3900	3861	1683
Grp Volume(v), veh/h	562	237	299	773	584	398
Grp Sat Flow(s),veh/h/ln	1829	1683	1905	1900	1881	1683
Q Serve(g_s), s	11.4	0.0	0.4	6.5	8.8	9.9
Cycle Q Clear(g_c), s	11.4	0.0	0.4	6.5	8.8	9.9
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	787	778	664	2593	1510	1012
V/C Ratio(X)	0.71	0.30	0.45	0.30	0.39	0.39
Avail Cap(c_a), veh/h	992	873	664	2593	1510	1012
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	29.1	13.5	19.6	5.1	17.0	8.3
Incr Delay (d2), s/veh	1.8	0.2	0.7	0.3	0.8	1.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.0	5.2	5.2	3.4	4.7	7.3
LnGrp Delay(d),s/veh	30.9	13.7	20.3	5.4	17.7	9.5
LnGrp LOS	C	B	C	A	B	A
Approach Vol, veh/h	799			1072	982	
Approach Delay, s/veh	25.8			9.5	14.4	
Approach LOS	C			A	B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		
Phs Duration (G+Y+Rc), s		58.5		21.5	22.5	36.0		
Change Period (Y+Rc), s		7.2		6.4	7.2	7.2		
Max Green Setting (Gmax), s		46.8		19.6	10.8	28.8		
Max Q Clear Time (g_c+I1), s		8.5		13.4	2.4	11.9		
Green Ext Time (p_c), s		7.6		1.7	4.0	4.6		

Intersection Summary	
HCM 2010 Ctrl Delay	15.8
HCM 2010 LOS	B

Intersection	
Int Delay, s/veh	62.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	438	299	22	15	549	59	8	1	3	6	12	395
Future Vol, veh/h	438	299	22	15	549	59	8	1	3	6	12	395
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	300	-	375	150	-	250	-	-	-	-	-	250
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	87	87	87	86	86	86	60	60	60	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	0	0	0	1	1	1
Mvmt Flow	503	344	25	17	638	69	13	2	5	7	13	429

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	638	0	0	344	0	0	2031	2024	344	2027	2024	638
Stage 1	-	-	-	-	-	-	1351	1351	-	673	673	-
Stage 2	-	-	-	-	-	-	680	673	-	1354	1351	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.1	6.5	6.2	7.11	6.51	6.21
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.11	5.51	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.11	5.51	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.5	4	3.3	3.509	4.009	3.309
Pot Cap-1 Maneuver	946	-	-	1215	-	-	43	59	703	43	58	478
Stage 1	-	-	-	-	-	-	187	221	-	446	456	-
Stage 2	-	-	-	-	-	-	444	457	-	186	220	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	946	-	-	1215	-	-	~ 2	27	703	23	27	478
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 2	27	-	23	27	-
Stage 1	-	-	-	-	-	-	88	103	-	209	450	-
Stage 2	-	-	-	-	-	-	43	451	-	85	103	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	7.5	0.2	$ 4766	60.8
HCM LOS			F	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	3	946	-	-	1215	-	-	26	478
HCM Lane V/C Ratio	6.667	0.532	-	-	0.014	-	-	0.753	0.898
HCM Control Delay (s)	$ 4766	13	-	-	8	-	-	$ 311.4	49.4
HCM Lane LOS	F	B	-	-	A	-	-	F	E
HCM 95th %tile Q(veh)	4	3.2	-	-	0	-	-	2.3	10

Notes

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

Intersection	
Int Delay, s/veh	12.6

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	365	166	243	0	0	204
Future Vol, veh/h	365	166	243	0	0	204
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	210	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	91	91	85	85
Heavy Vehicles, %	0	0	0	0	3	3
Mvmt Flow	397	180	267	0	0	240

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	507	267	0	-	-	-
Stage 1	267	-	-	-	-	-
Stage 2	240	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	-	-
Pot Cap-1 Maneuver	529	777	-	0	0	-
Stage 1	782	-	-	0	0	-
Stage 2	805	-	-	0	0	-
Platoon blocked, %			-			-
Mov Cap-1 Maneuver	529	777	-	-	-	-
Mov Cap-2 Maneuver	529	-	-	-	-	-
Stage 1	782	-	-	-	-	-
Stage 2	805	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	23.7	0	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	WBLn1	WBLn2	SBT
Capacity (veh/h)	-	529	777	-
HCM Lane V/C Ratio	-	0.75	0.232	-
HCM Control Delay (s)	-	29.5	11	-
HCM Lane LOS	-	D	B	-
HCM 95th %tile Q(veh)	-	6.5	0.9	-

Intersection	
Int Delay, s/veh	1.7

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	2	74	64	241	470	99
Future Vol, veh/h	2	74	64	241	470	99
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	91	91	90	90
Heavy Vehicles, %	0	0	0	0	1	1
Mvmt Flow	2	80	70	265	522	110

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	982	577	632	0	-	0
Stage 1	577	-	-	-	-	-
Stage 2	405	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	279	520	960	-	-	-
Stage 1	566	-	-	-	-	-
Stage 2	678	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	255	520	960	-	-	-
Mov Cap-2 Maneuver	255	-	-	-	-	-
Stage 1	566	-	-	-	-	-
Stage 2	620	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	13.5	1.9	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	960	-	506	-	-
HCM Lane V/C Ratio	0.073	-	0.162	-	-
HCM Control Delay (s)	9	0	13.5	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0.2	-	0.6	-	-

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	7	771	896	9	11	9
Future Vol, veh/h	7	771	896	9	11	9
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	150	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	87	87	88	88	92	92
Heavy Vehicles, %	0	1	1	0	2	2
Mvmt Flow	8	886	1018	10	12	10

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	1028	0	-	0	1482	514
Stage 1	-	-	-	-	1023	-
Stage 2	-	-	-	-	459	-
Critical Hdwy	4.1	-	-	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	2.2	-	-	-	3.52	3.32
Pot Cap-1 Maneuver	683	-	-	-	116	505
Stage 1	-	-	-	-	308	-
Stage 2	-	-	-	-	603	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	683	-	-	-	115	505
Mov Cap-2 Maneuver	-	-	-	-	231	-
Stage 1	-	-	-	-	308	-
Stage 2	-	-	-	-	596	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	17.7
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	683	-	-	-	306
HCM Lane V/C Ratio	0.012	-	-	-	0.071
HCM Control Delay (s)	10.3	-	-	-	17.7
HCM Lane LOS	B	-	-	-	C
HCM 95th %tile Q(veh)	0	-	-	-	0.2

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	28	754	889	36	19	16
Future Vol, veh/h	28	754	889	36	19	16
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	150	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	87	87	88	88	92	92
Heavy Vehicles, %	0	1	1	0	2	2
Mvmt Flow	32	867	1010	41	21	17

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	1051	0	-	0	1529	526
Stage 1	-	-	-	-	1031	-
Stage 2	-	-	-	-	498	-
Critical Hdwy	4.1	-	-	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	2.2	-	-	-	3.52	3.32
Pot Cap-1 Maneuver	670	-	-	-	108	496
Stage 1	-	-	-	-	305	-
Stage 2	-	-	-	-	576	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	670	-	-	-	103	496
Mov Cap-2 Maneuver	-	-	-	-	221	-
Stage 1	-	-	-	-	305	-
Stage 2	-	-	-	-	548	-

Approach	EB	WB	SB
HCM Control Delay, s	0.4	0	18.9
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	670	-	-	-	296
HCM Lane V/C Ratio	0.048	-	-	-	0.129
HCM Control Delay (s)	10.6	-	-	-	18.9
HCM Lane LOS	B	-	-	-	C
HCM 95th %tile Q(veh)	0.2	-	-	-	0.4

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	38	735	905	46	25	20
Future Vol, veh/h	38	735	905	46	25	20
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	200	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	87	87	88	88	92	92
Heavy Vehicles, %	0	1	1	0	2	2
Mvmt Flow	44	845	1028	52	27	22

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	1081	0	-	0	1565	1055
Stage 1	-	-	-	-	1055	-
Stage 2	-	-	-	-	510	-
Critical Hdwy	4.1	-	-	-	7.33	6.23
Critical Hdwy Stg 1	-	-	-	-	6.13	-
Critical Hdwy Stg 2	-	-	-	-	6.53	-
Follow-up Hdwy	2.2	-	-	-	3.519	3.319
Pot Cap-1 Maneuver	653	-	-	-	83	273
Stage 1	-	-	-	-	272	-
Stage 2	-	-	-	-	515	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	653	-	-	-	79	273
Mov Cap-2 Maneuver	-	-	-	-	183	-
Stage 1	-	-	-	-	254	-
Stage 2	-	-	-	-	480	-

Approach	EB	WB	SB
HCM Control Delay, s	0.5	0	26.7
HCM LOS			D

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	653	-	-	-	214
HCM Lane V/C Ratio	0.067	-	-	-	0.229
HCM Control Delay (s)	10.9	-	-	-	26.7
HCM Lane LOS	B	-	-	-	D
HCM 95th %tile Q(veh)	0.2	-	-	-	0.9

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	2	758	950	2	1	1
Future Vol, veh/h	2	758	950	2	1	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	150	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	87	87	88	88	92	92
Heavy Vehicles, %	0	1	1	0	2	2
Mvmt Flow	2	871	1080	2	1	1

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	1082	0	-	0	1957	1081
Stage 1	-	-	-	-	1081	-
Stage 2	-	-	-	-	876	-
Critical Hdwy	4.1	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.2	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	652	-	-	-	70	265
Stage 1	-	-	-	-	326	-
Stage 2	-	-	-	-	407	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	652	-	-	-	70	265
Mov Cap-2 Maneuver	-	-	-	-	197	-
Stage 1	-	-	-	-	326	-
Stage 2	-	-	-	-	406	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	21.1
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	652	-	-	-	226
HCM Lane V/C Ratio	0.004	-	-	-	0.01
HCM Control Delay (s)	10.5	-	-	-	21.1
HCM Lane LOS	B	-	-	-	C
HCM 95th %tile Q(veh)	0	-	-	-	0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	52	505	102	177	226	93	103	162	258	280	324	117
Future Volume (veh/h)	52	505	102	177	226	93	103	162	258	280	324	117
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1942	1942	1942	1923	1923	1923	1942	1942	1942	1942	1942	1942
Adj Flow Rate, veh/h	58	567	115	188	240	99	137	216	344	301	348	126
Adj No. of Lanes	1	2	1	1	2	1	1	1	1	1	1	1
Peak Hour Factor	0.89	0.89	0.89	0.94	0.94	0.94	0.75	0.75	0.75	0.93	0.93	0.93
Percent Heavy Veh, %	3	3	3	4	4	4	3	3	3	3	3	3
Cap, veh/h	475	813	585	266	571	383	257	313	500	408	422	488
Arrive On Green	0.14	0.22	0.22	0.08	0.16	0.16	0.08	0.16	0.16	0.13	0.22	0.22
Sat Flow, veh/h	1849	3689	1650	1832	3654	1635	1849	1942	1650	1849	1942	1650
Grp Volume(v), veh/h	58	567	115	188	240	99	137	216	344	301	348	126
Grp Sat Flow(s),veh/h/ln	1849	1845	1650	1832	1827	1635	1849	1942	1650	1849	1942	1650
Q Serve(g_s), s	0.0	9.1	0.0	1.9	3.8	0.0	0.5	6.7	2.6	4.2	10.9	0.0
Cycle Q Clear(g_c), s	0.0	9.1	0.0	1.9	3.8	0.0	0.5	6.7	2.6	4.2	10.9	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	475	813	585	266	571	383	257	313	500	408	422	488
V/C Ratio(X)	0.12	0.70	0.20	0.71	0.42	0.26	0.53	0.69	0.69	0.74	0.82	0.26
Avail Cap(c_a), veh/h	544	1297	802	452	1284	702	474	531	686	521	531	580
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	19.6	23.0	14.3	27.4	24.4	20.0	27.2	25.3	19.6	24.4	23.9	17.2
Incr Delay (d2), s/veh	0.1	1.1	0.2	3.4	0.5	0.4	1.7	2.7	1.7	4.1	8.3	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	4.7	1.4	3.4	1.9	1.5	2.4	3.8	1.4	5.4	6.8	1.7
LnGrp Delay(d),s/veh	19.8	24.1	14.5	30.8	24.9	20.3	28.9	28.1	21.3	28.5	32.2	17.5
LnGrp LOS	B	C	B	C	C	C	C	C	C	C	C	B
Approach Vol, veh/h		740			527			697			775	
Approach Delay, s/veh		22.3			26.2			24.9			28.4	
Approach LOS		C			C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	15.6	16.5	11.5	20.4	11.5	20.6	15.1	16.8
Change Period (Y+Rc), s	* 6.5	* 6.5	* 6.5	* 6.5	* 6.5	* 6.5	* 6.5	* 6.5
Max Green Setting (Gmax), s	* 12	* 23	* 13	* 18	* 12	* 23	* 13	* 18
Max Q Clear Time (g_c+I1), s	2.0	5.8	2.5	12.9	3.9	11.1	6.2	8.7
Green Ext Time (p_c), s	0.5	1.5	0.9	1.0	0.4	3.0	0.7	1.6

Intersection Summary	
HCM 2010 Ctrl Delay	25.4
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	366	560	1	1	135	9	0	0	0	44	1	233
Future Volume (veh/h)	366	560	1	1	135	9	0	0	0	44	1	233
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1942	1942	1942	1869	1869	1869	2000	1961	2000	2000	1942	1942
Adj Flow Rate, veh/h	426	651	1	1	157	10	0	0	0	46	1	245
Adj No. of Lanes	1	1	1	1	1	1	0	1	0	0	1	1
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.92	0.92	0.92	0.95	0.95	0.95
Percent Heavy Veh, %	3	3	3	7	7	7	2	2	2	3	3	3
Cap, veh/h	961	1407	1196	257	649	552	0	195	0	238	4	653
Arrive On Green	0.30	0.72	0.72	0.35	0.35	0.35	0.00	0.00	0.00	0.10	0.10	0.10
Sat Flow, veh/h	1849	1942	1650	741	1869	1589	0	1961	0	1368	42	1650
Grp Volume(v), veh/h	426	651	1	1	157	10	0	0	0	47	0	245
Grp Sat Flow(s),veh/h/ln	1849	1942	1650	741	1869	1589	0	1961	0	1410	0	1650
Q Serve(g_s), s	0.0	9.7	0.0	0.1	4.2	0.3	0.0	0.0	0.0	2.1	0.0	0.0
Cycle Q Clear(g_c), s	0.0	9.7	0.0	9.8	4.2	0.3	0.0	0.0	0.0	2.2	0.0	0.0
Prop In Lane	1.00		1.00	1.00		1.00	0.00		0.00	0.98		1.00
Lane Grp Cap(c), veh/h	961	1407	1196	257	649	552	0	195	0	242	0	653
V/C Ratio(X)	0.44	0.46	0.00	0.00	0.24	0.02	0.00	0.00	0.00	0.19	0.00	0.38
Avail Cap(c_a), veh/h	961	1407	1196	257	649	552	0	235	0	271	0	687
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	10.7	4.0	2.7	22.0	16.3	15.0	0.0	0.0	0.0	29.3	0.0	15.0
Incr Delay (d2), s/veh	0.3	1.1	0.0	0.0	0.9	0.1	0.0	0.0	0.0	0.4	0.0	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.6	5.5	0.0	0.0	2.3	0.1	0.0	0.0	0.0	0.9	0.0	3.4
LnGrp Delay(d),s/veh	11.1	5.1	2.7	22.0	17.2	15.1	0.0	0.0	0.0	29.7	0.0	15.4
LnGrp LOS	B	A	A	C	B	B				C		B
Approach Vol, veh/h		1078			168			0			292	
Approach Delay, s/veh		7.5			17.1			0.0			17.7	
Approach LOS		A			B						B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		8
Phs Duration (G+Y+Rc), s		56.4		13.6	26.4	30.0		13.6
Change Period (Y+Rc), s		* 5.7		* 6.6	* 5.7	* 5.7		* 6.6
Max Green Setting (Gmax), s		* 49		* 8.4	* 19	* 24		* 8.4
Max Q Clear Time (g_c+I1), s		11.7		4.2	2.0	11.8		0.0
Green Ext Time (p_c), s		6.0		0.4	5.1	0.6		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	10.4
HCM 2010 LOS	B

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	305	565	212	349	622	315	256	362	245	220	300	196
Future Volume (veh/h)	305	565	212	349	622	315	256	362	245	220	300	196
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1980	1980	1980	1980	1980	1980	1980	1980	1980	1980	1980	1980
Adj Flow Rate, veh/h	355	657	247	392	699	354	284	402	272	244	333	218
Adj No. of Lanes	1	2	1	1	2	1	1	1	1	1	1	1
Peak Hour Factor	0.86	0.86	0.86	0.89	0.89	0.89	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	1	1	1	1	1	1	1	1	1	1	1	1
Cap, veh/h	411	820	559	443	864	633	380	458	673	289	394	638
Arrive On Green	0.17	0.22	0.22	0.18	0.23	0.23	0.15	0.23	0.23	0.11	0.20	0.20
Sat Flow, veh/h	1886	3762	1683	1886	3762	1683	1886	1980	1683	1886	1980	1683
Grp Volume(v), veh/h	355	657	247	392	699	354	284	402	272	244	333	218
Grp Sat Flow(s),veh/h/ln	1886	1881	1683	1886	1881	1683	1886	1980	1683	1886	1980	1683
Q Serve(g_s), s	13.3	16.8	0.1	14.8	17.8	2.0	8.8	19.8	0.0	8.8	16.4	0.0
Cycle Q Clear(g_c), s	13.3	16.8	0.1	14.8	17.8	2.0	8.8	19.8	0.0	8.8	16.4	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	411	820	559	443	864	633	380	458	673	289	394	638
V/C Ratio(X)	0.86	0.80	0.44	0.88	0.81	0.56	0.75	0.88	0.40	0.85	0.85	0.34
Avail Cap(c_a), veh/h	531	1021	649	541	1021	704	391	537	740	362	537	760
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	38.7	37.6	26.5	38.0	36.9	25.0	38.9	37.6	21.8	42.3	39.1	22.5
Incr Delay (d2), s/veh	11.2	3.8	0.6	14.0	4.3	0.8	7.5	13.6	0.4	13.9	9.0	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	10.8	9.1	5.4	12.3	9.7	7.6	8.3	12.6	5.4	7.8	10.0	4.4
LnGrp Delay(d),s/veh	49.9	41.3	27.1	51.9	41.2	25.8	46.4	51.2	22.2	56.3	48.1	22.8
LnGrp LOS	D	D	C	D	D	C	D	D	C	E	D	C
Approach Vol, veh/h		1259			1445			958			795	
Approach Delay, s/veh		40.9			40.3			41.5			43.7	
Approach LOS		D			D			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	23.6	29.8	21.4	26.7	24.7	28.6	18.1	30.0
Change Period (Y+Rc), s	* 6.5	* 6.5	* 6.5	* 6.5	* 6.5	* 6.5	* 6.5	* 6.5
Max Green Setting (Gmax), s	* 24	* 28	* 16	* 28	* 24	* 28	* 16	* 28
Max Q Clear Time (g_c+I1), s	15.3	19.8	10.8	18.4	16.8	18.8	10.8	21.8
Green Ext Time (p_c), s	1.6	3.4	0.8	1.7	1.5	3.3	0.8	1.6

Intersection Summary	
HCM 2010 Ctrl Delay	41.4
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	438	299	22	15	549	59	8	1	3	6	12	395
Future Volume (veh/h)	438	299	22	15	549	59	8	1	3	6	12	395
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1961	1961	1961	1961	1961	1961	2000	2000	2000	2000	1980	1980
Adj Flow Rate, veh/h	503	344	25	17	638	69	13	2	5	7	13	429
Adj No. of Lanes	1	1	1	1	1	1	0	1	0	0	1	1
Peak Hour Factor	0.87	0.87	0.87	0.86	0.86	0.86	0.60	0.60	0.60	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	0	0	0	1	1	1
Cap, veh/h	603	1420	1207	466	821	698	148	31	32	105	148	546
Arrive On Green	0.22	0.72	0.72	0.42	0.42	0.42	0.10	0.10	0.10	0.10	0.10	0.10
Sat Flow, veh/h	1867	1961	1667	1009	1961	1667	633	313	315	357	1481	1683
Grp Volume(v), veh/h	503	344	25	17	638	69	20	0	0	20	0	429
Grp Sat Flow(s),veh/h/ln	1867	1961	1667	1009	1961	1667	1262	0	0	1838	0	1683
Q Serve(g_s), s	10.6	4.1	0.3	0.8	19.6	1.8	0.0	0.0	0.0	0.0	0.0	0.5
Cycle Q Clear(g_c), s	10.6	4.1	0.3	4.9	19.6	1.8	0.7	0.0	0.0	0.6	0.0	0.5
Prop In Lane	1.00		1.00	1.00		1.00	0.65		0.25	0.35		1.00
Lane Grp Cap(c), veh/h	603	1420	1207	466	821	698	211	0	0	253	0	546
V/C Ratio(X)	0.83	0.24	0.02	0.04	0.78	0.10	0.09	0.00	0.00	0.08	0.00	0.79
Avail Cap(c_a), veh/h	603	1420	1207	466	821	698	234	0	0	288	0	580
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	22.6	3.2	2.7	14.6	17.5	12.3	28.6	0.0	0.0	28.6	0.0	21.4
Incr Delay (d2), s/veh	9.9	0.4	0.0	0.1	7.1	0.3	0.2	0.0	0.0	0.1	0.0	6.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	10.6	2.4	0.1	0.2	12.1	0.9	0.4	0.0	0.0	0.4	0.0	8.4
LnGrp Delay(d),s/veh	32.5	3.6	2.7	14.7	24.7	12.6	28.8	0.0	0.0	28.8	0.0	28.2
LnGrp LOS	C	A	A	B	C	B	C			C		C
Approach Vol, veh/h		872			724			20			449	
Approach Delay, s/veh		20.2			23.3			28.8			28.2	
Approach LOS		C			C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		8
Phs Duration (G+Y+Rc), s		56.4		13.6	21.4	35.0		13.6
Change Period (Y+Rc), s		* 5.7		* 6.6	* 5.7	* 5.7		* 6.6
Max Green Setting (Gmax), s		* 49		* 8.4	* 14	* 29		* 8.4
Max Q Clear Time (g_c+I1), s		6.1		2.6	12.6	21.6		2.7
Green Ext Time (p_c), s		3.8		0.9	0.7	2.5		0.9

Intersection Summary	
HCM 2010 Ctrl Delay	23.1
HCM 2010 LOS	C

Notes

1: Whitmore Lake Road/Old US-23 & Grand River Avenue Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.3	0.0	2.6	0.0	0.7
Total Del/Veh (s)	33.5	32.2	28.2	33.1	31.9

2: Old US-23 & Spencer Road West Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	1.5	0.0	1.5	1.2
Total Del/Veh (s)	19.4	10.9	13.5	14.8

3: Bar None Drive/Pleasant Valley Road & Grand River Avenue Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.0	0.5	0.0	0.1
Total Del/Veh (s)	5.0	1.2	7.0	5.1

4: Pleasant Valley Road & WB I-96 Off-Ramp Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	0.9	0.0	0.2	0.4
Total Del/Veh (s)	7.0	0.2	1.4	3.1

5: Pleasant Valley Road & Culver Road Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	0.2	0.0	0.0	0.1
Total Del/Veh (s)	5.2	2.0	0.6	2.1

Total Zone Performance

Denied Del/Veh (s)	1.2
Total Del/Veh (s)	168.9

1: Whitmore Lake Road/Old US-23 & Grand River Avenue Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	1.0	0.0	6.4	0.0	1.7
Total Del/Veh (s)	51.5	76.1	59.9	52.8	61.7

2: Old US-23 & Spencer Road West Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	1.4	0.0	1.5	0.9
Total Del/Veh (s)	23.0	15.0	15.6	17.6

3: Bar None Drive/Pleasant Valley Road & Grand River Avenue Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.8	0.1	0.0	0.3
Total Del/Veh (s)	10.4	2.6	52.6	18.2	9.8

4: Pleasant Valley Road & WB I-96 Off-Ramp Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	1.5	0.0	0.2	0.9
Total Del/Veh (s)	9.7	0.4	1.9	5.9

5: Pleasant Valley Road & Culver Road Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	0.1	0.0	0.0	0.0
Total Del/Veh (s)	3.4	3.1	0.8	1.8

Total Zone Performance

Denied Del/Veh (s)	2.1
Total Del/Veh (s)	311.9

1: Whitmore Lake Road/Old US-23 & Grand River Avenue Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.8	0.0	2.7	0.0	0.8
Total Del/Veh (s)	26.5	28.2	27.7	36.3	30.2

2: Old US-23 & Spencer Road West Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	1.5	0.0	1.4	1.2
Total Del/Veh (s)	18.9	10.9	12.5	14.2

3: Bar None Drive/Pleasant Valley Road & Grand River Avenue Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.0	0.5	0.0	0.1
Total Del/Veh (s)	6.5	5.1	12.0	7.5

4: Pleasant Valley Road & WB I-96 Off-Ramp Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	0.9	0.0	0.2	0.4
Total Del/Veh (s)	6.8	0.1	1.3	3.0

5: Pleasant Valley Road & Culver Road Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	0.2	0.0	0.0	0.0
Total Del/Veh (s)	4.9	2.0	0.6	2.0

Total Zone Performance

Denied Del/Veh (s)	1.3
Total Del/Veh (s)	164.4

1: Whitmore Lake Road/Old US-23 & Grand River Avenue Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	1.5	0.0	2.4	0.0	1.0
Total Del/Veh (s)	41.9	41.7	44.3	43.2	42.6

2: Old US-23 & Spencer Road West Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	1.4	0.0	1.5	0.9
Total Del/Veh (s)	23.0	14.4	15.6	17.4

3: Bar None Drive/Pleasant Valley Road & Grand River Avenue Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.8	0.1	0.0	0.3
Total Del/Veh (s)	12.0	10.2	30.0	14.9	12.1

4: Pleasant Valley Road & WB I-96 Off-Ramp Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	1.4	0.0	0.2	0.8
Total Del/Veh (s)	10.5	0.4	2.0	6.3

5: Pleasant Valley Road & Culver Road Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	0.1	0.0	0.0	0.0
Total Del/Veh (s)	3.5	3.6	0.8	1.9

Total Zone Performance

Denied Del/Veh (s)	1.5
Total Del/Veh (s)	245.6

1: Whitmore Lake Road/Old US-23 & Grand River Avenue Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.4	0.0	2.7	0.1	0.7
Total Del/Veh (s)	33.5	32.3	27.7	36.3	32.9

2: Old US-23 & Spencer Road West Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	1.5	0.0	1.4	1.2
Total Del/Veh (s)	19.4	11.6	13.6	15.0

3: Bar None Drive/Pleasant Valley Road & Grand River Avenue Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.0	0.5	0.0	0.1
Total Del/Veh (s)	5.2	1.2	6.9	5.2

4: Pleasant Valley Road & WB I-96 Off-Ramp Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	0.9	0.0	0.2	0.4
Total Del/Veh (s)	6.9	0.2	1.4	2.9

5: Pleasant Valley Road & Culver Road Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	0.2	0.0	0.0	0.1
Total Del/Veh (s)	5.5	2.0	0.6	2.1

Total Zone Performance

Denied Del/Veh (s)	1.2
Total Del/Veh (s)	174.5

1: Whitmore Lake Road/Old US-23 & Grand River Avenue Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	1.0	0.0	2.4	0.0	0.8
Total Del/Veh (s)	87.3	167.9	67.7	49.7	101.6

2: Old US-23 & Spencer Road West Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	1.4	0.0	1.4	0.9
Total Del/Veh (s)	23.2	14.2	17.2	17.8

3: Bar None Drive/Pleasant Valley Road & Grand River Avenue Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.7	0.1	0.0	0.3
Total Del/Veh (s)	11.0	2.9	87.1	20.1	11.2

4: Pleasant Valley Road & WB I-96 Off-Ramp Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	1.5	0.0	0.2	0.8
Total Del/Veh (s)	11.4	0.4	2.0	6.7

5: Pleasant Valley Road & Culver Road Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	0.2	0.0	0.0	0.0
Total Del/Veh (s)	3.4	3.3	0.8	1.8

Total Zone Performance

Denied Del/Veh (s)	1.4
Total Del/Veh (s)	439.1

1: Whitmore Lake Road/Old US-23 & Grand River Avenue Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.4	0.0	2.7	0.0	0.7
Total Del/Veh (s)	34.6	32.2	28.4	34.6	32.8

2: Old US-23 & Spencer Road West Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	1.5	0.0	1.4	1.2
Total Del/Veh (s)	19.0	11.9	13.4	14.8

3: Bar None Drive/Pleasant Valley Road & Grand River Avenue Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.0	0.4	0.0	0.0
Total Del/Veh (s)	5.3	1.4	9.1	5.7

4: Pleasant Valley Road & WB I-96 Off-Ramp Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	0.8	0.0	0.2	0.4
Total Del/Veh (s)	7.4	0.1	1.4	3.1

5: Pleasant Valley Road & Culver Road Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	0.2	0.0	0.0	0.1
Total Del/Veh (s)	5.5	2.1	0.6	2.1

6: Grand River Avenue & Assisted Living Drive Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.0
Total Del/Veh (s)	2.2	0.5	7.1	1.7

7: Grand River Avenue & W. Residential Drive Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.0
Total Del/Veh (s)	0.7	1.0	7.1	1.1

8: Grand River Avenue & Middle Residential Drive Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.0
Total Del/Veh (s)	2.6	0.5	17.1	2.9

9: Grand River Avenue & E. Residential Drive Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.0
Total Del/Veh (s)	1.5	1.5	9.5	1.5

Total Zone Performance

Denied Del/Veh (s)	1.2
Total Del/Veh (s)	177.1

1: Whitmore Lake Road/Old US-23 & Grand River Avenue Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	1.0	0.1	2.4	0.0	0.8
Total Del/Veh (s)	78.3	164.6	48.1	73.7	99.7

2: Old US-23 & Spencer Road West Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	1.5	0.0	1.4	0.9
Total Del/Veh (s)	22.8	15.2	17.4	18.2

3: Bar None Drive/Pleasant Valley Road & Grand River Avenue Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.8	0.1	0.6	0.4
Total Del/Veh (s)	15.5	3.2	180.0	114.1	35.1

4: Pleasant Valley Road & WB I-96 Off-Ramp Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	1.4	0.0	0.2	0.8
Total Del/Veh (s)	13.2	0.4	2.1	7.8

5: Pleasant Valley Road & Culver Road Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	0.1	0.0	0.0	0.0
Total Del/Veh (s)	3.8	3.4	0.8	1.9

6: Grand River Avenue & Assisted Living Drive Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.0
Total Del/Veh (s)	2.2	0.8	9.5	1.5

7: Grand River Avenue & W. Residential Drive Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.0
Total Del/Veh (s)	0.8	1.9	9.4	1.6

8: Grand River Avenue & Middle Residential Drive Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.0
Total Del/Veh (s)	2.5	1.3	20.0	2.3

9: Grand River Avenue & E. Residential Drive Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.2	0.0
Total Del/Veh (s)	1.3	3.6	16.0	2.6

Total Zone Performance

Denied Del/Veh (s)	1.4
Total Del/Veh (s)	478.4

1: Whitmore Lake Road/Old US-23 & Grand River Avenue Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.9	0.0	2.7	0.0	0.8
Total Del/Veh (s)	26.4	30.8	28.5	38.1	31.3

2: Old US-23 & Spencer Road West Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	1.6	0.0	1.4	1.2
Total Del/Veh (s)	18.9	12.0	14.0	15.1

3: Bar None Drive/Pleasant Valley Road & Grand River Avenue Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.0	0.4	0.0	0.0
Total Del/Veh (s)	7.3	7.0	13.0	8.5

4: Pleasant Valley Road & WB I-96 Off-Ramp Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	0.9	0.0	0.2	0.4
Total Del/Veh (s)	8.3	0.1	1.5	3.5

5: Pleasant Valley Road & Culver Road Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	0.2	0.0	0.0	0.0
Total Del/Veh (s)	5.7	2.3	0.6	2.2

6: Grand River Avenue & Assisted Living Drive Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.0
Total Del/Veh (s)	2.2	0.4	7.8	1.7

7: Grand River Avenue & W. Residential Drive Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.0
Total Del/Veh (s)	0.7	1.0	7.6	1.1

8: Grand River Avenue & Middle Residential Drive Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.0
Total Del/Veh (s)	2.7	0.6	18.1	3.1

9: Grand River Avenue & E. Residential Drive Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.0
Total Del/Veh (s)	1.6	2.1	9.5	1.8

Total Zone Performance

Denied Del/Veh (s)	1.3
Total Del/Veh (s)	178.4

1: Whitmore Lake Road/Old US-23 & Grand River Avenue Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	1.4	0.0	3.8	0.0	1.2
Total Del/Veh (s)	45.0	45.6	64.5	47.8	50.0

2: Old US-23 & Spencer Road West Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	1.5	0.0	1.4	0.9
Total Del/Veh (s)	22.3	14.5	16.6	17.5

3: Bar None Drive/Pleasant Valley Road & Grand River Avenue Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.8	0.1	0.0	0.3
Total Del/Veh (s)	13.7	12.8	33.7	18.7	14.6

4: Pleasant Valley Road & WB I-96 Off-Ramp Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	1.4	0.0	0.2	0.8
Total Del/Veh (s)	13.6	0.5	2.1	7.9

5: Pleasant Valley Road & Culver Road Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	0.1	0.0	0.0	0.0
Total Del/Veh (s)	3.5	4.0	0.8	2.1

6: Grand River Avenue & Assisted Living Drive Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.0
Total Del/Veh (s)	2.4	0.8	10.6	1.6

7: Grand River Avenue & W. Residential Drive Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.0
Total Del/Veh (s)	0.9	2.0	11.3	1.7

8: Grand River Avenue & Middle Residential Drive Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.0
Total Del/Veh (s)	2.7	1.5	22.2	2.5

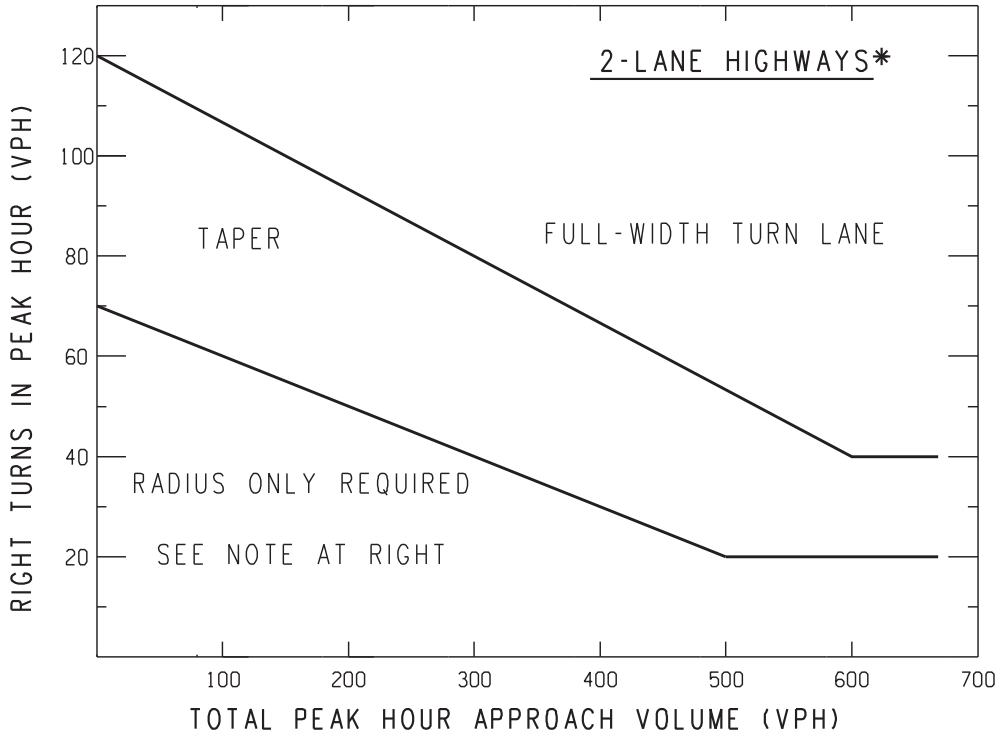
9: Grand River Avenue & E. Residential Drive Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.2	0.0
Total Del/Veh (s)	1.4	4.8	19.4	3.3

Total Zone Performance

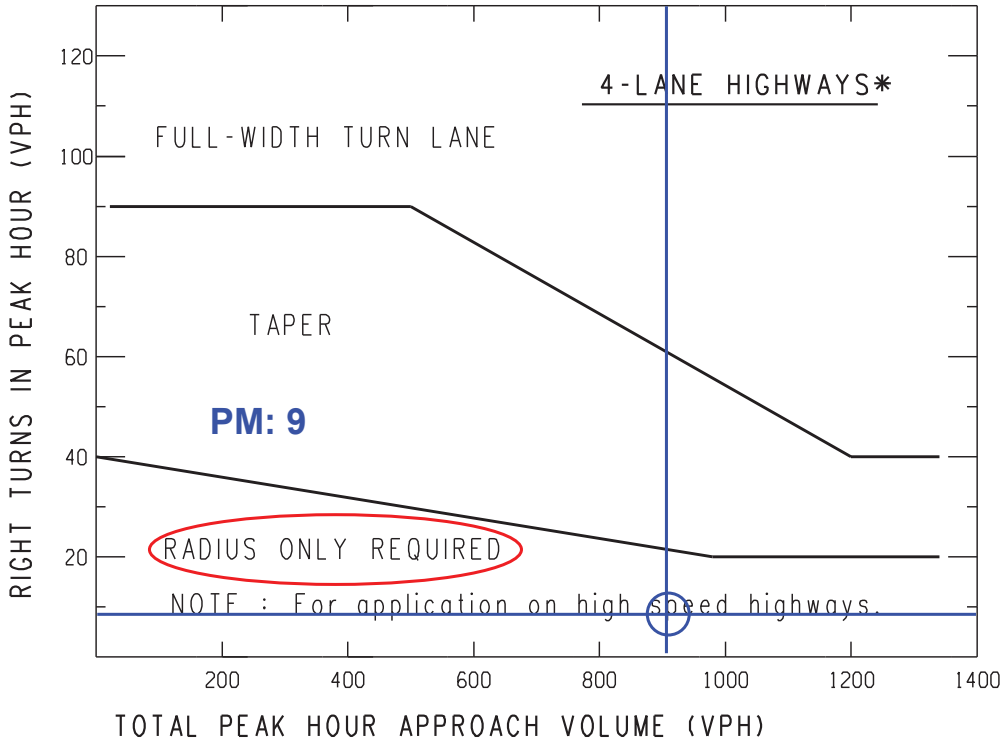
Denied Del/Veh (s)	1.7
Total Del/Veh (s)	285.4

GRAND RIVER AVENUE & ASSISTED LIVING DRIVE RT LANE WARRANT



NOTE:
For posted speeds at or under 45 mph, peak hour right turns greater than 40 vph, and total peak hour approach less than 300 vph, adjust right turn volumes.

Adjust peak hour right turns = Peak hour right turns - 20



*If a center left-turn lane exists(i.e. 3 or 5 lane highway), subtract the number of left turns in approach volume from the total approach volume to get an adjusted total approach volume.

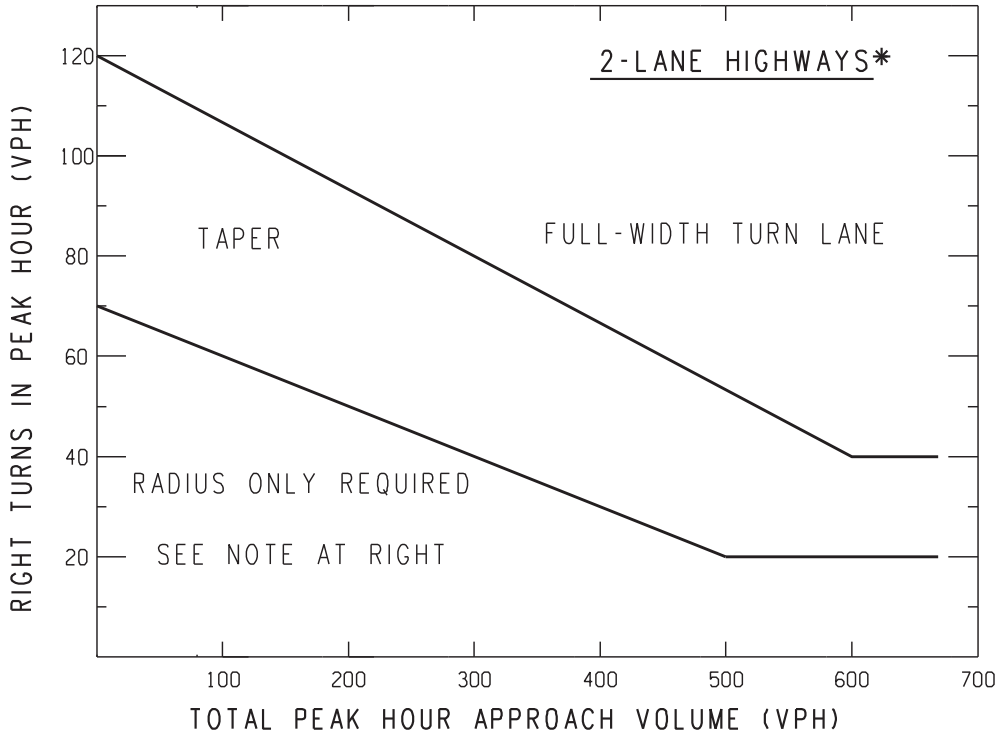
PM: 905

Sample Problem:
The Design Speed is 55 mph. The Peak Hour Approach Volume is 300 vph. The Number of Right Turns in the Peak Hour is 100 vph. Determine if a right turn lane is recommended.

Solution:
Figure indicates that the intersection of 300 vph and 100 vph is located above the upper trend line; thus,a right-turn lane may be recommended.

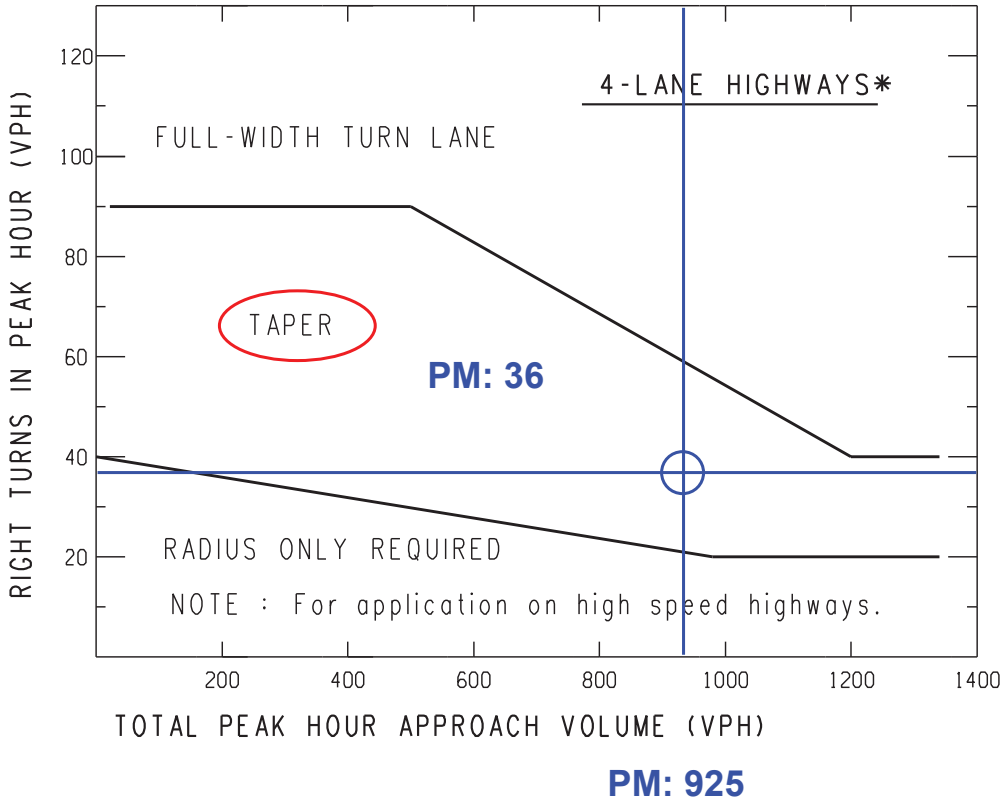
MDOT Michigan Department of Transportation TRAFFIC AND SAFETY NOTE	TRAFFIC VOLUME GUIDELINES FOR RIGHT-TURN LANES AND TAPERS		
DRAWN BY: MTS CHECKED BY: JAT	08/05/2004 PLAN DATE:	604A	SHEET 2 OF 2
FILE: K:/DGN/ts notes/Note604A tsn.dgn		REV. 08/05/2004	

GRAND RIVER AVENUE& W. RESIDENTIAL SITE DRIVE RT LANE WARRANT



NOTE:
For posted speeds at or under 45 mph, peak hour right turns greater than 40 vph, and total peak hour approach less than 300 vph, adjust right turn volumes.

Adjust peak hour right turns = Peak hour right turns - 20



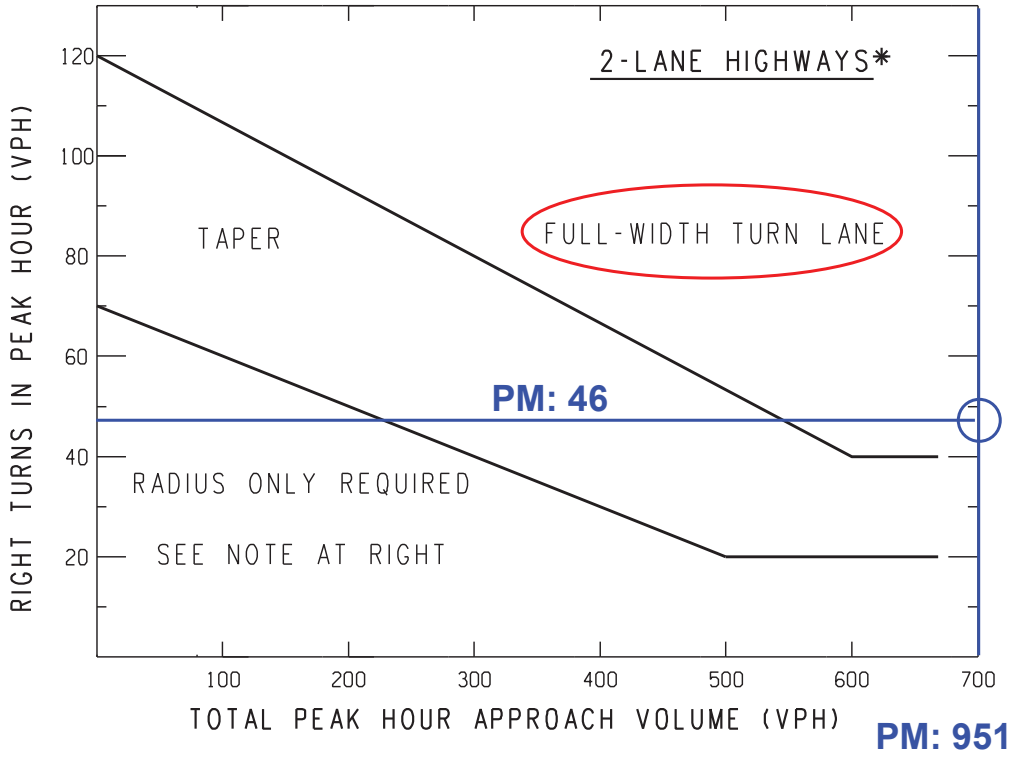
*If a center left-turn lane exists(i.e. 3 or 5 lane highway), subtract the number of left turns in approach volume from the total approach volume to get an adjusted total approach volume.

Sample Problem:
The Design Speed is 55 mph. The Peak Hour Approach Volume is 300 vph. The Number of Right Turns in the Peak Hour is 100 vph. Determine if a right turn lane is recommended.

Solution:
Figure indicates that the intersection of 300 vph and 100 vph is located above the upper trend line; thus,a right-turn lane may be recommended.

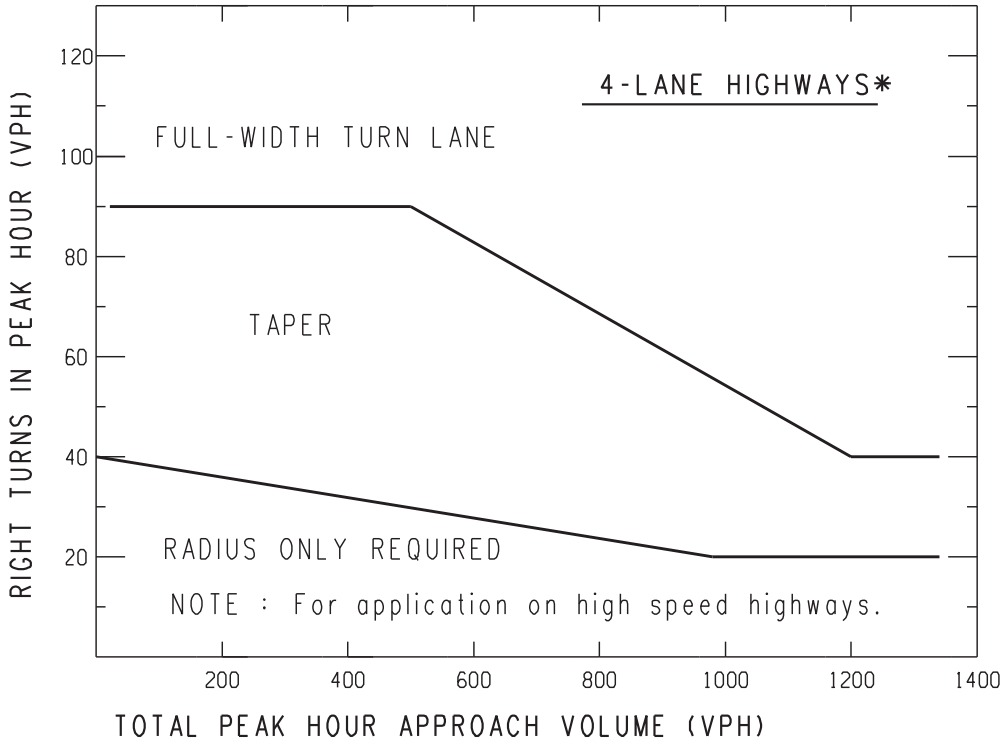
MDOT Michigan Department of Transportation TRAFFIC AND SAFETY NOTE	TRAFFIC VOLUME GUIDELINES FOR RIGHT-TURN LANES AND TAPERS		
DRAWN BY: MTS CHECKED BY: JAT	08/05/2004 PLAN DATE:	604A	SHEET 2 OF 2
FILE: K:/DGN/ts notes/Note604A tsn.dgn		REV. 08/05/2004	

GRAND RIVER AVENUE & MIDDLE RESIDENTIAL SITE DRIVE RT LANE WARRANT



NOTE:
For posted speeds at or under 45 mph, peak hour right turns greater than 40 vph, and total peak hour approach less than 300 vph, adjust right turn volumes.

Adjust peak hour right turns = Peak hour right turns - 20



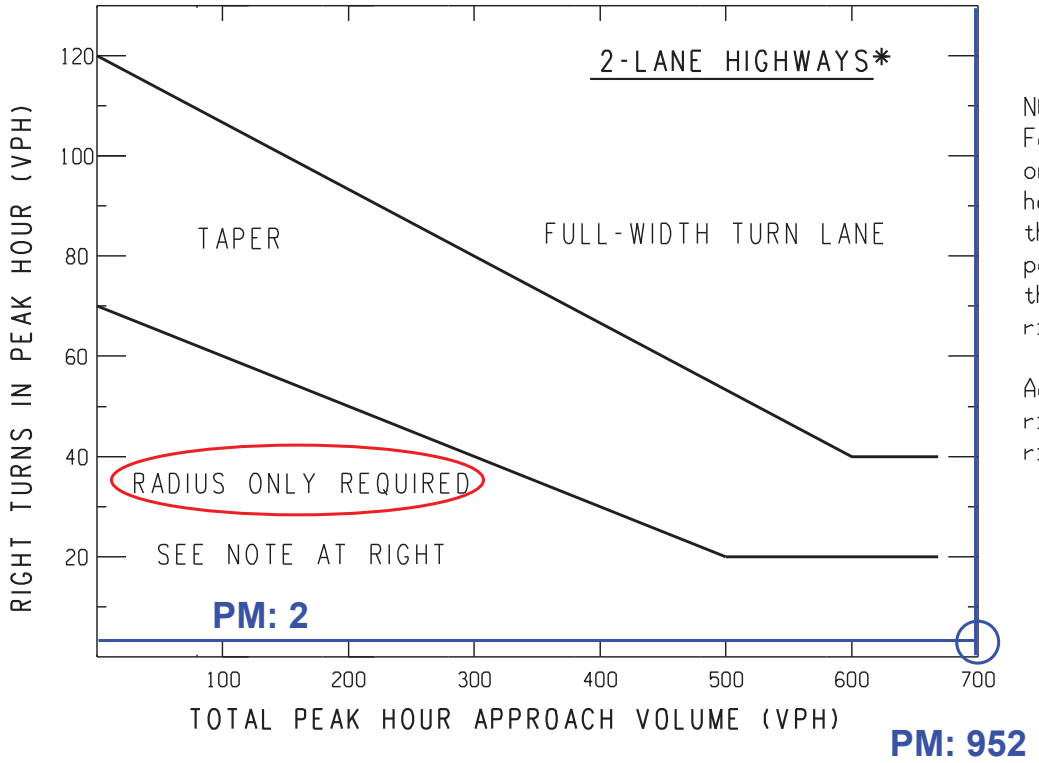
*If a center left-turn lane exists(i.e. 3 or 5 lane highway), subtract the number of left turns in approach volume from the total approach volume to get an adjusted total approach volume.

Sample Problem:
The Design Speed is 55 mph. The Peak Hour Approach Volume is 300 vph. The Number of Right Turns in the Peak Hour is 100 vph. Determine if a right turn lane is recommended.

Solution:
Figure indicates that the intersection of 300 vph and 100 vph is located above the upper trend line; thus,a right-turn lane may be recommended.

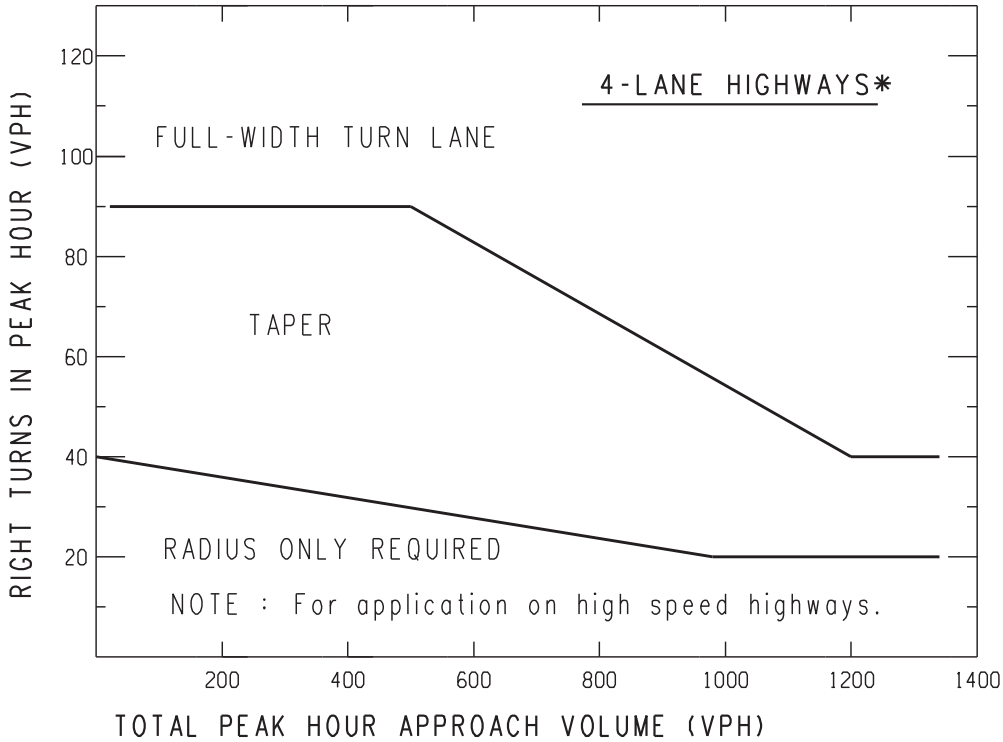
MDOT Michigan Department of Transportation TRAFFIC AND SAFETY NOTE	TRAFFIC VOLUME GUIDELINES FOR RIGHT-TURN LANES AND TAPERS		
DRAWN BY: MTS CHECKED BY: JAT	08/05/2004 PLAN DATE:	604A	SHEET 2 OF 2
FILE: K:/DGN/ts notes/Note604A tsn.dgn		REV. 08/05/2004	

GRAND RIVER AVENUE & E. RESIDENTIAL DRIVE RT LANE WARRANT



NOTE:
For posted speeds at or under 45 mph, peak hour right turns greater than 40 vph, and total peak hour approach less than 300 vph, adjust right turn volumes.

Adjust peak hour right turns = Peak hour right turns - 20



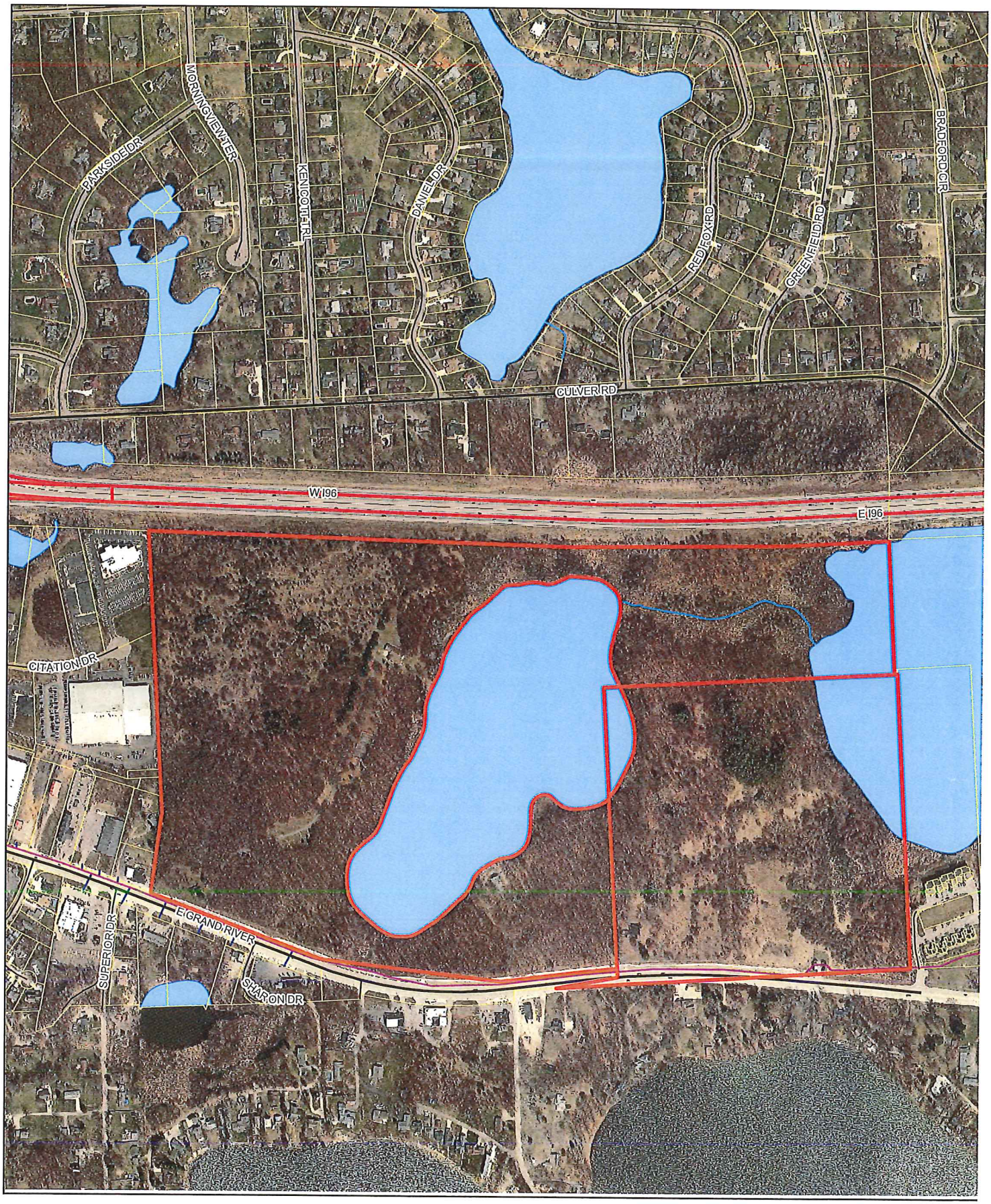
*If a center left-turn lane exists(i.e. 3 or 5 lane highway), subtract the number of left turns in approach volume from the total approach volume to get an adjusted total approach volume.

Sample Problem:
The Design Speed is 55 mph. The Peak Hour Approach Volume is 300 vph. The Number of Right Turns in the Peak Hour is 100 vph. Determine if a right turn lane is recommended.

Solution:
Figure indicates that the intersection of 300 vph and 100 vph is located above the upper trend line; thus,a right-turn lane may be recommended.

MDOT Michigan Department of Transportation TRAFFIC AND SAFETY NOTE	TRAFFIC VOLUME GUIDELINES FOR RIGHT-TURN LANES AND TAPERS		
DRAWN BY: MTS CHECKED BY: JAT	08/05/2004 PLAN DATE:	604A	SHEET 2 OF 2
FILE: K:/DGN/ts notes/Note604A tsn.dgn		REV. 08/05/2004	

Encore Village



N

0 187.5375 750 1,125 1,500
Feet

Planner

From: Kim Mical <kmical@vwcmi.com>
Sent: Sunday, September 18, 2016 7:51 PM
To: Planner
Subject: Encore development

Hi Kelly,
I noticed your name in the recent press on a proposed development. I was not aware of a recent meeting. But I would like to attend future meetings. I do not like the sounds of this new development. For not only my family, but for our entire community.
I moved Into this beautiful area in 1999. Before that I used to spend summers as a kid on Island Lake. I love natural settings, trees, lakes nestled throughout our community. Unfortunately, I have seen increased traffic over the years, along 96 and 23, even with the new designs. There are still many accidents with the distracted drivers and excessive speeds these days. Grand river has become worse, there is increased speeding, congestion. It is often scary attempting to exit out of our subdivision unto Grand River at certain times of the day.
I think you need to proceed cautiously with this development for many reasons. I think the plans sound excessive 555 units plus memory center etc on the land. Sounds a bit too much, not just for the land, roads, sewers, protective well area, animal habitats, and protective trees which act as a natural sound barrier from freeway noise.
There is a huge senior and memory center being built right now behind St John Providence Beck, it looks like a huge resort out of Walt Disney World. Then there is a memory center being built right now on 10 mile in South Lyon.
Do we need Encore development in Brighton? At this location We have the senior co ops next to the fire house, and the new appt buildings right there, fairly new condos across the street and the apartments. Do we need more of the same, right next door?

There is so many buildings in the area now that closed right after upon opening. HR equipment, Walgreens just to name a few.

Sometimes we have to stand up and say no to developers.
Is this right for our community? Our residents?
What would be the reprocussions?

Is this the same Michael Furnari who is tied to the Wayne County jail debacle? That has left the eyesore in the city half built pile of steel.

I'm sure you and your board are doing your homework and making sure you will do right for our hometown.

How can I be abreast of any news of this development Sincerely,Kim worried resident

Sent from my iPad

Planner

From: Jacob Rushlow <jacob.rushlow@ohm-advisors.com>
Sent: Friday, September 16, 2016 10:07 AM
To: Planner
Cc: Manager
Subject: FW: Encore Village question & request for .jpg color rendering

Were you contacted by this individual about Encore village? I have not responded and he directed his request at Mr. Funari so I don't think I need to respond but wanted you to be aware (if you were not already).

Jacob

From: J. Michael Lenninger [mailto:mlenninger@gmail.com]
Sent: Friday, September 16, 2016 9:54 AM
To: Michael@fairviewco.com; Jacob Rushlow <jacob.rushlow@ohm-advisors.com>
Subject: Encore Village question & request for .jpg color rendering

Mr. Funari,

Would you please provide a comment today before noon about Encore Village? The first question on everyone's mind is how did you decide there was a need for such a project, especially Phase One? Why is there a need for additional senior housing?

Also, would you happen to have a color rendering of the proposed outside architectural designs for the Phase Two living units you could send me?

I'm writing an article on deadline for the Livingston Post.

Thank you!

J. Michael Lenninger, APR
5840 Alan Drive
Brighton, MI 48116-8501
(810) 986-9320 - cell/text
(810) 225-9668 - home

September 12, 2016

Steve Holden, Chairman
Charter Township of Brighton
4363 Buno Road
Brighton, Michigan 48114

Dear Mr. Holden,

I am in receipt of your Planning Commission Public Hearing notice dated 9/6/16. As such, please review my comments and noted concerns below (in bold text) for submission to the public hearing this evening at 7 p.m.

From page 8 of the Traffic Impact Study by Fleis & Vanderbrink:

Conclusions
The conclusions of this Traffic Impact Study are as follows:

1. At the intersections of Grand River Avenue with Old US-23 / Whitmore Lake Road and Pleasant Valley Road, several approaches and movements currently operate at a LOS E or F during the PM peak period.

2. With the recommended existing improvements below, all study intersection approaches and movements will operate acceptably at a LOS D or better (**Note: these improvements are not currently planned;** therefore, background and future conditions were evaluated with the existing infrastructure.)

a. Construct right turn lanes on the EB and WB approaches at the intersection of Grand River Avenue & Old US-23 / Whitmore Lake Road.
b. Signalize the intersection of Grand River Avenue & Pleasant Valley Road / Bar None Drive.
Background conditions were evaluated which includes a traffic growth rate of 0.75% per year to the project buildout year of 2020.

3. Under background traffic conditions without the proposed development, traffic operations will operate in a manner similar to existing conditions with minor increases in vehicle delays and LOS.

4. The proposed development project would result in a significant decrease in daily and peak hour trips on the adjacent road network as compared to existing permitted site uses.

5. The analysis of future conditions with the proposed development indicates that several approaches and movements at the intersections of Grand River Avenue with Old US-23 / Whitmore Lake Road and Pleasant Valley Road will continue to operate at a LOS E or F.

6. With the recommended existing improvements, all movements at the study intersections will operate acceptably at a LOS D or better under future conditions.

7. All movements and approaches at the proposed site access points to Grand River Avenue will operate acceptably at a LOS C or better during both peak periods.

8. A right turn taper only is recommended at the proposed W. Residential Site Drive to Grand River

9. Avenue while a full width right turn lane is recommended at the Middle Apartment Site Driveway.

My question is if these improvements will reduce the existing and future LOS, why are they not currently planned as indicated in #2 above?

Also, as a frequent traveler along southbound Whitmore Lake Road onto US-23 South in the morning having LOS D as an acceptable benchmark (although the study shows a LOS C during peak AM hours currently) seems inefficient from a drivers' perspective. There are significant delays for me during this time, and I'm often at a stand still on southbound Whitmore Lake Road at 7:30 a.m. I request an evaluation or study on how to make the proposed development based on the above TIS study create aa LOS of B or above for greater flow efficiency in both the Whitmore Lake flow and the Pleasant Valley flow.

From Page 4 of the
THIS CONDITIONAL CONCEPTUAL ZONING AGREEMENT:

c. The development shall preserve the natural features surrounding Pickerel and Woodruff Lakes as shown on the Concept Plan and include the following passive and active recreational features—viewing points for the two lakes; walking paths, nature viewing opportunities.

d. The development shall provide, but limit, access to Pickerel and Woodruff Lakes as shown on the Concept Plans.

As an owner of a Woodruff Shore Condominium my concern is for both the wildlife and wetland areas of the proposed rezoning. What will happen to the displaced animals?

In d. above, we would like to preserve Woodruff Lake and not allow any use on our lake, even for observation as the proposed development has a lake for viewing (Pickerel). Also, proposed Phase III allows significant access to Woodruff Lake and opens up the possibility for access to Woodruff Lake as well. I would like to again limit the access to Woodruff Lake and perhaps evaluate whether adding another development to this area is warranted. Is there a MDEQ study done on how increasing the number of acres expanded toward Woodruff Lake will impact the quality of the water of Woodruff Lake, the quality we have on this Lake with limited residential access, the impact of any additional access on this resource, and how any additional pesticides or herbicides used in this proposed development will affect the water, wildlife and natural habitat of Woodruff Lake?

If there is not an existing MDEQ study done for the above-mentioned, I would like to request one be done prior to any development and be open for review by the residents of Brighton Township.

From the Natural Feature & Site Analysis portion:

"The main wetland on the site is located to the north of Pickerel Lake and extends over to Woodruff Lake. According to the United States Fish & Wildlife Services this wetland is classified as a freshwater emergent wetland. Freshwater emergent wetlands feature grass-like vegetation such as cattails which extend above the water surface and standing water is present for most of the growing season. Given that this wetland connects two lakes it could play an important role in water levels/flood control, maintain natural habitat for aquatic wildlife, and water purification. "

Appendix B from the Natural Feature & Site Analysis diagram shows the connection of Pickerel Lake to Woodruff Lake.

My question is: If Pickerel Lake feeds into Woodruff Lake and has done so for many, many years without upsetting the eco-system of this lake; how will the

grounds and Lake Pickerel be managed by the proposed owners of the Encore Village Development? Has a MDEQ study been done to evaluate the implications of using possible chemicals in this area on land, and/or in the water? What are the proposed maintenance plans for addressing the grassy, non-wetland, or woodland areas of the proposed Encore Village, and Pickerel Lake? And has this study determined the possible outcome to be either positive or negative to the current diverse habitat, eco-system, and wildlife of Woodruff Lake and the surrounding woodlands and wetlands?

Appendix B- Wetland Map

Pickerel Lake Development

From this same analysis:

"Due to the nature and location of the northern wetland system which connects to inland lakes and the other adjacent to Woodruff Lake which is greater than 5 acres in size, it is highly likely that the MDEQ does have jurisdiction over these wetlands."

Has a study been done by MDEQ in regard to these areas? If not, I would like to request this be done and the results open to review by the residents of Brighton Township.

Lastly, as an owner of a condominium at Woodruff Shore development, I am greatly concerned about our tax base. If this development were to happen, what tax base will help support our existing infrastructure and possible development in this area to maintain current service levels (i.e. water, sewer, upgrades to the roads in question, possible issues arising from the development of wetlands)? As an owner, how will having a rental/lease community impact our property value and our taxes?

Thank you for providing these valuable materials for our community to view, it is greatly appreciated. I am looking forward to clarification and discussion of all concerns provided by the community. We are all members in this community and I want to ensure the best possible living experience for all.

Sincerely,

Dana L. Casey
5573 Woodruff Shore Drive Owner

Planner

From: Potocki Bob <bp@potockitransport.us>
Sent: Monday, September 12, 2016 9:00 AM
To: Planner
Cc: Manager; Trustee Patrick; Treasurer; Clerk
Subject: RE: Traffic Studies Kroger/Encore

Brighton Township has a history of suing its Township Engineering firms for incompetence or worse.

OHM has shown lack of credibility when they rated Woodland Shore Drive Adequate for double bottom gravel haulers on abandoned Woodland Shore Drive.

Public Safety ALWAYS comes before development interests.

FAILURE TO PROTECT PUBLIC SAFETY has been a long-standing problem in Brighton Township. My communities safety is not for sale.

JUST DO THE DEVELOPMENT THE RIGHT WAY without all the blarney.
That means independent, competent engineers. Public Confidence depends on it. Please pass these concerns along to the Planning Commission.

Bob Potocki
Paid for by the Committee to Elect Robert Potocki
PO Box 171 Brighton, MI 48116

From: Planner [mailto:planner@brightontwp.com]
Sent: Monday, September 12, 2016 8:50 AM
To: Potocki Bob <bp@potockitransport.us>
Cc: Manager <manager@brightontwp.com>
Subject: RE: Traffic Studies Kroger/Encore

Our engineer and the LCRC review the traffic studies.

From: Potocki Bob [mailto:bp@potockitransport.us]
Sent: Monday, September 12, 2016 8:48 AM
To: Planner <planner@brightontwp.com>
Cc: Manager <manager@brightontwp.com>
Subject: RE: Traffic Studies Kroger/Encore

Bias???? Consultants write what the clients want. Ask Mr Unruh. He made that comment at several other hearings.

Have you required applicants and professionals to certify that the information provided is true and complete to the best of their knowledge?

Particularly after all the controversy over data submitted on Coves/Ridges.

Bob Potocki
Paid for by the Committee to Elect Robert Potocki
PO Box 171 Brighton, MI 48116

From: Planner [mailto:planner@brightontwp.com]
Sent: Monday, September 12, 2016 8:44 AM
To: Potocki Bob <bp@potockitransport.us>
Cc: Manager <manager@brightontwp.com>
Subject: RE: Traffic Studies Kroger/Encore

The applicant has to do a traffic study; they are paid by the applicant.

From: Potocki Bob [mailto:bp@potockitransport.us]
Sent: Monday, September 12, 2016 8:43 AM
To: Planner <planner@brightontwp.com>
Subject: Traffic Studies Kroger/Encore

Kelly-

Are these independent Traffic Studies supplied by the Road Commission or Paid by the Township?

Bob Potocki
Paid for by the Committee to Elect Robert Potocki
PO Box 171 Brighton, MI 48116

Planner

From: Diane Fleming <dianefleming2003@yahoo.com>
Sent: Monday, September 12, 2016 9:02 AM
To: Planner
Subject: Proposed apartments and Senior Citizen Facility

Grand River is ONE lane going both ways. Your proposed building will create a traffic nightmare for ALL.

PLEASE: Look for another location elsewhere.

Also, the Pleasant Valley Road area that you are proposing new building in is a quiet (for NOW) primarily OWNER occupied single-family home residential area.

As I am sure you well know, renters are a completely different demographic from tax paying, mortgage paying home OWNERS.

In addition, this could and most likely WOULD impact our property values negatively.

Crime, and NOISE abatement are all unresolved serious issues as well that must be attended to.

Would you want these apartments and senior housing (think ambulances with sirens, fire engine sirens) built next to YOUR homes?

I think not.

CEASE AND DESIST. Do not build.

Planner

From: Kim J. Logie <kim.logie@gmail.com>
Sent: Sunday, September 11, 2016 8:21 PM
To: Planner
Subject: Planning Commission Questions for Sept. 12 Meeting
Attachments: Questions for Planning Commission regarding Encore Village.docx

Good evening,
I am attaching a list of questions I have for the Planning commission meeting tomorrow night regarding the Encore community. I plan on attending the meeting with my wife and members of our condo association, where I am a member of the board. I would like to make sure that all my questions are received so they can be addressed at some point if possible during the meeting. Please advise as to the correct procedure to ensure that we receive all the answers we request.

Thank you
Kim Logie-Bates

--
Kim Logie-Bates
President Logie Consulting

Planner

From: Kelley Behrendt <kbzer@yahoo.com>
Sent: Saturday, September 10, 2016 4:16 PM
To: Planner
Subject: Proposed building

Dear planner
I strongly oppose the rezoning and building of the massive 300+ unit along grand river between 23 and pleasant valley.
I live in the condos adjacent to the property. I bought my condo in this area because it offered me peace and quiet along with the amenities in the town of Brighton.
The traffic down this stretch with all the "detours" is already out of control. The amount of traffic this complex would bring would make our peaceful area loud, noisy and difficult to maneuver.
Please do not allow this zoning change or allow the building of this massive property.
Sincerely,
Kelley Behrendt
5947 High Point Ct, Brighton MI 48116

Planner

From: Jessie Copeland <jruppel@gmail.com>
Sent: Thursday, September 08, 2016 12:59 PM
To: Planner
Subject: Comments for 9/12 meeting

Hello,

I have comments for the meeting regarding the Encore Village Development. My husband and I live on Woodruff Shore Drive on Woodruff Lake. We have been here since 2006. I'm extremely concerned with the amount of proposed units and how it will impact the quality of life on our lake. It's already small, with three boats out there it's crowded. Potentially adding 500-900 units that would very likely have access to it is terrifying. This is going to kill our property values, very likely raise our water and sewer rates, and make turning left out of our road even more difficult than it already is. There's also the potential for pollution. Our lakes are attached by a small marsh. If any sort of contamination happened from construction or the sheer volume of residents right across the lake our lake would be effected. I encourage you to take a second look at this proposal and deny it.

Thank you,

Jessie & Brad Copeland

Questions for Planning Commission regarding Encore Village
From Kim and Dawn Logie-Bates
5508 Woodruff Shore
Brighton, 48116

1. What data does the developer have that this is needed by the local community? With the new developments that have already opened, how does the developer propose to fill all the units? Is there a specific study that shows a need for such a large development now or in the near future?
2. Is there a contingency plan in place if the developer does not complete the project? What assurances does the township have that there is adequate funding for the proposed project?
3. How will this development affect the potential need for increased water and sewage use?
4. Is there a study from FIB regarding water use and the potential need for another well?
5. Has anyone contacted DTE regarding the increased load on the electrical grid and its current capacity?
6. Who will pay for the additional well or upgrading of the sewage system should that be needed?
7. Will there be any increased assessments from water, sewer or electrical grid upgrades that may be necessary? Will nearby communities face another assessment, will funds come from the developer, or will the township use tax funds for these upgrades or changes?
8. The traffic study shows that Grand River is already classified as near or failing in terms of peak hours on both ends. It also states that MDOT has NO plans to change traffic patterns or add lights or lanes. How will the developer ensure that the new traffic load will not create MORE failing times or longer wait issues for residents in the area? Are there any plans to work with MDOT to push along needed fixes along Grand River should this rezoning be authorized?
9. In this zoning request, there is a top number of 550. Is this a hard top number, or could the developer change the number to more of the land capacity of 942 in the future? Will we have written assurance from the developer that he is only building the proposed community and will not seek future revisions?
10. As this community is a lease only community, how will the planning commission address the potential decreased property values around the community due to its lack of owner residents?
11. Is the developer open to having a percentage of the units as owner occupied especially in phase 3, as opposed to leased in order to address adjacent property value concerns?
12. In the wetlands study, there is a recommendation to preserve the wetlands. Will the areas marked as preserved be left as is, or will they be changed in some way to accommodate the community? Will all wetlands be preserved, including the ones within the community? Does the developer have plans to move the small wetlands to another location?

13. Are the white rectangles in LS1 and LS2 really beds of flowers, or an access to lakes, trails and wetlands in the community? If they are trails, will members of the community be given access to Woodruff Lake for use via these trails.
14. What is the 7.80 acres of open space on Woodruff Lake refer to? Is it land, the lake or both? Where is this 7.80 acres located on the development map?
15. How does the developer propose to ensure that the additional load on Pickeral Lake does not adversely affect Woodruff Lake, due to increased use, runoff from construction and developed property, and any possible alteration of wetlands due to trails or construction?
16. The plans call for a thinning of the trees on the east side of the property. How many trees are expected to be culled? How will the developer ensure that the hillside will remain intact, and there will be minimal erosion and runoff into Woodruff Lake due to the loss of trees on the east?
17. As a clarification of the phase three small grouping of 10 in the south east corner near Woodruff Lake, will these units have direct access to Woodruff Lake? Can all residents of the community use trails and this section of the community to access Woodruff Lake for recreational use?
18. In reference to the proposed sound barrier, the Woodruff Shore association was told that we were not allowed to plant trees along the highway to act as a sound barrier to the lake from the freeway. How is Encore village allowed to build one on the wetland side of the development? If they are allowed a sound border, we are confused as to why others were not allowed to build a sound barrier along I96?

Planner

From: Brent LaVanway <brentl@bosseng.com>
Sent: Monday, October 17, 2016 6:41 AM
To: Planner
Subject: FW: Encore Village

Hi Kelly, below are Alan Greene's comments regarding the John Harris review. Is it ok if Alan has dialogue direct with John to iron these items out?

BOSS Engineering

Brent LaVanway, P.E.
Vice President
Director of Engineering
brentl@bosseng.com

3121 E. Grand River
Howell, Michigan 48843
tel 517.546.4836 / fx 517.548.1670

www.bosseng.com

Engineers / Surveyors / Planners / Landscape Architects

From: Greene, Alan [mailto:AGreene@dykema.com]
Sent: Thursday, October 13, 2016 3:56 PM
To: 'Michael Furnari' <michael@fairviewco.com>
Cc: Brent LaVanway <brentl@bosseng.com>
Subject: RE: Encore Village

Hi Mike, I understand John's comments and I can respond to them as follows (and feel free to forward this on to Kelly and John):

1 & 2. I removed the references to a separate exhibit for the conditions of rezoning, because all of the conditions of rezoning are set forth in the body of the Agreement in paragraph 4, subparagraphs (a) through (i), and they are specifically referenced as the conditions of rezoning. The exhibit would simply repeat what is already in the body of the Agreement. And, to be more all encompassing, we included a reference to the Concept Plan and all other provisions of the Agreement as being part of the conditions of rezoning.

3. The purpose of paragraph 4 was to provide an alternative if the more intense assisted living was not developed, the extra land could be used for residential of comparative density to the remainder of the development. I agree that this would be a material change in the plan, but as long as we set these mutually agreed upon parameters, we could modify the paragraph to provide that an amended site plan incorporating these changes would be reviewed by the PC for recommendation and then ultimate decision by Township Board.

4. I understand John's comments and we were simply trying to characterize minor versus major changes for purposes of this Agreement. In that the Agreement incorporates a "concept plan" it is likely that there may be tweaks to building configurations and other matters required by Township engineers and other consultants and other regulatory agencies, etc. and that the Agreement need not be amended (which would require Board approval) each time changes like that are made. We cannot make an increase in the number of units, or change set-back requirements, reduce open space or

project amenities, etc., however, without Board approval. I have worked with provisions like this for similar projects without any controversy ever arising.

Hopefully, the above explains the changes. But let me know if you should have a call to discuss further. Thanks. Alan.

Alan M. Greene
Member
AGreene@dykema.com

248-203-0757 Direct
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39577 Woodward Avenue, Suite 300
Bloomfield Hills, Michigan 48304
www.dykema.com

From: Michael Furnari [mailto:michael@fairviewco.com]
Sent: Wednesday, October 12, 2016 4:01 PM
To: Greene, Alan
Cc: 'Brent LaVanway'
Subject: FW: Encore Village

Alan
See below. Maybe give this guy a call.
Thanks

From: Planner [mailto:planner@brightontwp.com]
Sent: Wednesday, October 12, 2016 12:10 PM
To: Michael Furnari <michael@fairviewco.com>
Cc: Brent LaVanway <brentl@bosseng.com>
Subject: FW: Encore Village

From: john [mailto:john.harris@harrisandliterski.com]
Sent: Wednesday, October 12, 2016 11:34 AM
To: Planner <planner@brightontwp.com>
Subject: Encore Village

Kelly:

I have reviewed the revised CCZA ("Agreement") and have the following comments. I ask that you reference my previous email of September 6, 2016, commenting on that version of the Agreement. I presume this new Agreement was modified to address my concerns raised in that email.

1) In the original drafts of the Agreement, in section V of the Recitals, Exhibit 2 to the Agreement was to be a list of the enumerated conditions of rezoning. Though Exhibit 2 was attached to the previous version of the Agreements, there were no enumerated rezoning conditions. I highlighted that in my email to you of September 6, 2016 and indicated they needed to identify those conditions as "I believe this to be an integral part of the rezoning request." The latest version of the Agreement simply adopts the Concept Plan as the conditions for rezoning. There is no independent Exhibit 2 with a list of the rezoning conditions. The result is the conditions of rezoning are just those contained within the attached Concept Plan.

2) Paragraph 1 of the Agreement is an acknowledgment by the developer that the property will be developed in accordance with the approved Concept Plan. The previous version of the Agreement referenced rezoning conditions in the attached Exhibit 2, similar to section V of the Recitals. Those

additional conditions have been omitted and the Agreement simply incorporates the Concept Plan as the developer's commitment. This is similar to comment 1) above.

3) Paragraph 4 h. of the Agreement has been modified from the previous versions to include an acknowledgement by the Township that if the developer does not construct the assisted living portion of the development, the developer is permitted to develop that portion of the property into additional multiple family residential units. That paragraph further provides the developer shall submit to the Township for administrative review and approval, a revised development plan. This would bypass the normal planning commission review of a modification to the previously approved Concept Plan. I consider such a modification to the Concept Plan to be significant. I would not advise the Township to handle such a modification as an "administrative review." See section 18-07of the zoning ordinance.

4) Paragraph 5 of the Agreement has been modified from previous versions to include additional language. If modifications to the approved Concept Plan are made as a result of (a) other reviewing agencies having jurisdiction over the development; (b) final engineering and/or design considerations as confirmed by the Township's engineers, or (c) made to address design, marketing or other conditions, those modifications do not require Township Board approval or amendment of the Agreement, subject to the conditions set forth in the remainder of the paragraph. I ask that you review those carefully. Similar to my comment is paragraph 3 above, the developer is trying to avoid additional Township review of modifications to the previously approved Concept Plan. "Administrative review" may or may not be appropriate according to the terms of the Township's zoning ordinance. Minor changes are permitted to be handled as an "administrative review". Major changes require formal Township action. See section 18-07 of the zoning ordinance.

5) Paragraph 8 of the Agreement has additional language that provides that if the Agreement conflicts with any existing or future zoning or other ordinances of the Township, the provisions of the Agreement shall control. That is not unreasonable.

All other issues raised in my email to you dated September 6, 2016 have been addressed.

If you have any questions, please feel free to contact me.

John K. Harris
Law Offices of Harris & Literski
123 Brighton Lake Road, Suite 205
Brighton, MI 48116
810-229-9340
John.harris@harrisandliterski.com

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RECEIVED
SEP 0 6 2016
BRIGHTON TOWNSHIP

Brian Jonckheere
Livingston County Drain Commissioner
2300 E. Grand River Ave., Suite 105, Howell, MI 48843
Phone 517-546-0040 / Fax 517-545-9658
Website: www.livgov.com/drain

September 2, 2016

Mr. Michael Furnari
Manchester Brighton, LLC
1700 W. Big Beaver, Ste 120
Troy, MI 48084

Re: Encore Village/First & Main Assisted Living Facility
Preliminary Site Plans
Southeast and Southwest 1/4 of Section 33
Brighton Township

Dear Mr. Furnari,

We received Preliminary Site Plans for the development referenced above and have reviewed the submitted information for conformance with the L.C.D.C. "Procedures and Design Criteria for Stormwater Management systems." Our comments on the proposed drainage design are as follows:

1.) Drainage System Ownership – Construction Note 34 on Sheet 1 of the plans correctly states that "The existing and proposed onsite drainage systems are to be owned and properly maintained by the property owner."

2.) Overall Drainage Concept – The 147.06-acre project site is located on the north side of Grand River Avenue approximately 2,500 feet west of Pleasant Valley Road, extends approximately 3,300 feet west along Grand River Avenue and north to the I-96 right-of-way. The parcel encompasses Pickerel Lake and the western portion of Woodruff Lake. The proposed development is to be constructed in three phases. The first phase will consist of the 104 bed First & Main Assisted Living Facility located in the southwest corner of the development. The second phase is to be West Encore Village with 35 Active Adult Living Buildings containing 176 units located on the west side of Pickerel Lake. The third phase will consist of East Encore Village with 45 Active Adult Living Buildings containing 217 units located between Pickerel Lake and Woodruff Lake.

Runoff from the existing, mostly undeveloped site currently sheet flows to pocketed onsite wetland areas or the wetlands surrounding Pickerel and Woodruff Lakes. A significant amount of Grand River Avenue runoff also currently runs across the property in three locations and flows into the lakes. Runoff from the proposed development areas is to be routed by proposed storm sewers through pretreatment units and into the wetland areas surrounding Pickerel and Woodruff Lakes. The lakes are apparently intended to provide

the required stormwater detention storage for the development, since the incremental rises in the Pickerel Lake water level corresponding with the 1, 5, 10, 25, 50, and 100-year storms are provided.

3.) Existing Conditions Plan – The 1"=200' scale of the Existing Conditions plan on Sheet 2 is too small, making it mostly illegible. The information provided on this plan should be shown at a scale no smaller than 1"=100'. The following additional items concerning the Existing Conditions Plan should also be addressed.

a.) The property line bearing and distances should be labeled around the site perimeter. The property section corner ties should be labeled along with the related section corners.

b.) All onsite and adjacent buildings located within 100 feet of the property should be shown, including their addresses and current use. Any related existing improvements should also be shown and identified.

c.) All onsite and adjacent utilities should be labeled together with their structures, sizes, and rim and invert information.

d.) All existing onsite easements should be shown and clearly identified.

4.) Drainage Areas Plan – The Preliminary Site Plans should include a Drainage Areas Plan that indicates the boundaries, acreages, and runoff coefficients of all onsite and offsite tributary areas. The total tributary area to each of the proposed pretreatment areas should be shown and used in the required stormwater detention calculations. The total tributary area to each of the existing Grand River Avenue drainage outlets should also be indicated and used for designing any required downstream pipe enclosures within the site.

5.) Stormwater Detention – No stormwater detention calculations are provided on the plans. The Stormwater Narrative found on Sheet 7 states "The collected stormwater will be routed through pipes to mechanical pre-treatment units located throughout the site and outletted to Pickerel Lake." The narrative goes on to say the resulting incremental rise in Pickerel Lake from the 100-year frequency storm is calculated to be 0.152 inches. This statement conflicts with the table found on Sheet 10, that lists the 100-year storm increase in the Pickerel Lake level as 4.41 inches.

The proposed use of the wetlands around Pickerel and Woodruff Lakes for stormwater detention purposes will require an M.D.E.Q. Part 301/303 Permit and the installation of outlet control structures. A complete stormwater detention storage analysis should be prepared for the development that fully documents the proposed detention impacts on the wetlands surrounding both lakes and the intended methods of controlling the storage. The proposed design should also address the first flush, bankfull, and 100-year frequency storm events as outlined in the L.C.D.C. Design Criteria.

While the Stormwater Narrative states mechanical pre-treatment units are to be provided throughout the development, the Stormtech Isolator Row underground storage chamber

details shown on Sheet 10 do not appear to address first flush pretreatment requirements. Furthermore, the use of underground storage is typically discouraged in the L.C.D.C. Design Criteria due to the difficulties associated with its maintenance. Instead, we strongly recommend the use of sedimentation basins/forebays for stormwater pretreatment in large scale developments such as this. If the underground structures are necessary for safety reasons, we recommend that a maintenance agreement is signed with the Township or with our office to compel cleaning of these structures. After discussion with Township staff, our understanding is the maintenance of these structures can be addressed as part of the development agreement.

6.) Storm Sewer – The proposed drainage conveyance system should be designed to accommodate the runoff from a 10-year frequency storm over its tributary area. The development's Preliminary Site Plan should indicate preliminary storm sewer pipe sizes. Complete storm sewer plans, profiles, and design calculations will be required at the time of the project's Construction Plan submittal. It appears rear yard drainage structures will be required in some areas to maintain positive drainage and avoid excessive amounts of runoff flowing over the roadway curb lines. The existing Grand River Avenue R.O.W. runoff entering the site should be routed through the site to the wetland areas using properly sized pipe enclosures.

7.) Site Grading – The proposed building finished floor elevations together with the provided roadway high and low point elevations indicate significant grade differential is proposed in many areas of the site. Proposed contours should be shown on the Grading Plans sheets to better define the limits and impacts of the proposed grading. The following additional grading related items should also be addressed on the Preliminary Site Plans:

a.) The Typical Building Layout Plan shown on Sheet 9 should be revised to indicate the typical building and driveway grading design.

b.) A Typical Roadway Cross Section should be provided that indicates the intended pavement cross slope, curbs, walks, and the grading relationship between them.

c.) Proposed top and base of wall grades should be shown along the retaining walls proposed throughout the development. Some of these walls are indicated to be as tall as 23 feet and will require structural design at the time of the project Construction Plan submittal.

8.) Drainage Easements – All proposed storm sewers carrying offsite runoff through the development should be placed within permanent drainage easements. The width of the easements should be determined based on the pipe depth, as outlined in the L.C.D.C. Design Criteria. Permanent stormwater management easements should be provided around the Pickerel and Woodruff Lake wetland areas and the flow paths leading to and from them.

9.) Grand River Avenue Entrances – Construction of the development's four proposed entrances along Grand River Avenue will require an L.C.R.C. permit. Detailed grading

and drainage design information for the entrances will be required at the time of the project's Construction Plan submittal.

10.) Miscellaneous – The 1"=90' scale used on Sheets 5A and 5B is nonstandard and should be revised to be 1"=100' or some other larger standard size scale.

We are withholding approval of the Preliminary Site Plans for the Encore Village/First & Main Assisted Living Facility development until the items outlined above have been satisfactorily addressed.

Very truly yours,

Brian Jonckheere

Brian Jonckheere
Livingston County Drain Commissioner

C: Boss Engineering, Brent LaVanway
Brighton Township, Kelly Mathews
LCRC, Kim Hiller
Environmental Engineers, Paul Lewsley
MDOT, Pascal Bui
Orchard, Hiltz & McCliment, Ron Cavallaro

Date: October 10, 2016

To: Charter Township of Brighton Planning Commission

From: Kelly Mathews

Subject: **Conditional Rezoning for Encore Village**
Sheets dated 10/5/16 except sheets 10-15 dated 7/22/16; Sheets LS1-8 dated 8/20/16; and sheets A1-A7 dated 7/27/16

Location: 147 acres in the OS (office service) zoning designation, north of E. Grand River, east of Old 23 and west of Pleasant Valley and includes Pickerel and Woodruff Lakes

Request: Conditional Rezoning (based on RM-1)

Zoning: OS (Office Service)

Tax ID#'s: 12-33-400-001 and 12-33-400-010

Applicant: Manchester Brighton LLC (Michael Furnari)

Owner: Manchester Brighton LLC

The application for rezoning from existing OS (Office Service) designation to proposed Conditional Rezoning (based on a rezoning to a RM-1 multi-family designation) by Manchester Brighton LLC has been reviewed. This report is based on a review of the application materials, a site visit, and a comparison to applicable standards. In making a recommendation on this request, the Planning Commission should apply appropriate standards in consideration of the review, additional comments from the applicant, and any new information raised at the meeting.

LOCATION AND DESCRIPTION

The subject site is located in the OS (office service) zoning designation, north of E. Grand River, east of Old 23 and west of Pleasant Valley and includes Pickerel and Woodruff Lakes. The property is located in an area designated as a natural features protection area on the map so the project needs to be reviewed under *Article 10* of the Zoning Ordinance. The developer has prepared a natural features assessment and site analysis of the property as required in *Sec. 10-04* of the Zoning Ordinance. The conceptual site plan is approved as part of the rezoning; the developer is bound to that conceptual plan as part of their conditional zoning agreement. The applicant has submitted a detailed tree inventory with significant trees of twenty-four (24") inches designated on the plan and has identified tree zones with the number of types of trees in each zone estimated and indicates the trees to be removed and preserved. The applicant has stated that approximately thirty-two (32%) percent of trees will be saved. Besides wetlands and woodlands, *Article 10* also specifies preservation of steep slopes as a natural feature. The slopes and wetlands have also been designated in the natural features study. It appears that many of the proposed buildings are located very close to wetlands and some buildings appear very close to

each other. Some setbacks have been noted on the plans; however, all setbacks must be detailed on the plan. A detailed account of the proposed open space in each designated area has been depicted on the site plan. A detailed natural features setback evaluation was conducted by King & McGregor Environmental which is dated September 30, 2016.

PROCESS

The applicant is proposing a conditional zoning (CD-RZ) based on a rezoning to an RM-1 zoning designation. The applicant has provided a plan depicting what could be developed in the OS zoning district on sheet 15 which depicts seven (7) office/medical buildings of various sizes and associated parking. This site plan seems unrealistic since the property is located in a natural features area and developable verses preserved areas must be depicted and the entire site cannot be clear cut. However, the developer stated that the parking associated with hospital and/or medical offices could be proposed as a multi-level parking structure, so the plan depicting all surface parking can still be utilized for traffic purposes.

The applicant plans on developing 393 ranch style units in various size buildings and a three (3) story building consisting of seventy-three (73) independent units, fifty-one (51) assisted living units, and thirty-eight (38) memory care units for a total of 162 units. The total for both facets of the project is 555 units. Two (2) pools, two (2) clubhouses, walking trails, and sidewalks on both sides of the roadways are proposed for the development. Specific square footage sizes of the clubhouses should be depicted to determine if the parking specified is adequate. With a rough estimate of the sizes of the clubhouses, it appears that the parking is adequate. Parking for the multi-story building has been depicted with just the calculation for interim care but should also include a calculation for the senior independent housing units. Since 150 parking spaces are proposed and it appears that 135 parking spaces are required, the parking appears adequate. (It is assumed that there are 54 units on each of the 3 levels of the multi-story building). After the conditional rezoning, the applicant will follow the procedures for site plans in accordance with *Article 18*. The plan shall be reviewed as follows:

Step	Action	Approval
1. Planning Commission Public Hearing on Conditional Rezoning & Conceptual Site Plan & Conceptual Conditional Zoning Agreement	Planning Commission public hearing & review	Recommendation to Township Board
2. County Review of Conditional Rezoning	Livingston County Planning Commission review	Recommendation to Township Board
3. Township Board Conditional Rezoning & Conceptual Site Plan & Conceptual Conditional Zoning Agreement	Township Board review	Township Board
4. Planning Commission Preliminary Site Plan & Final Conditional Zoning Agreement	Planning Commission review	Recommendation to Township Board
5. Township Board Preliminary Site Plan & Final Conditional Zoning	Township Board review	Township Board

Agreement		
6. Construction Plan Review	Township staff and consultant review	Township Planner
7. Final Site Plan Review	Township staff and consultant review	Township Planner

CONDITIONAL ZONING

1. **Open Space.** The proposed open space is depicted on sheet 6 and is broken into lake, preserved wooded areas, open space, and wetland area. Most of the acreage depicted as open space is lake or wetland areas. Nineteen (19) acres of wooded area is being preserved out of the total acreage of wooded area which include approximately sixty-four (64) acres of woodland and thirty-one (31) acres of grassy upland. Amenities for the development include two (2) pools and clubhouses, walking trails, and sidewalk on both sides of the private roadways. The proposed roadways are thirty (30) ft. The width of the proposed R.O.W. must be depicted.

   The site is very wooded, and is designated as a natural features area, and has steep and varying slopes. The developer plans to preserve nineteen (19) acres of wooded area as depicted on the site plan. Is assumed that the wetlands on the site are regulated by the DEQ and will require permits for storm drainage. *Article 10, Natural Features Overlay*, requires natural feature buffer areas of one hundred (100) ft. which can be reduced to twenty-five (25) ft. if allowed by the Planning Commission. The applicant has depicted the buffers in general terms in the natural features assessment. Detailed setbacks from all wooded and wetland buffer areas are required on the site plan so the Planning Commission and Township Board can review any proposed deviations from those setbacks.

2. **Availability and Capacity of Public Services.** The development will be served by public sewer and FIB water.

3. **Compatibility with Master Plan.** This project is part of the Research and Development designation which is to accommodate both small and large-scale office, research and technology uses. Brighton Township has attracted some very light industrial and office uses that are not suitable within the business development or industrial categories of the master plan. However, these uses are critical to maintaining a solid, diverse tax base and they provide valuable jobs and services to Brighton area residents. As such, they are intended to remain where they currently exist along Old US-23 and E. Grand River Avenue, where they will attract similar uses that are seeking a more professional office environment. As opposed to the Industrial areas, the Research and Development areas are intermingled amongst the Neighborhood Business and Mixed Use designations since they are similar in character and many demand convenient access to retail and restaurant uses for their employees. It is intended that all uses in these designations will respect the existing

character and environmental characteristics of the land and will work in harmony to create a vibrant mix of uses along the Old US-23 and E. Grand River corridors.

The applicant must state in the conditional zoning agreement his intention to connect into public water and sewer.

4. **Development Impact.** The site is adjacent to multi-family units to the east, commercial uses to the west, single family and commercial to the south, and single family to the north (across I-96).

EXISTING LAND USE, ZONING, AND FUTURE LAND USE

The following table gives an overview of the existing uses and zoning, in addition to the future land use indicated in the Master Plan, for the subject site and surrounding parcels.

	Existing Land Use	Zoning	Master Plan
Subject Site	Vacant	OS	Research & Development
North	Single Family Homes	R-2	Low Density Residential
South	Single Family Homes/Commercial	B-2	Mixed Use
East	Multi Family Homes	RM-1	High Density Residential
West	Commercial	B-2/B-3	Mixed Use and Research & Development

PERMITTED USES

The following table gives an overview of both principal permitted uses and permitted uses after special approval in the existing OS zoning district.

Principal Uses Permitted OS
1. Banks, S&L, Credit Unions up to 4 Drive–Through Windows 2. Insurance Carriers, Agents, Brokers & Service 3. Mortgage, Loan Security & Commodity Brokers 4. Offices of General Executive, Administrative Functions, Accounting, Law, Professional Engineering & Management Services 5. Real Estate Agents, Leasers, Developers, Operators & Title Companies 6. Congregate Care & Dependent Care, Convalescent Homes & Nursing Homes 7. Extended Care Facilities 8. Hospitals 9. Medical Centers/Urgent Care 10. Medical Offices up to 40,000 sq. ft. 11. Medical Offices over 40,000 sq. ft. 12. Senior Independent Housing 13. Senior "Interim Care" & "Intermediate Care" Units

14. Beauty & Barber Shops
15. Child Day Care
16. Laundries, Dry Cleaners & Tailors
17. Massage Therapy/Massage Therapy Clinic
18. Photocopying, Printing & Office Services
19. Photography, Art & Graphic Design Studios
20. Dance Studios, Schools & Halls
21. Churches, Temples or other Places of Worship or Public Assembly
22. Colleges & Universities or other Institutions of Higher Learning
23. Essential Public Services
24. Governmental Executive, Legislative & Administrative Offices
25. Halls for Private Clubs & Membership Organizations
26. Libraries
27. Police & Fire Stations
28. Post Office
29. Schools, Primary or Secondary, Charter, Montessori

Permitted Uses after Special Approval OS

1. Banks, S&L, Credit Unions with 4 or more drive-through windows
2. Laboratories – Experimental, Film or Testing Enclosed within a Building
3. Research, Testing, Design, Technical Training or Experimental Product Development Enclosed within a Building
4. Conference Centers, Exhibit Halls, & Similar Uses
5. Funeral Homes & Mortuaries
6. Hotels & Motels
7. Restaurants & Bars Serving Alcoholic Beverages, Lodge, Tavern
8. Restaurants, Carry Out
9. Restaurants not Serving Alcoholic Beverages
10. Veterinary Clinic

Below are the principal permitted and special uses in the proposed underlying RM-1 zoning designation.

Principal Uses Permitted RM-1

1. Multiple Family Dwellings
2. Single Family Dwellings
3. Two Family Dwellings
4. Adult Foster Care Home (1-6 adults)
5. Foster Family Home (1-4 children 24 hrs.)
6. Foster Family Group Home (5-6 children 24 hrs.)
7. Family Day Care Home (1-6 children <24 hrs.)
8. Senior Independent Housing
9. Parks & Public Recreation Facilities
10. Churches, Temples, & Other Places of Worship
11. Essential Public Services
12. Governmental Administrative Offices
13. Libraries
14. Police and Fire Stations
15. Schools, Primary

Permitted Uses after Special Approval RM-1
1. Adult Foster Care Small Group Home (7-12 adults)
2. Adult Foster Care Large Group Home (13-20 adults)
3. Group Day Care Home (7-12 children < 24 hrs.)
4. Senior "Interim" Care & "Intermediate" Care
5. Congregate Care & Dependent Care (Convalescent/Nursing Home Units)
6. Cemeteries (Public only)
7. Golf Courses
8. Swimming Pool Clubs, & Recreation Clubs
9. Essential Public Service/Utility Buildings

PROPOSED USE

The applicant has indicated that the proposed use for the approximately 147 acres to be rezoned from OS to Conditional Rezoning (based on a RM-1 designation) would be for 555 leased multi-family units and a leased 162 bed independent, assisted living, and memory care facility. Private roads with four (4) accesses to E. Grand River are proposed. Per the TIS, three (3) of the four (4) proposed accesses require improvements to E. Grand River. Additionally, an emergency access to the property to the east is depicted; an easement needs to be attained for it. Per *Sec. 16-08*, a five (5) ft. concrete sidewalk is required along one side of the internal private roads; both sides of the development are proposed to have sidewalk. Additionally, walking trails are proposed throughout the development.

The applicant has proposed thirty (30) ft. wide roads. The width of the road R.O.W. must be provided. The Zoning Ordinance requires sixty-six (66) ft. R.O.W. and thirty (30) ft. wide roads.

The natural feature area requires buffer areas of one hundred (100) ft. but can be less than the one hundred (100) ft. requirement per *Article 10*. Most of the property is designated as natural features on the Natural Features Protection Area map. As part of the site plan review, the applicant has to comply with the requirements outlined in *Article 10* of the Zoning Ordinance which includes an environmental impact assessment which has been conducted. Additionally, many wetlands are located on the property which are assumed to be under the DEQ's jurisdiction. The applicant has provided a general environmental assessment. All setbacks to wetlands and preserved wooded areas must be provided.

DISCUSSION

The rezoning request was reviewed based on the review considerations listed in *Section 23-10* of the Zoning Ordinance and the Charter Township of Brighton Master Plan.

1) Consistency with the goals, policies and future land use map of the Brighton Township Master Plan including any sub area or corridor studies. If conditions have changed since the Master Plan was adopted, the consistency with recent development trends in the area.

This project is part of the Research and Development designation which is the area of the Township for small and large-scale office, research and technology uses. Brighton Township has attracted some very light industrial and office uses that are not suitable within the business development or industrial categories of the master plan. However, these uses are critical to maintaining a solid, diverse tax base and they provide valuable jobs and services to Brighton area residents. As such, they are intended to remain where they currently exist along Old US-23 and E. Grand River Avenue, where they will attract similar uses that are seeking a more professional office environment. As opposed to the Industrial areas, the Research and Development areas are intermingled amongst the Neighborhood Business and Mixed Use designations since they are similar in character and many demand convenient access to retail and restaurant uses for their employees. It is intended that all uses in these designations will respect the existing character and environmental characteristics of the land and will work in harmony to create a vibrant mix of uses along the Old US-23 and E. Grand River corridors. The applicant must state in the conditional zoning agreement his intention to connect into public water and sewer.

This proposal does not match the future land use of the Master Plan. Evidence has not been provided that the site could not develop under the current OS zoning designation.

2) Compatibility of the site's physical, geological, hydrological and other environmental features with the potential uses permitted in the proposed zoning district.

The soils in the area are depicted in detail in the natural features assessment and site analysis and consist of a variety of soil types, steep slope, wetlands, and woodlands.

This property is located in a Natural Features Protection Area as designated on the Charter Township of Brighton's Map. As part of the site plan review, the applicant will have to comply with the requirements outlined in *Article 10* of the Zoning Ordinance including an environmental impact assessment. The applicant has provided an environmental impact assessment. Buffer areas are mainly proposed for the perimeter of the site and around the lakes. The applicant has conducted a traffic impact analysis depicting the expected traffic from the proposed multi-family development to a potential development in the underlying zoning of OS as required in *Article 18* of the Zoning Ordinance. The Township Engineer and LCRC will review and comment on the TIS and the proposed improvements that are required for the proposed development.

3) Compatibility of all the potential uses allowed in the proposed zoning district with surrounding uses and zoning in terms of land suitability, impacts on the environment, density, nature of use, traffic impacts, aesthetics, infrastructure and potential influence on property values.

Evidence has not been provided that the site could not develop under the current OS zoning designation. However, the developer has a proposal for a multi-family development.

Since the applicant is proposing the project as a conditional zoning, the Township will have more control of the site and the preservation of natural features on the site than a straight rezoning. The conceptual plan depicts 555 total units in ranch style units and a three (3) story building comprised of independent, assisted living, and memory care units. Since this is proposed to be a

conditional rezoning, the proposed conceptual site plan and the preservation of the natural features would be what the Township would attain as part of the rezoning since the site plan will become the contract for the site, along with the conditional zoning agreement. At this time, we only have a conceptual plan but the entire site plan and all details of the site would be reviewed as part of the subsequent steps in the site plan process.

4) The capacity of Township infrastructure, utilities and services is sufficient to accommodate the uses permitted in the requested district without compromising the health, safety and welfare of the Township.

The Township has sufficient capacity in the sewer system and the applicant will provide information from FIB regarding the capacity of the water system.

5) The apparent demand for the types of uses permitted in the requested zoning district in the Township in relation to the amount of land in the Township currently zoned to accommodate the demand.

The types of uses proposed are permitted within the RM-1 district. The Township does not have a significant amount of land zoned RM-1. Areas in the Township with vacant multi-family zoning include the south side of Hilton east of W. Grand River and east of this property along E. Grand River and Pleasant Valley.

6) If a rezoning is reasonable given the above criteria, a determination shall be made that the requested zoning district is more appropriate than another zoning district.

Since the applicant is proposing the project as a conditional zoning, the Township will have more control of the site and the preservation of natural features on the site than a straight rezoning. The conceptual plan depicts 393 units in single family ranch units and a three (3) story building comprised of 162 units of independent, assisted living, and memory care units for a total of 555 units. Since this is proposed to be a conditional rezoning, the proposed conceptual site plan and the preservation of the natural features would be what the Township would attain as part of the rezoning since the site plan will become the contract for the site, along with the conditional zoning agreement. At this time, we only have a conceptual plan but the entire site plan and all details of the site would be reviewed as part of the subsequent steps in the site plan process.

Conditional Zonings shall meet the following requirements:

a. May include limitations on the uses permitted on the property in question, specification of lower density or less intensity of development and use, or may impose more restrictions on the location, size, height, or other measures for buildings, structures, improvements, setbacks, landscaping, buffers, design, architecture, and other features. (met)

b. Shall not authorize uses or developments of greater intensity or density, or which are not permitted in the proposed zoning district, but may restrict the use of the property to only certain uses permitted in the proposed zoning district. (met)

c. Shall not permit variations from height, area, setback, or similar dimensional requirements that are less restrictive than the proposed zoning district, but may require more restrictive dimensional requirements, unless variances have been granted by the Township Board. (met)

d. Shall include conditions that bear a reasonable and rational relationship and/or benefit to the property in question. The conditional zoning agreement may include conditions related to the use and development of the property that are necessary to:

1. Serve the property with improvements, including but not limited to, the extension, widening, or realignment of roads; construction, or extension of utilities, or other infrastructure improvements serving the site; or the construction of recreational facilities; (OHM and LCRC will determine the road improvements required; water and sewer will be extended to the property)

2. Minimize the impact of the development on surrounding properties and the Township overall; or, (met)

3. Preserve natural features and open space beyond what is normally required. (more natural features preserved verses a potential office development)

(1) **Content of Conditional Conceptual Zoning Agreement (CCZA).** In addition to any limitations on use or development of the site, preservation of site features or improvements described above, the CCZA shall also include the following:

a. An acknowledgement that the CCZA was proposed voluntarily by the applicant. (met)

b. A statement that the property shall not be developed or used in any manner that is inconsistent with the CCZA. (met)

c. A statement that the approval of the rezoning and the CCZA shall be binding upon and inure to the benefit of the property owner and the Township, and also their respective heirs, successors, assigns, receivers, or transferees. Where the applicant for rezoning is acting on behalf

of the landowner through some form of purchase agreement or other mechanism, then the landowner must also consent and sign the agreement. (must add language)

d. A statement that the CCZA shall not permit any activity, use, or condition that would otherwise violate any requirement or standard that is otherwise applicable in the new zoning district. (met)

e. Acknowledgement that the CCZA was proposed voluntarily by the applicant and that the Township relied upon the agreement and may not grant the rezoning but for the conditions offered in the CCZA. (met)

f. Agreement and understanding that the rezoning is conditioned upon obtaining site plan approval under ***Article 18***, or subdivision approval under the Township Subdivision Ordinance and obtaining other necessary approvals required by the Township and all applicable county, and state agencies. (met)

g. A legal description of the land to which the agreement pertains. (will provide)

h. The CCZA shall include and incorporate, by reference, a CSP. This CSP shall not replace the requirement for a site plan as outlined in ***Article 18***. The CSP requirements are outlined in subsection below. (met)

i. Any other provisions as are agreed upon by the parties.

SITE PLAN DISCUSSION

The site plan submittal is being reviewed in accordance with *Article 23-10*, which describes the information and standards for conditional rezonings and the conceptual plan submission requirements.

Content of Conceptual Site Plan (CSP). The following information shall be submitted with any application for conditional rezoning and CSP approval

(a) **Existing Site Conditions**

(1) An overall area map on a scale of not less than one inch equals two thousand feet (1"= 2000') showing the relationship of the development to its surroundings such as section lines and/or major roads or collector roads. (met)

(2) Physical development plan prepared at a minimum scale of one inch equals one hundred feet (1"=100'). (met)

(3) Boundaries of the proposed development, section or corporation lines within or adjacent to the development, and overall property dimensions. (met)

(4) Property lines of adjacent tracts of subdivided and unsubdivided land in relation to the development, including those of areas across abutting roads. (met)

(5) Locations, widths and names of existing or prior platted roads, private roads and easements within or adjacent to the development, including those of areas across abutting roads. (met)

(6) Location of existing sewers, water mains, storm drains and other underground facilities within or adjacent to the development. (met)

(7) Topography drawn as contours with a two foot contour interval. Topography to be based on USGS data and be extended a minimum distance of two hundred feet (200') outside the development's boundaries. (met)

(b) **Proposed Development Features**

(1) Layout of roads including proposed road names, right-of-way widths, and connections with adjoining roads, and also the widths and locations of easements and public walkways. (met except names of streets)

(2) Layouts, numbers and dimensions of single family homes, including building setback lines. (met)

(3) Layout of proposed multiple family dwellings, including setbacks, buildings, drives, parking spaces, walkway systems and landscaping. (submitted; need to have two (2) trees per unit per *Sec. 14-02* of the Zoning Ordinance and better detail of the parking spaces to ensure they meet the Zoning Ordinance requirements as far as size and aisle width)

(4) Location and definition of function of both developed and undeveloped space within the development. Layout of facilities to be included. (met)

(5) Description of major wooded areas and description of means to preserve them. (need conservation easement submitted for preservation of wooded areas)

(6) An indication of ownership and existing and proposed use of any parcels identified as "excepted". (met)

(7) An indication of the proposed sewage, water supply and drainage system. If county drains are involved, the proposed drainage shall be acceptable to the County Drain Commissioner. Storm drainage must be provided to an approved outlet or retention basin. (met)

(8) Conceptual site grading plan and conceptual landscaping site plan, including pedestrian circulation system. (met)

(9) Depiction of proposed development phases. (met)

(10) Architectural renderings of typical structures and landscape improvements, in detail sufficient to depict the basic architectural intent of the improvements. (submitted; need to meet requirements in *Article 14-01* of the Zoning Ordinance as far as percentage of materials allowed in RM-1 designation)

(11) Traffic impact study may be required by the Planning Commission when the use generates traffic that exceeds trip generation rates recognized by the Institute of Traffic Engineers (ITE) in accordance with ***Section 18-09.*** (submitted; needs to be reviewed and approved by OHM and LCRC)

(c) **Tabulations**

(1) Total site acreage and percent of total project in various uses (met).

(2) Draft of the CCZA (met).

(3) Statement of developer's intention in the land proposed for development (met).

(4) Statement regarding the developer's intention regarding sale and/or lease of all or portions of the development, including land area, units and recreational facilities (has stated leased units; must depict leasing information).

(5) Statement of requested modifications to the regulations that are otherwise applicable to the site. (need better detail of all setback to property lines, wetlands, between buildings and to roadways from all buildings to determine if any modifications are required per the RM-1 designation)

RECOMMENDATION

It is recommended that the applicant revise the conceptual site plan per the comments in this letter, comments in any other letters, and comments raised at the Planning Commission meeting prior to attending a Township Board meeting.

ARCHITECTS. ENGINEERS. PLANNERS.

OHM Advancing Communities

October 17, 2016

CHARTER TOWNSHIP OF BRIGHTON
4363 Buno Road
Brighton, MI 48114

Attention: Kelly Mathews

Regarding: Encore Village - Traffic Impact Study Review #2
OHM Job No. 0024-16-1097

Dear Ms. Mathews:

A Traffic Impact Study (TIS) for the above-mentioned project was prepared by Fleis & VandenBrink dated October 4, 2016 and was received by this office on October 6, 2016. As submitted, we are in general agreement with the study methodology. A summary of the study, followed by our comments and recommendations, are noted below.

OVERVIEW

The traffic impact study is based on a proposed multi-family residential development (393 apartment units & a 162-bed assisted living facility) on the north side of East Grand River Road, approximately one mile east of Old US-23. The study methodology is generally in accordance with the most recent editions of industry standard publications. The traffic analysis was based on the Highway Capacity Manual (2010) and uses Synchro/Sim Traffic Version 9 software. Trip generation was performed using the methodology described in the ITE Trip Generation Manual using the 9th Edition data set.

TRIP GENERATION

1. The study indicates that the apartment portion of the site is targeted towards "active adult living", which more closely matches ITE Land Use 252 (Senior Adult Housing- Attached), instead of ITE Land Use 220 (Apartments). As stated in the study, the units will not be age restricted. Therefore, we concur with the studies use of the Apartment rate to generate a more conservative estimate.
2. The study indicates that 1,292,208 SFT of office space can be accommodated on the existing site, under the OS zoning classification, and that trip generation estimates with the proposed rezoning result in a significant decrease in traffic compared to other permitted uses. We concur that residential use will result in less traffic than office use, but question the permitted density under OS zoning.

BACKGROUND TRAFFIC

1. The study has been revised to include traffic form the proposed Kroger expansion in background traffic.
2. Volume Figure 3 has some incorrect volumes at the intersection of Grand River and Old US-23 but it appears that the correct volumes were used for analysis and modeling.

PROPOSED DRIVEWAYS

Previous LCRC review comments expressed concern about sight distance at the proposed easterly main residential drive. If changes required to meet LCRC requirements substantially relocate or eliminate any of the proposed driveways, trip assignments will need to be revisited and the study adjusted accordingly.

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CONCLUSIONS

A summary of the report conclusions are as follows:

1. Install a right turn taper at the west residential site drive (as shown in site plan).
2. Install a full-width right turn lane at the Middle Residential site drive (as shown in site plan).
3. Construct right turn lanes on the EB & WB approaches at Grand River Ave & Old US-23.
4. Install traffic signal at the intersection of Grand River Ave & Pleasant Valley Rd.

RECOMMENDATIONS

As submitted, the TIS appears to be in substantial compliance with the Charter Township of Brighton requirements, and we take no exception to the TIS conditional upon LCRC approval. We do however note that previous LCRC review comments indicate their goal for development to mitigate impacts to the background delay level. The study does not attempt to mitigate the development impacts without the improvements recommended under the existing conditions. As such, we agree with the recommendation in the traffic study's cover letter that there be further discussion between the petitioner and LCRC on the timing and responsibility for the improvements recommended by the study.

If you have any questions regarding this review or any of the comments presented, feel free to contact us at (734) 522-6711 or jacob.rushlow@ohm-advisors.com.

Sincerely,
OHM ADVISORS

Jacob Rushlow, P.E.
Client Representative

Rhett Gronevelt, P.E.
Client Principal

cc: Brian Vick, Township Manager (via e-mail)
Michael Evans, Deputy Fire Chief, Brighton Area Fire Department (via email)
Mike Goryl, PE, Livingston County Road Commission (via e-mail)
Brent LaVanway, PE, Boss Engineering (via e-mail)
Mike Labadie, PE, Fleis & VandenBrink (via e-mail)
Michael Funari, Manchester Brighton, LLC (via e-mail)
Steve Loveland, PE, PTOE, OHM Advisors (via e-mail)
File

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ARCHITECTS. ENGINEERS. PLANNERS.

OHM Advancing Communities™

October 18, 2016

CHARTER TOWNSHIP OF BRIGHTON
4363 Buno Road
Brighton, MI 48114

Attention: Kelly Mathews, Township Planner

Regarding: Encore Village
Conditional Rezoning Review #2
OHM Job Number: 0024-16-1098

Dear Ms. Mathews:

We have reviewed the conditional rezoning material, received by this office on October 10, 2016 for the above-referenced project with respect to existing site conditions, proposed site layout, proposed sewage, water supply, and drainage systems, proposed road network and pedestrian systems, concept site grading, and traffic impacts of the requested conditional rezoning. Concept Site Plans were prepared by Boss Engineering, and have a latest revision date of October 5, 2016. A general summary of the site, followed by our review comments and recommendations, are noted below.

GENERAL

The applicant is requesting to rezone the property from OS (office service) to RM-1 Conditional (residential multi-family) to develop a planned active and assisted living residential development. The proposed site is located north of Grand River Avenue and South of I-96 between Meridian Blvd. to the west and High Point Ct. to the east. The property is approximately 147 acres, of which approximately 35 acres are open water and 18 acres are wetland. This planned development is proposed to include a total of 555 residential units. The project is proposed to be developed in three (3) phases as summarized below.

- Phase 1: multi-story assisted living/memory care facility consisting of 162 units
  - 73 independent living units
  - 51 assisted living units
  - 38 memory care units
- Phase 2: West Encore Village active adult living area consisting of 176 units
  - 3 unit buildings – 1
  - 4 unit buildings – 11
  - 5 unit buildings – 9
  - 6 unit buildings – 14
  - 1 clubhouse
- Phase 3: East Encore Village active adult living area consisting of 217 units
  - 2 unit buildings – 1
  - 3 unit buildings – 3
  - 4 unit buildings – 16
  - 5 unit buildings – 8
  - 6 unit buildings – 17
  - 1 clubhouse

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Most of the site is in a Natural Features Protection Area. As such, setbacks from natural features shall have a minimum width of 100 feet however, the Planning Commission can elect to reduce the width to not less than 25 feet. The concept plan indicates a 25-foot setback line from wetlands. Most site improvements are proposed outside this 25-foot setback, with the exception of the main boulevard entrance and retaining wall which appear to be located within the 25-foot setback.

Multi-family residential buildings internal to a development within RM-1 zoning shall be spaced a minimum of 30 feet apart. We note various building locations within the active adult living areas that have spacing less than 30 feet apart and it appears that a minimum standard of 25 feet was applied to the proposed building layout. We also note that the draft Conditional Conceptual Zoning Agreement states a side yard setback between buildings of not less than 20 feet in total.

A sound barrier wall, 8 feet in height, is proposed on the north side of West Encore Village between the development and I-96. Details and elevations for this proposed wall were not provided on the concept site plan.

PAVING/ACCESS/PARKING

Access to the site is provided by a series of four (4) road connections to Grand River Avenue. The concept plan indicates a typical road width of 30 feet, which provides for on-street parking on one side. The plans indicate the applicant's intention to propose all internal roads as private access drives, which would seem acceptable with the understanding that a single ownership is maintained over the entire development.

A gated emergency access point is proposed on the north side of West Encore Village providing a connection to Citation Drive. An easement for ingress/egress will need to be obtained for this emergency access through the neighboring property. The Brighton Area Fire Authority (BAFA) will also review the concept plan in regards to emergency vehicle access and circulation.

Parking is provided throughout the development by private driveways/garages in the West/East Encore Village area along with available on-street parking on one side of the road. The West Encore Village clubhouse has a parking lot containing 31 spaces, of which 2 are indicated as barrier free and the East Encore Village clubhouse includes a parking lot containing 28 parking spaces, of which 2 are indicated as barrier free. The assisted living/memory care building includes 149 parking spaces, of which 8 are indicated as barrier free. Based on the uses proposed for this development the number of barrier free parking spaces provided appears to be inadequate.

Sidewalk is proposed on both sides of the roads throughout the majority of the development, with the exception of the segment connecting West and East Encore Village in which sidewalk is only proposed on the south side of the road. We note that all pedestrian facilities shall be in compliance with current ADA guidelines.

TRAFFIC

A traffic impact study (TIS), dated October 4, 2016, was received by this office on October 6, 2016 with the conditional rezoning submittal. A detailed review of the TIS was performed and a review letter dated October 17, 2016 was provided under separate cover. In general, we agree with the recommendation in the traffic study's cover letter that there should be further discussion between the petitioner and the LCRC on the timing and responsibility for the road improvements recommended in the study.

DRAINAGE/STORMWATER MANAGEMENT

A stormwater narrative was include on the concept plan. The majority of site currently drains overland into the Pickerel Lake and Woodruff Lake. Stormwater runoff generated from the proposed development is proposed to be collected into underground storm sewer, routed through mechanical pre-treatment devices, and discharged directly into wetlands and lakes on-site. Located immediately west of the proposed boulevard entrance is an existing stormwater drainage system within an easement, which appears to direct stormwater runoff from Grand River Avenue into Pickerel Lake. This existing discharge should be incorporated into the onsite storm water management system and will need to be further vetted during the site plan review process.

GRADING

Existing grades are shown via contour lines on the concept plan. The topographic survey plan shall extend 200 feet beyond the property lines. It is evident that the topography varies significantly across the site. Proposed contours have not been provided and very limited proposed grades have been shown that include spot elevations for high/low points in the proposed roads and finished floor elevations for buildings. We note there are retaining walls indicated on the concept plan at eight (8) locations throughout the proposed development. These retaining walls vary in height from 3 feet to 23 feet. Wall elevations and dimensions were not provided on the concept plan.

UTILITIES

An existing Brighton Township sanitary pump station (pump station no. 1) exists in the southeast corner of the site. A 30-inch diameter gravity sewer flows into this pump station and is discharged through a 16-inch diameter force main that bisects the southeast corner of this property. These existing sewer facilities are located within a public utility easement on the property. Wastewater is proposed to be collected onsite and discharged into the Brighton Township public sanitary sewer system. Gravity sewers are proposed within the West Encore Village and assisted living/memory care building with a connection to the existing gravity sewer on the north side of Grand River Ave. Some gravity sewers along with two sanitary sewer pump stations and two areas of force main sewer are proposed to serve East Encore Village and are proposed to discharge into the existing Brighton Township sanitary pump station. The proposed connections and use of the Brighton township sanitary sewer system will require the assignment of additional REUs to the property. The concept plan does not indicate public utility easements but it should be noted and shown on the plans that all public sewer shall be located within dedicated easements.

Water supply is proposed to be supplied throughout the site via connection to the Fonda, Island & Briggs Lake Joint Water Authority (FIBJWA) system. Connection to the existing water main will require the approval of FIBJWA and a capacity analysis will be required. It is also likely that FIBJWA will require dedicated easements for the water main supply system and these easements shall be noted and shown on the plans.

CONCLUSIONS

As submitted, the conditional rezoning submittal appears to be in compliance with The Charter Township of Brighton requirements and consideration of this request by the Planning Commission appears to be appropriate. We offer the following comments for your consideration:

1. An easement or other agreement for ingress/egress will need to be obtained for the proposed emergency access to Citation Drive through the neighboring property.
2. The petitioner should endeavor to further discussions with the LCRC on the timing and responsibility for the road improvements recommended in the traffic impact study.
3. Easements for the proposed utilities shall be indicated on the concept plans. A note was added indicating water main to conform to FIB requirements and sanitary sewer easement width of 20 feet

per township standards. It should be noted that 20 feet is the minimum acceptable easement width and varying wider easements will be required for deeper sewer to maintain a 1:1 excavated side slope.

If you have any questions regarding this review or any of the comments presented, feel free to contact us at (734) 522-6711 or jacob.rushlow@ohm-advisors.com.

Sincerely,
OHM ADVISORS

Jacob Rushlow, P.E.
Client Representative

Rhett Gronevelt, P.E.
Client Principal

cc: Brian Vick, Township Manager (via e-mail)
Michael Evans, Deputy Fire Chief, Brighton Area Fire Department (via email)
Michael Funari, Manchester Brighton LLC (via e-mail)
Brent LaVanway, PE, Boss Engineering (via e-mail)
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LCRC Review Comments (October 19, 2016)

Traffic Impact Study
Proposed Encore Village – Brighton Township

Below are Livingston County Road Commission (LCRC) comments with respect to a revised traffic impact study prepared for a proposed multi-family residential development called Encore Village, located on the north side of Grand River Avenue west of Pleasant Valley Road in Brighton Township. The study, prepared by Fleis & VandenBrink and dated October 4, 2016, was submitted to our office for review on October 6, 2016.

Trip Generation and Trip Distribution

Trip generation calculated for the proposed development (393 apartment units and 162-bed assisted living facility) is acceptable to the LCRC.

Trip distribution as proposed in the study is acceptable to the LCRC.

Study Scope

The study scope was completed in conformance with accepted engineering practice and prior discussion.

Existing Conditions and Existing Improvements

We agree with the findings in Table 1: Existing Intersection Operations.

We acknowledge that there are a number of movements at the intersection of Grand River and Old US-23 that currently operate at LOS D, E and F, depending on which delay values are used (HCM vs. SimTraffic).

In our opinion it is worthy to note that, while not shown in Table 1, the existing overall delay at the intersection of Grand River and Pleasant Valley is calculated as 15 .6 sec/veh by HCM and 9.8 sec/veh by SimTraffic. These values correspond to LOS B.

The report discusses in detail improvements that can be made to the existing road network in order to achieve LOS D for all intersection approaches and movements. This was not a requirement of the LCRC. To reiterate from our last set of comments, the LCRC is less concerned with intersection movements operating at specific levels of service (such as LOS C or LOS D) as we are with a development mitigating their traffic impacts to background delay levels.

Having stated the position above, we acknowledge that the right-turn lane improvements recommended for the intersection of Grand River and Old US-23 should result in LOS D or better. The report is correct to note that no such improvements are planned.

We don't agree with the report's recommendation for a traffic signal at the intersection of Grand River and Pleasant Valley for existing conditions. As noted above, the overall intersection delay is LOS B. Only the northbound approach and the southbound left-turn movement currently experience long delays in the PM peak, and both have very low traffic volumes in the peak hour. While a traffic signal would help those two low-volume movements, the report shows it would result in an increase to overall intersection delay, computed as 18.4 sec/veh by HCM and 12.1 sec/veh by SimTraffic. We do not consider this a good option at this time given the low overall delay and safe operating history. Our own review shows an average of 2 to 3 crashes at this intersection annually over the last 5 years, with very few as the type correctable by a traffic signal. With a daily volume of approximately 15,000 vehicles through this intersection, the crash rate computes to about 0.50 crashes per million entering vehicles. This is considered very low and a signal could increase this rate by resulting in more rear-end crashes on Grand River.

Future Operations vs Background Operations

We generally agree with the findings for future and background operations.

However, we believe that the simulated overall intersection delay value of 101.6 sec/veh, shown in Table 3 for the PM peak at Grand River and Old US-23, may be in error. The value is higher than the value of 99.7 sec/veh found in Table 7 for future operations. When we re-simulated the provided PM peak traffic model for background conditions, and averaged the results for 10 simulations, the overall delay result was approximately 80 sec/veh. This delay value makes more sense to us for background operations because it is about midway between existing and future delay values, similar to background traffic volumes being about midway between existing and future volumes. The 99.7 sec/veh delay in future operations would represent a significant increase in delay over 80 sec/veh for background.

We would also like to note that neither Table 3 nor Table 7 lists the overall intersection delay for non-signalized intersections. We think it is important to note these values for the intersection of Grand River and Pleasant Valley for traffic signal consideration purposes. Per the study results found in the back of the report, the background overall delay at the intersection of Grand River and Pleasant Valley is calculated as 23.6 sec/veh by HCM and 11.2 sec/veh by SimTraffic. The future overall delay at the intersection of Grand River and Pleasant Valley is calculated as 62.6 sec/veh by HCM and 35.1 sec/veh by SimTraffic. In our opinion the background delay values are only slightly higher than existing delay values and would not likely warrant traffic signal consideration. The future delay values, however, are significantly higher and may warrant traffic signal consideration. A full warrant analysis would be needed prior to approval of traffic signals, but the overall 35.1 sec/veh delay combined with the southbound 114.1 sec/veh delay are good indicators that traffic signal warrants would be met under future conditions. We do, however, acknowledge that the trip generation numbers found in this report are based in large part on 393 apartment units which is a conservative analysis over senior adult housing units. Accordingly, if the actual trips generated by this development are more in line with senior adult housing then there should be less impact to the road system.

Whether these impacts would delay or lower the need for traffic signals is unknown at this time.

Future Improvements

The report provides analyses of future conditions with the same improvements (i.e., EB and WB right-turn lanes on Grand River at Old US-23, and traffic signals at Grand River and Pleasant Valley) identified for existing conditions. While this provides LOS D or better operation, it results in significantly lower delay at Grand River and Old US-23 than under background conditions. We take no exception to this approach but would be happy to review other mitigation measures that are more directly attributed to this development, if so desired.

Recommendations

The LCRC accepts the Encore Village traffic impact study with the comments noted above.

The Road Commission cannot require off-site improvements, such as mitigation measures outlined in the report, as part of our permit application process. However, we do recommend that consideration be given to the mitigation measures outlined in the traffic study during the Brighton Township site plan approval process of the Encore Village site. We recognize that the timing of the traffic signal measure at Grand River and Pleasant Valley is difficult to determine at this time. Perhaps any agreement that is reached toward participation of this countermeasure can be tied to a future year and dependent on a future traffic signal warrant analysis.

Finally, we provided a copy of the report and Synchro files to MDOT because of the analysis at Pleasant Valley and the I-96 ramps. MDOT replied with their acceptance of the study findings.

BRIGHTON AREA FIRE AUTHORITY

615 W. Grand River Ave.
Brighton, MI 48116
o: 810-229-6640 f: 810-229-1619

August 15, 2016

Kelly Mathews, Planner
Charter Township of Brighton
Building and Planning
4363 Buno Road
Brighton, MI 48114

RE: Encore Village
10675, 11065 & 10723 Grand River
Re-zoning Review

Dear Kelly:

The Brighton Area Fire Department has reviewed the above mentioned site plan. The plans were received for review on August 1, 2016 and the drawings are dated July 22, 2016. The project is for the re-zoning of an existing Office Space use property located on the North side of E. Grand River Ave. The property was previously approved for over 1.2 million square feet of office space and is proposed to be re-zoned as Residential, consisting of 411 multi-family condominiums and a 104 Bed Assisted Living Facility.

I have spoken with the Boss Engineering regarding this project and have conducted a cursory review based upon need for approval of re-zoning. The Brighton Area Fire Authority has no objection to the re-zoning under the condition of compliance with a complete civil plan review for the property when the final details have been completed regarding the project. Comments will be submitted in a separate letter to the your office and Boss Engineering with areas requiring revision.

The plan review will be based on the requirements of the International Fire Code (IFC) 2015 edition.

Respectfully,

Capt. Rick Boisvert, CFPS
Fire Inspector

cc:Jacob Rushlow-OHM Advisors

BRIGHTON AREA FIRE AUTHORITY

615 W. Grand River Ave.
Brighton, MI 48116
o: 810-229-6640 f: 810-229-1619

October 17, 2016

Kelly Mathews, Planner
Charter Township of Brighton
Building and Planning
4363 Buno Road
Brighton, MI 48114

RE: Manchester of Brighton/Encore Village
10675, 11065 & 10723 E. Grand River
Site Plan Review

Dear Kelly:

The Brighton Area Fire Department has reviewed the above mentioned site plan. The plans were received for review on October 7, 2016 and the drawings are dated October 5, 2016. The project is for the re-zoning of an existing Office Space use property located on the North side of E. Grand River Ave. The property is previously approved for over 1.2 million square feet of office and is proposed to be re-zoned as Multi Family Residential; consisting of 393 attached multi-family dwelling units, two clubhouses and a 162-Unit Assisted Living Facility. The project is proposed to be a phased development with the Assisted Living being constructed first with the multi-family dwellings and clubhouses to follow with two additional phases. The plan review is based on the requirements of the International Fire Code (IFC) 2015 edition.

Encore Village Multi-Family Residential

1. *Although not required by code, residential fire sprinklers are highly encouraged in all new residential construction, especially those with high-risk occupant populations.*

2. Provide the size of the water mains and gate valve locations on the utility plan. **(To be addressed during site plan and construction phases)**

3. Hydrant spacing is based off a fire flow of 2,000 gallons per minute required fire flow (Avg. 450'). Hydrant spacing has been evaluated and revised by the fire authority. A meeting must be set up with the fire authority to discuss proper spacing. **(Hydrant spacing adjusted based upon meeting with Brent LaVanway)**

4. Future project submittals shall include the project specific address and street name of the project in the title block. **(To be addressed during site plan phase)**

   IFC 105.4.2

5. The building shall include the building address on the building. The address shall be a **minimum of 4"** high letters of contrasting colors and be clearly visible from the street. **(To be addressed site plan phase)**

   IFC 505.1

6. The access roads throughout the site are shown at 30'. With a width of 30' one side of the road shall be marked as a fire lane. For parking to be permitted on both sides of the street the road width may be increased to 32'. Include the location of the proposed fire lane signage and include a detail of the fire lane sign in the submittal. Access roads to site shall

be provided and maintained during construction. Access roads shall be constructed to be capable of supporting the imposed load of fire apparatus weighing at least 75,000 pounds. **(To be addressed during site plan phase. To be maintained during construction)**

IFC D 102.1
IFC D 103.6

7. The secondary emergency vehicle access off of Citation Dr. will be required to be 26' wide to provide two-way traffic capabilities. The gate shall be provided with signage and the access drive shall be signed as a Fire Lane on both sides. The gate will be required to be secured with a Knox Padlock as opposed to a Knox Box with a key (both are identified on drawing details). **(Acknowledged)**

IFC 506.1
IFC D103.6

8. Access around building shall provide emergency vehicles with a turning radius of 50' outside and 30' inside. **(Acknowledged)**

9. A minimum vertical clearance of 13½ feet over the access road shall be maintained through the project. **(Acknowledged)**

10. Dead end roads at Buildings 16-18 and at Building 48 require an emergency vehicle turn-around of a 120'-hammerhead, 60'-"Y", 96' cul-de-sac, or alternative hammerhead. **(To be addressed during site plan)**

IFC D 103.4

11. Provide minimum dimensions of 26', inside turning radii of 30' and an outside radius of 50' for Cul-de-sac at Buildings 78-80. **(Revised to meet BAFA minimum requirements)**

12. Each unit shall be provided with a residential knox box. The box shall be installed adjacent to the front door entrance of each dwelling unit. This shall be indicated on future submittals. **(To be addressed during site plan)**

IFC 506.1

13. Provide names, addresses, phone numbers, emails of owner or owner's agent, contractor, architect, on-site project supervisor. **(Provided on Cover Sheet)**

<u>Manchester of Brighton Assisted Living</u>

The proposed Phase 1 of the project is for a 162-Unit Assisted Living Facility. Details are unknown regarding building construction, size and architecture of the structure.

14. Based upon proposed building design and layout, additional access drives may be required for emergency vehicles along the "wings" of the building.

15. Provide the size of water mains, gate valve locations on the utility plan. **(To be addressed during site plan and construction phases)**

16. Provide the size of fire protection lead, gate valve locations and connection on the utility plan. **(To be addressed during site plan phase)**

17. Hydrant spacing is based off a fire flow of 2,000 gallons per minute required fire flow. (Avg. 450'). Hydrant spacing has been evaluated and revised by the fire authority. A meeting

must be set up with the fire authority to discuss proper spacing. **(Hydrant spacing adjusted based upon meeting with Brent LaVanway)**

18. The building shall be provided with an automatic sprinkler system in accordance with NFPA 13, *Standard for the Installation of Automatic Sprinkler Systems*. **(Acknowledged)**

IFC 903

A. The FDC shall be located on the front of the building (East Grand River). **(Acknowledged)**

B. A hydrant shall be located within 100' of the fire department connection. Location shall be approved by the fire authority. **(Acknowledged)**

IFC 912.2

19. Future project submittals shall include the address and street name of the project in the title block. **(To be addressed during site plan phase)**

IFC 105.4.2

20. The building shall include the building address on the building. The address shall be a **minimum of 6"** high letters of contrasting colors and be clearly visible from the street. The location and size shall be verified prior to installation. **(To be addressed during site plan phase)**

IFC 505.1

21. The access road around the site shall be a minimum of 26' wide. With a width of 26' wide, the building side of the street shall be marked as a fire lane. Include the location of the proposed fire lane signage and include a detail of the fire lane sign in the submittal. Access roads to site shall be provided and maintained during construction. Access roads shall be constructed to be capable of supporting the imposed load of fire apparatus weighing at least 84,000 pounds. Inside parking areas shall be at least 26' wide as well. **(To be addressed during site plan phase)**

IFC D 102.1
IFC D 103.6

22. Access around building shall provide emergency vehicles with a turning radius of 50' outside and 30' inside. Additionally, inside parking areas shall provide proper radius. **(Acknowledged)**

23. A minimum vertical clearance of 13½ feet over the access road shall be maintained through the project. **(Acknowledged)**

24. The location of the Knox Box's shall be indicated on future submittals. A knox box shall be installed at the main entrance and also at the rear ambulance bay. If fire suppression mechanicals have direct access to the exterior an additional box will be required at that location as well. **(To be addressed during site plan phase)**

IFC 506.1

25. Provide names, addresses, phone numbers, emails of owner or owner's agent, contractor, architect, on-site project supervisor. **(Provided on Cover Sheet)**

Additional comments will be given during the building plan review process (specific to the building plans and occupancy). The applicant is reminded that the fire authority must review the fire protection systems submittals (sprinkler & alarm) prior to permit issuance by the Building

Department and that the authority will also review the building plans for life safety requirements in conjunction with the Building Department.

If you have any questions about the comments on this plan review please contact me at 810-299-0033.

Respectfully,

Capt. Rick Boisvert, CFPS
Fire Inspector

cc:Jacob Rushlow - OHM Advisors

Site Plan/Conditional Rezoning Plan

For Encore Village

Dated October 5, 2016

Available for viewing in the

Planning and Clerk's Department

MEMORANDUM

TO: BRIGHTON TOWNSHIP RESIDENTS
FROM: ANN M. BOLLIN, CLERK
SUBJECT: PLANNING COMMISSION ELECTRONIC PACKETS
DATE: MAY 6, 2016

Packets for the Brighton Township Planning Commission meetings posted to the website contain scanned original documents. These electronic packets are subject to change based on meeting material presented to the Planning Commission throughout the course of the meeting. For a complete original packet following the Planning Commission meeting contact the Clerk's Office at 810-229-0560 or via email: clerk@brightontwp.com