

PROPOSED AGENDA

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

**SEPTEMBER 12, 2016
REGULAR 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. AUGUST 22, 2016 REGULAR MEETING

G. BUSINESS

- 1. PUBLIC HEARING FOR SPECIAL LAND USES SU#: 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)**
- 2. 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)**
- 3. PUBLIC HEARING FOR 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**

**AUGUST 22, 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
Absent: D. Schifko, L. Herzinger

CALL TO THE PUBLIC
None

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 July 11, 2016 regular meeting as presented.**
Motion carried.

RECOMMENDATION TO TOWNSHIP BOARD ON LIASION FROM PLANNING COMMISSION TO ZBA
G. Mitsopoulos moved and G. Unruh seconded **to recommend to the Township Board Jeff Stinedurf as the liaison from the Planning Commission to the ZBA.**
Motion carried.

CONDITIONAL REZONING PROJECT INTRODUCTION # 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, Michael Furnari, and Applicant Representatives Brent LaVanway, Boss Engineering, and Mark Abanatha, Active Community Architects, were in attendance. S. Holden made suggestions for the format of the meeting. K. Mathews introduced the topic to the Planning Commission and the review process. B. LaVanway overviewed the 147 acre project located on the north side of Grand River and distributed a copy of the power point presentation. The overview included that this property was zoned to OS several years ago but prior to that it was zoned multi-family; the property contains numerous wetlands and woodlands; legal counsel prepared the Conditional Zoning Agreement and there are various other consultants involved in the project which will have three (3) phases of construction. He stated they feel that multi-family is a better fit with the natural features of the site than the office service and that the project fits into the master plan for E. Grand River pathway since it will help promote walking and they have changed from their initial plans of a one story to a three (3) story building to include assisted living, independent, and memory care; the individual living units will be for-lease single story ranch units and the total number of units for both the three (3) story building and the individual units will be 555 units. He stated they they've tried to work with the features of the site and that Grand River sits twenty-five (25) ft. above the lake and they plan on a grand entrance to the project and are offering walking paths and other amenities including sidewalks on both sides of the road and many natural viewing areas to the lake. He stated that they could obtain 994 units under the RM-1 zoning but are proposing 555 units with 162 units in the multi-story building and referenced the east side which has a significant grade that will be mainly clear-cut for development and reforested. The west side is where more of the natural features are remaining. They are constructing a sound barrier along I-96 and the architecture will be varied in roofline, color, and materials and the architecture for the clubhouses and multi-story facility will be compatible with the living units which were described as two (2) bedroom units: end units and interior units. He referenced several locations where similar facilities are currently being built. The Traffic Impact Study (TIS) indicates that

traffic in 2020 will not be significantly different than today. Four (4) entrance/exits are planned with the first three (3) going eastward requiring improvements to Grand River. The Planning Commission suggested that other large developments in the area be included in the TIS such as the Challis Rd. / Grand River intersection where UM is proposing a new facility; they stated that all of the distances from the proposed buildings to natural features: wooded and wet areas need to be properly dimensioned; they stated that a good soil erosion plan is needed so run-off does not go into the lakes and wetlands; and they stated that no sub leases should be allowed. The Planning Commission stated that there are some typos in the conditional rezoning agreement and legal description. It was stated that King and McGregor, the DEQ, and Boss have flagged all of the wetlands on the site. It was stated that the LCDC and OHM will be reviewing the soil erosion control for the project. It will be a four (4) year build out. Mr. Furnari stated that they did not pursue a PUD since they don't need the density bonus but are moving forward with conditional rezoning instead of a straight rezoning so that the Planning Commission and Township Board have more comfort in knowing what is being proposed for the site rather than a straight rezoning. It was stated that the multi-story building will be separate from the rest of the units as far as amenities. The rental rate is proposed to be \$1500-\$2500 per month. There is a proposed western side emergency access from the development to the adjacent business park which will need an easement.

REPORTS AND CORRESPONDENCE

K. Mathews - Upcoming ZBA Meeting.

CALL TO THE PUBLIC

Kim Logie-Bates, 5508 Woodruff Shore Drive - Just saw the rezoning sign put up and was curious about the project and process.

ADJOURNMENT

G. Mitsopoulos moved and G. Unruh seconded **to adjourn.**

Motion carried.

The meeting adjourned at 8:45 P.M.

Respectfully submitted,

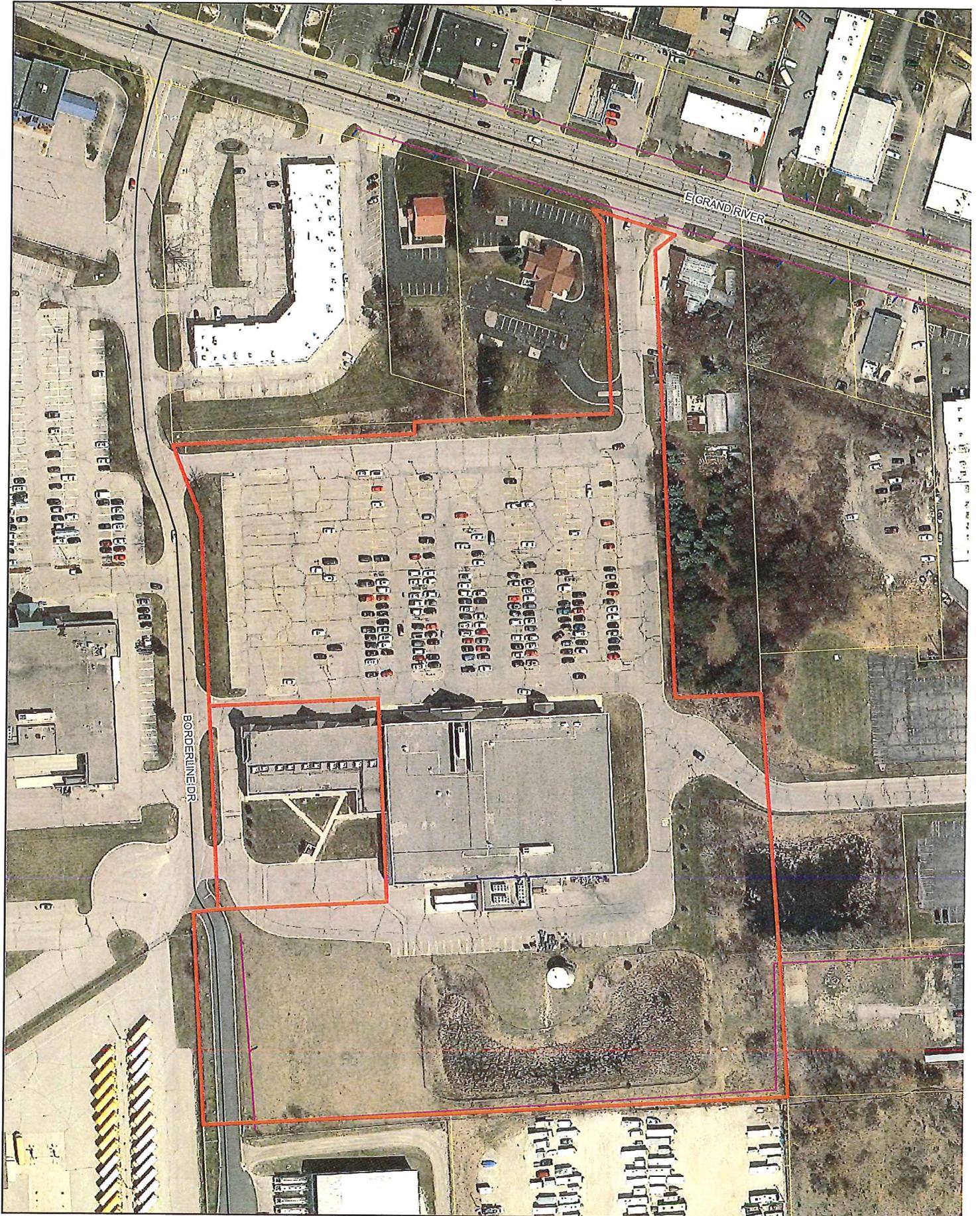
Steve Holden, Chairperson

Gary Unruh, Secretary

Kelly Mathews, Recording Secretary

Ann M. Bollin, CMC, CMMC, Clerk

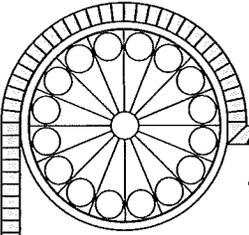
Kroger's Expansion



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CHARTER TOWNSHIP OF BRIGHTON

4363 Buno Rd. • Brighton, Michigan 48114-9298 • Telephone: (810) 229-0550 Fax: (810) 229-1778
www.brightontwp.com

September 9, 2016

Mr. Adam Crane
The Kroger Company
40393 Grand River
Novi, MI 48375

Dear Mr. Crane:

The Brighton Township Planning Commission is scheduled to review your site plan application on September 12, 2016. Your proposed expansion of 40,872 square feet, will bring the total size of Kroger's store to 104,637 square feet.

Per Chapter 22, Sanitary Sewer System, of the Brighton Township Ordinance, particularly Appendix A, the REU equivalent unit factor table calculates the connection to the sewer system by a grocery store at .5 REU per 1,000 square feet. Based on that unit factor and the total square footage, the total REU assignment would be 53 REU's.

Kroger's currently has 36 REU's between the original Kroger's building and the adjacent retail center (30 for Kroger's and 6 for the retail center). No water system REU's have been purchased to date since LCWA water has not yet been extended to the building.

An additional 17 sanitary sewer REU's (\$10,260 each) are required to be purchased at a total cost of \$174,420. Also required is the purchase of 53 water REU's (\$5,700 each) at a total cost of \$302,100.

Payment in the amount of \$476,520 is required prior to the Township issuing of a land use permit for the proposed project. Please consult the township sanitary sewer/water ordinance, which is listed on the Township website, for further information regarding this topic. Thank you for your attention to this matter.

Sincerely,

Brian Vick
Township Manager

cc: A. Boyer, LSG Engineers

Date: September 6, 2016

To: Charter Township of Brighton Planning Commission

From: Kelly Mathews

Subject: **Kroger's Expansion**
SP 16/05
Sheets dated 8/12/16 except topo survey dated 11/10/15 and standard detail sheets

Location: 9968 E. Grand River and 5771 Borderline

Request: Kroger's Expansion

Zoning: B-2 (general business)

Applicant: The Kroger Company

Tax ID#: 12-32-300-061 and 062

A special land use permit (SLUP) application for a 40,872 sq. ft. addition (25,313 sq. ft. addition and 15,559 sq. ft. expansion into adjacent retail businesses) to the existing store for a total of 104,637 sq. ft. with a small mezzanine is planned. Additionally, a drive-thru pharmacy and open air business (outside display) is planned. The business is located at 9968 E. Grand River and 5771 Borderline, on the south side of E. Grand River, west of Whitmore Lake Rd. The special land use permits are in a B-2 (general business) zoning district. The sewer and water REU's for grocery stores is .5 per 1,000 sq. ft. Existing sewer REU's are thirty (30) REU's for the grocery store and six (6) REU's for the retail stores. Additional sewer and water REU's are required for the addition.

SITE PLAN DISCUSSION

This site plan has been reviewed utilizing the standards in *Article 18 Site Plan Review*. Based on the review of the plans and a visit to the site, the following comments are outlined for your review.

1. **Use.** The proposed retail business greater than 30,000 sq. ft., drive-thru pharmacy, and open air business (outdoor display) are special land uses in the B-2 zoning district per *Article 6, Section 6-02*. The area for the open air business (outside display) is clearly marked on the site plan per the special land use permit (SLUP) requirements.
2. **Site Layout.** The site has been reviewed in accordance with the area and bulk requirements described in *Article 6, Section 6-03*.

	Required	Provided	Comments
Building Height	45 ft./3 stories	27 - 38.8 ft./1 story	In compliance
Front Yard Setback - E. Grand River North	30 ft.	635 ft.	In compliance
Front Yard Setback - Victor Dr. East	30 ft.	30 ft.	In compliance
Front Yard Setback - Borderline West	30 ft.	30 ft.	In compliance
Rear Yard Setback South	20 ft.	262 ft. min. - varies	In compliance
Parking Lot Setback (Front) North	20 ft.	11 ft. min.	Not in compliance; existing
Parking Lot Setback (East - Victor Dr.)	20 ft.	0 ft.	Not in compliance; existing
Parking Lot Setback (Rear) South	10 ft.	22 ft.	In compliance
Parking Lot Setback (West - Borderline Drive)	20 ft.	30 ft.	In compliance
Minimum Lot Area (sq. ft.)	40,000	14 acres	In compliance
Minimum Lot Width (ft.)	150	66 ft. (E. Grand River)	Not in compliance; existing
Maximum Lot Coverage	50%	17%	In compliance

3. **Loading/Unloading.** An existing loading/unloading area (truck well) is depicted in the rear which meets the requirements of *Sec. 15-02*. The size is thirty-nine (39) ft. wide by sixty-five (65) ft. in length for a total of 2,535 sq. ft. The minimum is ten (10) ft. by 200 ft. for 2,000 sq. ft. (Minimum requirements are four (4) ten (10) ft. by fifty (50) ft. (2,000 sq. ft.) loading areas so the amount proposed exceeds the minimum).

4. Vehicular and Pedestrian Circulation.

- a. The proposed access is via three (3) entrances. One off of Whitmore Lake Rd., one off of E. Grand River (Victor Dr.), and one off of Borderline Drive off E. Grand River.
- b. A five (5) ft. sidewalk was recently constructed in front of the gas station site as required per *Sec. 16-08* of the Zoning Ordinance and the Pathways Plan.

5. Parking. The proposed parking was reviewed in accordance with *Article 15, Section 15-01* as described in the following table.

	Required	Provided	Comments
Parking Spaces Retail/Shopping Centers- One (1) parking space per 200 SF of usable (74,923/200) = 375 usable plus 1 space per employee (118 employees on largest shift)	493	494	In compliance
Parking Spaces Outdoor Commercial Display and Sales - One (1) space per each 500 SF of land (1/2,730 sf) plus 1/employee	5	5	In compliance
Parking Spaces Stacking Spaces for Drive-Thru Pharmacy - requires 4 spaces	4	4	In compliance
Barrier-Free Spaces	9	16	In compliance
Parking Space Dimensions	9 ft. by 20 ft.	9.5 ft. by 20 ft.	In compliance
Aisle Width	24 ft. for 2 way traffic	23 ft. min for two way traffic	Rec'd. ZBA variance on 8/24/16

Asphalt pavement and concrete curbing and gutter exists as is required per *Section 15-01(e)(5)*. The proposed sidewalks abutting parking spaces must be a minimum seven (7) ft. wide and the existing and proposed are more than seven (7) ft. wide along the front of the building and connecting from the parking area. Eight (8) spaces are proposed in the front for

click list which is where you can order your groceries on-line and pick them up at the store. During construction, there will be two (2) temporary click list parking spaces located in the rear of the building.

6. **Signage.** Two (2) existing freestanding ground signs exist for the grocery store; one at each entrance to the store (along Whitmore Lake Rd. and off of Victor Drive off of E. Grand River) which are identified on the site plan. No signage exists off of Borderline Drive off of E. Grand River. Additionally, there is a ground sign located on E. Grand River for the gas station. The existing wall signage exceeds the Zoning Ordinance requirements. The applicant received ZBA variances on 8/24/16 for wall signage as depicted on the preliminary site plan. Details on "handicap parking" and traffic control and click list signs are depicted on the site plan.
7. **Building Materials.** *Article 14, Section 14-01(c)(1)* depicts the building materials required. Per *Table 14-01*, each wall has a percentage of coverage of the various building materials. A table has been provided by the applicant depicting the total percentage of proposed materials for all four (4) walls and each elevation must comply with the stated percentages. The front elevation is sixty-four (64%) which is less than the seventy-five (75%) required on a front elevation and the rear elevation has ninety-four (94%) concrete block, more than the twenty-five (25%) allowable. The Planning Commission can waive strict compliance with *Sec. 14-01(c)(1)* if the Planning Commission feels the intent is met as described in *Sec. 14-01(c)(2)*.

The applicant plans to leave the existing portion of the building the same as it is existing and the addition will match the existing. The plans are for brick, EIFS cornice, ceramic tile accents, and split face block. A roof plan has been submitted and materials will be brought to the Planning Commission meeting.

Per *Sec. 14-01(c)(5)*, colors are to be earth tone colors and be compatible with the surrounding area. The existing and proposed brick is an orange/beige color. Additionally, samples of all materials must be brought to the Planning Commission meeting for review.

A floor plan has been submitted which depicts the layout of the proposed facility. Additionally, per *Sec. 14-01 (c)(4)*, when walls are greater than one hundred (100) ft. in length, design variations must be applied per the suggestions in that section. Per *Sec. 14-01(c)(4)* interest is supposed to be added to the walls so there are not large blank walls such as ten (10) ft. recesses. The frontage is mainly a large blank wall with a few recesses. The Planning Commission will have to discuss this issue.

8. **Landscaping.** A landscape plan has been submitted and has been reviewed in accordance with *Article 14, Section 14-02* as follows. Due to the uses being proposed being special uses, additional landscaping beyond the minimum is suggested for the site.

	Required	Provided
<p>Greenbelt - Borderline Western Property Line 20 ft. with 1 decid. per 30 lineal ft. (916 ft.)</p>	31 trees	31 trees; in compliance
<p>Buffer along Southern Property Line - to industrial 20 ft. with 1 decid., 1 evergreen and 4 shrubs per 30 lineal ft. (751 ft.) and wall/fence/berm</p>	25 decid., 25 evergreen, and 100 shrubs	19 decid., 26 evergreen in rear, 70 shrubs are elsewhere on site; in compliance due to bldg. and parking lot increase
<p>Buffer along Northern Property Line - to commercial 10 ft. buffer with 1 decid. or 1 evergreen or 4 shrubs per 20 ft. (560 ft.) No berm/wall required</p>	28 trees or 112 shrubs	6 trees and 37 shrubs; in compliance due to size of bldg. and parking lot increase
<p>Greenbelt - Victor Eastern Property Line 20 ft. with 1 decid. per 30 lineal ft. (1,275 ft.)</p>	42 decid.	19 trees and 56 shrubs; in compliance due to size of bldg. and parking lot increase

<p>Detention/Retention Ponds/Basins - 1 tree and 10 shrubs per 50 linear ft. of detention basin perimeter. Reconfiguration of existing pond with proposed chain link fencing around pond. 1,071 l.f.</p>	<p>22 trees and 215 shrubs</p>	<p>22 trees and 215 shrubs; in compliance</p>
<p>Parking Lot - 498 spaces Required for parking lots of 20 spaces or more - 1 canopy tree for each 10 parking spaces, in no case less than 2 trees shall be provided and a continuous row of shrubs along the front of the parking lot. A min. 1/3rd of the trees shall be placed in islands (min. size of islands specified in ordinance).</p>	<p>50 trees and continuous row of shrubs in front; 17 trees in islands</p>	<p>50 trees and 37 trees in islands; in compliance</p>

The building and parking lot increase is 13.56% so that requires 54.24% compliance with the landscaping requirements of the Zoning Ordinance. Additionally, the applicant has restrictions on the eastern and southern portions of the property which make it difficult to fully comply with the landscaping requirements with utilities. Landscaping may need to be adjusted due to the utilities. The applicant meets the Zoning Ordinance as far as the percentage increase of landscaping required per the size of the proposed addition as depicted in *Sec. 14-02(b)(6)* of the Zoning Ordinance. Only thirty-three percent (33%) of plant material should be utilized of any one plant material. All existing trees have specified sizes and types. As a note, trees and shrubs are setback ten (10) ft. from the edge of a road and five (5) ft. from sidewalks as required. And, the method of irrigation has been specified on the site plan which is automatic underground systems.

- Lighting.** The existing lighting includes sixteen (16) light poles approximately twenty-seven and a half (27.5) ft. in height. Additionally there are eleven (11) existing building mounted lights. A detail for the wall lights has been depicted on the site plan. An as-built photometric plan has been submitted which includes the gas station and grocery

sites. The grocery site does not meet the photometric requirements per *Article 14, Section 14-03*. The applicant received an exception for the grocery store lighting at a meeting on 6/30/97 when the original store was approved which includes light output exceeding ten (10) foot candles within the site and exceeding one foot candle at the property lines per the original exception granted on 6/30/97. Additionally, the existing light poles are higher than fifteen (15) ft. high per the exception granted on 6/30/97.

Eight (8) new pole lights are proposed for the new rear parking lot area. The new light poles meet the Zoning Ordinance requirements of fifteen (15) ft. high. The rear four (4) light poles have cut-off shields. The proposed number of light squares is four (4) for the light poles must be depicted on the site plan. Additionally seven (7) new wall mounted lights are proposed for the addition which will be mounted at fifteen (15) ft. high. The proposed photometrics for the new lighting meets the Zoning Ordinance requirements. As-built photometric plans will be required after the light pole in front is relocated and after the new pole lighting in the rear has been installed.

10. **Waste Receptacle.** The applicant has an existing trash compactor located in the rear of the building and does not identify any waste receptacles on the site plan. All waste receptacles are located inside of the building. An existing waste receptacle behind the retail portion of the building will be removed.
11. **Mechanical and Electrical Equipment.** Existing transformers are located in the rear of the building and a new one proposed on the east side of the building which must be screened per the Zoning Ordinance. Landscaping is proposed to screen the easterly transformer. A detail has been provided of the screening for the rear transformers. All mechanical equipment must be screened per *Section 14-05*. All roof mounted equipment must be screened per *Section 14-01(d)(3)*.
12. **Agency Approvals.** Copies of all applicable County, State, and Agency approvals need to be submitted to the Township prior to site plan approval, including but not limited to:
 - a. Livingston County Drain Commissioner
 - b. Township Engineer
 - c. Livingston County Road Commission
 - d. Livingston County Public Health Department
 - e. The Brighton Area Fire Department

RECOMMENDATION

It is recommended that the Planning Commission approve the preliminary site plan for Kroger's expansion subject to any issues in this letter and other letters being handled administratively.

Date: August 26, 2016

To: Charter Township of Brighton Planning Commission

From: Kelly Mathews

Subject: Special Land Use Permit Review
Kroger's Expansion
SU 16/02
Sheets dated 8/12/16 except topo survey dated 11/10/15 and standard detail sheets

Location: 9968 E. Grand River and 5771 Borderline

Requests: Kroger's expansion, drive-thru pharmacy, and open air business (outdoor display)

Zoning: B-2 (general business)

Applicant: The Kroger Company

Tax ID#: 12-32-300-061 and 062

A special land use permit (SLUP) application for a 40,872 sq. ft. (25,313 sq. ft. addition and 15,559 sq. ft. expansion into adjacent retail businesses) to the existing store for a total of 104,637 sq. ft. with a small mezzanine is planned. Additionally, SLUP's for a drive-thru pharmacy and open air business (outside display) is planned. The business is located at 9968 E. Grand River and 5771 Borderline, on the south side of E. Grand River, west of Whitmore Lake Rd. The special land use permits are in a B-2 (general business) zoning district.

BACKGROUND

The special land use permits have been reviewed utilizing the standards in *Article 19, Special Land Use Review*. Based on the review of the plans and a visit to the site, the following comments are outlined:

- (1) (a) **Use. Retail over 30,000 sq. ft.** The use, shopping center/retail over 30,000 sq. ft., is a special use in the B-2 (general business) zoning district per *Section 6-02*.
- (b) **Use. Drive-through Pharmacy.** Drive-thru pharmacies are a special use in the B-2 (general business) zoning district per *Section 6-02*.
- (c) **Use. Open Air Business.** (outside display). Open air businesses are a special use in the B-2 (general business) zoning district per *Section 6-02*.

- (2) **Site and Surroundings.** The site is located on the south side of E. Grand River, west of Whitmore Lake Rd., in a B-2 zoning district. The surrounding sites to the north and east are B-2 (general business), to the south is I-1 (light industrial) and to the west in the City of Brighton is C1, general business, and LIP, light industrial park. Currently there is a residential use to the east.

SPECIAL USE STANDARDS

The special land uses have been reviewed in accordance with the standards in *Section 19* of the Zoning Ordinance.

- (1) **Compatibility with Adjacent Uses.** The planned Kroger's expansion, drive-thru pharmacy, and open air business (outside display) is compatible with the commercial nature of this section of the Township and the adjacent City of Brighton's commercial and industrial areas.
- (2) **Compatibility with the Master Plan.** The master plan identifies the site as being part of the general business corridor. Businesses that rely on and serve a broader customer-base including the entire Township, the cities of Howell and Brighton, and pass by traffic along Grand River, are included in this designation. Appropriate uses include auto dealerships, grocery stores, restaurants, and retail centers. Special consideration needs to be given to highway commercial uses to minimize their impact on adjacent land uses, to accommodate the volumes of vehicular traffic generated, their potential impact on the aesthetics of the site and surrounding area, and the need to ensure compatibility between vehicular and pedestrian traffic. The General Business category may include Neighborhood Business uses; however, larger-scale General Business uses should not be located within Neighborhood Business areas in order to protect their character and low-intensity nature. General Business uses have been designated along Grand River Avenue corridor near the Township's western border, where these uses currently exist. These segments of Grand River abut more intense, regional commercial uses located within the City of Brighton.
- (3) **Compliance with Applicable Regulations.** The proposed special land uses shall be and shall remain in compliance with all applicable federal, state, and local ordinances.
- (4) **Use of Adjacent Property.** The surrounding sites to the east and north are B-2 (general business) but to the east is currently a residential use, to the south is I-1 (light industrial), to the west is C1, general business, and LIP, light industrial park in the City of Brighton. The businesses that surround the site include dental office, gas station, U-Store, American Compounding and the Brighton School bus garage.
- (5) **Public Services.** The site plan has designated LCWA water and Township sewer for the proposed building expansion.

- (6) **Impacts of Traffic.** The additional traffic in the area must be evaluated for the addition. A traffic study has been submitted which includes traffic for the Kroger's gas station and Kroger's grocery site with expansion which will be reviewed by the Township Engineer and LCRC.
- (7) **Enhancement of Surrounding Environment.** Additional landscaping should be added along the sides of the property to buffer the adjacent commercial properties as required in *Article 14, Section 14-02* of the Zoning Ordinance since the uses are special land uses.
- (8) **Impact on Public Health, Safety and Welfare.** The property is zoned B-2, general business, which allows for retail over 30,000 sq. ft., drive-thru pharmacies, and open air business (outside display) as special land uses. Traffic, noise, lighting, etc. must be considered as part of this review.
- (9) **Isolation of Existing Uses.** This issue is to ensure that a small residential area will not be substantially surrounded by non-residential development. The property to the east is currently residential.
- (10) **Impact on the Overall Environment.** The proposed special land uses will not have a significant adverse effect on the quality of the natural environment since the use is already there; it is being expanded.

Additional standards required for restaurants and other drive-thrus which must be met.

- a. A minimum sixty (60) foot setback shall be provided from the front lot line and any adjoining Residential District. (met)
- b. A six (6) foot high, completely obscuring brick wall shall be provided between the site and any adjoining Residential District. (not met)
- c. When constructed adjacent to other commercial developments, the restaurant (drive-thru) shall have a direct vehicular access to the existing commercial development where possible. (n/a)
- d. Clear delineation between the drive-thru stacking lane and the parking lot shall be provided such that vehicles waiting in the drive-thru lane do not block access to parking spaces. (met)
- e. Each drive-thru facility shall provide a lane to allow other vehicles to pass those waiting to be served at the drive-thru. (met)

Additional standards required for the open air business (outside display) which must be met.

- a. All open air businesses shall be accessory to the approved principal use, and shall be directly related to the business or activity conducted within the main building. (met)
- b. The material(s) utilized for any use shall not create a noxious odor, create blight condition, or create an unsafe traffic condition (i.e. reduction of sight distance to road(s), maneuvering lanes and/or parking areas). (met)
- c. The display of any material(s) and/or products shall be limited to not more than ten percent (10%) of the existing front or side yard(s), exclusive of all required maneuvering lanes, driveways and/or parking spaces. (met)
- d. The minimum setback from a front or side property line for any open air business shall be twenty (20) feet from the front property line and not less than one-half (1/2) of any required side yard. (met)
- e. All display materials shall be safely anchored or secured in place, in a method and manner designed to safely resist overturn by wind loads or impact. (met)
- f. Display materials shall be limited to those approved for use by the Michigan State Construction Code and Fire Codes. (met)
- g. The Planning Commission may require fencing, greenbelts and/or masonry walls to isolate or screen any outdoor display area. (met)
- h. Open air businesses which require lighting or the use of electricity shall not be constructed, installed or utilized unless and until a certificate of safety compliance has first been issued by the Township Electrical Inspector. Display lighting shall comply with the lighting standards of *Section 14-03*. (met)
- i. Any display involving soil or berming shall be constructed in a manner which will eliminate surface water, soil, sand, sediment and/or any other material from eroding, washing or otherwise being transported onto any roadway, storm sewer, or adjacent property. (met)
- j. A site plan, drawn to scale, shall be submitted to the Planning Commission for review in accordance with *Article 18*. The plot plan shall clearly illustrate the location, setbacks, and the designated area of the property proposed for outdoor display. (met)

RECOMMENDATION

It is recommended that the special land use permits (SLUP's) for retail over 30,000 sq. ft., drive-thru pharmacy, and open air business (outside display) per *Section 6-02* be approved, subject to the approval of the preliminary site plan.



ARCHITECTS. ENGINEERS. PLANNERS.

September 1, 2016

CHARTER TOWNSHIP OF BRIGHTON

4363 Buno Road
Brighton, MI 48114

Attention: Kelly Mathews, Township Planner

**Regarding: Kroger Expansion
Site Plan Review #2
OHM Job Number: 0024-16-1081
Special Land Use #2
OHM Job Number: 0024-16-1084**

Dear Ms. Mathews:

We have reviewed the material, received by this office on August 19, 2016 for the above-referenced project based on the Township's Engineering Standards. Plans were prepared by LSG Engineers and Surveyors, and have a latest revision date of August 12, 2016. The applicant is requesting site plan approval for a building addition. A general summary of the site, followed by our review comments and recommendations, is noted below.

GENERAL

The existing site is located at 9968 East Grand River Avenue. The project site is comprised of an existing 63,110 square foot Kroger grocery store with parking lot, along with an attached 15,559 square foot 1-story commercial building comprises of 7 retail units. The site also includes a detention pond, two private wells for water supply, and a 90,000-gallon water storage tank. The site is located on two Parcels, #4712-32-300-061 and #4712-31-300-062, and both are zoned B-1. Parcel one (#4712-32-300-061) has an area of 12.99 acres and Parcel two (#4712-31-300-062) has an area of 1.31 acres for a combined area of 14.3 acres. The Kroger Company is proposing to demolish the 1-story commercial retail building and construct a 40,872 square foot addition to the current supermarket. Included with this project are various site improvements necessary to accommodate the building addition.

SPECIAL LAND USE

The applicant is requesting special land use for retail establishments & shopping centers greater than 30,000 square feet, drive-thru pharmacy, and outdoor seasonal sales. The existing grocery store is approximately 63,110 square feet with a proposed 40,872 square feet addition. Considering the existing use and available space on the property, we take no exception to the request for retail establishments & shopping centers greater than 30,000 square feet. The proposed drive-thru pharmacy provides four (4) stacking spaces and is situated at a location that would not impede the normal traffic flow around the store or parking lot. As such we take no exception to the request for a drive-thru pharmacy. The proposed outdoor sales area is shown on the plans near the east entrance into the grocery store as well as a proposed outdoor seating area near the west entrance to the new building addition. We take no exception to the proposed outdoor seasonal sales conditional on the sales areas being situated such that the sidewalk and walkways are not impeded and maintain a minimum aisle width of 4 feet meeting applicable ADA requirements for accessibility.

UTILITIES

Water supply is currently provided by an on-site private well system consisting of two wells and one 90,000-gallon storage tank. The applicant proposes to remove this private system and install a looped water main system connected to the LCWA public water main on Whitmore Lake Road. The existing water supply system will be removed once the proposed water main loop has been installed, tested, and connected. We understand that LCWA has already reviewed and approved the water main construction plans and the plans are currently under review by the MDEQ for permitting. We note that the water main plan and profile sheets were omitted from the site plan. These plans shall be included for reference.

Wastewater is conveyed into the Brighton Township public sanitary sewer system. No improvements have been proposed to the existing sanitary sewer system and the applicant proposes to continue using the existing sanitary sewer lead from the existing store. Currently, 36 REUs are allocated to the property (30 for the Kroger Store and 6 for the commercial retail building units). Based on the additional square footage proposed for the building addition it is anticipated that additional REU's will need to be assigned to the property.

PAVING/ACCESS/PARKING

Access to the site is provided by private easements along Victor Drive to both East Grand River Ave. and Whitmore Lake Road, and along Borderline Drive via three (3) drive approaches. There is also an ingress/egress easement on the south side of the site providing access to the neighboring American Compounding Spec LLC site.

Parking is provided by a total of 427 parking spaces, of which 16 are designated handicap accessible, along with an additional 72 future parking spaces on the south side of the site for a total of 499 parking spaces. Aisle widths throughout the parking lot are proposed to be 23.65 feet. We note that the minimum aisle width per ordinance is 24 feet. An application to the ZBA was made for a variance to allow 23.65 feet aisle widths through the parking lot. We understand that the ZBA approved this variance request at the August 24, 2016 meeting.

A majority of the existing asphalt pavement (parking lot and drives) is proposed to be milled and resurfaced with two inches of new HMA pavement. Borderline Drive, on the west side of the site, will also be milled and overlaid with two inches of HMA. Also proposed is an additional future parking lot consisting of 72 parking spaces located in the southwest corner of the site. Additionally, in the same corner as the parking lot, the plans propose realignment and reconstruction of the drive to the American Compounding Spec LLC building.

We note that all barrier free parking and pedestrian site access shall be in compliance with current ADA guidelines. Spot elevations will be required on the site plan to verify compliance.

We defer to the Brighton Area Fire Authority (BAFA) in regards to emergency vehicle access and circulation.

TRAFFIC

A traffic impact study, dated August 12, 2016, was received by this office with the site plan submittal. The TIS was reviewed by this office and comments and recommendations were provided under separate cover. Approval from the Livingston County Road Commission will be required for the proposed road improvements and traffic impact of the proposed development.

DRAINAGE/GRADING

Existing grades and proposed grades are shown via contour lines and spot elevations on the site plan. Additional spot elevations will be required to verify site accessibility is compliant with ADA standards.

The existing surface drainage patterns shall be included on the plans. The majority of the paved areas appear to flow into the underground storm sewer system and are conveyed to the south into the detention pond located in the southeast corner of the site. The detention pond outlets into an underground storm water system that discharges into the offsite Appian Way Drain and ultimately into a closed wetland. The plans propose several changes to the existing storm water management system. They propose to convert a portion of the detention basin into a sediment forebay connected to the pond via outlet control structure. Also proposed are two catch basins servicing the proposed parking lot and a set of roof drains servicing the building extension. We note that approval from the LCDC is required for discharge of stormwater into the offsite county drain.

PERMITS AND OTHER AGENCY APPROVALS

Copies of all permits, letters of approvals, and/or letters of waiver, obtained to date, shall be forwarded to this office and other outside regulatory agencies. The current status of all necessary permits should be included on the cover sheet. At a minimum, the following permits and other agency approvals should be obtained before final approval:

- LCWA and MDEQ for construction of public water main
- Livingston County Drain Commission for SESC and stormwater discharge
- Livingston County Road Commission for any work in the public road ROW
- Livingston County Building Department
- Brighton Area Fire Authority

RECOMMENDATIONS

As submitted, the Special Land Use appears to be in substantial compliance with The Charter Township of Brighton requirements and we recommend the Planning Commission consider approval, conditional on the site plan being approved.

As submitted, the site plan appears to be in substantial compliance with the Charter Township of Brighton site plan requirements. We take no exceptions to the proposed site plan and recommend the Planning Commission consider approval of the site plan conditional upon the following comments being addressed administratively.

1. A dimensioned truck turning plan shall be included to verify that site circulation can adequately accommodate a standard fire apparatus or the largest truck anticipated to traverse the site. This shall include the proposed fire routes and illustration that a standard fire apparatus can adequately access the locations of proposed fire hydrants.
2. On the landscape plan, it appears that on the northwest corner of the site, trees are proposed over the proposed water main. Trees are also proposed over sanitary sewer on the east and west sides of the proposed parking lot. Trees are not permitted to be constructed within these public utility easements and must be relocated.

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)
Ken Recker, PE, Chief Deputy Drain Commissioner, Livingston County (via e-mail)
Michelle LaRose, PE, Environmental Projects Manager, Livingston County (via e-mail)
Jim Rowell, Building Official, Livingston County (via e-mail)
Kim Hiller, Livingston County Road Commission (via e-mail)
Adam Crane, Kroger Co. (via e-mail)
Alan Boyer, PE, LSG Engineers & Surveyors (via e-mail)
File

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ARCHITECTS. ENGINEERS. PLANNERS.

August 1, 2016

CHARTER TOWNSHIP OF BRIGHTON

4363 Buno Road
Brighton, MI 48114

Attention: Kelly Mathews

Regarding: Kroger Expansion - Traffic Impact Study
OHM Job No. 0024-16-1087

Dear Ms. Mathews:

A Traffic Impact Study (TIS) for the above-mentioned project was prepared by Fleis & VandenBrink dated July 22, 2016 and was received by this office on July 23, 2016. As submitted, we are in general agreement with the study methodology. However, the TIS does not appear to be in substantial compliance with the Charter Township of Brighton requirements and does not adequately address the traffic related impacts of the proposed site. A summary of the study, followed by our comments and recommendations, are noted below.

OVERVIEW

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.

The site plan reflects an existing Kroger Supermarket (78,668 SFT), demolition of the adjacent retail space (15,529 SFT), and proposed Kroger addition (42,241 SFT). However, the traffic impact study indicates that the proposed Supermarket addition is 27,267 SFT (net change in building area between retail space to be demolished and supermarket addition).

TRIP GENERATION

The traffic study uses the net change in building area (27,267 SFT) to determine the number of additional site-generated trips, then subtracts trips for the existing retail space to determine the total number of "new" trips. This results in a significant underestimation of the number of new trips. The full addition area (42,241 SFT) should be used in the initial calculation, then subtraction of the existing retail trips to determine the number of additional site-generated trips.

SYNCHRO ANALYSIS

Peak-hour factors (PHF) used in the traffic analysis do not match the values from the traffic counts. Although a few values were updated by approach, it appears that a default value of 0.93 was used at most intersections and was not updated.

RECOMMENDATIONS

As submitted, the TIS does not appear to be in substantial compliance with the Charter Township of Brighton requirements, and at this time we recommend that the following comments be addressed prior to approval:

OHM Advisors
34000 PLYMOUTH ROAD
LIVONIA, MICHIGAN 48150

T 734.522.6711
F 734.522.6427

OHM-Advisors.com



1. Revise trip generation estimates based on additional building square footage.
2. Revise peak hour factor to match values from the traffic counts.
3. Approval from the Livingston County Road Commission will be required for traffic impact of the proposed development on the existing road network.

Once the above-noted comments have been addressed, the applicant should update trip distributions, figures, traffic models, and report accordingly and resubmit for further review. 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)
Michelle Shumaker, PE, LSG Engineers & Surveyors (via e-mail)
Mike Labadie, PE, Fleis & VandenBrink (via e-mail)
Adam Crane, Kroger (via e-mail)
File



BRIGHTON AREA FIRE AUTHORITY

615 W. Grand River Ave.

Brighton, MI 48116

o: 810-229-6640 f: 810-229-1619

August 24, 2016

Kelly Mathews, Planner
Charter Township of Brighton
Building and Planning
4363 Buno Road
Brighton, MI 48114

RE: Kroger Expansion
9968 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 July 8, 2016 and the drawings are dated June 3, 2016. The project is a site plan for the proposed addition of 40,782 sqft. to an existing 63,110 sqft. structure for a total size of 103,892 sqft. The existing structure is a Mercantile occupancy and will remain as such. The property will also be connection to the local municipal water system for domestic and fire protection, including fire hydrants (previously approved). The plan review is based on the requirements of the International Fire Code (IFC) 2015 edition.

1. All fire hydrant locations and spacing meet or exceed the minimum requirements. Fire hydrant model shall be an EJIW 5BR in accordance with LCWA requirement. Hydrant steamers shall be oriented to face the roadway when placed into service. **(Noted and detail provided)**

IFC 912.2
2. The building shall be provided with an automatic sprinkler system in accordance with NFPA 13, *Standard for the Installation of Automatic Sprinkler Systems*. **(Noted to be completed)**

IFC 903

 - A. The proposed FDC location is approved where proposed on the drawing. **(Reflected by note on drawing)**
 - B. The location of the fire protection lead does not correspond with the location of the existing fire pump/riser room. **(Location will be revised in field as needed)**
3. The building shall include the address number a minimum of 6" high and of contrasting colors. Numbers shall be clearly visible from the street (Grand River). The location and size shall be verified prior to installation. Location shall be on the upper right (northwest) corner of front building elevation. **(Noted to be provided at time of construction)**

IFC 505.1
4. All access drives in and through the site meet or exceeds the minimum 26' width requirement. With a width of 26' wide the building side of the drives shall be marked as a fire lane. Fire lane signs shall be placed at maximum every 50' around the structure. 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. There is a detail for Heavy Duty asphalt; however it does not appear that it is proposed along the perimeter of the structure. The fire lane around the structure shall be constructed of HD asphalt or engineer documentation indicating the proposed has the capability to support 84,000 pounds. **(Existing fire access drives are to be milled and resurfaced, meet previous specifications therefore acceptable)**

IFC D 103.6

IFC D103.1

IFC D 102.1

IFC D 103.3

5. Turning radii for all drive entrances and turns shall be 50' outside and 30' inside. **(Circulation plan provided is for tractor-trailer; however it does appear the current proposed configuration will be more than sufficient for our access onto and through the site.)**

IFC 503.2.4

6. A minimum vertical clearance of 13 ½ feet shall be maintained at all times along the fire lanes. The landscape plan indicates trees that may impede upon this over time. A means of preventing the overhang of the canopy of the trees must be provided such as species, location or a widened lane along the front of the building. **(Tree selection has been revised to a species that will not impede the drive)**

IFC 503.2.1

7. A Knox box shall be provided at the new "Vestibule A" Entrance. The location of the Knox box shall be indicated on future submittals. The Knox box will be located adjacent to the door of the structure and installed in accordance with the manufacturer's instructions. Go to www.knoxbox.com to order. **(Noted to be coordinated at time of construction with fire department)**

IFC 506.1

8. The building shall be evaluated for emergency responder radio coverage. If coverage is found to be deficient, a system to amplify the radio signal strength of responders shall be installed where necessary to meet minimum radio frequency levels. **(To be included in the fire protection plan by Kroger)**

IFC 510

9. Provide names, addresses, phone numbers, emails of owner or owner's agent, contractor, architect, on-site project supervisor. **(Listed on cover sheet, construction contractor TBD)**

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 810-229-6640.



August 24, 2016

Page 3

Kroger Expansion
9968 E. Grand River
Site Plan Review

Respectfully,

A handwritten signature in black ink, appearing to read "R. Boisvert".

Capt. Rick Boisvert, CFPS
Fire Inspector

cc: Jacob Rushlow-OHM Advisors

Planner

From: Ken Recker <KRecker@livgov.com>
Sent: Wednesday, September 07, 2016 10:54 AM
To: Planner
Cc: Jacob Rushlow (jacob.rushlow@ohm-advisors.com); Michelle LaRose
Subject: RE: Kroger's expansion

Kelly,

If this is the demolition of the commercial bldgs and parking lot to the east of the current Krogers, we met with the developer earlier this summer and are ok with the concept. The drainage characteristics as to discharge to the Appian Way Drain aren't going to generally change, although some reconfiguration of the detention area is proposed.

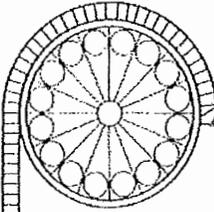
If Jacob gives you an inclination otherwise let me know.

Ken

From: Planner [mailto:planner@brightontwp.com]
Sent: Tuesday, September 06, 2016 3:40 PM
To: Ken Recker <KRecker@livgov.com>
Subject: Kroger's expansion

Do you have any comments on Kroger's expansion?

Kelly Mathews
Planner
Charter Township of Brighton
4363 Buno Rd.
Brighton, MI 48114
Office: 810-229-0562
Fax: 810-229-1778



CHARTER TOWNSHIP OF BRIGHTON

4363 Buno Rd. • Brighton, Michigan 48114-9298. • Telephone: (810)229-0550 Fax: (810) 229-1778

www.brightontwp.com

PLANNING COMMISSION APPLICATION

1. Date Filed July 7, 2016 3. PC Number _____

2. Meeting Date August 22, 2016 4. Fee Paid \$2,500

5. Applicant Information

Name The Kroger Co. of Michigan
Address 40393 Grand River Avenue
City/State/Zip Novi, MI 48375
Phone 248-536-1500 Fax 248-957-2277
Interest in the Property (e.g. fee simple, land option, etc.)
 Property Owner Other (Specify) _____

6. Current Property Owner Information

Name The Kroger Co. of Michigan
Address 40393 Grand River Avenue
City/State/Zip Novi, MI 48375
Phone 248-536-1500 Fax 248-957-2277
Length of Ownership _____

7. Location of Property for which the Application is Requested

Address 9968 East Grand River Avenue
Cross Streets Grand River Avenue and Borderline Drive
Tax I.D. # 4712-32-300-061

8. Property Information

Zoning District B-2 General Business
Area (Acreage) 14.3 Acres Width Varies Depth Varies
Current Use Kroger and Retail Shops

RECEIVED

JUL 08 2016

BRIGHTON TOWNSHIP

PLANNING COMMISSION
SITE PLAN REVIEW
PROCEDURES AND SPECIFICATIONS

1. All plans or blueprints shall be prepared, signed and sealed by a licensed Architect or Engineer.
2. All petitions and plans must be filed with the Planning Department no later than thirty (30) days prior to the regular meeting of the Township Planning Commission. RESUBMITTALS MUST BE IN THE PLANNING OFFICE FOURTEEN (14) DAYS PRIOR TO THE NEXT SCHEDULED REGULAR MEETING DATE.
3. The applicant(s), architect, or engineer of record or his/her authorized agent (by way of written letter) must appear at the meeting. A brief presentation of the proposed project may be done at that time.
4. Applicant must initially submit five (5) copies; when ready for planning commission approval (15) copies of the site plan with the application.

5. **The following fees are non refundable and include two (2) reviews by the staff:**

Residential site plan review for a plat/site condo	\$4,400***
Residential site plan review for a plat/site condo and PUD	\$5,200***
Commercial site plan review	\$2,500***

The above fees include the cost of one meeting per phase (optional, preliminary, etc.) If additional meetings are necessary, applicant will be responsible for additional costs. If reviews go beyond two (2) reviews, applicant is responsible for additional costs.

***Note: If the property is located within the Natural Features Overlay district, per Section 10-04 of the Zoning Ordinance, an Environmental Impact Assessment will be required. In addition, a Traffic Impact Study and a wetland survey may be required for all projects with impacts, as stated per Section 18-09. Additional costs incurred for these studies/surveys, will be the sole responsibility of the developer.

6. Following the site plan phase of the project, there is a final site plan/construction plan review phase of the project. This phase is handled administratively and the fee for this phase of the project is based on the construction cost of the job and includes two (2) plan reviews; the fee is paid at the time of submittal of plans. Construction plan reviews beyond two (2) submittals will be charged on an hourly

basis but an escrow amount will be established up-front which will need to be paid prior to any additional reviews. After the construction plans are approved and the engineer issues his final letter, an inspection escrow amount based on the construction cost, performance bond amount, and any other fees associated with the project will be identified in the engineer's letter which will need to be paid prior to the issuance of a building permit. In addition, the building department has permit fees. The adopted Brighton Township Engineering Standards are on the Township's web site which applicants can review for more detail on the entire construction process.

REQUIRED SPECIFICATIONS:

GENERAL INFORMATION:

Include a north arrow, drawing scaled, drawing numbers, drawing date and revision dates, area location map, the proposed use, the property zoning, and adjacent zoning.

Include the name of the developer, developer's name, address and phone number.

All sites plans should be prepared, signed and sealed by a registered architect or engineer.

GENERAL SITE INFORMATION:

The legal description of the property, a boundary survey, and the tax numbers of the parcel need to be provided. The location and dimensions of lot lines and easements need to be shown.

All existing and proposed topography shall be represented on a contour map which will accompany all proposed new structures. Existing topography information at a contour interval of two (2) feet or less plus proposed grading plan (including design of any on site storm water retention/detention area).

The site plan needs to identify natural features such as wooded areas, soils, flood plains, wetlands and watercourses. The Planning Commission may require scenic easements, woodlands, or portions of woodlands, rock formations or any natural feature of land or resource which would perpetuate the natural attractiveness of any site. All such scenic easements shall be maintained in perpetuity as described and approved on the site plan and supporting documents of record.

PROPOSED DEVELOPMENT INFORMATION:

Structures need to meet the area, height and bulk requirements for the zoning district. All required yards and setbacks need to be shown.

Screening walls, greenbelts and landscaped areas need to be detailed and labeled. The location of any trees (5" caliper or greater) to be removed must be indicated.

X A lighting plan showing lighting location, height, area of illumination, and fixture details should be provided.

 X Solid waste disposal methods need to be identified including the location of dumpsters and screening details.

 X Details on signage need to be provided such as the type, size, height, illumination and location.

 X Off-street parking calculations as required by the Ordinance should be met. Parking spaces (double striped), driveways, maneuvering lanes and acceleration and deceleration lanes shall be drawn to scale on all site plans. Barrier-free parking per ADA standards shall be designed in the same method and manner.

 X Loading/unloading areas shall be accurately drawn and labeled. Access to loading areas need to provide adequate turning radii for trucks.

 X Storm water drainage plan should be provided indicating drainage routes, slopes, materials, manholes, inverts and catch basin locations, and storm water detention / retention with supporting calculations.

 X Sanitary sewage disposal and water systems should be identified.

 X Include details on any pavement surface showing a cross section with pavement materials. An access permit from the Livingston County Road Commission may be required.

 X Type and proposed location of any outdoor storage.

 X Proposed use of each existing and each proposed structure in this development, number of stories, gross building floor space, and distances between structures.

 X Elevation plans, including height of exterior (front, side, and rear) facades of all buildings or structures on site, indicating proposed construction materials, including color and architecture.

IF CONSTRUCTION OR USE HAS NOT COMMENCED WITHIN TWELVE (12) MONTHS OF THE DATE OF PLANNING COMMISSION APPROVAL ON A SITE PLAN, THE APPROVAL BECOMES NULL AND VOID AND A NEW APPLICATION WILL BE REQUIRED. UPON WRITTEN REQUEST FROM THE APPLICANT, ONE (1) TWELVE (12) MONTH EXTENSION OF THE APPROVED SITE PLAN MAY BE GRANTED BY THE PLANNING COMMISSION UPON AN ADEQUATE SHOWING OF NEED BY THE APPLICANT.

9. Type and Description of Development

The existing retail will be removed and the Kroger store will be expanded to approximately 105,935 square feet.

PUD _____ Subdivision _____ Site Condo _____
New Site Plan X Revised Site Plan _____ Additional Phase _____

10. Site Plan Request

Describe your Request _____

The development will include expansion of existing Kroger store to approximately 105,935 square feet. The site will connect to public water and the existing water tank will be removed. The detention basin will be modified. Parking lot improvements and additional landscape will be provided.

I, Adam Crane (applicant), do hereby swear that the above statements are true.

I, Adam Crane (property owner), hereby give permission for the Charter Township of Brighton staff and consultants to go on the property for which the above referenced petition is proposed for purposes of verifying information provided on the submitted application.

Signature of Applicant [Signature] Date: 7/7/2016

Signature of Property Owner [Signature] Date: 7/7/2016
on behalf of The Kroger Co.

Brighton Township Planning Commission Action	
Approved/Denied	_____
Date	_____
Conditions of Approval	_____
_____	_____
_____	_____

SPECIAL LAND USE APPLICATION
Charter Township of Brighton
Planning Department

Date July 7, 2016

Permit # _____

Fee: \$1,400

Name of Petitioner The Kroger Co. of Michigan

Address 40393 Grand River Avenue, Novi, MI 48375

Contact #'s

<small>street</small>	<small>city</small>	<small>state</small>	<small>zip</small>
248-536-1500	248-957-2277		
<small>home</small>	<small>work</small>	<small>fax #</small>	

Email adam.crane@kroger.com

Name of Property Owner The Kroger Co. of Michigan

Address 40393 Grand River Avenue, Novi, MI 48375

Contact #'s

<small>street</small>	<small>city</small>	<small>state</small>	<small>zip</small>
248-536-1500	248-957-2277		
<small>home</small>	<small>work</small>	<small>fax #</small>	

Email adam.crane@kroger.com

Property Tax ID # 4712-32-300-061 Zoning District B-2 General Business

Location Address 9968 East Grand River Avenue

DESCRIBE IN DETAIL THE CURRENT USE AT THIS SITE

Lower level/basement N/A

1st Floor Kroger grocery store and existing retail shops

2nd Floor 767 SF Mezzanine within Kroger

Describe the SPECIAL USE requested:

1. Retail Establishments & Shopping Centers Greater Than 30,000 SF
2. Drug Stores with Drive Thru Pickup
3. Open Air Businesses

Does the proposed SPECIAL USE involve the interior storage of materials or goods.

Describe below:

No.

RECEIVED

JUL 08 2016

BRIGHTON TOWNSHIP

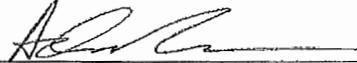
Is the requested use limited to the exterior of the structure?

Retail greater than 30,000 SF and drive through include interior and exterior of the building. Open air business is limited to the exterior.

Does the proposed SPECIAL USE affect the existing or approved parking, loading/unloading area, driveway, sanitary system, water supply, required planted setback and/or required greenbelt?

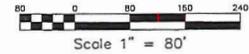
The parking lot will be modified as part of expansion to create additional parking for the expanded building and provide the required lane and stacking width at the drive through pharmacy. The exiting loading dock will remain. Driveways along the west side will be modified as part of the expansion. A grease trap will be provided. The site will be connected to public water. Additional landscape will be provided.

Receipt # _____

Signature 

*Adam Crane
Regional Construction Manager
The Kroger Co.*

WHITMORE LAKE ROAD (OLD U.S. 23)
(120' PUBLIC R.O.W.)



NOTES

- BENCHMARKS**
 - CONTROL BENCHMARK, CHISELED "C" IN CONCRETE LIGHT POLE MADE IN THE NORTHEAST QUADRANT OF THE EAST ENTRANCE DRIVE TO VEGGER PARKING LOT. ELEV = 958.68 U.S.C.S.
 - SITE BENCHMARK, SET CHISELED "C" ON TOP OF EAST SIDE OF CONCRETE LIGHT BASE, 10.6 NORTH AND 20.6 EAST OF NORTHWEST CORNER OF SUBJECT PROPERTY. ELEV = 961.25
- THE CONTRACTOR SHALL CALL "MGS DIG" AT 811 OR 1-800-482-7171 AT LEAST THREE (3) WORKING DAYS (EXCLUDING WEEKENDS AND HOLIDAYS) PRIOR TO CONSTRUCTION.
- L&S ENGINEERS & SURVEYORS WILL NOT BE RESPONSIBLE FOR FIELD DECISIONS MADE BY THE CONTRACTOR OR THE CONTRACTOR'S SUPERVISOR UNLESS THESE DECISIONS HAVE NOT BEEN APPROVED BY L&S ENGINEERS & SURVEYORS.
- UNLESS OTHERWISE NOTED, ALL DIMENSIONS ARE TO THE FACE OF CURB.

PARKING

PARKING REQUIREMENTS
GENERAL RETAIL STORES AND SUPERMARKETS REQUIRE ONE PARKING SPACE PER 200 SQUARE FEET OF USABLE FLOOR AREA. USABLE FLOOR AREA IS DEFINED AS 80% OF GROSS FLOOR AREA UNLESS SPECIFICALLY CALCULATED.
FLOOR AREA: 100,935 S.F.
NUMBER OF EMPLOYEES ON LARGEST SHIFT: 118
USABLE FLOOR AREA: 76,880 S.F. (75%) FOR FUTURE PLAN BATED 4/21/16
PARKING REQUIRED BY CODE: 385 + 118 EMPLOYEES = SPACES 498 SPACES
PARKING PROVIDED: 418 SPACES + 8 CLOSET PICK UP SPACES = 427
418 INCLUDES THE 24 SPACING SPACES AT THE BACK AND DOES NOT INCLUDE THE 12 FUTURE SPACES AT THE BACK
PARKING PROVIDED INCLUDING THE 12 SPACES: 439 SPACES
RATIO: 4.09 SPACES/1000 S.F. OF FLOOR AREA (4.09 SPACES)
CART CORNERS ARE NOT COUNTED AS PARKING SPACES
SPACES SHOWN ON THIS PLAN ARE 9.5' WIDE

SITE DATA

SITE ZONING:	B-2
SITE USE:	GENERAL BUSINESS
SITE AREA:	64.2 AC
BUILDING AREA:	100,935 SQ FT
BUILDING HEIGHT:	35' - 0" FT
REAR SETBACK:	30'
FRONT SETBACK:	10'
SIDE SETBACK:	10'

SPECIAL LAND USE: RETAIL STORES/RESTAURANTS & SHOPPING CENTERS GREATER THAN 30,000 SQ FT

DRIVE THRU PHARMACY
OUTDOOR SEASONAL SALES

NOTE TO CONTRACTOR:
AT NO TIME SHALL CONSTRUCTION TRAFFIC, CONSTRUCTION EQUIPMENT OR MATERIALS ENTER OR OCCUPY THIS EASEMENT AREA. NO CONSTRUCTION IS PROPOSED WITHIN THE LIMITS OF THIS EASEMENT. THE CONTRACTOR SHALL REFER TO THE CONTRACT/AGREEMENT FOR PENALTIES ASSOCIATED WITH NON-COMPLIANCE WITH THIS REQUIREMENT.

GRAND RIVER AVENUE
(100' PUBLIC R.O.W.)

BORDERLINE DRIVE
(66' WIDE PRIVATE EASEMENT)

PROPOSED ADDITION
42,241 SQ FT
F.F. = 959.50
10' DIE EASEMENT LATERAL 1162

TITLE EASEMENT FOR BUSINESS-EXPANSION
L 2016, P. 413, L 1018, P. 414, L 2016, P. 413, L 1018, P. 414

66' PRIVATE EASEMENT FOR BUSINESS-EXPANSION
L 2016, P. 413, L 1018, P. 414, L 2016, P. 413, L 1018, P. 414

20' DRAINAGE RETENTION EASEMENT A
L 1016, P. 22

DRAINAGE RETENTION EASEMENT B
L 2210, P. 913 & L 2206, P. 913

66' INDEMNIFICATION EASEMENT
L 1016, P. 22, L 1018, P. 22, L 1018, P. 22, L 1018, P. 22

DATE	BY	REVISIONS/SUBMITTALS

L&S
Engineers & Surveyors

3135 PINE TREE ROAD
SUITE D
LANSING, MI 48911
PH. (313) 293-2922
FAX (313) 293-2908
www.lg-es.com

PREPARED FOR:

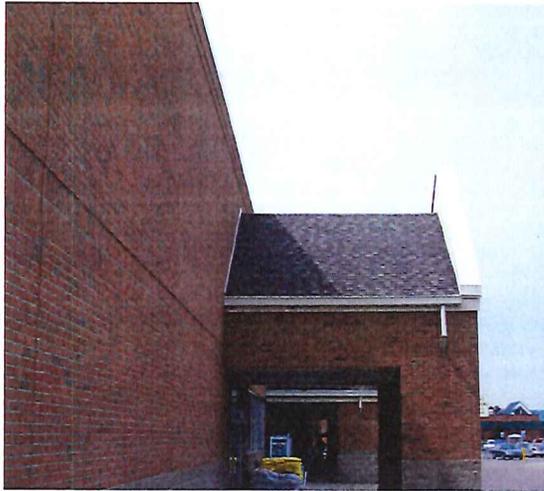
THE KROGER
CO. OF MICHIGAN
40399 GRAND RIVER RD
SUITE 110
NOVATA, MI 48373
PHONE: (248) 536-1000

OVERALL SITE PLAN
FOR
KROGER STORE #10-038 EXPANSION
8910
BRIGHTON, MICHIGAN 48116

MISS DIG

3 WORKING DAYS
BEFORE YOU DIG
OR DRILL
CALL
1-800-482-7171
(TOLL FREE)

FILE	CT-1 (308)
REVISION BY	ADD/ALS
DRAWN BY	CEP
DESIGNED BY	ADD
DATE	JUL 28, 2016
SCALE	1" = 80'
WDR	N/A
PROJECT NO.	1379
SHEET NO.	C.1



existing building photos

July 7, 2016

Kroger D638

Brighton, MI
516306



MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

PERMIT APPLICATION FOR WATER SUPPLY SYSTEMS
 (CONSTRUCTION - ALTERATION - ADDITION OR IMPROVEMENT) AS DESCRIBED HEREIN
 Required under the Authority of 1976 PA 399, as amended

This application becomes an Act 399 Permit only when signed and issued by authorized Michigan Department of Environmental Quality (DEQ) Staff. See instructions below for completion of this application.

<p>1. Municipality or Organization, Address and WSSN that will own or control the water facilities to be constructed. This permit is to be issued to: Livingston Community Water Authority 10001 Silver Lake Road Brighton, MI 48116</p> <p>WSSN: 03929</p>	<p style="text-align: right;">Permit Stamp Area (DEQ use only)</p> <p style="text-align: center;">MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY</p> <p style="text-align: center;">PERMIT NO. W 163043 AUG 23 '16 <i>4 PJB</i></p> <p style="text-align: center;">EXAMINED AND APPROVED FOR COMPLIANCE WITH ACT 399, P.A. 1976</p>	
<p>2. Owner's Contact Person (provide name for questions):</p> <p>Contact: Mark St. Charles Title: Chairman Phone: 1-810-231-1333</p>		
<p>3. Project Name (Provide phase number if project is segmented):</p> <p>Kroger D-638 Watermain Extension</p>	<p>4. Project Location (City, Village, Township): Brighton Township</p>	<p>5. County (location of project): Livingston</p>

ISSUED UNDER THE AUTHORITY OF THE DIRECTOR OF THE DEPARTMENT OF ENVIRONMENT QUALITY

cc: Alan Boyer, PE, LSG Engineers & Surveyors
 OHM Advisors
 Brighton Township
 Livingston 06 DPH

Issued by: *Patrick J. Brennan*
 Patrick J. Brennan, P.E., Dist. Engineer
 517-581-2769
 Reviewed by: *Zach Tallmadge*

If this box is marked see attached special conditions. Zach Tallmadge, E.I.T., Area Engineer
 517-937-6799

Instructions: Complete items 1 through 5 above and 6 through 21 on the following pages of this application. Print or type all information except for signatures. Mail completed application, plans and specifications, and any attachments to the DEQ District Office having jurisdiction in the area of the proposed construction.

Please Note:

- a. This **PERMIT** only authorizes the construction, alteration, addition or improvement of the water system described herein and is issued solely under the authority of 1976 PA 399, as amended.
- b. The issuance of this **PERMIT** does not authorize violation of any federal, state or local laws or regulations, nor does it obviate the necessity of obtaining such permits, including any other DEQ permits, or approvals from other units of government as may be required by law.
- c. This **PERMIT** expires two (2) years after the date of issuance in accordance with R 325.11306, 1976 PA 399, administrative rules, unless construction has been initiated prior to expiration.
- d. Noncompliance with the conditions of this permit and the requirements of the Act constitutes a violation of the Act.
- e. Applicant must give notice to public utilities in accordance with 1974 PA 53, (MISS DIG), being Section 460.701 to 460.718 of the Michigan Compiled Laws, and comply with each of the requirements of that Act.
- f. All earth changing activities must be conducted in accordance with the requirements of the Soil Erosion and Sedimentation Control Act, Part 91, 1994 PA 451, as amended.
- g. All construction activity impacting wetlands must be conducted in accordance with the Wetland Protection Act, Part 303, 1994 PA 451, as amended.
- h. Intentionally providing false information in this application constitutes fraud which is punishable by fine and/or imprisonment.
- i. Where applicable for water withdrawals, the issuance of this permit indicates compliance with the requirements of Part 327 of Act 451, Great Lakes Preservation Act.

Permit Application for Water Systems (Continued)

6. **Facilities Description** – In the space below provide a detailed description of the proposed project. Applications without adequate facilities descriptions will be returned. SEE EXAMPLES BELOW. Use additional sheets if needed.

86 LF of 14-inch HDPE Watermain (ID 12-inch) by directional bore beneath Whitmore Lake Road (Old US-23),

1,550 LF of 12-inch DIP Watermain in Victor Drive ¹² and an easement from Whitmore Lake Road (Old US-23), west and south to the south property line of the existing Kroger parcel;

2,005 LF of 8-inch DIP Watermain in an easement from the proposed 12-inch main in Victor Drive, north, west and south to the proposed 12-inch main south of the Kroger store; and,

58 LF of 6-inch DIP Watermain in an easement as fire hydrant lead.

EXAMPLES – EXAMPLES – EXAMPLES – EXAMPLES – EXAMPLES – EXAMPLES	
Water Mains	500 feet of 8-inch water main in First Street from Main Street north to State Street. OR 250 feet of 12-inch water main in Clark Road from an existing 8-inch main in Third Avenue north to a hydrant.
Booster Stations	A booster station located at the southwest corner of Third Avenue and Main Street, and equipped with two, 15 Hp pumps each rated 150 gpm @ 200 feet TDH. Station includes backup power and all other equipment as required for proper operation.
Elevated Storage Tank	A 300,000 gallon elevated storage tank located in City Park. The proposed tank shall be spherical, all welded construction and supported on a single pedestal. The tank shall be 150 feet in height, 40 feet in diameter with a normal operating range of 130 – 145 feet. The interior coating system shall be ANSI/NSF Standard 61 approved or equivalent. The tank will be equipped with a cathodic protection system, and includes a tank level control system with telemetry.
Chemical Feed	A positive displacement chemical feed pump, rated at 24 gpd @ 110 psi to apply a chlorine solution for Well No. 1. Chlorine is 12.5% NaOCL, ANSI/NSF Standard 60 approved and will be applied at a rate of 1.0 mg/l of actual chlorine.
Water Supply Well	Well No. 3, a 200 foot deep well with 170 feet of 8-inch casing and 30 feet of 8-inch, 10 slot screen. The well will be equipped with a 20 Hp submersible pump and motor rated 200 gpm @ 225 feet TDH, set at 160 feet below land surface.
Treatment Facilities	A 5 million gpd water treatment plant located at the north end of Second Avenue. The facility will include 6 low service pumps, 2 rapid mix basins, 4 flocculation/sedimentation basins, 8 dual media filters, 3 million gallon water storage reservoir and 6 high service pumps. Also included are chemical feed pumps and related appurtenances for the addition of alum, fluoride, phosphate and chlorine.

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

Permit Application for Water Systems (Continued)

General Project Information – Complete all boxes below.	
<p>7. Design engineer's name, engineering firm, address, phone number, and email address:</p> <p>Alan Boyer, PE LSG Engineers & Surveyors 3135 Pinetree Road, Suite D Lansing, MI 48911 517-393-2902 x225</p>	<p>8. Indicate who will provide project construction inspection:</p> <p><input type="checkbox"/> Organization listed in Box 1. <input type="checkbox"/> Engineering firm listed in Box 7. <input checked="" type="checkbox"/> Other - name, address, and phone number listed below. OHM Advisors Inc 34000 Plymouth Road Livonia, MI 48150 734-522-6711</p>
<p>9. Is a basis of design attached? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO</p> <p>If no, briefly explain why a basis of design is not needed.</p>	
<p>10. Are sealed and signed engineering plans attached? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO</p> <p>If no, briefly explain why engineering plans are not needed.</p>	
<p>11. Are sealed and signed construction specifications attached? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO</p> <p>If specifications are not attached, they need to be on file at DEQ.</p>	
<p>12. Were Recommended Standards for Water Works, Suggested Practice for Water Works, AWWA guidelines, and the requirements of Act 399 and its administrative rules followed? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO</p> <p>If no, explain which deviations were made and why.</p>	
<p>13. Are all coatings, chemical additives and construction materials ANSI/NSF or other adequate 3rd party approved? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO</p> <p>If no, describe what coatings, additives or materials did not meet the applicable standard and why.</p>	
<p>14. Are all water system facilities being installed in the public right-of-way or a dedicated utility easement? (For projects not located in the public right-of-way, utility easements must be shown on the plans.) <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO</p> <p>If no, explain how access will be obtained.</p>	
<p>15. Is the project construction activity within a wetland (as defined by Section 324.30301(d)) of Part 303, 1994 PA 451? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO</p> <p>If yes, a wetland permit must be obtained.</p>	
<p>16. Is the project construction activity within a 100-year floodplain (as defined by R 323.1311(e)) of Part 31, 1994 PA 451, administrative rules? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO</p> <p>If yes, a flood plain permit must be obtained.</p>	
<p>17. Is the project construction activity within 500 feet of a lake, reservoir, or stream? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO</p> <p>If yes, a Soil and Erosion Control Permit must be obtained <u>or</u> indicate if the owner listed in box 2 of this application is an Authorized Public Agency (Section 10 of Part 91, 1994 PA 451) <input type="checkbox"/> Owner is APA.</p>	

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

Permit Application for Water Systems (Continued)

18. Will the proposed construction activity be part of a project involving the disturbance of five (5) or more acres of land?
 YES NO

If yes, is this activity regulated by the National Pollutant Discharge Elimination System storm water regulations?
 YES: NPDES Authorization to discharge storm water from construction activities must be obtained.

NO: Describe why activity is not regulated: Activity will occur prior to the commencement of the later site construction phase that will involve a disturbance of five (5) acres or more. An NPDES NOC will be obtained prior to the commencement of activities that will disturb five (5) acres or more.

Please call 517-241-8993 with questions regarding the applicability of the storm water regulations.

19. Is the project in or adjacent to a site of suspected or known soil or groundwater contamination?

YES NO

If yes, attach a copy of a plan acceptable to the DEQ for handling contaminated soils and/or groundwater disturbed during construction. Contact the local DEQ district office for listings of Michigan sites of environmental contamination.

20. IF YOU ARE A CUSTOMER/WHOLESALE/BULK PURCHASER, COMPLETE THE FOLLOWING

1) Name and WSSN of source water supply system (seller) _____

2) Does the water service contract require water producer/seller to review and approve customer/wholesale/bulk purchaser water system construction plans?

YES NO

If yes to #2, the producer/seller approval letter must be attached when submitted to DEQ.

21. **Owner's Certification** The owner of the proposed facilities or the owner's authorized representative shall complete the owner's certification. It is anticipated that the owner will either be a governmental agency (city, village, township, county, etc.) or a private owner (individual, company, association, etc.) of a Type I public water supply.

OWNER'S CERTIFICATION

I, Mark St. Charles (name), acting as the Chairman (title/position) for
(print) (print)

Livingston Community Water Authority (entity owning proposed facilities) certify that this project has
(print)

been reviewed and approved as detailed by the Plans and Specifications submitted under this application, and is in compliance with the requirements of 1976 PA 399, as amended, and its administrative rules.

Mark St. Charles
Signature*

6-15-16
Date

810-231-1333
Phone

*Original signature only, no photocopies will be accepted.

RECEIVED

JUN 27 2016

DEQ-RMG-JACKSON

PROJECT BASIS OF DESIGN – FOR WATER MAIN PROJECTS

PROJECT NAME: Kroger D-638 Watermain Extension

For this PROJECT the following information must be provided per Act 399 unless waived by the Department. For projects other than water main installation, or if additional space is needed, attach separate sheet(s) with detailed Basis of Design calculations.

- A. A general map of the initial and ultimate service areas
 Included on engineering plans Attached separately
- B. Number of service connections served by this permit application 1
- C. Total number of service connections ultimately served by entire project 1
- D. Residential Equivalent Units (REUs) served by this permit application 18
- E. Total Residential Equivalent Units (REUs) ultimately served by entire project 18
- F. Water flow rates for proposed project based on REUs listed in "D" and "E" above

- 1. Initial design average day flow (mgd) 0.005
- 2. Initial design maximum day flow (mgd) 0.019
- 3. Total design average day flow (mgd) 0.005
- 4. Total design maximum day flow (mgd) 0.019
- 5. Required fire flows: ⁽¹⁾ 2,500 gpm for 2 hours

- G. Actual flows and pressures of existing system at the connection point(s) ⁽²⁾
 - 1898 gpm at 52 psi
 - _____ gpm at _____ psi
 - _____ gpm at _____ psi
 - _____ gpm at _____ psi

- H. Estimated minimum flows and pressures within the proposed water main system ⁽³⁾ 20 gpm at 40 psi

(1) Every water system must decide what levels of fire fighting flows they wish to provide. Fire flow should be appropriate for the area (residential, commercial, industrial) being served by the project. Typical fire flow rates can be obtained from the water supply, local fire dept., ISO or AWWA. The water system must then be designed to be able to provide the required fire flows while maintaining at least 20 psi in all portions of the distribution system.

(2) Flows and pressures at the connection points must be given to determine if the existing water main(s) are able to deliver water to the new service area. These numbers can be obtained from a properly modeled and calibrated distribution system hydraulic analysis or hydrant flow tests performed in the field. If more than one connection is proposed, list as needed.

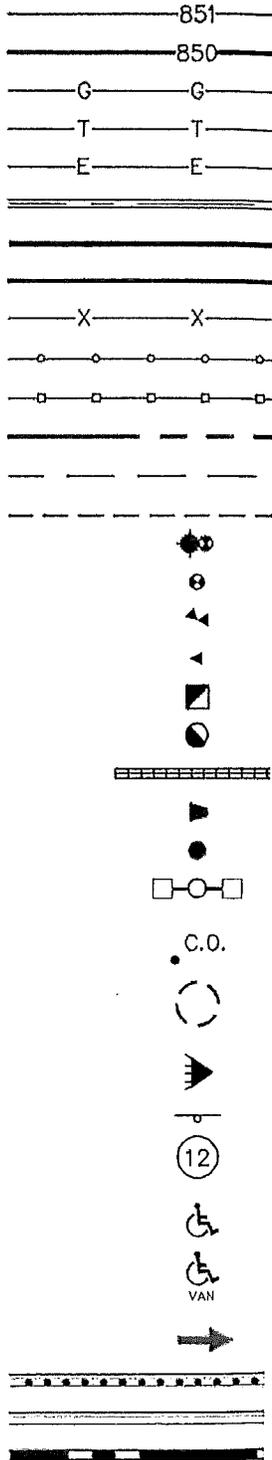
(3) List what the estimated minimum flows can be expected in the proposed water mains based on estimated water demands, head losses, elevation changes and other factors that may affect flows, such as dead end mains.



800.50 (TOC)
800.00 (GUTTER)

ERIALS LIST

- POT ELEVATION
- CONTOUR
- ' CONTOUR
- AS LINE
- ELEPHONE LINE
- ELECTRIC LINE
- FORM DRAIN
- ANITARY SEWER
- ATER MAIN
- HAIN LINK FENCE
- OOD FENCE
- UARD RAIL
- ROPERTY LINE
- .O.W. LINE
- ASEMENT LINE
- IRE HYDRANT ASSEMBLY
- ATER MAIN VALVE
- ATER MAIN BEND
- ATER MAIN REDUCER
- URB INLET
- ATCH BASIN
- RENCH DRAIN
- LARED END SECTION
- MANHOLE
- IGHT POLE
- ANITARY SEWER CLEANOUT
- ILITY CROSSING
- BUILDING WALLPACK
- IGN
- PARKING COUNT
- BARRIER-FREE PARKING
- BARRIER-FREE VAN ACCESSIBLE
- RAFFIC FLOW
- ODIFIED CURB & GUTTER
- REGULAR CURB & GUTTER
- CREEN WALL OR RETAINING WALL



- 14" HDPE DR II WATER MAIN
- 6" DUCTILE IRON PIPE PRESSURE CLASS 350 WATER MAIN
- 8" DUCTILE IRON PIPE PRESSURE CLASS 350 WATER MAIN
- 12" DUCTILE IRON PIPE PRESSURE CLASS 350 WATER MAIN
- FIRE HYDRANT ASSEMBLY AND 6" GATE VALVE
- 12"x8" REDUCER
- 12"x6" REDUCER
- 8"x6" REDUCER
- 20"x12" TAPPING SLEEVE AND GATE VALVE IN WELL
- 8" GATE VALVE IN BOX
- 12" GATE VALVE IN WELL
- 8"x8"x8" TEE
- 8"x8"x6" TEE
- 12"x12"x6" TEE
- 12"x12"x8" TEE
- 12"x12"x12" TEE
- 8" PLUG
- 8" 45° BEND
- 12" 45° BEND
- 12" 22 1/2° BEND
- MDOT F-4 CURB AND GUTTER
- AGGREGATE BASE AND PAVEMENT REPLACEMENT

PREPARED FOR:



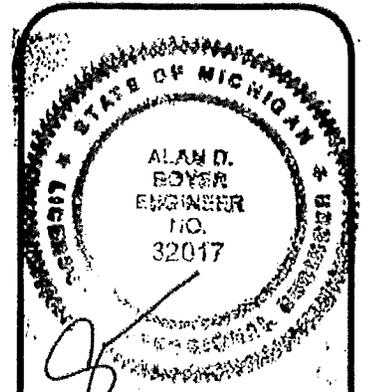
**THE KROGER
CO. OF
MICHIGAN**

40399 GRAND RIVER RD.
SUITE 110
NOVI, MI 48375
PHONE: (248) 536-1500

LSG

Engineers & Surveyors

3135 PINE TREE ROAD
SUITE D
LANSING, MI 48911
PH. (517) 393-2902
FAX (517) 393-2608
www.lsg-es.com



DATE FEBRUARY 3, 2016

PROJECT NO

1379

SHEET NO.

C0

NOTE:

(E) - INDICATES EXISTING

(P) - INDICATES PROPOSED

MEMO

VIA EMAIL

To: **Mr. Adam Crane**
Kroger Company of Michigan

From: **Michael J. Labadie, PE**
Julie M. Kroll, PE, PTOE
Steven J. Russo, E.I.T.
Fleis & VandenBrink

Date: **August 12, 2016**

Re: **Proposed Kroger Expansion**
Brighton Township, Michigan
Traffic Impact Study

RECEIVED

AUG 12 2016

BRIGHTON TOWNSHIP

Introduction

This memorandum presents the results of a Traffic Impact Study (TIS) for the proposed Kroger expansion in Brighton Township, Michigan. The project site is located in an area near the southwest quadrant of the Grand River Avenue & Whitmore Lake Road intersection. The proposed development plans include a 40,872 square feet (SF) expansion of the existing Kroger store into the adjacent retail space. Site access for the subject site is not proposed to change as part of the development plans. Access is currently provided via one driveway to Whitmore Lake Road and two driveways to Grand River Avenue. The study section of 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 & Whitmore Lake Road / Old US-23,
- Grand River Avenue & Borderline Drive,
- Grand River Avenue & Kroger Drive, and
- Whitmore Lake Road & Victor Street

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 (ITE). Additionally, F&V solicited input regarding the proposed scope of work from 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 at the study intersections by F&V subconsultant Traffic Data Collection, Inc. (TDC). Vehicular turning movement count data were collected in 15-minute intervals on Tuesday July 19, 2016 from 4:00 PM to 6:00 PM and Saturday July 16, 2016 from 11:00 AM to 1:00 PM. This data was used as a baseline to establish the current peak hour traffic volumes for the existing traffic conditions analysis. Additionally, F&V collected an inventory of existing lane use and traffic controls and obtained existing traffic signal timing information from LCRC.

The peak hour volumes for each intersection were utilized for this study and the volumes were balanced upward through the study network. In general, the peak hours of existing network traffic were identified to occur between 4:45 PM to 5:45 PM and 12:00 PM to 1:00 PM. The traffic volume data are attached and summarized in the attached Figure 2.

At the time these traffic counts were collected, the Michigan Department of Transportation (MDOT) had commenced with a construction project at the I-96/US-23 interchange located approximately ½ mile from the study area. Comparison of counts collected in February, 2015 (prior to construction) and the existing counts indicate that peak hour volumes at the intersection of Grand River Avenue & Whitmore Lake Road / Old US-23 have increased 16%. This increase is significant and likely related to construction activities associated with the I-96/US-23 interchange improvements.

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

Intersection	Control	Approach	PM Peak		SAT Peak	
			Delay (s/veh)	LOS	Delay (s/veh)	LOS
1. Grand River Avenue & Whitmore Lake Road / Old US-31	Signalized	EB	55.2	E	31.5	C
		WB	67.8	E	31.3	C
		NB	51.5	D	30.0	C
		SB	<u>51.6</u>	<u>D</u>	<u>28.7</u>	<u>C</u>
		Overall	57.9	E	30.5	C
2. Grand River Avenue & Borderline Drive	Signalized	EB	7.9	A	7.2	A
		WB	4.3	A	3.5	A
		NB	<u>30.5</u>	<u>C</u>	<u>30.6</u>	<u>C</u>
		Overall	9.1	A	8.6	A
3. Grand River Avenue & Kroger Drive	STOP (Minor)	EB	Free		Free	
		WB LT	10.4	B	9.9	A
		NB	14.9	B	13.2	B
4. Whitmore Lake Road & Victor Street / Shopping Center Drive	STOP (Minor)	EB	29.3	D	18.7	C
		WB	138.7	F	82.0	F
		NB LT	11.0	B	9.9	A
		SB LT	10.0	B	9.6	A

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 PM and Saturday (SAT) peak periods with the exception of the following:

- The signalized intersection of Grand River Avenue & Whitmore Lake Road / Old US-23 which currently operates at an overall LOS E during the PM peak period with several approaches and movements operating at a LOS E.

- The STOP controlled eastbound and westbound left turn movements from Victor Street and the opposing shopping center driveway onto Whitmore Lake Road which currently operate at a LOS F during both the PM and SAT peak periods.

Review of network simulations indicates acceptable traffic operations during the SAT 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. On the westbound approach a long vehicle queue is observed for the left turn movement which frequently exceeds available storage length and spills back into the through travel lanes along Grand River Avenue. On the northbound approach, a long vehicle queue is observed for the through movement which extends back past Victor Street for approximately 30 minutes of the peak hour. At all other study intersections vehicle queues are observed to be acceptably processed.

At the intersection of Whitmore Lake Road & Victor Street / Shopping Center Driveway, network simulations indicate acceptable traffic operations during both peak periods as a result of the low traffic demand for the STOP controlled egress left turn movements.

At the intersection of Grand River Avenue & Whitmore Lake Road / Old US-23, all approaches have dynamic no turn on red restrictions where a dynamic regulatory sign displays a "NO TURN ON RED" message for right turning vehicles during the protected phase of the conflicting left turn movement only. As Synchro / SimTraffic cannot replicate a dynamic no turn on red, right turns on red were assumed prohibited on all approaches as a conservative approach. As a result, simulations at the intersection of Grand River Avenue & Whitmore Lake Road / Old US-23 show the eastbound and westbound approaches to have slightly longer vehicle queues than field observations indicate.

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 Avenue approaches and corresponding right turn overlap signal phases should be provided. 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

Intersection	Control	Approach	PM Peak		SAT Peak	
			Delay (s/veh)	LOS	Delay (s/veh)	LOS
1. Grand River Avenue & Whitmore Lake Road / Old US-31	Signalized	EB	37.7	D	22.8	C
		WB	39.5	D	24.8	C
		NB	39.0	D	24.3	C
		SB	41.1	D	24.2	C
		Overall	39.2	D	23.9	C

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

Historical traffic data from LCRC were referenced in order to determine the applicable growth rate for the existing traffic volumes to the project build-out year in 2018. 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%.



Therefore, an annual growth rate of 0.75% was applied to the 2016 traffic volumes for two years to calculate the 2018 traffic volumes for the analysis of background conditions **without the proposed development**.

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 background conditions analysis are attached and summarized in Table 3.

Table 3: Background Intersection Operations

Intersection	Control	Approach	PM Peak		SAT Peak	
			Delay (s/veh)	LOS	Delay (s/veh)	LOS
1. Grand River Avenue & Whitmore Lake Road / Old US-31	Signalized	EB	57.1	E	32.9	C
		WB	73.0	E	31.9	C
		NB	53.5	D	31.0	C
		SB	52.9	D	29.4	C
		Overall	60.8	E	31.5	C
2. Grand River Avenue & Borderline Drive	Signalized	EB	8.0	A	7.3	A
		WB	4.3	A	3.6	A
		NB	30.5	C	30.7	C
		Overall	9.2	A	8.7	A
3. Grand River Avenue & Kroger Drive	STOP (Minor)	EB	Free	Free		
		WB LT	10.5	B	10.0	A
		NB	15.1	C	13.4	B
4. Whitmore Lake Road & Victor Street / Shopping Center Drive	STOP (Minor)	EB	30.8	D	19.1	C
		WB	153.0	F	89.9	F
		NB LT	11.2	B	10.0	A
		SB LT	10.1	B	9.7	A

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. 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 with long vehicle queues at the intersection of Grand River Avenue & Whitmore Lake Road / Old US-23 during the PM peak hour.

Site Trip Generation and Assignment

The number of PM and SAT peak hour vehicle trips that would be generated by the Kroger expansion was forecast based on data published by ITE in *Trip Generation, 9th Edition* and the *Trip Generation Handbook, 3rd Edition*. The existing 15,559 SF of retail space adjacent to Kroger is currently generating peak hour traffic volumes that are included in the existing peak hour traffic counts; therefore, in order to determine the potential impact of the proposed Kroger expansion, the net increase in vehicle trips associated with the change in land use and occupancy was calculated.

The ITE description for Specialty Retail Center (Land Use 826) was determined to best fit the existing uses and sizes of the retail space; however, this land use does not provide trip generation for the Saturday peak hour. Therefore, the ITE Shopping Center Land Use was utilized during the Saturday peak hour. Due to the relatively small size of the proposed retail use as compared to the ITE Shopping Center dataset, the average trip generation rate was referenced as opposed to the fitted curve equation.

As is typical of retail and supermarket uses, a portion of the site-generated trips are already present on the adjacent road network and are interrupted to visit the site. These trips are known as "pass-by" trips and account for a percentage of the total site-generated traffic. Pass-by trips result in turning movements at the



site driveways, but do not increase traffic volumes on the adjacent road network. Similar to pass-by trips, a portion of the site-generated trips are vehicles that are traveling on the adjacent roadway that alter their direction of travel to visit the site then return to their original route. These trips are known as "diverted-link" trips. For the purposes of this study, pass-by trips were applied along Grand River Avenue while diverted link trips were assumed to originate from Whitmore Lake Road.

The percentage of pass-by and diverted-link trips was determined based on the rates published by ITE in *Trip Generation Handbook, 3rd Edition*. ITE pass-by data is not available for the Specialty Retail Center Land Use; therefore, pass-by rates for the Shopping Center Land Use were utilized. Furthermore, pass-by data is not available for Supermarkets during the Saturday peak hour. In order to develop a Saturday pass-by rate, Weekday PM peak hour pass-by rates were compared to Saturday mid-day pass-by rates for the Free Standing Discount Superstore and Shopping Center land uses. The results of this comparison indicate that there are approximately 23% fewer pass-by trips during the weekday SAT mid-day peak hour as compared to the weekday PM peak hour. This reduction in pass-by trips was applied to the supermarket weekday pass-by rate to calculate the Saturday mid-day pass-by rate for supermarkets. The site trip generation forecast is summarized in Table 4.

Table 4: Site Trip Generation

Land Use	ITE Code	Amount	Units	Average Daily Traffic	PM Peak Hour			SAT Peak Hour		
					In	Out	Total	In	Out	Total
Supermarket	850	40,872	SF	4,179	197	190	387	222	213	435
<i>Pass-By</i>	36% PM, 28% SAT			1,337	71	68	139	62	60	122
New Trips				2,842	126	122	248	160	153	313
Existing Retail	826	15,559	SF	690	26	33	59	39	36	75
<i>Pass-By</i>	34% PM, 26% SAT			207	9	11	20	10	10	20
New Trips				483	17	22	39	29	26	55
NET CHANGE IN TRIPS				3,489	171	157	328	183	177	360
<i>Pass-By</i>				1,130	62	57	119	52	50	102
New Trips				2,359	109	100	209	131	127	258

The vehicle trips that would be generated by the Kroger expansion were assigned to the study road network based on existing peak hour traffic patterns for the site, the existing site access locations, and the methodologies published by ITE. This methodology indicates that pass-by trips enter and exit the development in their original direction of travel, diverted-link trips return to the original road on which they were traveling, and new trips will return to their direction of origin. The existing traffic patterns indicate the distribution of site-generated traffic summarized in Table 5.

Table 5: Site Trip Distribution

New Trips				Pass-By / Diverted			
From	To	PM	SAT	From	To	PM	SAT
East	East	28%	25%	East	West	33%	23%
West	West	28%	32%	West	East	25%	31%
North	North	13%	12%	North	South	15%	19%
South	South	31%	31%	South	North	27%	27%
		100%	100%			100%	100%

The site-generated vehicle trips were assigned to the study road network based on this trip distribution model and as shown on the attached Figure 4. New site generated trips were assigned at the off-site study intersections based on existing turning movement patterns. The site-generated trips were added to the background traffic volumes shown on the attached Figure 3 to calculate the future peak hour traffic volumes shown on the attached Figure 5.

Future Conditions

Future peak hour vehicle delays and LOS were calculated at the study intersections based on the existing lane use and traffic control shown on the attached Figure 1, the future peak hour traffic volumes shown on the attached Figure 5, and the methodologies presented in the HCM. The results of the future conditions analysis are attached and summarized in Table 6.

Table 6: Future Intersection Operations

Intersection	Control	Approach	PM Peak		SAT Peak	
			Delay (s/veh)	LOS	Delay (s/veh)	LOS
1. Grand River Avenue & Whitmore Lake Road / Old US-31	Signalized	EB	60.2	E	34.4	C
		WB	80.9	F	32.2	C
		NB	53.6	D	31.3	C
		SB	<u>53.1</u>	<u>D</u>	<u>29.3</u>	<u>C</u>
		Overall	64.3	E	32.1	C
2. Grand River Avenue & Borderline Drive	Signalized	EB	9.2	A	8.5	A
		WB	5.2	A	4.4	A
		NB	<u>31.5</u>	<u>C</u>	<u>32.2</u>	<u>C</u>
		Overall	10.7	B	10.3	B
3. Grand River Avenue & Kroger Drive	STOP (Minor)	EB	Free	Free		
		WB LT	11.0	B	10.4	B
		NB	17.0	C	15.0	C
4. Whitmore Lake Road & Victor Street / Shopping Center Drive	STOP (Minor)	EB	38.4	E	22.4	C
		WB	340.9	F	160.7	F
		NB LT	11.7	B	10.4	B
		SB LT	10.0	B	9.6	A

The results of the future conditions analysis indicate that the proposed expansion will not have a significant impact on the adjacent road network. At the signalized intersection of Grand River Avenue & Whitmore Lake Road / Old US-23, overall vehicle delays at the intersection will increase by 3.5 and 0.6 seconds during the PM and SAT peak periods, respectively, which will not be discernable to existing network traffic. Additionally, the proposed expansion will increase traffic at the intersection by approximately 2% and 3% during the PM and SAT peak periods, which is not significant.

At the intersection of Whitmore Lake Road & Victor Street / Shopping Center Drive, the minor street eastbound and westbound left turn movements will continue to operate at LOS F during the peak periods, while the eastbound right turn movement from Victor Street will operate at a LOS E. At this intersection, the predominant driveway movements are the northbound left turn and eastbound right turn (Kroger shopping center traffic entering and exiting to the south on Whitmore Lake Road). Review of network simulations indicates that the signalized intersection of Grand River Avenue & Whitmore Lake Road / Old US-23 creates gaps in the southbound Whitmore Lake Road traffic stream to help facilitate these movements. Additionally, egress site-generated traffic to the north on Old US-23 and east on Grand River Avenue can be accommodated via the Kroger Driveway to Grand River Avenue.

Review of network simulations indicates future traffic operations which are similar to background conditions. During the PM peak hour, long vehicle queues are continued to be observed for several approaches and movements at the intersection of Grand River Avenue & Old US-23 / Whitmore Lake Road which lasts throughout the duration of the peak periods and exceed available storage lengths.

Future Improvements

In order to mitigate future traffic operations at the signalized intersection of Grand River Avenue & Old US-23 / Whitmore Lake Road back to background conditions, improvements to the study network were investigated. The results of this analysis indicate that with the construction of a westbound right turn lane all approaches and movement would operate in an improved manner as compared to existing conditions; however, some approaches and movements will continue to operate at a LOS E during the PM peak hour as shown in Table 7.

Table 7: Future Intersection Operations with Improvements

Intersection	Control	Approach	PM Peak		SAT Peak	
			Delay (s/veh)	LOS	Delay (s/veh)	LOS
1. Grand River Avenue & Whitmore Lake Road / Old US-31	Signalized	EB	51.0	D	33.5	C
		WB	58.6	E	31.2	C
		NB	50.9	D	30.6	C
		SB	<u>51.9</u>	<u>D</u>	<u>29.0</u>	<u>C</u>
		Overall	53.7	D	31.4	C

Conclusions

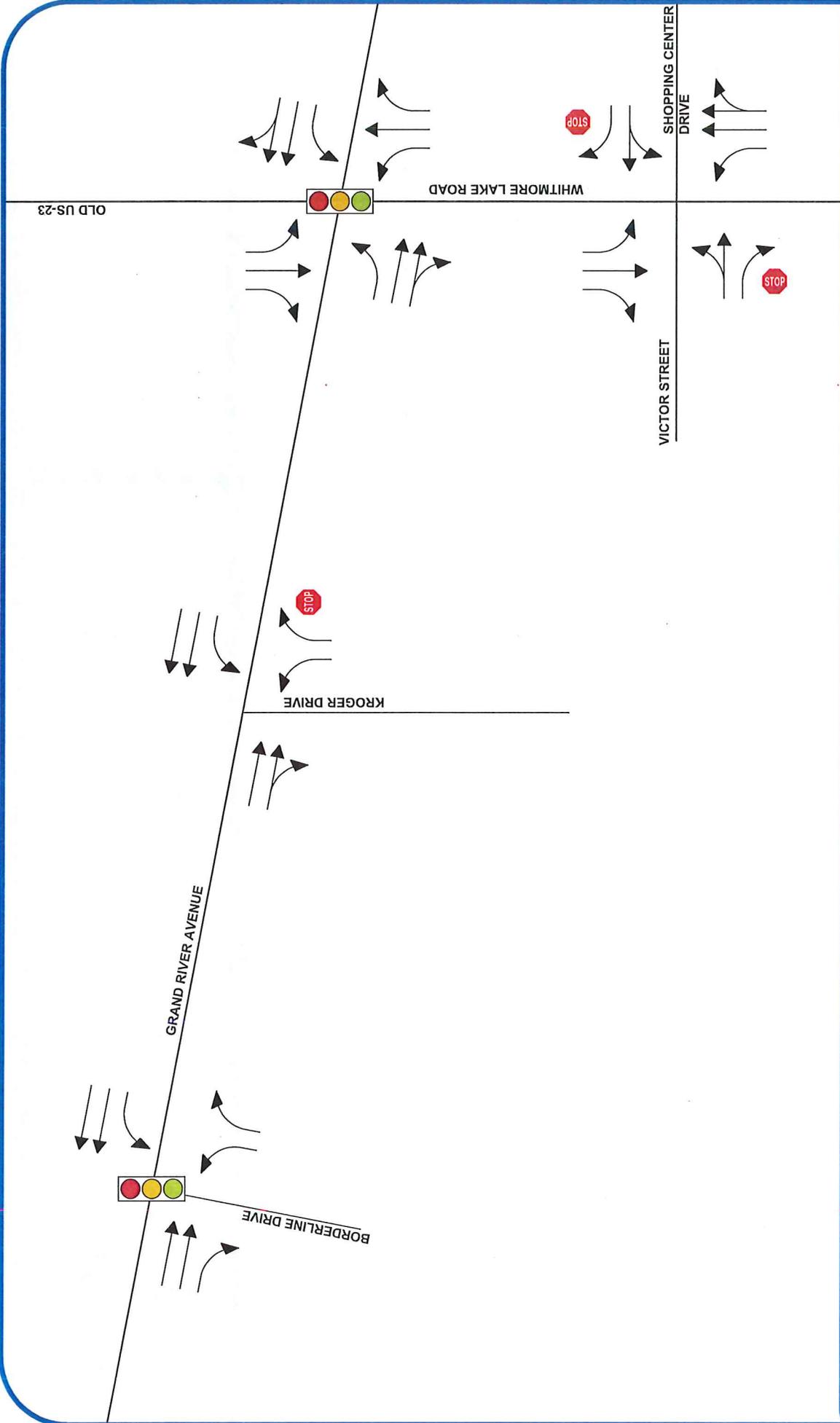
The conclusions of this Traffic Impact Study are as follows:

1. Currently, the signalized intersection of Grand River Avenue & Whitmore Lake Road / Old US-23 operates at an overall LOS E during the PM peak hour and requires geometric improvements to mitigate currently unacceptable traffic operations.
2. The minor street eastbound and westbound left turn movements at the intersection of Whitmore Lake Road & Victor Street / Shopping Center Drive currently operate at a LOS F during the peak periods; however, review of network simulations indicate acceptable traffic operations during both peak periods as a result of the low traffic demand for the STOP controlled egress left turn movements.
3. Background conditions were evaluated which includes a traffic growth rate of 0.75% per year to the project buildout year of 2018.
4. Under background traffic conditions *without the proposed development*, all study intersections will operate in a manner similar to existing conditions with minor increases in vehicle delays and LOS.
5. The analysis of future conditions *with the proposed development* indicates that the proposed expansion will not have a significant impact on the adjacent road network. At the intersection of Grand River Avenue & Old US-23 / Whitmore Lake Road overall vehicle delays will increase by less than two seconds during the peak periods which will not be discernable.
6. The proposed expansion will increase traffic at the intersection of Grand River Avenue & Old US-23 / Whitmore Lake Road by less than 2% during both peak periods, which is not significant.
7. With the recommended improvements below, all study intersection approaches and movements will operate in an improved manner as compared to existing conditions.
 - a. Construct right turn lane on the westbound approach at the intersection of Grand River Avenue & Old US-23 / Whitmore Lake Road.
 - b. Provide corresponding right turn overlap phase.

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 / SimTraffic Results

SJR:mjl:jmk

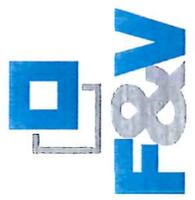


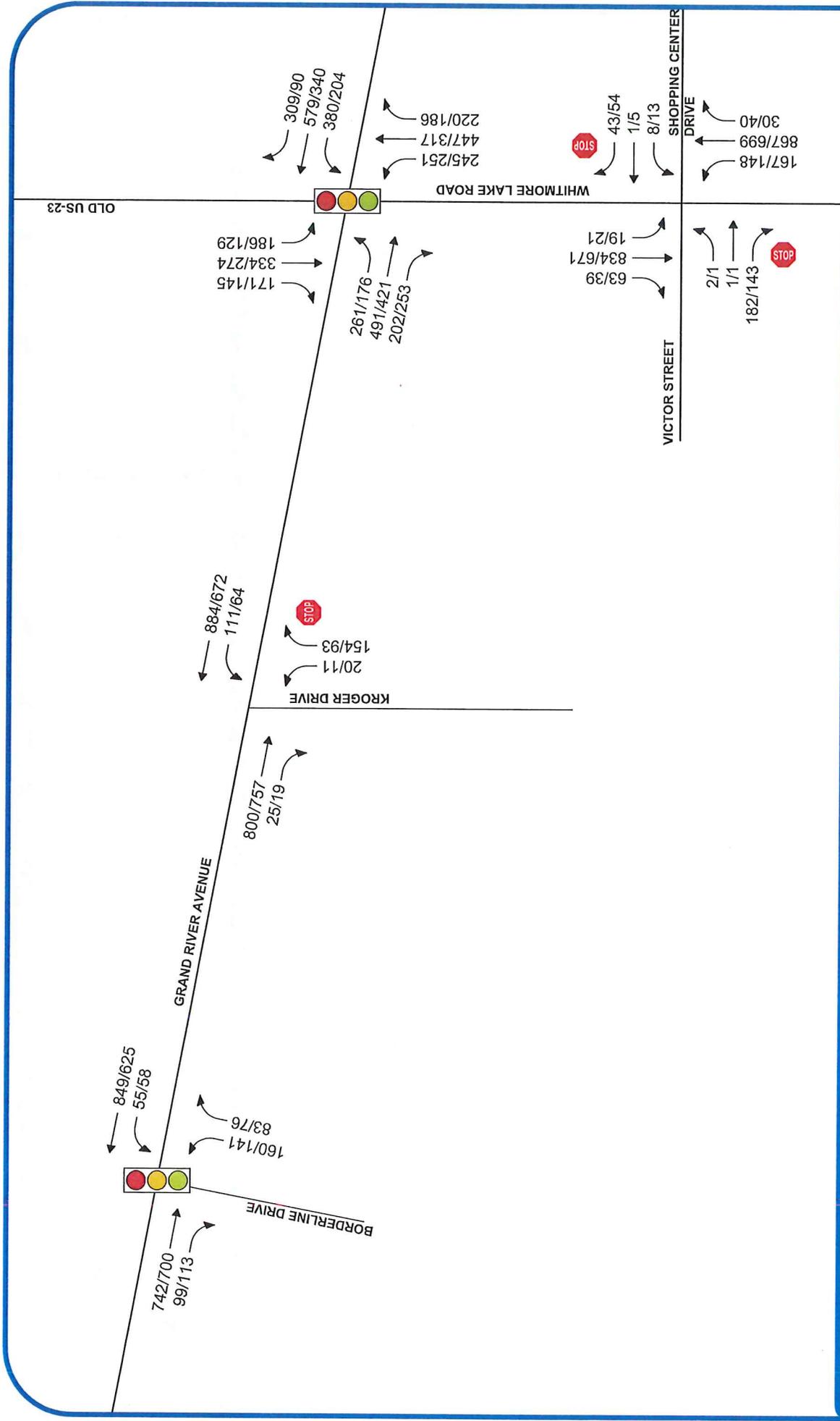
LEGEND

- SIGNALIZED INTERSECTION
- UNSIGNALIZED INTERSECTION
- ROADS
- LANE USE

NORTH
SCALE: NOT TO SCALE

FIGURE 1
LANE USE AND TRAFFIC CONTROL
 KROGER EXPANSION TIS - BRIGHTON TOWNSHIP, MI



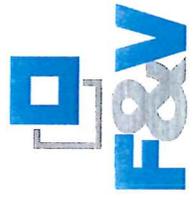


LEGEND

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

NORTH
SCALE: NOT TO SCALE

FIGURE 2
EXISTING TRAFFIC VOLUMES
 KROGER EXPANSION TIS - BRIGHTON TOWNSHIP, MI



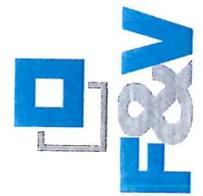


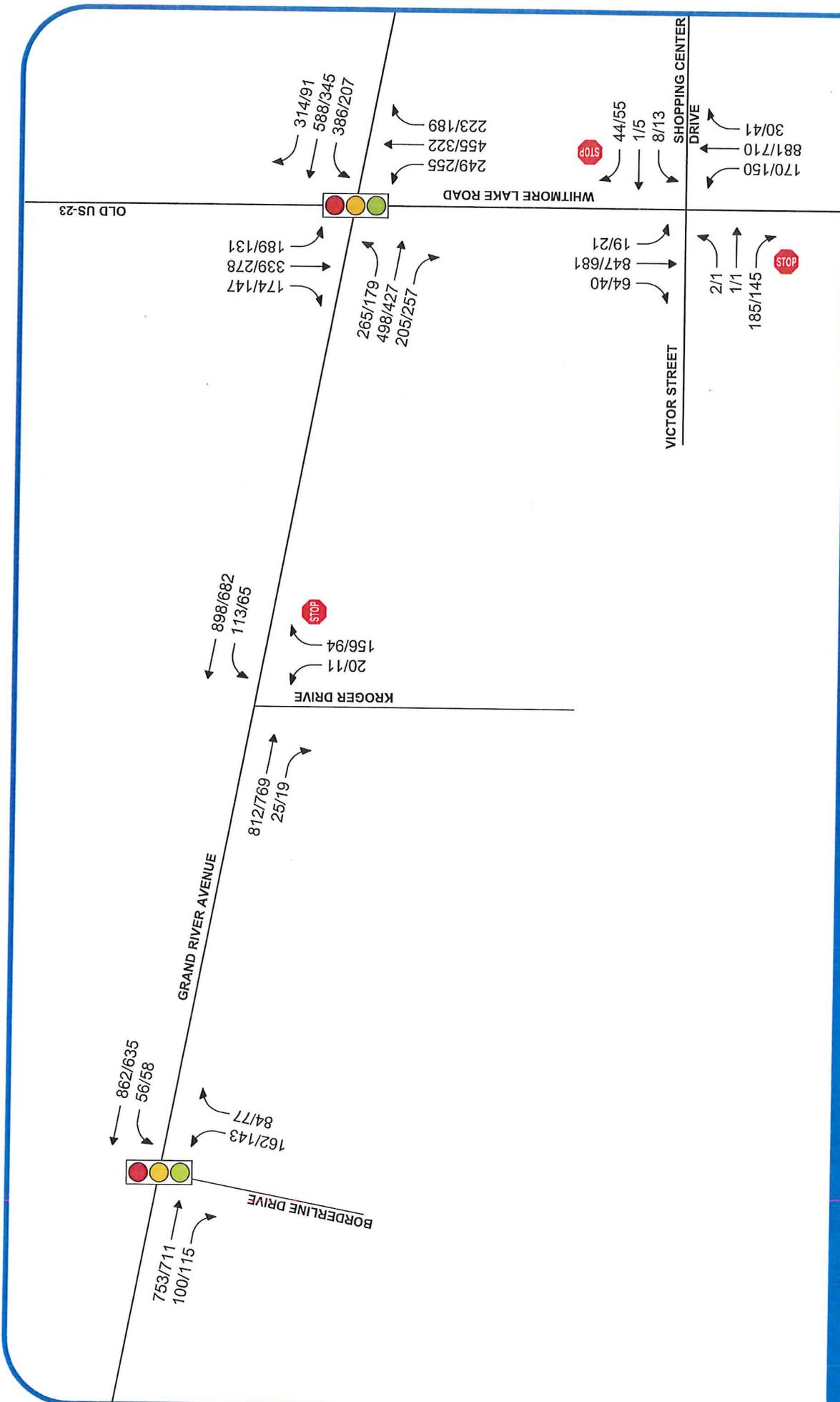
FIGURE 3 BACKGROUND TRAFFIC VOLUMES

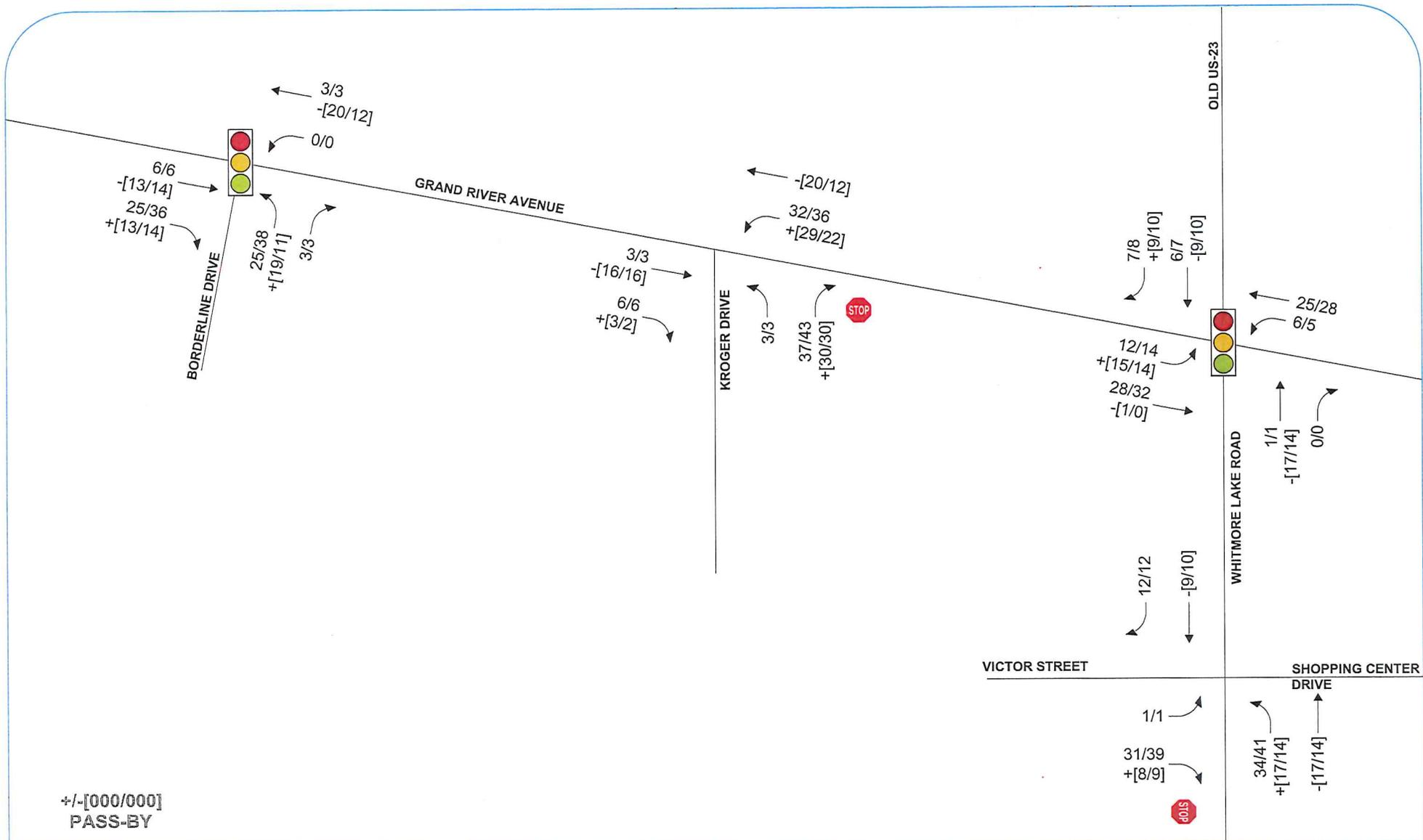
KROGER EXPANSION TIS - BRIGHTON TOWNSHIP, MI

- LEGEND**
- SIGNALIZED INTERSECTION
 - UNSIGNALIZED INTERSECTION
 - TRAFFIC VOLUMES (PM/SAT)
 - ROADS



NORTH
SCALE: NOT TO SCALE





+/-[000/000]
PASS-BY



FIGURE 4 SITE-GENERATED TRAFFIC VOLUMES

KROGER EXPANSION TIS - BRIGHTON TOWNSHIP, MI

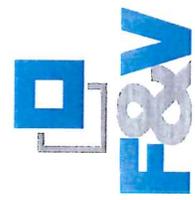
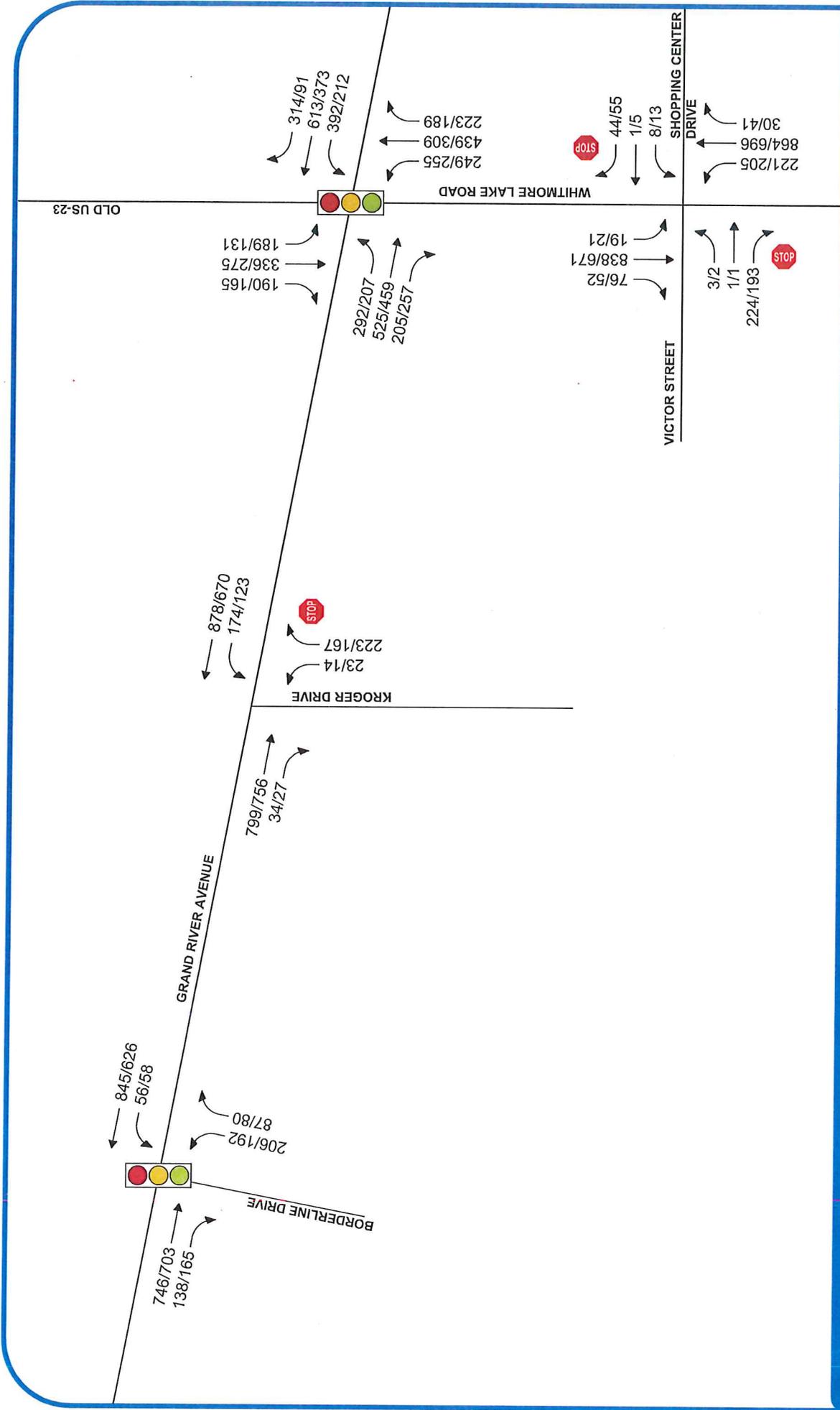


FIGURE 5
FUTURE TRAFFIC VOLUMES
 KROGER EXPANSION TIS - BRIGHTON TOWNSHIP, MI

LEGEND

- SIGNALIZED INTERSECTION
- UNSIGNALIZED INTERSECTION
- TRAFFIC VOLUMES (P/M/SAT)
- ROADS



Traffic Data Collection (TDC)

tdccounts.com

Phone: (586) 786-5407

Traffic Study Performed For:

Fleis & VandenBrink



Project: Brighton Traffic Study
 Study Type: 2 Hr. Video Turning Movement
 Weather: Cldy, Dry Temp 60's
 Count By: Miovision Video SCU 24L

File Name : TMC_1 Borderline & GrandRiver_Sat 7-16-16
 Site Code : TMC_1
 Start Date : 7/16/2016
 Page No : 1

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

Start Time	NA Southbound					Grand River Avenue Westbound					Borderline Drive Northbound					Grand River Avenue Eastbound					Int. Total
	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	
11:00 AM	0	0	0	0	0	0	124	18	0	142	18	0	27	0	45	32	140	0	0	172	359
11:15 AM	0	0	0	0	0	0	141	14	0	155	13	0	45	0	58	27	164	0	0	191	404
11:30 AM	0	0	0	0	0	0	144	19	0	163	19	0	43	0	62	33	160	0	0	193	418
11:45 AM	0	0	0	0	0	0	150	18	0	168	15	0	28	0	43	31	175	0	0	206	417
Total	0	0	0	0	0	0	559	69	0	628	65	0	143	0	208	123	639	0	0	762	1598
12:00 PM	0	0	0	0	0	0	140	10	0	150	26	0	29	0	55	20	171	0	0	191	396
12:15 PM	0	0	0	0	0	0	143	15	0	158	16	0	40	0	56	34	163	0	0	197	411
12:30 PM	0	0	0	0	0	0	165	16	0	181	19	0	37	0	56	23	168	0	0	191	428
12:45 PM	0	0	0	0	0	0	149	17	0	166	15	0	35	0	50	36	181	0	0	217	433
Total	0	0	0	0	0	0	597	58	0	655	76	0	141	0	217	113	683	0	0	796	1668
Grand Total	0	0	0	0	0	0	1156	127	0	1283	141	0	284	0	425	236	1322	0	0	1558	3266
Apprch %	0	0	0	0	0	0	90.1	9.9	0		33.2	0	66.8	0		15.1	84.9	0	0		
Total %	0	0	0	0	0	0	35.4	3.9	0	39.3	4.3	0	8.7	0	13	7.2	40.5	0	0	47.7	
Pass Cars	0	0	0	0	0	0	1144	126	0	1270	140	0	284	0	424	235	1313	0	0	1548	3242
% Pass Cars	0	0	0	0	0	0	99	99.2	0	99	99.3	0	100	0	99.8	99.6	99.3	0	0	99.4	99.3
Single Units	0	0	0	0	0	0	11	0	0	11	1	0	0	0	1	1	8	0	0	9	21
% Single Units	0	0	0	0	0	0	1	0	0	0.9	0.7	0	0	0	0.2	0.4	0.6	0	0	0.6	0.6
Heavy Trucks	0	0	0	0	0	0	1	1	0	2	0	0	0	0	0	0	1	0	0	1	3
% Heavy Trucks	0	0	0	0	0	0	0.1	0.8	0	0.2	0	0	0	0	0	0	0.1	0	0	0.1	0.1
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: 2 hour traffic study conducted during weekend (Saturday) from 11:00 AM - 1:00 PM mid-day peak hours. Signalized intersection, no ped signals. Video SCU camera was located within SE intersection quadrant.

Traffic Data Collection (TDC)

tdccounts.com

Phone: (586) 786-5407

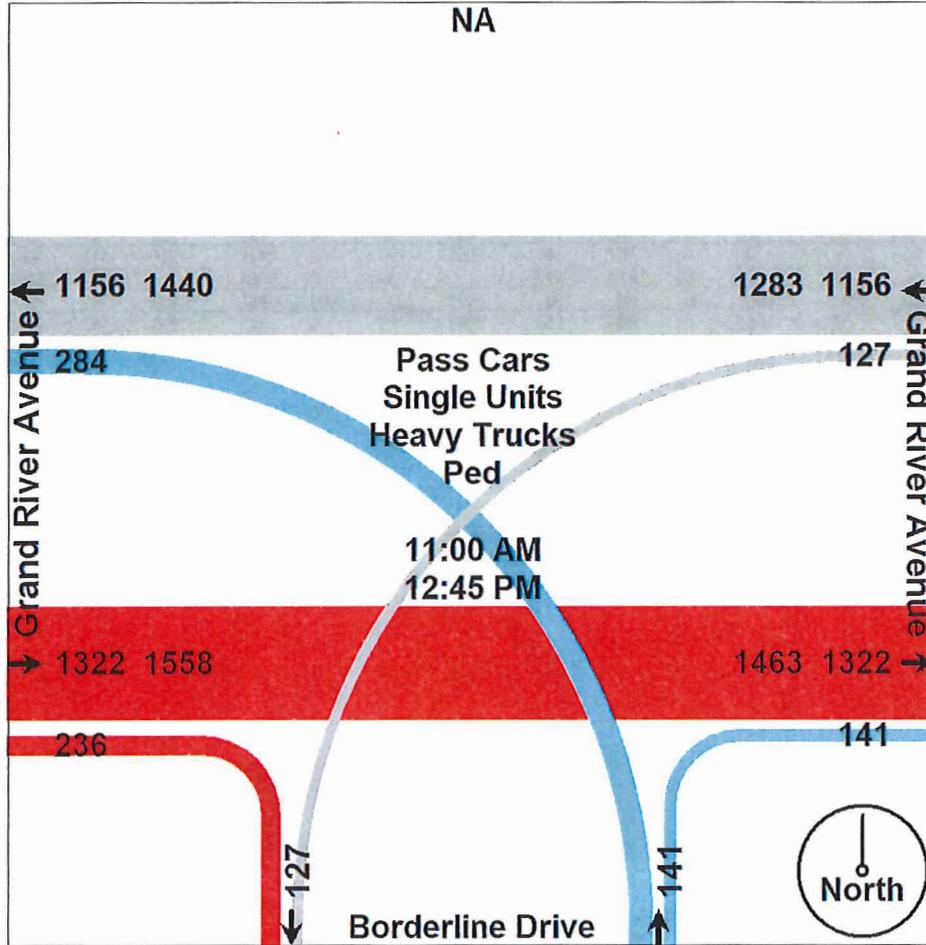
Traffic Study Performed For:

Fleis & VandenBrink



Project: Brighton Traffic Study
Study Type: 2 Hr. Video Turning Movement
Weather: Cldy, Dry Temp 60's
Count By: Miovision Video SCU 24L

File Name : TMC_1 Borderline & GrandRiver_Sat 7-16-16
Site Code : TMC_1
Start Date : 7/16/2016
Page No : 2



Traffic Data Collection (TDC)

tdccounts.com

Phone: (586) 786-5407

Traffic Study Performed For:

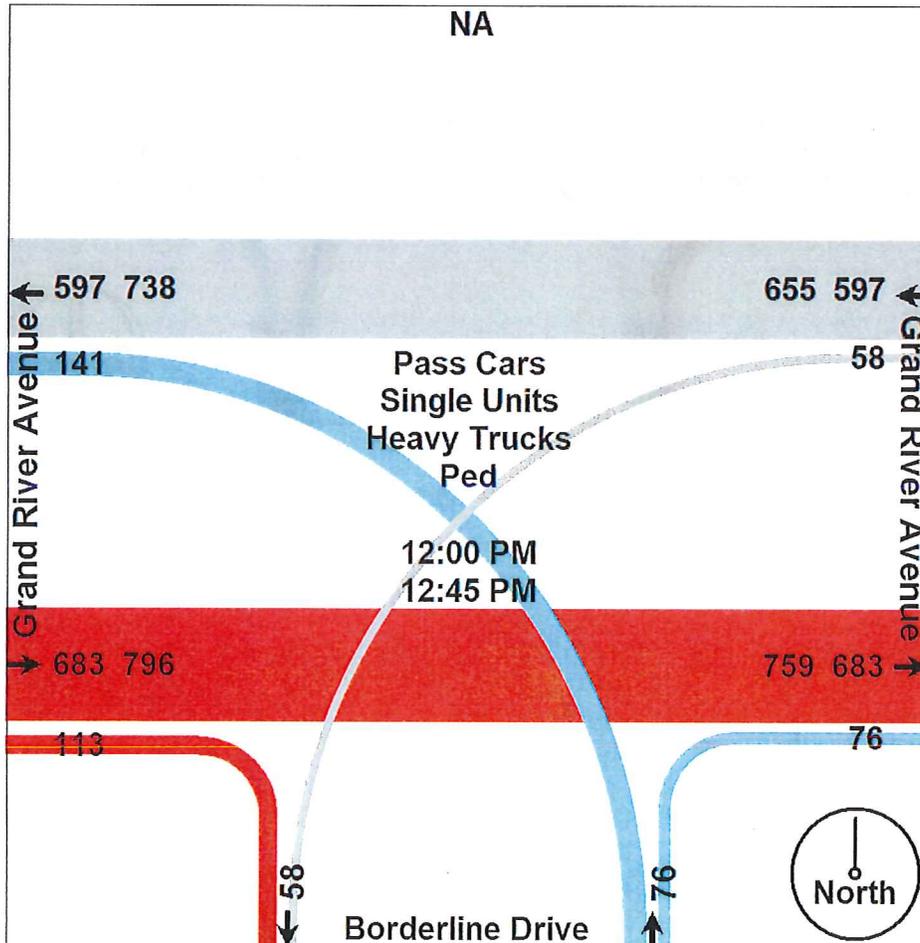
Fleis & VandenBrink



Project: Brighton Traffic Study
 Study Type: 2 Hr. Video Turning Movement
 Weather: Cldy, Dry Temp 60's
 Count By: Miovision Video SCU 24L

File Name : TMC_1 Borderline & GrandRiver_Sat 7-16-16
 Site Code : TMC_1
 Start Date : 7/16/2016
 Page No : 3

Start Time	NA Southbound				Grand River Avenue Westbound				Borderline Drive Northbound				Grand River Avenue Eastbound				Int. Total
	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 12:00 PM																	
12:00 PM	0	0	0	0	0	140	10	150	26	0	29	55	20	171	0	191	396
12:15 PM	0	0	0	0	0	143	15	158	16	0	40	56	34	163	0	197	411
12:30 PM	0	0	0	0	0	165	16	181	19	0	37	56	23	168	0	191	428
12:45 PM	0	0	0	0	0	149	17	166	15	0	35	50	36	181	0	217	433
Total Volume	0	0	0	0	0	597	58	655	76	0	141	217	113	683	0	796	1668
% App. Total	0	0	0	0	0	91.1	8.9		35	0	65		14.2	85.8	0		
PHF	.000	.000	.000	.000	.000	.905	.853	.905	.731	.000	.881	.969	.785	.943	.000	.917	.963
Pass Cars	0	0	0	0	0	591	58	649	75	0	141	216	113	680	0	793	1658
% Pass Cars	0	0	0	0	0	99.0	100	99.1	98.7	0	100	99.5	100	99.6	0	99.6	99.4
Single Units	0	0	0	0	0	5	0	5	1	0	0	1	0	3	0	3	9
% Single Units	0	0	0	0	0	0.8	0	0.8	1.3	0	0	0.5	0	0.4	0	0.4	0.5
Heavy Trucks	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1
% Heavy Trucks	0	0	0	0	0	0.2	0	0.2	0	0	0	0	0	0	0	0	0.1
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
 Study Type: 2 Hr. Video Turning Movement
 Weather: Cldy, Dry Temp 60's
 Count By: Miovision Video SCU 4PU

File Name : TMC_2 Victor & GrandRiver_Sat 7-16-16
 Site Code : TMC_2
 Start Date : 7/16/2016
 Page No : 1

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

Start Time	Victory Oil Change Dw. Southbound					Grand River Avenue Westbound					Victors Street Northbound					Grand River Avenue Eastbound					Int. Total
	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	
11:00 AM	0	0	0	0	0	0	147	23	0	170	26	0	1	1	28	3	166	0	0	169	367
11:15 AM	0	0	0	0	0	0	156	17	0	173	30	0	4	0	34	4	164	0	0	168	375
11:30 AM	0	0	0	0	0	1	156	10	0	167	27	0	1	0	28	3	178	0	0	181	376
11:45 AM	0	0	1	0	1	1	184	20	0	205	29	0	4	0	33	10	180	0	0	190	429
Total	0	0	1	0	1	2	643	70	0	715	112	0	10	1	123	20	688	0	0	708	1547
12:00 PM	1	0	0	0	1	2	147	16	0	165	29	0	0	0	29	3	197	2	0	202	397
12:15 PM	0	0	0	0	0	1	153	15	0	169	17	0	3	0	20	4	181	0	0	185	374
12:30 PM	0	0	1	0	1	0	188	13	0	201	18	0	4	0	22	2	199	1	0	202	426
12:45 PM	0	0	0	0	0	1	159	17	0	177	20	0	4	0	24	5	190	1	0	196	397
Total	1	0	1	0	2	4	647	61	0	712	84	0	11	0	95	14	767	4	0	785	1594
Grand Total	1	0	2	0	3	6	1290	131	0	1427	196	0	21	1	218	34	1455	4	0	1493	3141
Approch %	33.3	0	66.7	0		0.4	90.4	9.2	0		89.9	0	9.6	0.5		2.3	97.5	0.3	0		
Total %	0	0	0.1	0	0.1	0.2	41.1	4.2	0	45.4	6.2	0	0.7	0	6.9	1.1	46.3	0.1	0	47.5	
Pass Cars	1	0	2	0	3	6	1274	130	0	1410	194	0	20	0	214	34	1443	4	0	1481	3108
% Pass Cars	100	0	100	0	100	100	98.8	99.2	0	98.8	99	0	95.2	0	98.2	100	99.2	100	0	99.2	98.9
Single Units	0	0	0	0	0	0	15	1	0	16	2	0	0	0	2	0	10	0	0	10	28
% Single Units	0	0	0	0	0	0	1.2	0.8	0	1.1	1	0	0	0	0.9	0	0.7	0	0	0.7	0.9
Heavy Trucks	0	0	0	0	0	0	1	0	0	1	0	0	1	0	1	0	2	0	0	2	4
% Heavy Trucks	0	0	0	0	0	0	0.1	0	0	0.1	0	0	4.8	0	0.5	0	0.1	0	0	0.1	0.1
Ped	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1
% Ped	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0.5	0	0	0	0	0	0

Comments: 2 hour traffic study conducted during weekend (Saturday) from 11:00 AM - 1:00 PM mid-day peak hours. Non-signalized intersection. Video SCU camera was located within NE intersection quadrant.

Traffic Data Collection (TDC)

tdccounts.com

Phone: (586) 786-5407

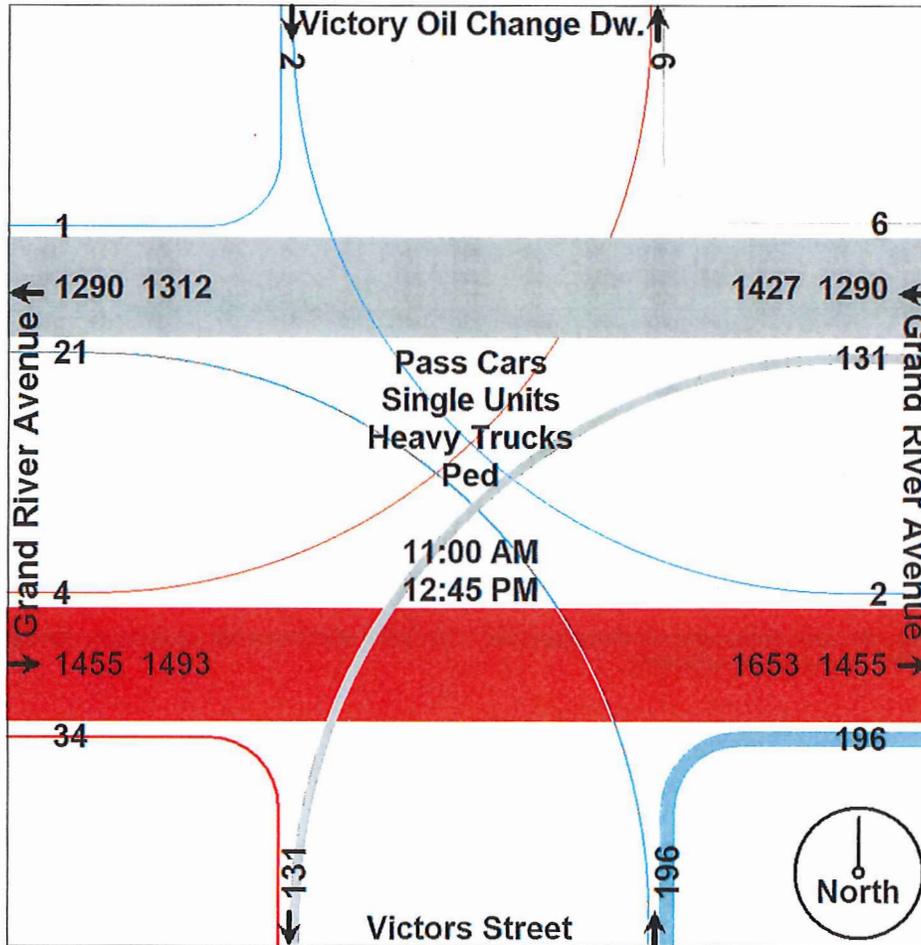
Traffic Study Performed For:

Fleis & VandenBrink



Project: Brighton Traffic Study
Study Type: 2 Hr. Video Turning Movement
Weather: Cldy, Dry Temp 60's
Count By: Miovision Video SCU 4PU

File Name : TMC_2 Victor & GrandRiver_Sat 7-16-16
Site Code : TMC_2
Start Date : 7/16/2016
Page No : 2



Traffic Data Collection (TDC)

tdccounts.com

Phone: (586) 786-5407

Traffic Study Performed For:

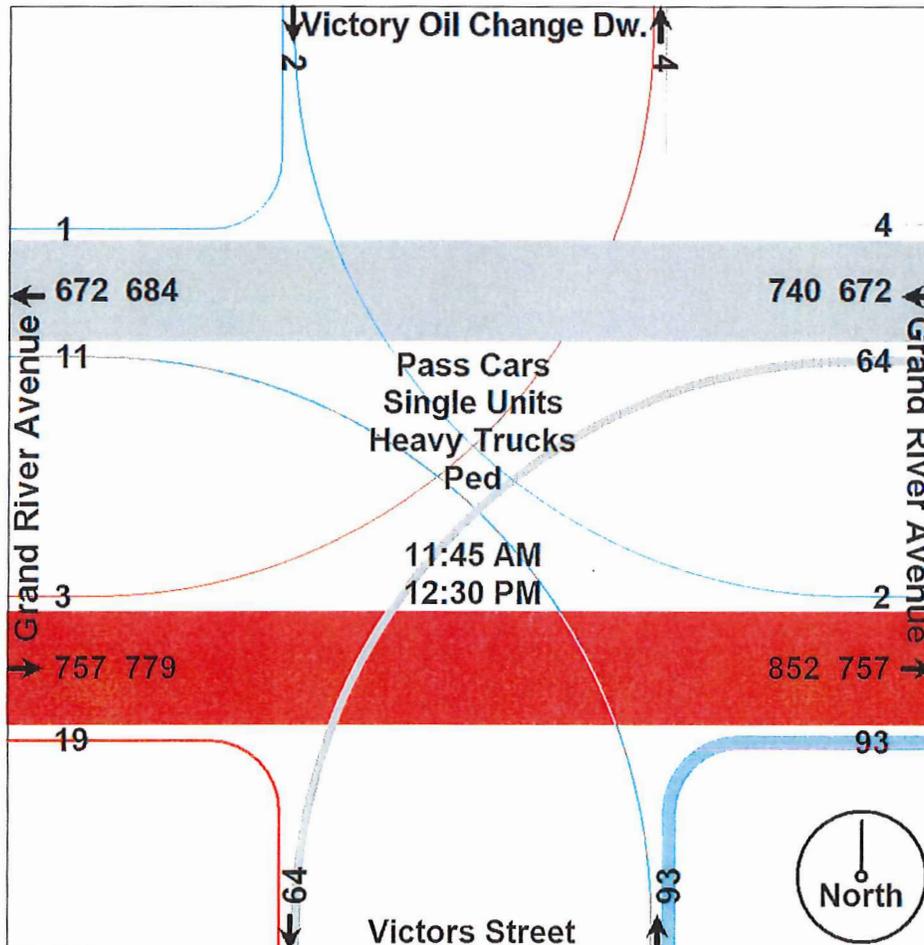
Fleis & VandenBrink



Project: Brighton Traffic Study
 Study Type: 2 Hr. Video Turning Movement
 Weather: Cldy, Dry Temp 60's
 Count By: Miovision Video SCU 4PU

File Name : TMC_2 Victor & GrandRiver_Sat 7-16-16
 Site Code : TMC_2
 Start Date : 7/16/2016
 Page No : 3

Start Time	Victory Oil Change Dw. Southbound				Grand River Avenue Westbound				Victors Street Northbound				Grand River Avenue Eastbound				Int. Total
	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 11:45 AM																	
11:45 AM	0	0	1	1	1	184	20	205	29	0	4	33	10	180	0	190	429
12:00 PM	1	0	0	1	2	147	16	165	29	0	0	29	3	197	2	202	397
12:15 PM	0	0	0	0	1	153	15	169	17	0	3	20	4	181	0	185	374
12:30 PM	0	0	1	1	0	188	13	201	18	0	4	22	2	199	1	202	426
Total Volume	1	0	2	3	4	672	64	740	93	0	11	104	19	757	3	779	1626
% App. Total	33.3	0	66.7		0.5	90.8	8.6		89.4	0	10.6		2.4	97.2	0.4		
PHF	.250	.000	.500	.750	.500	.894	.800	.902	.802	.000	.688	.788	.475	.951	.375	.964	.948
Pass Cars	1	0	2	3	4	665	63	732	92	0	11	103	19	751	3	773	1611
% Pass Cars	100	0	100	100	100	99.0	98.4	98.9	98.9	0	100	99.0	100	99.2	100	99.2	99.1
Single Units	0	0	0	0	0	6	1	7	1	0	0	1	0	4	0	4	12
% Single Units	0	0	0	0	0	0.9	1.6	0.9	1.1	0	0	1.0	0	0.5	0	0.5	0.7
Heavy Trucks	0	0	0	0	0	1	0	1	0	0	0	0	0	2	0	2	3
% Heavy Trucks	0	0	0	0	0	0.1	0	0.1	0	0	0	0	0	0.3	0	0.3	0.2
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
 Study Type: 2 Hr. Video Turning Movement
 Weather: Clidy, Dry Temp 60's
 Count By: Miovision Video SCU 1TM

File Name : TMC_3 WhitmoreLk & GrandRiver_Sat 7-16-16
 Site Code : TMC_3
 Start Date : 7/16/2016
 Page No : 1

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

Start Time	Old US Hwy 23 Southbound					Grand River Avenue Westbound					Whitmore Lake Road Northbound					Grand River Avenue Eastbound					Int. Total
	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	
11:00 AM	43	85	30	0	158	18	81	48	0	147	44	60	47	1	152	47	96	41	0	184	641
11:15 AM	37	53	27	0	117	34	75	40	0	149	29	56	58	0	143	47	86	52	0	185	594
11:30 AM	28	60	29	0	117	25	91	52	0	168	33	55	47	0	135	48	103	48	0	199	619
11:45 AM	40	66	33	0	139	35	100	44	0	179	34	70	62	0	166	57	103	39	0	199	683
Total	148	264	119	0	531	112	347	184	0	643	140	241	214	1	596	199	388	180	0	767	2537
12:00 PM	37	60	40	0	137	20	85	48	0	153	43	74	45	0	162	72	94	59	0	225	677
12:15 PM	29	72	22	0	123	12	67	52	0	131	59	73	67	0	199	44	98	38	0	180	633
12:30 PM	37	61	36	0	134	26	88	48	0	162	41	81	72	0	194	59	115	36	0	210	700
12:45 PM	34	69	31	0	134	32	84	49	0	165	43	89	55	0	187	66	110	43	0	219	705
Total	137	262	129	0	528	90	324	197	0	611	186	317	239	0	742	241	417	176	0	834	2715
Grand Total	285	526	248	0	1059	202	671	381	0	1254	326	558	453	1	1338	440	805	356	0	1601	5252
Apprch %	26.9	49.7	23.4	0		16.1	53.5	30.4	0		24.4	41.7	33.9	0.1		27.5	50.3	22.2	0		
Total %	5.4	10	4.7	0	20.2	3.8	12.8	7.3	0	23.9	6.2	10.6	8.6	0	25.5	8.4	15.3	6.8	0	30.5	
Pass Cars	285	522	244	0	1051	197	663	378	0	1238	321	558	449	0	1328	439	800	354	0	1593	5210
% Pass Cars	100	99.2	98.4	0	99.2	97.5	98.8	99.2	0	98.7	98.5	100	99.1	0	99.3	99.8	99.4	99.4	0	99.5	99.2
Single Units	0	4	4	0	8	4	8	3	0	15	5	0	3	0	8	1	4	2	0	7	38
% Single Units	0	0.8	1.6	0	0.8	2	1.2	0.8	0	1.2	1.5	0	0.7	0	0.6	0.2	0.5	0.6	0	0.4	0.7
Heavy Trucks	0	0	0	0	0	1	0	0	0	1	0	0	1	0	1	0	1	0	0	1	3
% Heavy Trucks	0	0	0	0	0	0.5	0	0	0	0.1	0	0	0.2	0	0.1	0	0.1	0	0	0.1	0.1
Ped	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1
% Ped	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0.1	0	0	0	0	0	0

Comments: 2 hour traffic study conducted during weekend (Saturday) from 11:00 AM - 1:00 PM mid-day peak hours. Signalized intersection, no ped signals. Overhead NTOR signs exist for all approach legs. Video SCU cameras were located within NW & SE intersection quadrants.

Traffic Data Collection (TDC)

tdccounts.com

Phone: (586) 786-5407

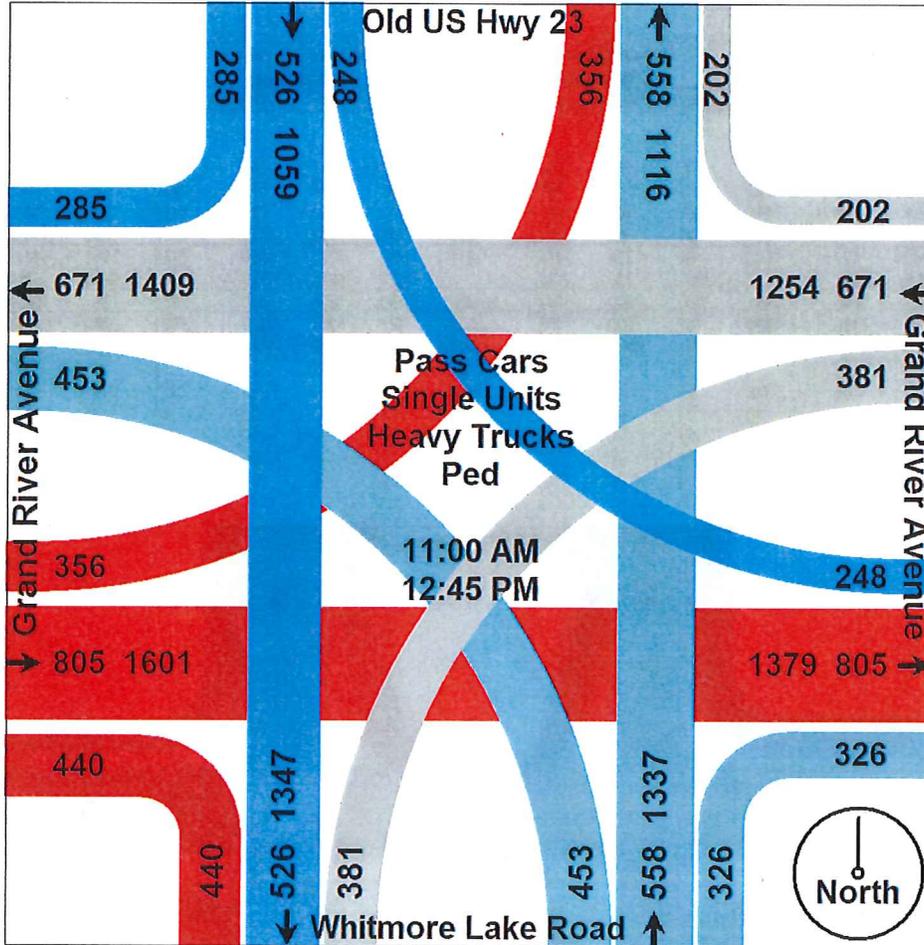
Traffic Study Performed For:

Fleis & VandenBrink



Project: Brighton Traffic Study
Study Type: 2 Hr. Video Turning Movement
Weather: Cldy, Dry Temp 60's
Count By: Miovision Video SCU 1TM

File Name : TMC_3 WhitmoreLk & GrandRiver_Sat 7-16-16
Site Code : TMC_3
Start Date : 7/16/2016
Page No : 2



Traffic Data Collection (TDC)

tdccounts.com

Phone: (586) 786-5407

Traffic Study Performed For:

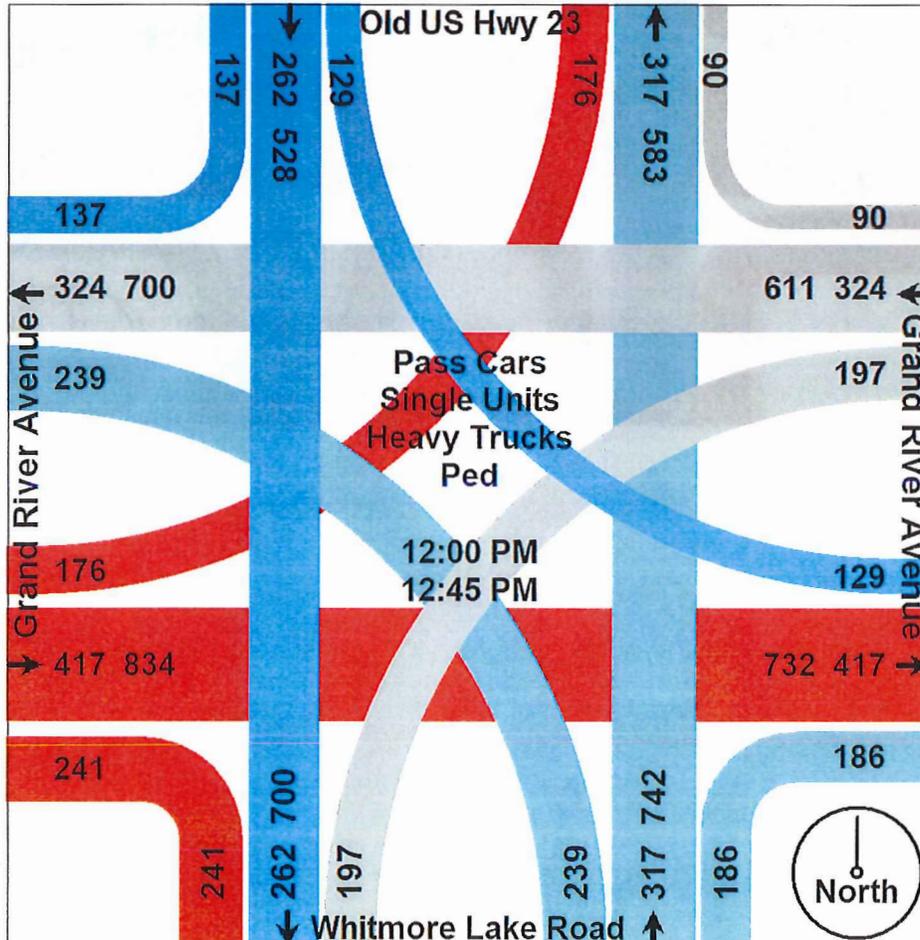
Fleis & VandenBrink



Project: Brighton Traffic Study
Study Type: 2 Hr. Video Turning Movement
Weather: Cldy, Dry Temp 60's
Count By: Miovision Video SCU 1TM

File Name : TMC_3 WhitmoreLk & GrandRiver_Sat 7-16-16
Site Code : TMC_3
Start Date : 7/16/2016
Page No : 3

Start Time	Old US Hwy 23 Southbound				Grand River Avenue Westbound				Whitmore Lake Road Northbound				Grand River Avenue Eastbound				Int. Total
	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 12:00 PM																	
12:00 PM	37	60	40	137	20	85	48	153	43	74	45	162	72	94	59	225	677
12:15 PM	29	72	22	123	12	67	52	131	59	73	67	199	44	98	38	180	633
12:30 PM	37	61	36	134	26	88	48	162	41	81	72	194	59	115	36	210	700
12:45 PM	34	69	31	134	32	84	49	165	43	89	55	187	66	110	43	219	705
Total Volume	137	262	129	528	90	324	197	611	186	317	239	742	241	417	176	834	2715
% App. Total	25.9	49.6	24.4		14.7	53	32.2		25.1	42.7	32.2		28.9	50	21.1		
PHF	.926	.910	.806	.964	.703	.920	.947	.926	.788	.890	.830	.932	.837	.907	.746	.927	.963
Pass Cars	137	261	126	524	86	323	196	605	182	317	237	736	240	415	175	830	2695
% Pass Cars	100	99.6	97.7	99.2	95.6	99.7	99.5	99.0	97.8	100	99.2	99.2	99.6	99.5	99.4	99.5	99.3
Single Units	0	1	3	4	3	1	1	5	4	0	2	6	1	1	1	3	18
% Single Units	0	0.4	2.3	0.8	3.3	0.3	0.5	0.8	2.2	0	0.8	0.8	0.4	0.2	0.6	0.4	0.7
Heavy Trucks	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	1	2
% Heavy Trucks	0	0	0	0	1.1	0	0	0.2	0	0	0	0	0	0.2	0	0.1	0.1
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
 Study Type: 2 Hr. Video Turning Movement
 Weather: Cldy, Dry Temp 60's
 Count By: Miovision Video SCU 3CU

File Name : TMC_4 WhitmoreLk & Victor_Sat 7-16-16
 Site Code : TMC_4
 Start Date : 7/16/2016
 Page No : 1

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

Start Time	Whitmore Lake Road Southbound					Shopping Center Driveway Westbound					Whitmore Lake Road Northbound					Victor Street Eastbound					Int. Total
	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	
11:00 AM	15	155	4	0	174	12	1	3	0	16	7	122	30	0	159	38	0	1	0	39	388
11:15 AM	13	133	8	0	154	17	2	4	0	23	10	135	27	0	172	28	3	1	0	32	381
11:30 AM	17	145	5	0	167	12	4	9	0	25	8	135	32	0	175	38	0	0	0	38	405
11:45 AM	14	163	4	0	181	7	1	7	0	15	11	158	36	0	205	33	0	1	0	34	435
Total	59	596	21	0	676	48	8	23	0	79	36	550	125	0	711	137	3	3	0	143	1609
12:00 PM	6	176	7	0	189	18	1	2	0	21	8	151	39	0	198	32	0	0	0	32	440
12:15 PM	11	154	6	0	171	16	1	4	0	21	9	205	40	0	254	33	0	0	0	33	479
12:30 PM	7	175	6	0	188	9	2	2	0	13	13	159	40	0	212	37	1	1	0	39	452
12:45 PM	15	166	2	0	183	11	1	5	0	17	10	178	29	0	217	41	0	0	0	41	458
Total	39	671	21	0	731	54	5	13	0	72	40	693	148	0	881	143	1	1	0	145	1829
Grand Total	98	1267	42	0	1407	102	13	36	0	151	76	1243	273	0	1592	280	4	4	0	288	3438
Apprch %	7	90	3	0		67.5	8.6	23.8	0		4.8	78.1	17.1	0		97.2	1.4	1.4	0		
Total %	2.9	36.9	1.2	0	40.9	3	0.4	1	0	4.4	2.2	36.2	7.9	0	46.3	8.1	0.1	0.1	0	8.4	
Pass Cars	98	1260	42	0	1400	102	13	35	0	150	75	1230	271	0	1576	277	4	4	0	285	3411
% Pass Cars	100	99.4	100	0	99.5	100	100	97.2	0	99.3	98.7	99	99.3	0	99	98.9	100	100	0	99	99.2
Single Units	0	7	0	0	7	0	0	1	0	1	1	10	2	0	13	3	0	0	0	3	24
% Single Units	0	0.6	0	0	0.5	0	0	2.8	0	0.7	1.3	0.8	0.7	0	0.8	1.1	0	0	0	1	0.7
Heavy Trucks	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	3
% Heavy Trucks	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0	0.2	0	0	0	0	0	0.1
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: 2 hour traffic study conducted during weekend (Saturday) from 11:00 AM - 1:00 PM mid-day peak hours. Non-signalized intersection. Video SCU camera was located within NE intersection quadrant.

Traffic Data Collection (TDC)

tdccounts.com

Phone: (586) 786-5407

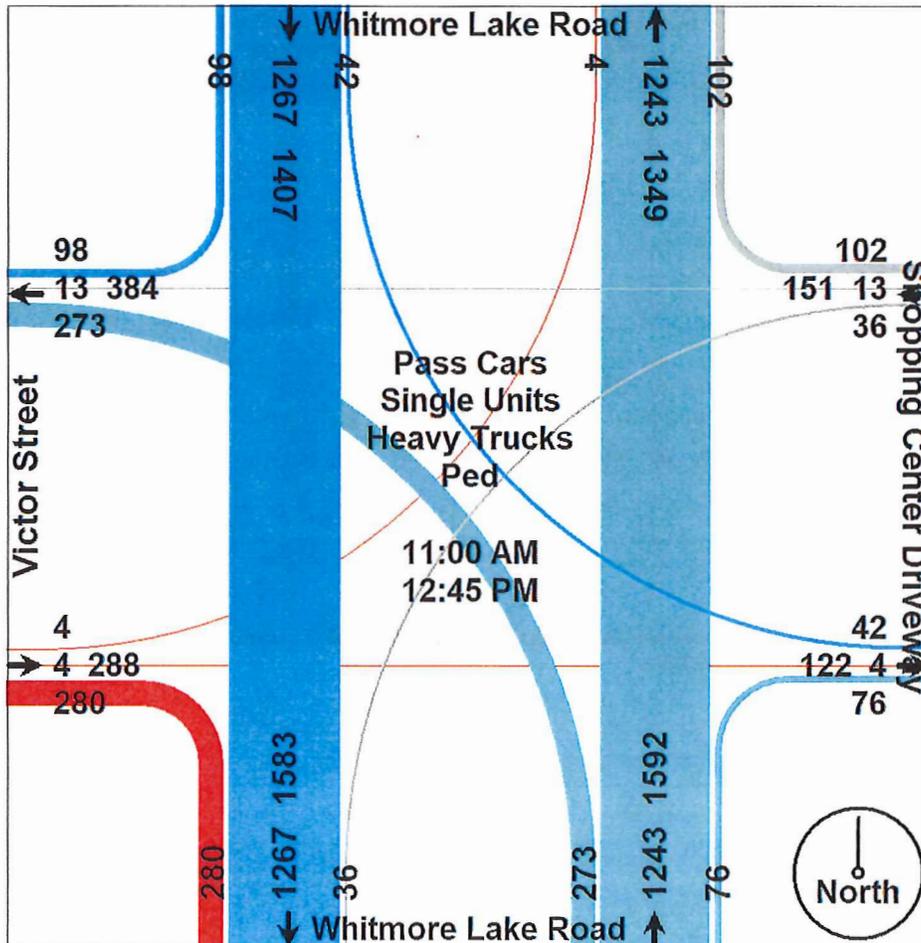
Traffic Study Performed For:

Fleis & VandenBrink



Project: Brighton Traffic Study
 Study Type: 2 Hr. Video Turning Movement
 Weather: Cldy, Dry Temp 60's
 Count By: Miovision Video SCU 3CU

File Name : TMC_4 WhitmoreLk & Victor_Sat 7-16-16
 Site Code : TMC_4
 Start Date : 7/16/2016
 Page No : 2



Traffic Data Collection (TDC)

tdccounts.com

Phone: (586) 786-5407

Traffic Study Performed For:

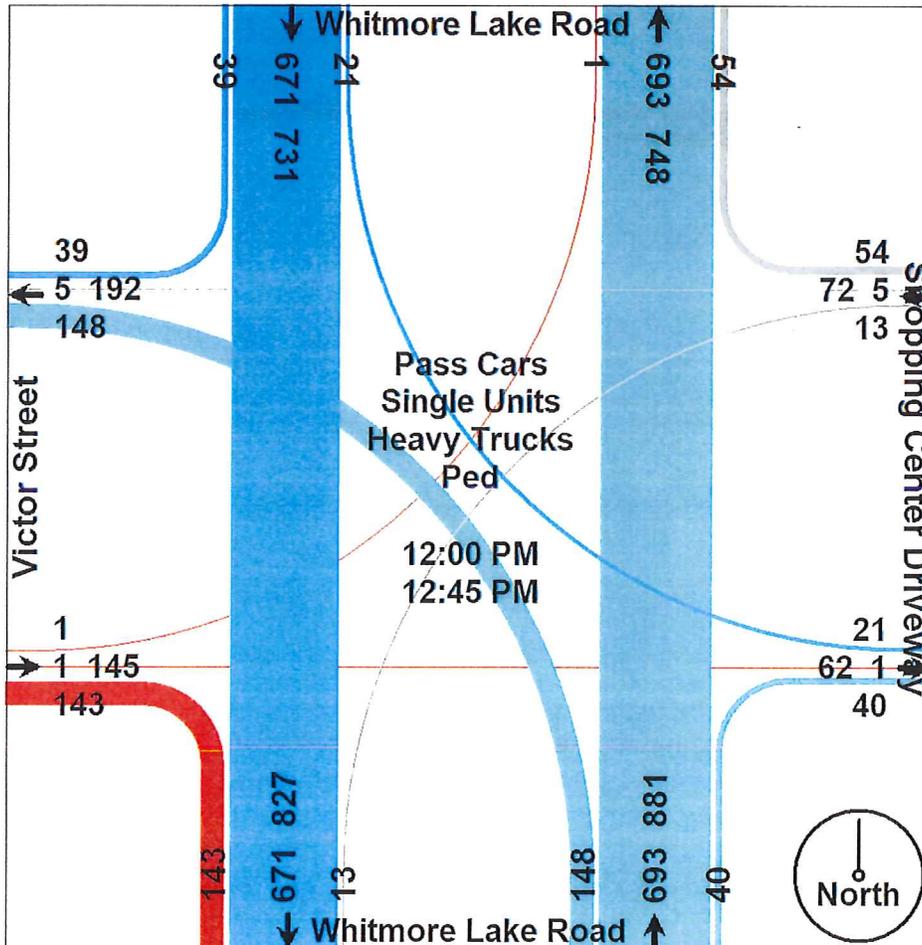
Fleis & VandenBrink



Project: Brighton Traffic Study
 Study Type: 2 Hr. Video Turning Movement
 Weather: Cldy, Dry Temp 60's
 Count By: Miovision Video SCU 3CU

File Name : TMC_4 WhitmoreLk & Victor_Sat 7-16-16
 Site Code : TMC_4
 Start Date : 7/16/2016
 Page No : 3

Start Time	Whitmore Lake Road Southbound				Shopping Center Driveway Westbound				Whitmore Lake Road Northbound				Victor Street Eastbound				Int. Total
	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 12:00 PM																	
12:00 PM	6	176	7	189	18	1	2	21	8	151	39	198	32	0	0	32	440
12:15 PM	11	154	6	171	16	1	4	21	9	205	40	254	33	0	0	33	479
12:30 PM	7	175	6	188	9	2	2	13	13	159	40	212	37	1	1	39	452
12:45 PM	15	166	2	183	11	1	5	17	10	178	29	217	41	0	0	41	458
Total Volume	39	671	21	731	54	5	13	72	40	693	148	881	143	1	1	145	1829
% App. Total	5.3	91.8	2.9		7.5	6.9	18.1		4.5	78.7	16.8		98.6	0.7	0.7		
PHF	.650	.953	.750	.967	.750	.625	.650	.857	.769	.845	.925	.867	.872	.250	.250	.884	.955
Pass Cars	39	667	21	727	54	5	13	72	40	684	147	871	142	1	1	144	1814
% Pass Cars	100	99.4	100	99.5	100	100	100	100	100	98.7	99.3	98.9	99.3	100	100	99.3	99.2
Single Units	0	4	0	4	0	0	0	0	0	8	1	9	1	0	0	1	14
% Single Units	0	0.6	0	0.5	0	0	0	0	0	1.2	0.7	1.0	0.7	0	0	0.7	0.8
Heavy Trucks	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1
% Heavy Trucks	0	0	0	0	0	0	0	0	0	0.1	0	0.1	0	0	0	0	0.1
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
 Study Type: 2 Hr. Video Turning Movement
 Weather: Pt. Sunny, Dry Temp 80's
 Count By: Miovision Video SCU 3CU

File Name : TMC_1 Borderline & GrandRiver_Tues 7-19-16
 Site Code : TMC_1
 Start Date : 7/19/2016
 Page No : 1

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

Start Time	NA Southbound					Grand River Avenue Westbound					Boderline Drive Northbound					Grand River Avenue Eastbound					Int. Total
	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	
04:00 PM	0	0	0	0	0	0	151	18	0	169	24	0	38	0	62	33	202	0	0	235	466
04:15 PM	0	0	0	0	0	0	172	16	0	188	19	0	48	0	67	28	151	0	0	179	434
04:30 PM	0	0	0	0	0	0	213	15	0	228	24	0	43	0	67	21	164	0	0	185	480
04:45 PM	0	0	0	0	0	0	209	16	0	225	20	0	42	0	62	29	180	0	0	209	496
Total	0	0	0	0	0	0	745	65	0	810	87	0	171	0	258	111	697	0	0	808	1876
05:00 PM	0	0	0	0	0	0	197	9	0	206	20	0	31	0	51	24	189	0	0	213	470
05:15 PM	0	0	0	0	0	0	193	15	0	208	19	0	44	0	63	25	170	0	0	195	466
05:30 PM	0	0	0	0	0	0	180	16	0	196	21	0	44	0	65	25	169	0	0	194	455
05:45 PM	0	0	0	0	0	0	176	11	0	187	12	0	37	0	49	18	146	0	0	164	400
Total	0	0	0	0	0	0	746	51	0	797	72	0	156	0	228	92	674	0	0	766	1791
Grand Total	0	0	0	0	0	0	1491	116	0	1607	159	0	327	0	486	203	1371	0	0	1574	3667
Apprch %	0	0	0	0	0	0	92.8	7.2	0	32.7	0	67.3	0	12.9	87.1	0	0	0	0		
Total %	0	0	0	0	0	0	40.7	3.2	0	43.8	4.3	0	8.9	0	13.3	5.5	37.4	0	0	42.9	
Pass Cars	0	0	0	0	0	0	1478	114	0	1592	156	0	327	0	483	201	1347	0	0	1548	3623
% Pass Cars	0	0	0	0	0	0	99.1	98.3	0	99.1	98.1	0	100	0	99.4	99	98.2	0	0	98.3	98.8
Single Units	0	0	0	0	0	0	9	1	0	10	2	0	0	0	2	2	20	0	0	22	34
% Single Units	0	0	0	0	0	0	0.6	0.9	0	0.6	1.3	0	0	0	0.4	1	1.5	0	0	1.4	0.9
Heavy Trucks	0	0	0	0	0	0	4	1	0	5	1	0	0	0	1	0	4	0	0	4	10
% Heavy Trucks	0	0	0	0	0	0	0.3	0.9	0	0.3	0.6	0	0	0	0.2	0	0.3	0	0	0.3	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: 2 hour traffic study conducted during typical weekday (Tuesday) from 4:00-6:00 PM afternoon peak hours. Signalized intersection, no ped. signals. Video SCU camera was located within SE intersection quadrant.

Traffic Data Collection (TDC)

tdccounts.com

Phone: (586) 786-5407

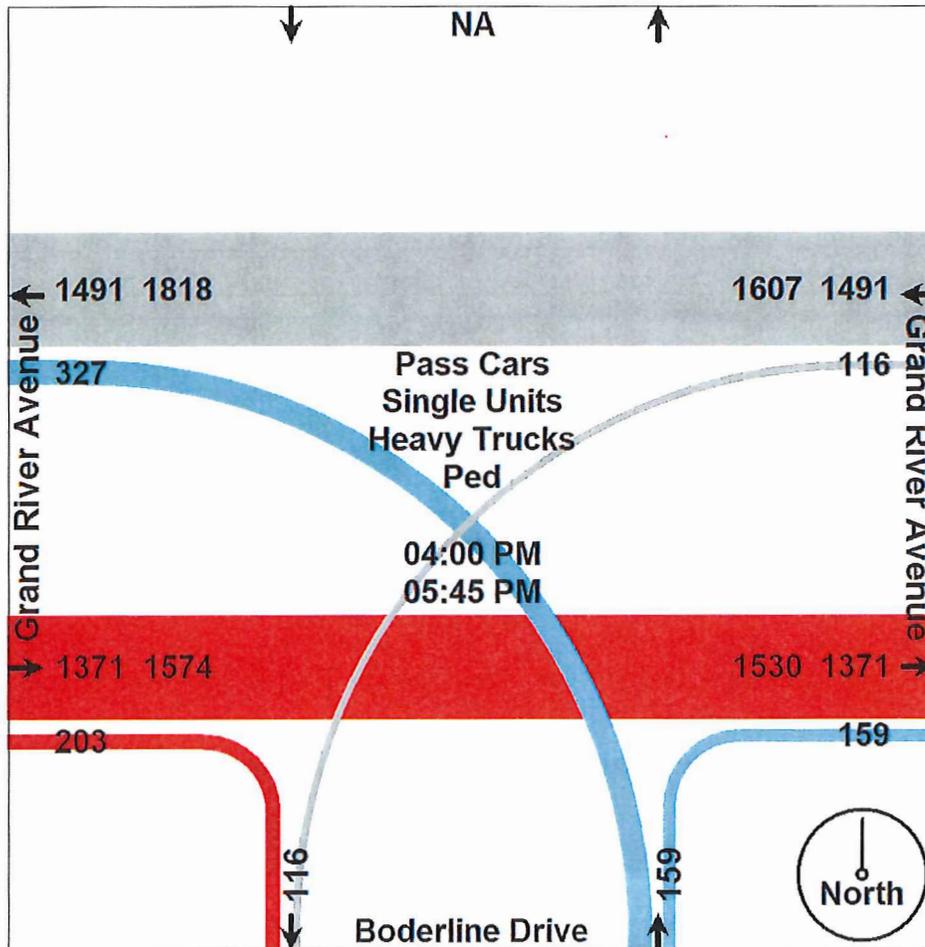
Traffic Study Performed For:

Fleis & VandenBrink



Project: Brighton Traffic Study
Study Type: 2 Hr. Video Turning Movement
Weather: Pt. Sunny, Dry Temp 80's
Count By: Miovision Video SCU 3CU

File Name : TMC_1 Borderline & GrandRiver_Tues 7-19-16
Site Code : TMC_1
Start Date : 7/19/2016
Page No : 2



Traffic Data Collection (TDC)

tdccounts.com

Phone: (586) 786-5407

Traffic Study Performed For:

Fleis & VandenBrink



Project: Brighton Traffic Study
Study Type: 2 Hr. Video Turning Movement
Weather: Pt. Sunny, Dry Temp 80's
Count By: Miovision Video SCU 3CU

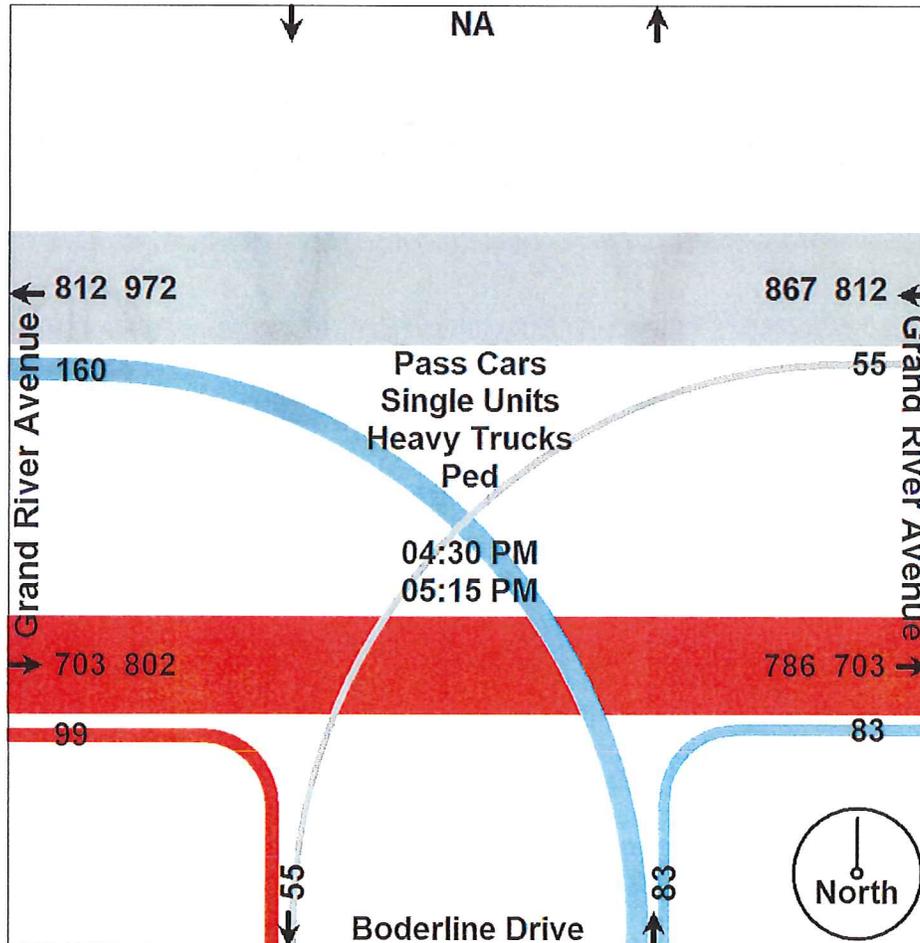
File Name : TMC_1 Borderline & GrandRiver_Tues 7-19-16

Site Code : TMC_1

Start Date : 7/19/2016

Page No : 3

Start Time	NA Southbound				Grand River Avenue Westbound				Boderline Drive Northbound				Grand River Avenue Eastbound				Int. Total
	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:30 PM																	
04:30 PM	0	0	0	0	0	213	15	228	24	0	43	67	21	164	0	185	480
04:45 PM	0	0	0	0	0	209	16	225	20	0	42	62	29	180	0	209	496
05:00 PM	0	0	0	0	0	197	9	206	20	0	31	51	24	189	0	213	470
05:15 PM	0	0	0	0	0	193	15	208	19	0	44	63	25	170	0	195	466
Total Volume	0	0	0	0	0	812	55	867	83	0	160	243	99	703	0	802	1912
% App. Total	0	0	0	0	0	93.7	6.3	90.0	34.2	0	65.8	100.0	12.3	87.7	0	92.7	100.0
PHF	.000	.000	.000	.000	.000	.953	.859	.951	.865	.000	.909	.907	.853	.930	.000	.941	.964
Pass Cars	0	0	0	0	0	805	54	859	81	0	160	241	99	691	0	790	1890
% Pass Cars	0	0	0	0	0	99.1	98.2	99.1	97.6	0	100	99.2	100	98.3	0	98.5	98.8
Single Units	0	0	0	0	0	5	0	5	2	0	0	2	0	10	0	10	17
% Single Units	0	0	0	0	0	0.6	0	0.6	2.4	0	0	0.8	0	1.4	0	1.2	0.9
Heavy Trucks	0	0	0	0	0	2	1	3	0	0	0	0	0	2	0	2	5
% Heavy Trucks	0	0	0	0	0	0.2	1.8	0.3	0	0	0	0	0	0.3	0	0.2	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
 Study Type: 2 Hr. Video Turning Movement
 Weather: Pt. Sunny, Dry Temp 80's
 Count By: Miovision Video SCU 1TM

File Name : TMC_2 Victor & GrandRiver_Tues 7-19-16
 Site Code : TMC_2
 Start Date : 7/19/2016
 Page No : 1

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

Start Time	Victory Oil Change Dw. Southbound					Grand River Avenue Westbound					Victor Street Northbound					Grand River Avenue Eastbound					Int. Total
	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	
04:00 PM	0	0	0	0	0	3	183	17	0	203	35	0	1	0	36	7	219	0	0	226	465
04:15 PM	0	0	0	0	0	2	189	21	0	212	26	0	4	0	30	2	182	0	0	184	426
04:30 PM	0	0	0	0	0	2	225	27	0	254	35	0	4	0	39	7	186	0	0	193	486
04:45 PM	0	0	1	0	1	0	228	24	0	252	40	0	7	0	47	5	206	0	0	211	511
Total	0	0	1	0	1	7	825	89	0	921	136	0	16	0	152	21	793	0	0	814	1888
05:00 PM	0	0	1	0	1	0	216	25	0	241	40	0	4	0	44	7	201	1	0	209	495
05:15 PM	0	0	1	0	1	2	215	35	0	252	39	0	5	0	44	6	207	0	0	213	510
05:30 PM	0	0	0	0	0	2	196	26	0	224	39	0	3	0	42	5	191	0	0	196	462
05:45 PM	0	0	0	0	0	1	190	9	0	200	28	0	3	0	31	7	147	0	0	154	385
Total	0	0	2	0	2	5	817	95	0	917	146	0	15	0	161	25	746	1	0	772	1852
Grand Total	0	0	3	0	3	12	1642	184	0	1838	282	0	31	0	313	46	1539	1	0	1586	3740
Apprch %	0	0	100	0		0.7	89.3	10	0		90.1	0	9.9	0		2.9	97	0.1	0		
Total %	0	0	0.1	0	0.1	0.3	43.9	4.9	0	49.1	7.5	0	0.8	0	8.4	1.2	41.1	0	0	42.4	
Pass Cars	0	0	3	0	3	12	1624	184	0	1820	279	0	31	0	310	46	1513	1	0	1560	3693
% Pass Cars	0	0	100	0	100	100	98.9	100	0	99	98.9	0	100	0	99	100	98.3	100	0	98.4	98.7
Single Units	0	0	0	0	0	0	13	0	0	13	3	0	0	0	3	0	21	0	0	21	37
% Single Units	0	0	0	0	0	0	0.8	0	0	0.7	1.1	0	0	0	1	0	1.4	0	0	1.3	1
Heavy Trucks	0	0	0	0	0	0	5	0	0	5	0	0	0	0	0	0	5	0	0	5	10
% Heavy Trucks	0	0	0	0	0	0	0.3	0	0	0.3	0	0	0	0	0	0	0.3	0	0	0.3	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: 2 hour traffic study conducted during typical weekday (Tuesday) from 4:00-6:00 PM afternoon peak hours. Non-signalized intersection. Video SCU camera was located within NE intersection quadrant.

Traffic Data Collection (TDC)

tdccounts.com

Phone: (586) 786-5407

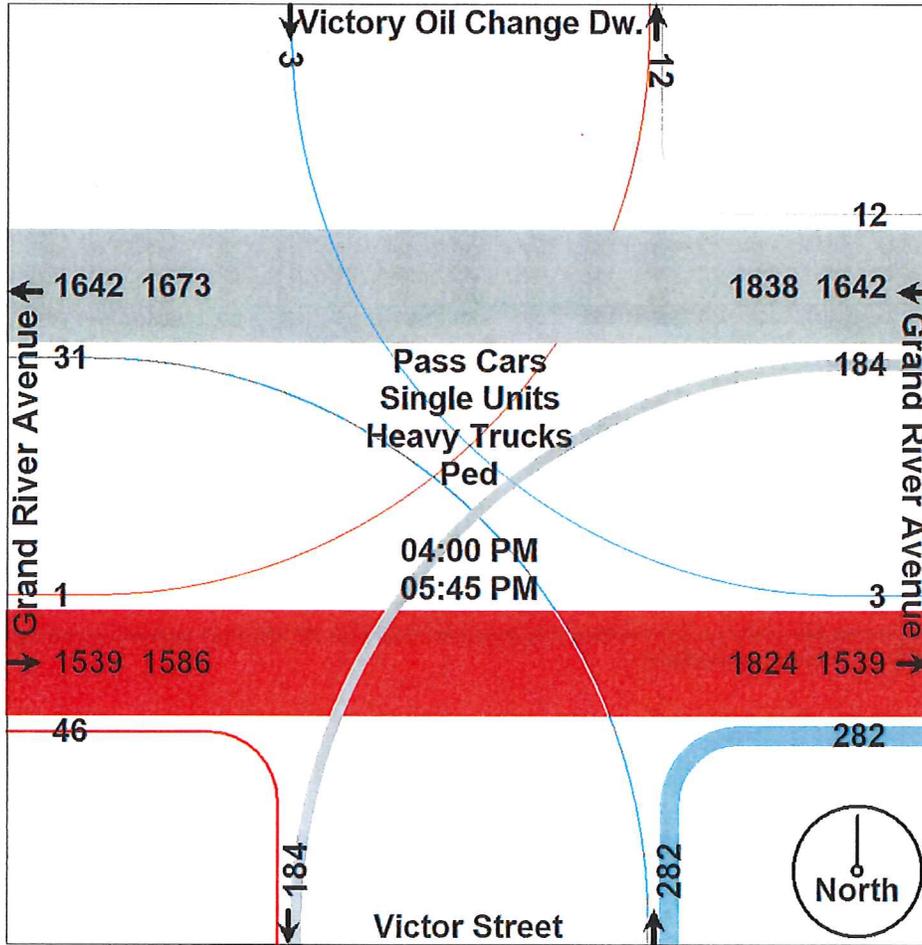
Traffic Study Performed For:

Fleis & VandenBrink



Project: Brighton Traffic Study
Study Type: 2 Hr. Video Turning Movement
Weather: Pt. Sunny, Dry Temp 80's
Count By: Miovision Video SCU 1TM

File Name : TMC_2 Victor & GrandRiver_Tues 7-19-16
Site Code : TMC_2
Start Date : 7/19/2016
Page No : 2



Traffic Data Collection (TDC)

tdccounts.com

Phone: (586) 786-5407

Traffic Study Performed For:

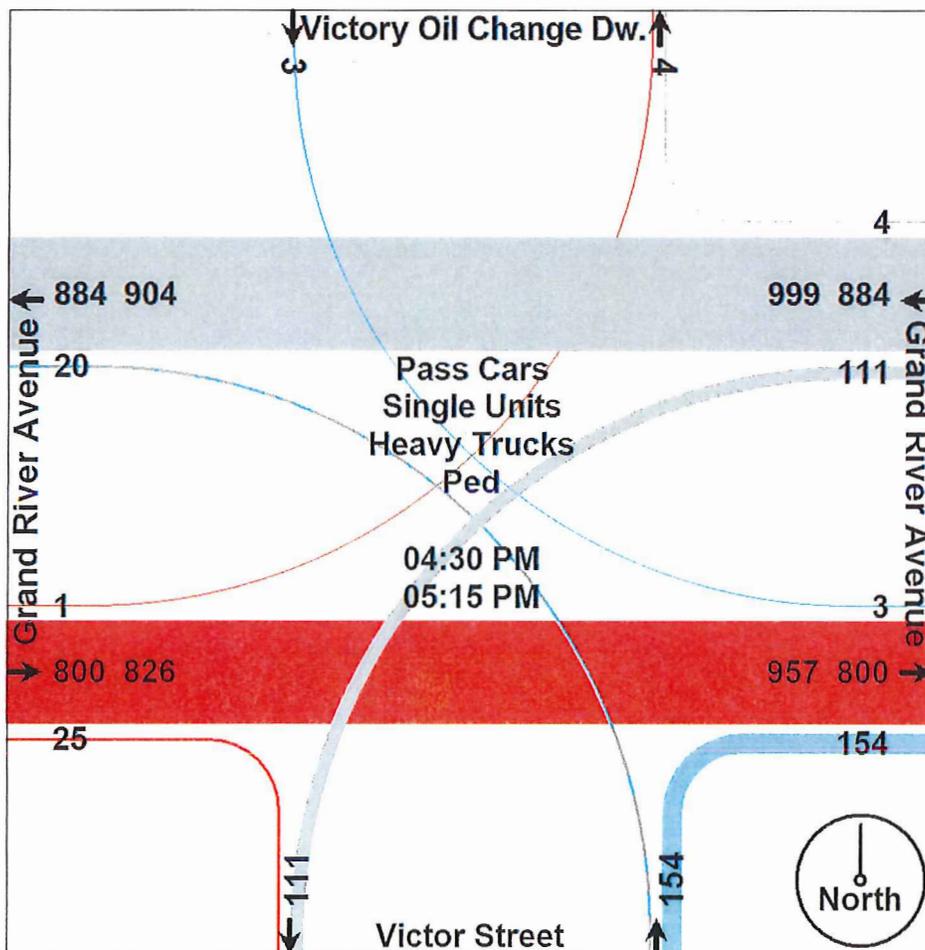
Fleis & VandenBrink



Project: Brighton Traffic Study
 Study Type: 2 Hr. Video Turning Movement
 Weather: Pt. Sunny, Dry Temp 80's
 Count By: Miovision Video SCU 1TM

File Name : TMC_2 Victor & GrandRiver_Tues 7-19-16
 Site Code : TMC_2
 Start Date : 7/19/2016
 Page No : 3

Start Time	Victory Oil Change Dw. Southbound				Grand River Avenue Westbound				Victor Street Northbound				Grand River Avenue Eastbound				Int. Total
	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:30 PM																	
04:30 PM	0	0	0	0	2	225	27	254	35	0	4	39	7	186	0	193	486
04:45 PM	0	0	1	1	0	228	24	252	40	0	7	47	5	206	0	211	511
05:00 PM	0	0	1	1	0	216	25	241	40	0	4	44	7	201	1	209	495
05:15 PM	0	0	1	1	2	215	35	252	39	0	5	44	6	207	0	213	510
Total Volume	0	0	3	3	4	884	111	999	154	0	20	174	25	800	1	826	2002
% App. Total	0	0	100	100	0.4	88.5	11.1		88.5	0	11.5		3	96.9	0.1		
PHF	.000	.000	.750	.750	.500	.969	.793	.983	.963	.000	.714	.926	.893	.966	.250	.969	.979
Pass Cars	0	0	3	3	4	875	111	990	153	0	20	173	25	787	1	813	1979
% Pass Cars	0	0	100	100	100	99.0	100	99.1	99.4	0	100	99.4	100	98.4	100	98.4	98.9
Single Units	0	0	0	0	0	7	0	7	1	0	0	1	0	11	0	11	19
% Single Units	0	0	0	0	0	0.8	0	0.7	0.6	0	0	0.6	0	1.4	0	1.3	0.9
Heavy Trucks	0	0	0	0	0	2	0	2	0	0	0	0	0	2	0	2	4
% Heavy Trucks	0	0	0	0	0	0.2	0	0.2	0	0	0	0	0	0.3	0	0.2	0.2
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
 Study Type: 2 Hr. Video Turning Movement
 Weather: Pt. Sunny, Dry Temp 80's
 Count By: Miovision Video SCU 3DQ

File Name : TMC_3 WhitmoreLk & GrandRiver_Tues 7-19-16
 Site Code : TMC_3
 Start Date : 7/19/2016
 Page No : 1

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

Start Time	Old US Hwy. 23 Southbound					Grand River Avenue Westbound					Whitmore Lake Road Northbound					Grand River Avenue Eastbound					Int. Total
	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	
04:00 PM	29	55	35	0	119	69	114	87	0	270	70	92	57	0	219	55	124	63	0	242	850
04:15 PM	44	72	45	0	161	66	128	66	0	260	53	99	53	0	205	41	100	57	0	198	824
04:30 PM	51	93	36	0	180	71	135	73	0	279	60	98	57	0	215	52	109	49	0	210	884
04:45 PM	42	75	35	0	152	66	148	80	0	294	53	115	53	0	221	47	129	77	0	253	920
Total	166	295	151	0	612	272	525	306	0	1103	236	404	220	0	860	195	462	246	0	903	3478
05:00 PM	44	68	58	0	170	94	141	102	0	337	63	107	74	0	244	51	108	59	0	218	969
05:15 PM	40	91	49	0	180	77	149	95	0	321	53	112	49	0	214	45	142	67	0	254	969
05:30 PM	43	89	44	0	176	72	133	90	0	295	51	113	66	0	230	52	112	58	0	222	923
05:45 PM	43	77	45	0	165	50	94	81	0	225	59	111	58	0	228	43	77	53	0	173	791
Total	170	325	196	0	691	293	517	368	0	1178	226	443	247	0	916	191	439	237	0	867	3652
Grand Total	336	620	347	0	1303	565	1042	674	0	2281	462	847	467	0	1776	386	901	483	0	1770	7130
Apprch %	25.8	47.6	26.6	0		24.8	45.7	29.5	0		26	47.7	26.3	0		21.8	50.9	27.3	0		
Total %	4.7	8.7	4.9	0	18.3	7.9	14.6	9.5	0	32	6.5	11.9	6.5	0	24.9	5.4	12.6	6.8	0	24.8	
Pass Cars	332	615	332	0	1279	549	1030	657	0	2236	449	835	465	0	1749	384	879	480	0	1743	7007
% Pass Cars	98.8	99.2	95.7	0	98.2	97.2	98.8	97.5	0	98	97.2	98.6	99.6	0	98.5	99.5	97.6	99.4	0	98.5	98.3
Single Units	4	4	15	0	23	14	9	9	0	32	9	9	1	0	19	2	18	3	0	23	97
% Single Units	1.2	0.6	4.3	0	1.8	2.5	0.9	1.3	0	1.4	1.9	1.1	0.2	0	1.1	0.5	2	0.6	0	1.3	1.4
Heavy Trucks	0	1	0	0	1	2	3	8	0	13	4	3	1	0	8	0	4	0	0	4	26
% Heavy Trucks	0	0.2	0	0	0.1	0.4	0.3	1.2	0	0.6	0.9	0.4	0.2	0	0.5	0	0.4	0	0	0.2	0.4
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: 2 hour traffic study conducted during typical weekday (Tuesday) from 4:00-6:00 PM afternoon peak hours. Signalized intersection, no ped. signals. Overhead NTOR signs exist for all approach legs. Video SCU cameras were located within NW & SE intersection quadrants.

Traffic Data Collection (TDC)

tdccounts.com

Phone: (586) 786-5407

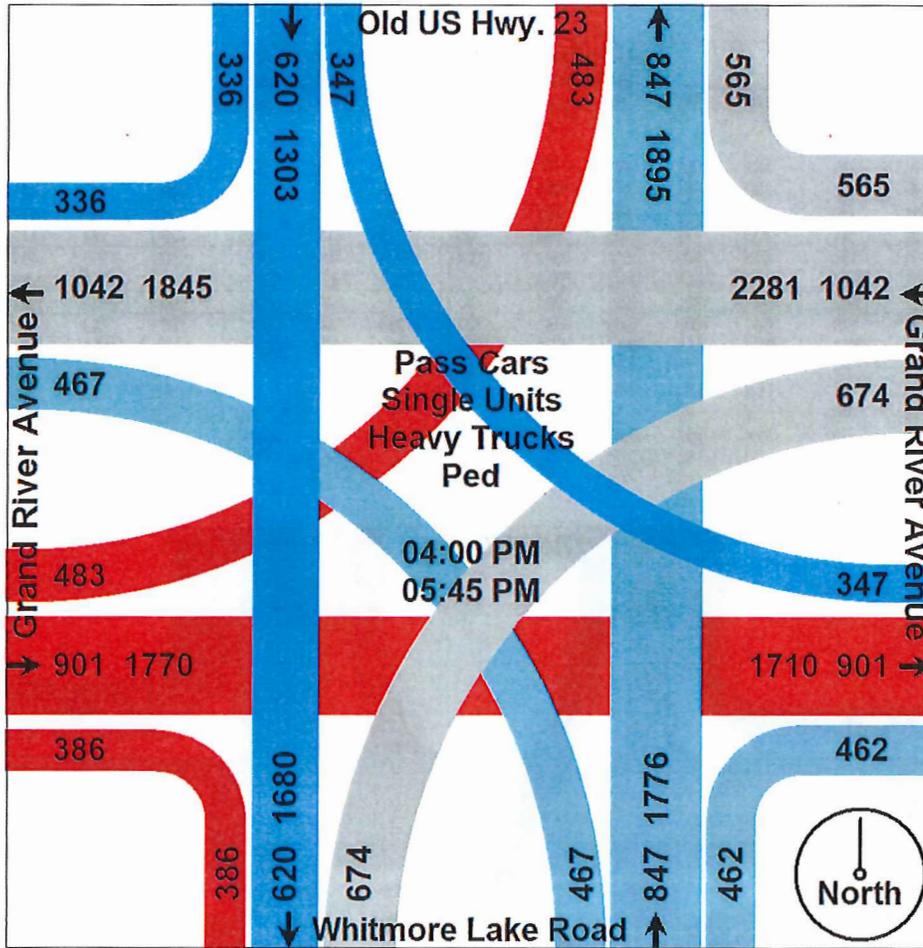
Traffic Study Performed For:

Fleis & VandenBrink



Project: Brighton Traffic Study
Study Type: 2 Hr. Video Turning Movement
Weather: Pt. Sunny, Dry Temp 80's
Count By: Miovision Video SCU 3DQ

File Name : TMC_3 WhitmoreLk & GrandRiver_Tues 7-19-16
Site Code : TMC_3
Start Date : 7/19/2016
Page No : 2



Traffic Data Collection (TDC)

tdccounts.com

Phone: (586) 786-5407

Traffic Study Performed For:

Fleis & VandenBrink



Project: Brighton Traffic Study
 Study Type: 2 Hr. Video Turning Movement
 Weather: Pt. Sunny, Dry Temp 80's
 Count By: Miovision Video SCU 3DQ

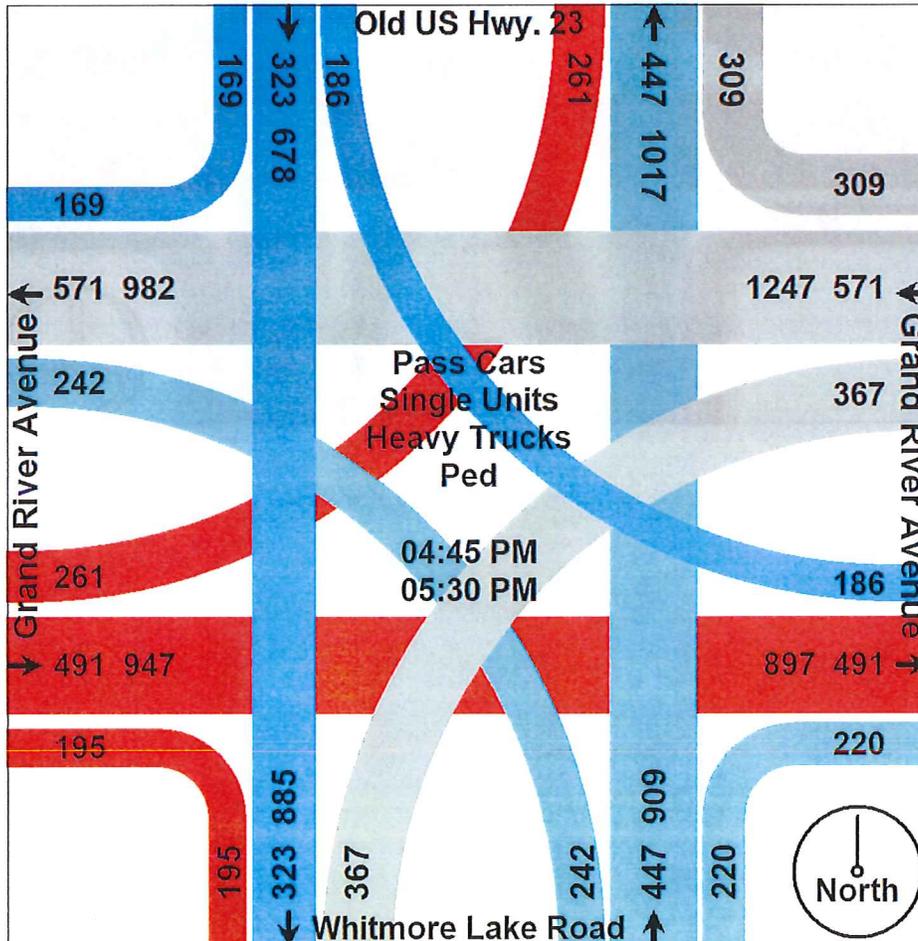
File Name : TMC_3 WhitmoreLk & GrandRiver_Tues 7-19-16

Site Code : TMC_3

Start Date : 7/19/2016

Page No : 3

Start Time	Old US Hwy. 23 Southbound				Grand River Avenue Westbound				Whitmore Lake Road Northbound				Grand River Avenue Eastbound				Int. Total
	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:45 PM																	
04:45 PM	42	75	35	152	66	148	80	294	53	115	53	221	47	129	77	253	920
05:00 PM	44	68	58	170	94	141	102	337	63	107	74	244	51	108	59	218	969
05:15 PM	40	91	49	180	77	149	95	321	53	112	49	214	45	142	67	254	969
05:30 PM	43	89	44	176	72	133	90	295	51	113	66	230	52	112	58	222	923
Total Volume	169	323	186	678	309	571	367	1247	220	447	242	909	195	491	261	947	3781
% App. Total	24.9	47.6	27.4		24.8	45.8	29.4		24.2	49.2	26.6		20.6	51.8	27.6		
PHF	.960	.887	.802	.942	.822	.958	.900	.925	.873	.972	.818	.931	.938	.864	.847	.932	.975
Pass Cars	169	319	178	666	300	566	357	1223	215	442	241	898	193	478	260	931	3718
% Pass Cars	100	98.8	95.7	98.2	97.1	99.1	97.3	98.1	97.7	98.9	99.6	98.8	99.0	97.4	99.6	98.3	98.3
Single Units	0	3	8	11	7	4	4	15	4	4	0	8	2	11	1	14	48
% Single Units	0	0.9	4.3	1.6	2.3	0.7	1.1	1.2	1.8	0.9	0	0.9	1.0	2.2	0.4	1.5	1.3
Heavy Trucks	0	1	0	1	2	1	6	9	1	1	1	3	0	2	0	2	15
% Heavy Trucks	0	0.3	0	0.1	0.6	0.2	1.6	0.7	0.5	0.2	0.4	0.3	0	0.4	0	0.2	0.4
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
 Study Type: 2 Hr. Video Turning Movement
 Weather: Pt. Sunny, Dry Temp 80's
 Count By: Miovision Video SCU 4SY

File Name : TMC_4 WhitmoreLk & Victor_Tues 7-19-16
 Site Code : TMC_4
 Start Date : 7/19/2016
 Page No : 1

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

Start Time	Whitmore Lake Road Southbound					Shopping Center Dw. Westbound					Whitmore Lake Road Northbound					Victor Street Eastbound					Int. Total
	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	
04:00 PM	10	191	4	0	205	11	2	6	0	19	4	208	34	0	246	40	0	0	0	40	510
04:15 PM	13	175	6	0	194	10	0	3	0	13	4	193	37	0	234	47	1	0	0	48	489
04:30 PM	18	199	5	0	222	8	0	1	0	9	5	222	42	0	269	43	0	1	0	44	544
04:45 PM	16	188	5	0	209	12	0	1	0	13	9	215	50	0	274	42	0	0	0	42	538
Total	57	753	20	0	830	41	2	11	0	54	22	838	163	0	1023	172	1	1	0	174	2081
05:00 PM	16	212	3	0	231	13	1	3	0	17	5	218	30	0	253	48	0	2	0	50	551
05:15 PM	17	225	3	0	245	9	0	3	0	12	6	223	34	0	263	45	1	0	0	46	566
05:30 PM	14	209	8	0	231	9	0	1	0	10	10	203	53	0	266	47	0	0	0	47	554
05:45 PM	8	196	2	0	206	13	0	3	0	16	8	225	33	0	266	36	0	2	0	38	526
Total	55	842	16	0	913	44	1	10	0	55	29	869	150	0	1048	176	1	4	0	181	2197
Grand Total	112	1595	36	0	1743	85	3	21	0	109	51	1707	313	0	2071	348	2	5	0	355	4278
Apprch %	6.4	91.5	2.1	0		78	2.8	19.3	0		2.5	82.4	15.1	0		98	0.6	1.4	0		
Total %	2.6	37.3	0.8	0	40.7	2	0.1	0.5	0	2.5	1.2	39.9	7.3	0	48.4	8.1	0	0.1	0	8.3	
Pass Cars	112	1573	36	0	1721	84	3	21	0	108	51	1680	313	0	2044	348	2	5	0	355	4228
% Pass Cars	100	98.6	100	0	98.7	98.8	100	100	0	99.1	100	98.4	100	0	98.7	100	100	100	0	100	98.8
Single Units	0	11	0	0	11	1	0	0	0	1	0	19	0	0	19	0	0	0	0	0	31
% Single Units	0	0.7	0	0	0.6	1.2	0	0	0	0.9	0	1.1	0	0	0.9	0	0	0	0	0	0.7
Heavy Trucks	0	11	0	0	11	0	0	0	0	0	0	8	0	0	8	0	0	0	0	0	19
% Heavy Trucks	0	0.7	0	0	0.6	0	0	0	0	0	0	0.5	0	0	0.4	0	0	0	0	0	0.4
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: 2 hour traffic study conducted during typical weekday (Tuesday) from 4:00-6:00 PM afternoon peak hours. Non-signalized intersection. Video SCU camera was located within NE intersection quadrant.

Traffic Data Collection (TDC)

tdccounts.com

Phone: (586) 786-5407

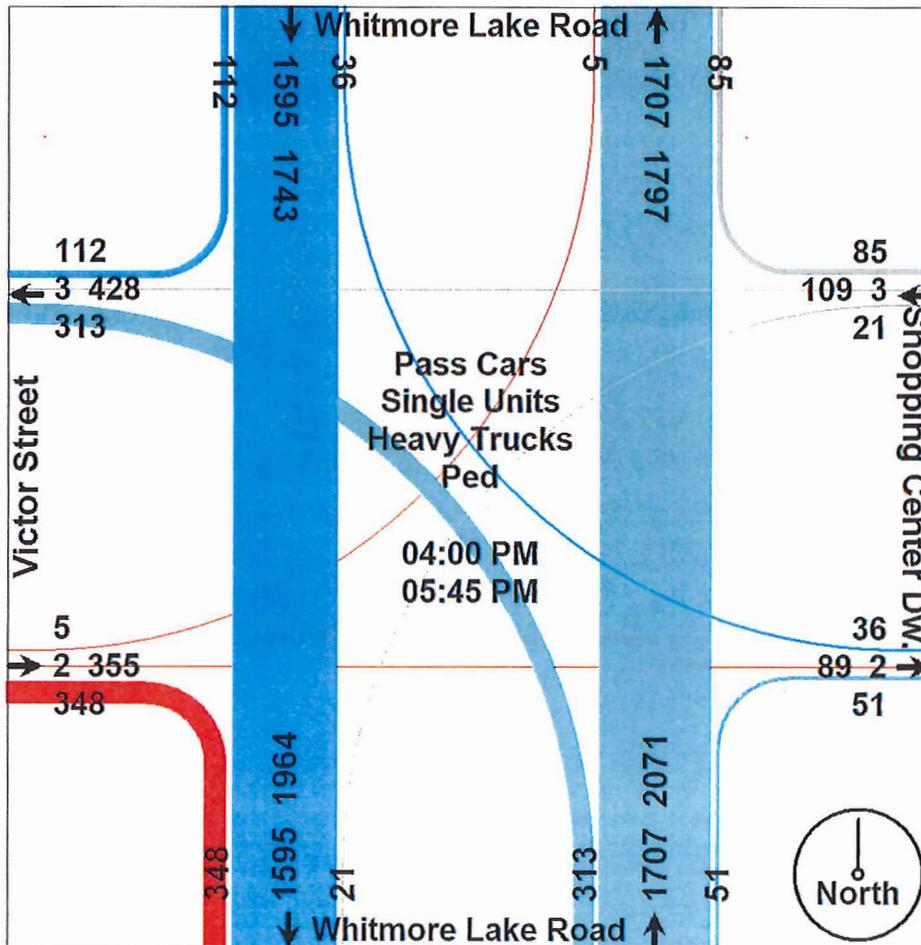
Traffic Study Performed For:

Fleis & VandenBrink



Project: Brighton Traffic Study
Study Type: 2 Hr. Video Turning Movement
Weather: Pt. Sunny, Dry Temp 80's
Count By: Miovision Video SCU 4SY

File Name : TMC_4 WhitmoreLk & Victor_Tues 7-19-16
Site Code : TMC_4
Start Date : 7/19/2016
Page No : 2



Traffic Data Collection (TDC)

tdccounts.com

Phone: (586) 786-5407

Traffic Study Performed For:

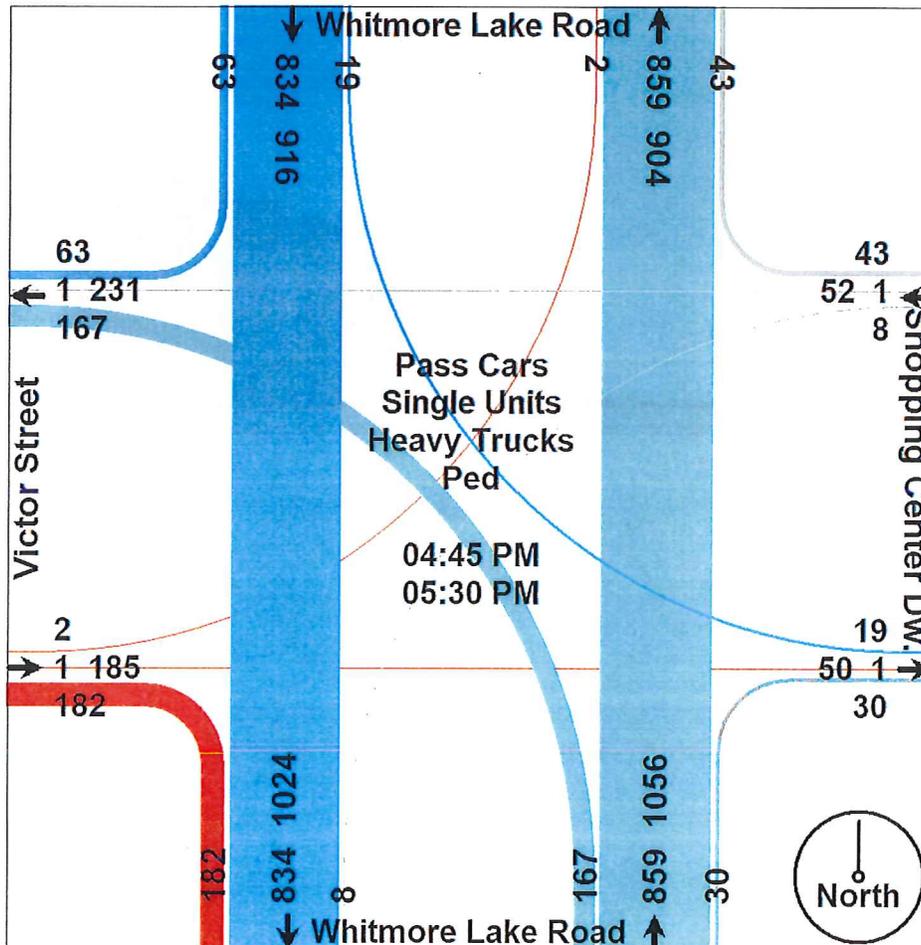
Fleis & VandenBrink



Project: Brighton Traffic Study
Study Type: 2 Hr. Video Turning Movement
Weather: Pt. Sunny, Dry Temp 80's
Count By: Miovision Video SCU 4SY

File Name : TMC_4 WhitmoreLk & Victor_Tues 7-19-16
Site Code : TMC_4
Start Date : 7/19/2016
Page No : 3

Start Time	Whitmore Lake Road Southbound				Shopping Center Dw. Westbound				Whitmore Lake Road Northbound				Victor Street Eastbound				Int. Total
	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:45 PM																	
04:45 PM	16	188	5	209	12	0	1	13	9	215	50	274	42	0	0	42	538
05:00 PM	16	212	3	231	13	1	3	17	5	218	30	253	48	0	2	50	551
05:15 PM	17	225	3	245	9	0	3	12	6	223	34	263	45	1	0	46	566
05:30 PM	14	209	8	231	9	0	1	10	10	203	53	266	47	0	0	47	554
Total Volume	63	834	19	916	43	1	8	52	30	859	167	1056	182	1	2	185	2209
% App. Total	6.9	91	2.1		82.7	1.9	15.4		2.8	81.3	15.8		98.4	0.5	1.1		
PHF	.926	.927	.594	.935	.827	.250	.667	.765	.750	.963	.788	.964	.948	.250	.250	.925	.976
Pass Cars	63	818	19	900	43	1	8	52	30	847	167	1044	182	1	2	185	2181
% Pass Cars	100	98.1	100	98.3	100	100	100	100	100	98.6	100	98.9	100	100	100	100	98.7
Single Units	0	7	0	7	0	0	0	0	0	9	0	9	0	0	0	0	16
% Single Units	0	0.8	0	0.8	0	0	0	0	0	1.0	0	0.9	0	0	0	0	0.7
Heavy Trucks	0	9	0	9	0	0	0	0	0	3	0	3	0	0	0	0	12
% Heavy Trucks	0	1.1	0	1.0	0	0	0	0	0	0.3	0	0.3	0	0	0	0	0.5
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





YOU ARE VIEWING DATA FOR:

Brighton Township

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

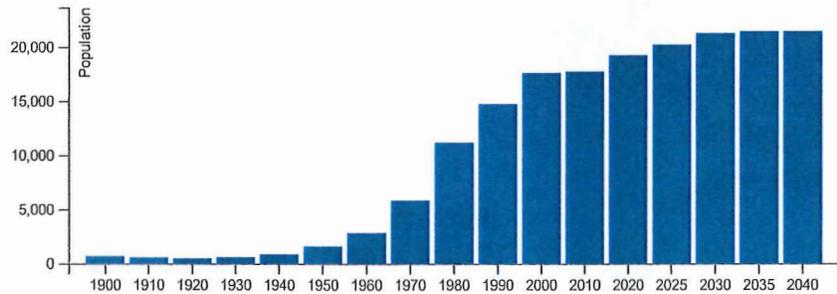


Census 2010 Population:
17,791
Area: 34.6 square miles

Population and Households

Link to American Community Survey (ACS) Profiles: 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

HCM 2010 Signalized Intersection Summary
 1: Whitmore Lake Road/Old US-23 & Grand River Avenue

Existing Conditions
 PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	261	491	202	380	579	309	245	447	220	186	334	171
Future Volume (veh/h)	261	491	202	380	579	309	245	447	220	186	334	171
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	1961	1961	2000	1961	1961	2000	1980	1980	1980	1961	1961	1961
Adj Flow Rate, veh/h	281	528	217	409	623	332	263	481	237	198	355	182
Adj No. of Lanes	1	2	0	1	2	0	1	1	1	1	1	1
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	2	2	2	1	1	1	2	2	2
Cap, veh/h	321	617	252	429	662	353	348	515	669	230	407	647
Arrive On Green	0.14	0.24	0.24	0.18	0.28	0.28	0.14	0.26	0.26	0.09	0.21	0.21
Sat Flow, veh/h	1867	2581	1057	1867	2350	1252	1886	1980	1683	1867	1961	1667
Grp Volume(v), veh/h	281	381	364	409	494	461	263	481	237	198	355	182
Grp Sat Flow(s),veh/h/ln	1867	1863	1774	1867	1863	1740	1886	1980	1683	1867	1961	1667
Q Serve(g_s), s	12.6	21.9	22.1	18.7	29.1	29.1	10.0	26.6	0.0	7.8	19.6	0.0
Cycle Q Clear(g_c), s	12.6	21.9	22.1	18.7	29.1	29.1	10.0	26.6	0.0	7.8	19.6	0.0
Prop In Lane	1.00		0.60	1.00		0.72	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	321	445	424	429	525	490	348	515	669	230	407	647
V/C Ratio(X)	0.88	0.86	0.86	0.95	0.94	0.94	0.76	0.93	0.35	0.86	0.87	0.28
Avail Cap(c_a), veh/h	397	531	506	429	531	496	348	530	682	264	524	746
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	40.8	40.9	43.1	39.4	39.4	44.0	40.6	23.7	48.9	43.0	23.6
Incr Delay (d2), s/veh	16.5	11.3	12.2	31.6	24.9	26.1	9.1	23.6	0.3	21.8	12.2	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	10.0	12.7	12.3	16.3	18.6	17.5	8.6	17.9	5.1	7.4	12.0	3.9
LnGrp Delay(d),s/veh	62.2	52.1	53.1	74.7	64.3	65.5	53.1	64.1	24.0	70.7	55.2	23.8
LnGrp LOS	E	D	D	E	E	E	D	E	C	E	E	C
Approach Vol, veh/h		1026			1364			981			735	
Approach Delay, s/veh		55.2			67.8			51.5			51.6	
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	21.9	38.1	22.3	29.8	26.7	33.3	16.5	35.7				
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	14.6	31.1	12.0	21.6	20.7	24.1	9.8	28.6				
Green Ext Time (p_c), s	0.8	0.6	0.0	1.6	0.0	2.7	0.1	0.5				
Intersection Summary												
HCM 2010 Ctrl Delay			57.9									
HCM 2010 LOS			E									
Notes												

HCM 2010 Signalized Intersection Summary
 2: Borderline Drive & Grand River Avenue

Existing Conditions
 PM Peak Hour

Movement	EBT	EBR	WBL	WBT	NBL	NBR		
Lane Configurations	↑↑	↑	↑	↑↑	↑	↑		
Traffic Volume (veh/h)	742	99	55	849	160	83		
Future Volume (veh/h)	742	99	55	849	160	83		
Number	2	12	1	6	7	14		
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	1961	2000	1980	1980	2000	1961		
Adj Flow Rate, veh/h	789	105	58	894	176	91		
Adj No. of Lanes	2	1	1	2	1	1		
Peak Hour Factor	0.94	0.94	0.95	0.95	0.91	0.91		
Percent Heavy Veh, %	2	0	1	1	0	2		
Cap, veh/h	2355	1074	494	2793	235	1259		
Arrive On Green	0.63	0.63	0.04	0.74	0.12	0.12		
Sat Flow, veh/h	3824	1700	1886	3861	1905	1667		
Grp Volume(v), veh/h	789	105	58	894	176	91		
Grp Sat Flow(s),veh/h/ln	1863	1700	1886	1881	1905	1667		
Q Serve(g_s), s	8.9	2.2	0.9	7.2	8.0	1.3		
Cycle Q Clear(g_c), s	8.9	2.2	0.9	7.2	8.0	1.3		
Prop In Lane		1.00	1.00		1.00	1.00		
Lane Grp Cap(c), veh/h	2355	1074	494	2793	235	1259		
V/C Ratio(X)	0.34	0.10	0.12	0.32	0.75	0.07		
Avail Cap(c_a), veh/h	2355	1074	705	2793	508	1498		
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	7.7	6.5	5.0	3.9	38.1	2.9		
Incr Delay (d2), s/veh	0.4	0.2	0.1	0.3	6.7	0.0		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	4.6	1.1	0.5	3.8	4.6	2.1		
LnGrp Delay(d),s/veh	8.1	6.7	5.1	4.2	44.8	2.9		
LnGrp LOS	A	A	A	A	D	A		
Approach Vol, veh/h	894			952	267			
Approach Delay, s/veh	7.9			4.3	30.5			
Approach LOS	A			A	C			
Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	9.9	63.0		17.1		72.9		
Change Period (Y+Rc), s	6.1	* 6.1		6.0		* 6.1		
Max Green Setting (Gmax), s	4	* 34		24.0		* 54		
Max Q Clear Time (g_c+I), s	10.9			10.0		9.2		
Green Ext Time (p_c), s	0.1	2.1		1.1		2.1		
Intersection Summary								
HCM 2010 Ctrl Delay			9.1					
HCM 2010 LOS			A					
Notes								

Intersection

Int Delay, s/veh 1.9

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↑	↑↑	↑	↑
Traffic Vol, veh/h	800	25	111	884	20	154
Future Vol, veh/h	800	25	111	884	20	154
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	50
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	95	95	93	93
Heavy Vehicles, %	2	0	0	1	0	1
Mvmt Flow	842	26	117	931	22	166

Major/Minor	Major1	Major2	Minor1	Minor2
Conflicting Flow All	0	0	868	0
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Critical Hdwy	-	-	4.1	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-
Follow-up Hdwy	-	-	2.2	-
Pot Cap-1 Maneuver	-	-	785	-
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Platoon blocked, %	-	-	-	-
Mov Cap-1 Maneuver	-	-	785	-
Mov Cap-2 Maneuver	-	-	-	-
Stage 1	-	-	-	-
Stage 2	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.2	14.9
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	217	573	-	-	785	-
HCM Lane V/C Ratio	0.099	0.289	-	-	0.149	-
HCM Control Delay (s)	23.4	13.8	-	-	10.4	-
HCM Lane LOS	C	B	-	-	B	-
HCM 95th %tile Q(veh)	0.3	1.2	-	-	0.5	-

HCM 2010 TWSC
 4: Whitmore Lake Road & Victor Street/Shopping Center Drive

Existing Conditions
 PM Peak Hour

Intersection												
Int Delay, s/veh	7.3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑	↑		↑	↑	↑	↑↑		↑	↑	↑
Traffic Vol, veh/h	2	1	182	8	1	43	167	867	30	19	834	63
Future Vol, veh/h	2	1	182	8	1	43	167	867	30	19	834	63
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	0	-	-	20	100	-	1	100	-	75
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	77	77	77	95	95	95	94	94	94
Heavy Vehicles, %	0	0	0	0	0	0	0	1	0	0	2	0
Mvmt Flow	2	1	196	10	1	56	176	913	32	20	887	67

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1737	2224	887	2208	2208	472	887	0	0	944	0	0
Stage 1	928	928	-	1280	1280	-	-	-	-	-	-	-
Stage 2	809	1296	-	928	928	-	-	-	-	-	-	-
Critical Hdwy	7.3	6.5	6.2	7.3	6.5	6.9	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.5	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.5	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	63	44	346	28	45	544	772	-	-	735	-	-
Stage 1	324	349	-	178	239	-	-	-	-	-	-	-
Stage 2	345	234	-	324	349	-	-	-	-	-	-	-
Platoon blocked, %												
Mov Cap-1 Maneuver	44	33	346	~ 10	34	544	772	-	-	735	-	-
Mov Cap-2 Maneuver	44	33	-	~ 10	34	-	-	-	-	-	-	-
Stage 1	250	340	-	137	185	-	-	-	-	-	-	-
Stage 2	237	181	-	136	340	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	29.3	138.7	1.7	0.2
HCM LOS	D	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	772	-	-	40	346	11	544	735	-	-
HCM Lane V/C Ratio	0.228	-	-	0.081	0.566	1.063	0.103	0.028	-	-
HCM Control Delay (s)	11	-	-	102.8	28.1	742.2	12.4	10	-	-
HCM Lane LOS	B	-	-	F	D	F	B	B	-	-
HCM 95th %tile Q(veh)	0.9	-	-	0.2	3.3	2.1	0.3	0.1	-	-

Notes

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

HCM 2010 Signalized Intersection Summary
 1: Whitmore Lake Road/Old US-23 & Grand River Avenue

Existing Conditions
 SAT Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	176	421	253	204	340	90	251	317	186	129	274	145
Future Volume (veh/h)	176	421	253	204	340	90	251	317	186	129	274	145
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	189	453	272	219	366	97	270	341	200	139	295	156
Adj No. of Lanes	1	2	0	1	2	0	1	1	1	1	1	1
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	1	1	1	1	1	1	1	1	1	1	1	1
Cap, veh/h	464	556	332	284	511	134	331	418	637	266	372	478
Arrive On Green	0.17	0.25	0.25	0.10	0.17	0.17	0.10	0.21	0.21	0.07	0.19	0.19
Sat Flow, veh/h	1886	2269	1354	1886	2952	773	1886	1980	1683	1886	1980	1683
Grp Volume(v), veh/h	189	375	350	219	232	231	270	341	200	139	295	156
Grp Sat Flow(s),veh/h/ln	1886	1881	1741	1886	1881	1844	1886	1980	1683	1886	1980	1683
Q Serve(g_s), s	0.4	13.1	13.2	4.0	8.1	8.3	4.2	11.4	0.0	0.2	9.9	0.0
Cycle Q Clear(g_c), s	0.4	13.1	13.2	4.0	8.1	8.3	4.2	11.4	0.0	0.2	9.9	0.0
Prop In Lane	1.00		0.78	1.00		0.42	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	464	461	427	284	326	319	331	418	637	266	372	478
V/C Ratio(X)	0.41	0.81	0.82	0.77	0.71	0.72	0.82	0.82	0.31	0.52	0.79	0.33
Avail Cap(c_a), veh/h	499	540	500	455	540	529	472	540	741	449	540	620
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	23.8	24.8	24.8	29.3	27.2	27.2	28.8	26.2	15.3	29.7	27.0	19.7
Incr Delay (d2), s/veh	0.6	8.1	9.1	4.4	2.9	3.1	7.3	7.4	0.3	1.6	5.0	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	3.1	7.8	7.4	4.4	4.4	4.5	5.6	7.1	2.7	2.6	5.9	2.3
LnGrp Delay(d),s/veh	24.3	32.9	34.0	33.7	30.0	30.4	36.1	33.6	15.5	31.3	32.0	20.1
LnGrp LOS	C	C	C	C	C	C	D	C	B	C	C	C
Approach Vol, veh/h		914			682			811			590	
Approach Delay, s/veh		31.5			31.3			30.0			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	18.2	18.6	13.3	19.6	13.2	23.6	11.7	21.2				
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	* 13	* 20	* 12	* 19	* 13	* 20	* 12	* 19				
Max Q Clear Time (g_c+I1), s	2.4	10.3	6.2	11.9	6.0	15.2	2.2	13.4				
Green Ext Time (p_c), s	0.9	1.8	0.6	1.2	0.7	1.8	0.9	1.3				
Intersection Summary												
HCM 2010 Ctrl Delay			30.5									
HCM 2010 LOS			C									
Notes												

HCM 2010 Signalized Intersection Summary
 2: Borderline Drive & Grand River Avenue

Existing Conditions
 SAT Peak Hour

Movement	EBT	EBR	WBL	WBT	NBL	NBR		
Lane Configurations	↑↑	↑	↑	↑↑	↑	↑		
Traffic Volume (veh/h)	700	113	58	625	141	76		
Future Volume (veh/h)	700	113	58	625	141	76		
Number	2	12	1	6	7	14		
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	2000	2000	2000	1980	2000	1980		
Adj Flow Rate, veh/h	761	123	64	687	148	80		
Adj No. of Lanes	2	1	1	2	1	1		
Peak Hour Factor	0.92	0.92	0.91	0.91	0.95	0.95		
Percent Heavy Veh, %	0	0	0	1	0	1		
Cap, veh/h	2455	1098	520	2853	204	1268		
Arrive On Green	0.65	0.65	0.04	0.76	0.11	0.11		
Sat Flow, veh/h	3900	1700	1905	3861	1905	1683		
Grp Volume(v), veh/h	761	123	64	687	148	80		
Grp Sat Flow(s),veh/h/ln	1900	1700	1905	1881	1905	1683		
Q Serve(g_s), s	8.0	2.5	0.9	4.9	6.8	1.1		
Cycle Q Clear(g_c), s	8.0	2.5	0.9	4.9	6.8	1.1		
Prop In Lane		1.00	1.00		1.00	1.00		
Lane Grp Cap(c), veh/h	2455	1098	520	2853	204	1268		
V/C Ratio(X)	0.31	0.11	0.12	0.24	0.72	0.06		
Avail Cap(c_a), veh/h	2455	1098	730	2853	508	1536		
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	7.0	6.1	4.5	3.2	38.9	2.9		
Incr Delay (d2), s/veh	0.3	0.2	0.1	0.2	6.8	0.0		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	4.2	1.2	0.5	2.6	4.0	1.9		
LnGrp Delay(d),s/veh	7.4	6.3	4.6	3.4	45.6	2.9		
LnGrp LOS	A	A	A	A	D	A		
Approach Vol, veh/h	884			751	228			
Approach Delay, s/veh	7.2			3.5	30.6			
Approach LOS	A			A	C			
Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	60.1	64.3		15.7		74.3		
Change Period (Y+Rc), s	6.1	* 6.1		6.0		* 6.1		
Max Green Setting (Gmax), s	45	* 34		24.0		* 54		
Max Q Clear Time (g_c+I), s	10.0			8.8		6.9		
Green Ext Time (p_c), s	0.1	1.7		0.9		1.7		
Intersection Summary								
HCM 2010 Ctrl Delay			8.6					
HCM 2010 LOS			A					
Notes								

HCM 2010 TWSC
3: Kroger Drive & Grand River Avenue

Existing Conditions
SAT Peak Hour

Intersection

Int Delay, s/veh 1.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↑	↑↑	↑	↑
Traffic Vol, veh/h	757	19	64	672	11	93
Future Vol, veh/h	757	19	64	672	11	93
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	50
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	90	90	79	79
Heavy Vehicles, %	1	0	2	1	0	1
Mvmt Flow	797	20	71	747	14	118

Major/Minor	Major1	Major2	Minor1	Minor2
Conflicting Flow All	0	0	817	0
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Critical Hdwy	-	-	4.14	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-
Follow-up Hdwy	-	-	2.22	-
Pot Cap-1 Maneuver	-	-	807	-
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Platoon blocked, %	-	-	-	-
Mov Cap-1 Maneuver	-	-	807	-
Mov Cap-2 Maneuver	-	-	-	-
Stage 1	-	-	-	-
Stage 2	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.9	13.2
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	269	595	-	-	807	-
HCM Lane V/C Ratio	0.052	0.198	-	-	0.088	-
HCM Control Delay (s)	19.1	12.5	-	-	9.9	-
HCM Lane LOS	C	B	-	-	A	-
HCM 95th %tile Q(veh)	0.2	0.7	-	-	0.3	-

Intersection

Int Delay, s/veh 5.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↕		↕	↕	↕	↕↕		↕	↕	↕
Traffic Vol, veh/h	1	1	143	13	5	54	148	699	40	21	671	39
Future Vol, veh/h	1	1	143	13	5	54	148	699	40	21	671	39
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	0	-	-	20	100	-	1	100	-	75
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	88	88	88	86	86	86	87	87	87	95	95	95
Heavy Vehicles, %	0	0	1	0	0	0	0	1	1	0	1	0
Mvmt Flow	1	1	163	15	6	63	170	803	46	22	706	41

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1496	1941	706	1918	1918	425	706	0	0	849	0	0
Stage 1	751	751	-	1167	1167	-	-	-	-	-	-	-
Stage 2	745	1190	-	751	751	-	-	-	-	-	-	-
Critical Hdwy	7.3	6.5	6.215	7.3	6.5	6.9	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.5	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.5	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4.3	3.095	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	94	66	437	46	68	583	902	-	-	798	-	-
Stage 1	406	421	-	209	270	-	-	-	-	-	-	-
Stage 2	377	263	-	406	421	-	-	-	-	-	-	-
Platoon blocked, %							-	-	-	-	-	-
Mov Cap-1 Maneuver	65	52	437	24	54	583	902	-	-	798	-	-
Mov Cap-2 Maneuver	65	52	-	24	54	-	-	-	-	-	-	-
Stage 1	329	409	-	170	219	-	-	-	-	-	-	-
Stage 2	266	213	-	247	409	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	18.7	82	1.7	0.3
HCM LOS	C	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	902	-	-	58	437	28	583	798	-	-
HCM Lane V/C Ratio	0.189	-	-	0.039	0.372	0.748	0.108	0.028	-	-
HCM Control Delay (s)	9.9	-	-	69.6	18	292.3	11.9	9.6	-	-
HCM Lane LOS	A	-	-	F	C	F	B	A	-	-
HCM 95th %tile Q(veh)	0.7	-	-	0.1	1.7	2.4	0.4	0.1	-	-

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vehicles Exited	257	490	207	351	574	306	225	445	205	186	327	178
Hourly Exit Rate	257	490	207	351	574	306	225	445	205	186	327	178
Input Volume	261	496	202	380	579	309	245	450	220	186	334	171
% of Volume	99	99	102	92	99	99	92	99	93	100	98	104

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

Movement	All
Vehicles Exited	3751
Hourly Exit Rate	3751
Input Volume	3832
% of Volume	98

2: Borderline Drive & Grand River Avenue Performance by movement

Movement	EBT	EBR	WBL	WBT	NBL	NBR	All
Vehicles Exited	736	95	50	840	159	75	1955
Hourly Exit Rate	736	95	50	840	159	75	1955
Input Volume	742	99	55	850	160	83	1988
% of Volume	99	96	91	99	99	91	98

3: Kroger Drive & Grand River Avenue Performance by movement

Movement	EBT	EBR	WBL	WBT	NBL	NBR	All
Vehicles Exited	790	24	106	877	20	149	1966
Hourly Exit Rate	790	24	106	877	20	149	1966
Input Volume	804	25	111	894	20	154	2008
% of Volume	98	95	95	98	101	97	98

4: Whitmore Lake Road & Victor Street/Shopping Center Drive Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vehicles Exited	1	1	174	8	1	31	160	850	30	19	804	65
Hourly Exit Rate	1	1	174	8	1	31	160	850	30	19	804	65
Input Volume	2	1	182	8	1	43	167	867	30	19	837	63
% of Volume	50	100	96	103	100	72	96	98	101	99	96	103

4: Whitmore Lake Road & Victor Street/Shopping Center Drive Performance by movement

Movement	All
Vehicles Exited	2144
Hourly Exit Rate	2144
Input Volume	2220
% of Volume	97

Total Network Performance

Vehicles Exited	4429
Hourly Exit Rate	4429
Input Volume	14566
% of Volume	30

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vehicles Exited	186	422	257	194	339	90	258	314	182	131	285	142
Hourly Exit Rate	186	422	257	194	339	90	258	314	182	131	285	142
Input Volume	176	421	253	204	340	90	251	331	186	129	274	145
% of Volume	106	100	101	95	100	100	103	95	98	101	104	98

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

Movement	All
Vehicles Exited	2800
Hourly Exit Rate	2800
Input Volume	2801
% of Volume	100

2: Borderline Drive & Grand River Avenue Performance by movement

Movement	EBT	EBR	WBL	WBT	NBL	NBR	All
Vehicles Exited	702	119	57	635	145	77	1735
Hourly Exit Rate	702	119	57	635	145	77	1735
Input Volume	700	113	58	627	141	76	1716
% of Volume	100	105	98	101	103	101	101

3: Kroger Drive & Grand River Avenue Performance by movement

Movement	EBT	EBR	WBL	WBT	NBL	NBR	All
Vehicles Exited	768	19	62	686	9	99	1643
Hourly Exit Rate	768	19	62	686	9	99	1643
Input Volume	765	19	64	679	11	93	1632
% of Volume	100	99	96	101	82	106	101

4: Whitmore Lake Road & Victor Street/Shopping Center Drive Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vehicles Exited	0	1	137	9	3	55	138	686	37	19	681	36
Hourly Exit Rate	0	1	137	9	3	55	138	686	37	19	681	36
Input Volume	1	1	143	13	5	54	148	699	40	21	675	39
% of Volume	0	100	96	71	57	102	93	98	92	89	101	93

4: Whitmore Lake Road & Victor Street/Shopping Center Drive Performance by movement

Movement	All
Vehicles Exited	1802
Hourly Exit Rate	1802
Input Volume	1839
% of Volume	98

Total Network Performance

Vehicles Exited	3440
Hourly Exit Rate	3440
Input Volume	11408
% of Volume	30

HCM 2010 Signalized Intersection Summary

Existing Conditions W / Improvements

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

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 						 	
Traffic Volume (veh/h)	261	491	202	380	579	309	245	447	220	186	334	171
Future Volume (veh/h)	261	491	202	380	579	309	245	447	220	186	334	171
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	1961	1961	1961	1961	1961	1961	1980	1980	1980	1961	1961	1961
Adj Flow Rate, veh/h	281	528	217	409	623	332	263	481	237	198	355	182
Adj No. of Lanes	1	2	1	1	2	1	1	1	1	1	1	1
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	2	2	2	1	1	1	2	2	2
Cap, veh/h	384	700	459	457	804	604	374	543	725	236	421	666
Arrive On Green	0.16	0.19	0.19	0.18	0.22	0.22	0.15	0.27	0.27	0.09	0.21	0.21
Sat Flow, veh/h	1867	3725	1667	1867	3725	1667	1886	1980	1683	1867	1961	1667
Grp Volume(v), veh/h	281	528	217	409	623	332	263	481	237	198	355	182
Grp Sat Flow(s),veh/h/ln	1867	1863	1667	1867	1863	1667	1886	1980	1683	1867	1961	1667
Q Serve(g_s), s	9.0	13.1	2.1	14.8	15.4	1.2	7.6	22.8	0.0	6.3	17.0	0.0
Cycle Q Clear(g_c), s	9.0	13.1	2.1	14.8	15.4	1.2	7.6	22.8	0.0	6.3	17.0	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	384	700	459	457	804	604	374	543	725	236	421	666
V/C Ratio(X)	0.73	0.75	0.47	0.90	0.77	0.55	0.70	0.89	0.33	0.84	0.84	0.27
Avail Cap(c_a), veh/h	522	1049	614	542	1049	713	374	638	806	313	632	845
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(l)	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	37.0	37.5	29.5	36.2	36.1	24.8	37.3	34.0	18.4	42.4	36.8	19.8
Incr Delay (d2), s/veh	3.4	1.7	0.8	15.6	2.7	0.8	5.8	12.7	0.3	14.0	6.5	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	7.5	6.9	4.8	12.7	8.2	7.0	7.2	14.3	4.3	6.1	9.9	3.3
LnGrp Delay(d),s/veh	40.4	39.3	30.3	51.8	38.8	25.6	43.1	46.7	18.7	56.4	43.3	20.0
LnGrp LOS	D	D	C	D	D	C	D	D	B	E	D	B
Approach Vol, veh/h		1026			1364			981			735	
Approach Delay, s/veh		37.7			39.5			39.0			41.1	
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	21.8	27.6	20.8	27.5	24.5	24.9	15.0	33.3				
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	* 23	* 28	* 13	* 32	* 23	* 28	* 13	* 32				
Max Q Clear Time (g_c+I1), s	11.0	17.4	9.6	19.0	16.8	15.1	8.3	24.8				
Green Ext Time (p_c), s	1.7	3.7	0.4	2.0	1.2	3.3	0.3	2.0				
Intersection Summary												
HCM 2010 Ctrl Delay			39.2									
HCM 2010 LOS			D									
Notes												

HCM 2010 Signalized Intersection Summary

Existing Conditions W / Improvements

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

SAT Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	176	421	253	204	340	90	251	317	186	129	274	145
Future Volume (veh/h)	176	421	253	204	340	90	251	317	186	129	274	145
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	189	453	272	219	366	97	270	341	200	139	295	156
Adj No. of Lanes	1	2	1	1	2	1	1	1	1	1	1	1
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	1	1	1	1	1	1	1	1	1	1	1	1
Cap, veh/h	392	718	459	311	616	454	369	434	552	301	387	467
Arrive On Green	0.11	0.19	0.19	0.08	0.16	0.16	0.11	0.22	0.22	0.08	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	189	453	272	219	366	97	270	341	200	139	295	156
Grp Sat Flow(s),veh/h/ln	1886	1881	1683	1886	1881	1683	1886	1980	1683	1886	1980	1683
Q Serve(g_s), s	0.0	6.8	3.6	1.6	5.5	0.0	2.7	9.9	0.0	0.0	8.6	0.0
Cycle Q Clear(g_c), s	0.0	6.8	3.6	1.6	5.5	0.0	2.7	9.9	0.0	0.0	8.6	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	392	718	459	311	616	454	369	434	552	301	387	467
V/C Ratio(X)	0.48	0.63	0.59	0.70	0.59	0.21	0.73	0.78	0.36	0.46	0.76	0.33
Avail Cap(c_a), veh/h	589	1233	689	559	1233	730	540	616	707	518	616	662
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	23.4	22.7	19.3	25.6	23.6	17.3	24.4	22.5	15.6	25.5	23.2	17.6
Incr Delay (d2), s/veh	0.9	0.9	1.2	2.9	0.9	0.2	2.8	4.3	0.4	1.1	3.1	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	2.9	3.6	1.8	3.7	2.9	1.3	4.6	5.9	2.6	2.3	5.0	2.1
LnGrp Delay(d),s/veh	24.3	23.6	20.5	28.5	24.6	17.5	27.2	26.8	16.0	26.6	26.3	18.0
LnGrp LOS	C	C	C	C	C	B	C	C	B	C	C	B
Approach Vol, veh/h		914			682			811			590	
Approach Delay, s/veh		22.8			24.8			24.3			24.2	
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	13.1	16.5	13.0	18.4	11.5	18.1	11.5	19.9				
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	* 13	* 20	* 12	* 19	* 13	* 20	* 12	* 19				
Max Q Clear Time (g_c+I1), s	2.0	7.5	4.7	10.6	3.6	8.8	2.0	11.9				
Green Ext Time (p_c), s	0.9	2.0	0.7	1.3	0.8	2.9	0.9	1.5				
Intersection Summary												
HCM 2010 Ctrl Delay			23.9									
HCM 2010 LOS			C									
Notes												

HCM 2010 Signalized Intersection Summary
 1: Whitmore Lake Road/Old US-23 & Grand River Avenue

Background Conditions
 PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	265	498	205	386	588	314	249	455	223	189	339	174
Future Volume (veh/h)	265	498	205	386	588	314	249	455	223	189	339	174
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	1961	1961	2000	1961	1961	2000	1980	1980	1980	1961	1961	1961
Adj Flow Rate, veh/h	285	535	220	415	632	338	268	489	240	201	361	185
Adj No. of Lanes	1	2	0	1	2	0	1	1	1	1	1	1
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	2	2	2	1	1	1	2	2	2
Cap, veh/h	321	620	254	425	661	353	348	518	672	232	412	648
Arrive On Green	0.14	0.24	0.24	0.18	0.28	0.28	0.14	0.26	0.26	0.09	0.21	0.21
Sat Flow, veh/h	1867	2580	1057	1867	2347	1255	1886	1980	1683	1867	1961	1667
Grp Volume(v), veh/h	285	386	369	415	502	468	268	489	240	201	361	185
Grp Sat Flow(s),veh/h/ln	1867	1863	1774	1867	1863	1739	1886	1980	1683	1867	1961	1667
Q Serve(g_s), s	13.1	22.6	22.7	19.6	30.1	30.1	10.5	27.5	0.0	8.2	20.3	0.0
Cycle Q Clear(g_c), s	13.1	22.6	22.7	19.6	30.1	30.1	10.5	27.5	0.0	8.2	20.3	0.0
Prop In Lane	1.00		0.60	1.00		0.72	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	321	448	426	425	524	490	348	518	672	232	412	648
V/C Ratio(X)	0.89	0.86	0.87	0.98	0.96	0.96	0.77	0.94	0.36	0.87	0.88	0.29
Avail Cap(c_a), veh/h	392	524	499	425	524	490	348	523	676	260	517	738
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	46.4	41.4	41.4	44.0	40.2	40.2	44.7	41.2	23.9	49.5	43.5	23.9
Incr Delay (d2), s/veh	18.6	12.3	13.2	37.2	28.7	29.9	10.1	26.0	0.3	23.2	13.2	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	10.4	13.1	12.6	17.3	19.6	18.5	8.9	18.8	5.3	7.7	12.4	4.0
LnGrp Delay(d),s/veh	65.1	53.7	54.7	81.2	68.8	70.1	54.8	67.2	24.2	72.6	56.7	24.1
LnGrp LOS	E	D	D	F	E	E	D	E	C	E	E	C
Approach Vol, veh/h		1040			1385			997			747	
Approach Delay, s/veh		57.1			73.0			53.5			52.9	
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	22.2	38.5	22.6	30.4	26.9	33.8	16.8	36.2				
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	15.1	32.1	12.5	22.3	21.6	24.7	10.2	29.5				
Green Ext Time (p_c), s	0.6	0.0	0.0	1.6	0.0	2.6	0.1	0.2				
Intersection Summary												
HCM 2010 Ctrl Delay			60.8									
HCM 2010 LOS			E									
Notes												

HCM 2010 Signalized Intersection Summary
 2: Borderline Drive & Grand River Avenue

Background Conditions
 PM Peak Hour

								
Movement	EBT	EBR	WBL	WBT	NBL	NBR		
Lane Configurations	↑↑	↑	↑	↑↑	↑	↑		
Traffic Volume (veh/h)	753	100	56	862	162	84		
Future Volume (veh/h)	753	100	56	862	162	84		
Number	2	1	1	6	7	14		
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	1961	2000	1980	1980	2000	1961		
Adj Flow Rate, veh/h	801	106	59	907	178	92		
Adj No. of Lanes	2	1	1	2	1	1		
Peak Hour Factor	0.94	0.94	0.95	0.95	0.91	0.91		
Percent Heavy Veh, %	2	0	1	1	0	2		
Cap, veh/h	2349	1072	488	2789	237	1258		
Arrive On Green	0.63	0.63	0.04	0.74	0.12	0.12		
Sat Flow, veh/h	3824	1700	1886	3861	1905	1667		
Grp Volume(v), veh/h	801	106	59	907	178	92		
Grp Sat Flow(s),veh/h/ln	1863	1700	1886	1881	1905	1667		
Q Serve(g_s), s	9.1	2.2	0.9	7.4	8.1	1.3		
Cycle Q Clear(g_c), s	9.1	2.2	0.9	7.4	8.1	1.3		
Prop In Lane		1.00	1.00		1.00	1.00		
Lane Grp Cap(c), veh/h	2349	1072	488	2789	237	1258		
V/C Ratio(X)	0.34	0.10	0.12	0.33	0.75	0.07		
Avail Cap(c_a), veh/h	2349	1072	699	2789	508	1495		
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00		
Upstream Filter(l)	1.00	1.00	1.00	1.00	1.00	1.00		
Uniform Delay (d), s/veh	7.8	6.5	5.1	4.0	38.1	2.9		
Incr Delay (d2), s/veh	0.4	0.2	0.1	0.3	6.7	0.0		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	4.8	1.1	0.5	3.9	4.7	2.1		
LnGrp Delay(d),s/veh	8.2	6.7	5.2	4.3	44.7	2.9		
LnGrp LOS	A	A	A	A	D	A		
Approach Vol, veh/h	907			966	270			
Approach Delay, s/veh	8.0			4.3	30.5			
Approach LOS	A			A	C			
Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	60.0	62.9		17.2		72.8		
Change Period (Y+Rc), s	6.1	* 6.1		6.0		* 6.1		
Max Green Setting (Gmax), s	34	* 34		24.0		* 54		
Max Q Clear Time (g_c+I), s	11.1			10.1		9.4		
Green Ext Time (p_c), s	0.1	2.1		1.1		2.1		
Intersection Summary								
HCM 2010 Ctrl Delay			9.2					
HCM 2010 LOS			A					
Notes								

HCM 2010 TWSC
3: Kroger Drive & Grand River Avenue

Background Conditions
PM Peak Hour

Intersection

Int Delay, s/veh 1.9

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↓	↑↑	↓	↓
Traffic Vol, veh/h	812	25	113	898	20	156
Future Vol, veh/h	812	25	113	898	20	156
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	50
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	95	95	93	93
Heavy Vehicles, %	2	0	0	1	0	1
Mvmt Flow	855	26	119	945	22	168

Major/Minor	Major1	Major2	Minor1	Minor2
Conflicting Flow All	0	0	881	0
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Critical Hdwy	-	-	4.1	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-
Follow-up Hdwy	-	-	2.2	-
Pot Cap-1 Maneuver	-	-	776	-
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Platoon blocked, %	-	-	-	-
Mov Cap-1 Maneuver	-	-	776	-
Mov Cap-2 Maneuver	-	-	-	-
Stage 1	-	-	-	-
Stage 2	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.2	15.1
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	213	567	-	-	776	-
HCM Lane V/C Ratio	0.101	0.296	-	-	0.153	-
HCM Control Delay (s)	23.8	14	-	-	10.5	-
HCM Lane LOS	C	B	-	-	B	-
HCM 95th %tile Q(veh)	0.3	1.2	-	-	0.5	-

HCM 2010 TWSC
 4: Whitmore Lake Road & Victor Street/Shopping Center Drive

Background Conditions
 PM Peak Hour

Intersection												
Int Delay, s/veh	7.9											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔	↔		↔	↔	↔	↔↔		↔	↔	↔
Traffic Vol, veh/h	2	1	185	8	1	44	170	881	30	19	847	64
Future Vol, veh/h	2	1	185	8	1	44	170	881	30	19	847	64
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	0	-	-	20	100	-	1	100	-	75
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	77	77	77	95	95	95	94	94	94
Heavy Vehicles, %	0	0	0	0	0	0	0	1	0	0	2	0
Mvmt Flow	2	1	199	10	1	57	179	927	32	20	901	68

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1763	2258	901	2243	2242	479	901	0	0	959	0	0
Stage 1	941	941	-	1301	1301	-	-	-	-	-	-	-
Stage 2	822	1317	-	942	941	-	-	-	-	-	-	-
Critical Hdwy	7.3	6.5	6.2	7.3	6.5	6.9	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.5	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.5	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	60	42	340	27	43	538	763	-	-	725	-	-
Stage 1	319	345	-	173	233	-	-	-	-	-	-	-
Stage 2	339	229	-	318	345	-	-	-	-	-	-	-
Platoon blocked, %												
Mov Cap-1 Maneuver	42	31	340	~9	32	538	763	-	-	725	-	-
Mov Cap-2 Maneuver	42	31	-	~9	32	-	-	-	-	-	-	-
Stage 1	244	335	-	132	178	-	-	-	-	-	-	-
Stage 2	230	175	-	128	335	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	30.8	153	1.8	0.2
HCM LOS	D	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	763	-	-	38	340	10	538	725	-	-
HCM Lane V/C Ratio	0.235	-	-	0.085	0.585	1.169	0.106	0.028	-	-
HCM Control Delay (s)	11.2	-	-	108.3	29.5	839.8	12.5	10.1	-	-
HCM Lane LOS	B	-	-	F	D	F	B	B	-	-
HCM 95th %tile Q(veh)	0.9	-	-	0.3	3.5	2.2	0.4	0.1	-	-

Notes

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

HCM 2010 Signalized Intersection Summary
 1: Whitmore Lake Road/Old US-23 & Grand River Avenue

Background Conditions
 SAT Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	179	427	257	207	345	91	255	322	189	131	278	147
Future Volume (veh/h)	179	427	257	207	345	91	255	322	189	131	278	147
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	192	459	276	223	371	98	274	346	203	141	299	158
Adj No. of Lanes	1	2	0	1	2	0	1	1	1	1	1	1
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	1	1	1	1	1	1	1	1	1	1	1	1
Cap, veh/h	464	557	333	287	513	134	334	420	643	267	374	484
Arrive On Green	0.17	0.25	0.25	0.10	0.17	0.17	0.10	0.21	0.21	0.08	0.19	0.19
Sat Flow, veh/h	1886	2267	1355	1886	2954	771	1886	1980	1683	1886	1980	1683
Grp Volume(v), veh/h	192	380	355	223	235	234	274	346	203	141	299	158
Grp Sat Flow(s),veh/h/ln	1886	1881	1741	1886	1881	1844	1886	1980	1683	1886	1980	1683
Q Serve(g_s), s	0.7	13.6	13.7	4.3	8.4	8.5	4.5	11.8	0.0	0.4	10.2	0.0
Cycle Q Clear(g_c), s	0.7	13.6	13.7	4.3	8.4	8.5	4.5	11.8	0.0	0.4	10.2	0.0
Prop In Lane	1.00		0.78	1.00		0.42	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	464	462	427	287	327	320	334	420	643	267	374	484
V/C Ratio(X)	0.41	0.82	0.83	0.78	0.72	0.73	0.82	0.82	0.32	0.53	0.80	0.33
Avail Cap(c_a), veh/h	489	530	491	447	530	520	463	530	737	440	530	616
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	24.1	25.3	25.4	29.8	27.7	27.7	29.3	26.7	15.4	30.1	27.5	19.9
Incr Delay (d2), s/veh	0.6	9.1	10.2	4.5	3.0	3.2	8.1	8.3	0.3	1.6	5.7	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	3.2	8.1	7.8	4.6	4.6	4.6	5.9	7.4	2.8	2.7	6.2	2.5
LnGrp Delay(d),s/veh	24.7	34.4	35.6	34.3	30.6	31.0	37.4	35.0	15.7	31.7	33.1	20.3
LnGrp LOS	C	C	D	C	C	C	D	C	B	C	C	C
Approach Vol, veh/h		927			692			823			598	
Approach Delay, s/veh		32.9			31.9			31.0			29.4	
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	18.6	18.8	13.6	19.9	13.5	23.9	12.0	21.5				
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	* 13	* 20	* 12	* 19	* 13	* 20	* 12	* 19				
Max Q Clear Time (g_c+I1), s	2.7	10.5	6.5	12.2	6.3	15.7	2.4	13.8				
Green Ext Time (p_c), s	0.9	1.8	0.6	1.2	0.7	1.7	0.9	1.2				
Intersection Summary												
HCM 2010 Ctrl Delay			31.5									
HCM 2010 LOS			C									
Notes												

HCM 2010 Signalized Intersection Summary
 2: Borderline Drive & Grand River Avenue

Background Conditions
 SAT Peak Hour

Movement	EBT	EBR	WBL	WBT	NBL	NBR		
Lane Configurations	↑↑	↑	↑	↑↑	↑	↑		
Traffic Volume (veh/h)	711	115	58	635	143	77		
Future Volume (veh/h)	711	115	58	635	143	77		
Number	2	12	1	6	7	14		
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	2000	2000	2000	1980	2000	1980		
Adj Flow Rate, veh/h	773	125	64	698	151	81		
Adj No. of Lanes	2	1	1	2	1	1		
Peak Hour Factor	0.92	0.92	0.91	0.91	0.95	0.95		
Percent Heavy Veh, %	0	0	0	1	0	1		
Cap, veh/h	2449	1096	513	2847	208	1268		
Arrive On Green	0.64	0.64	0.04	0.76	0.11	0.11		
Sat Flow, veh/h	3900	1700	1905	3861	1905	1683		
Grp Volume(v), veh/h	773	125	64	698	151	81		
Grp Sat Flow(s),veh/h/ln1900	1700	1905	1881	1905	1683			
Q Serve(g_s), s	8.2	2.5	0.9	5.0	6.9	1.1		
Cycle Q Clear(g_c), s	8.2	2.5	0.9	5.0	6.9	1.1		
Prop In Lane		1.00	1.00		1.00	1.00		
Lane Grp Cap(c), veh/h	2449	1096	513	2847	208	1268		
V/C Ratio(X)	0.32	0.11	0.12	0.25	0.73	0.06		
Avail Cap(c_a), veh/h	2449	1096	723	2847	508	1534		
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	7.1	6.1	4.5	3.3	38.8	2.9		
Incr Delay (d2), s/veh	0.3	0.2	0.1	0.2	6.8	0.0		
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	1.2	0.5	2.6	4.0	1.9		
LnGrp Delay(d),s/veh	7.5	6.4	4.6	3.5	45.6	2.9		
LnGrp LOS	A	A	A	A	D	A		
Approach Vol, veh/h	898			762	232			
Approach Delay, s/veh	7.3			3.6	30.7			
Approach LOS	A			A	C			
Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	60.1	64.1		15.8		74.2		
Change Period (Y+Rc), s	6.1	* 6.1		6.0		* 6.1		
Max Green Setting (Gmax), s	4	* 34		24.0		* 54		
Max Q Clear Time (g_c+I), s	10.2			8.9		7.0		
Green Ext Time (p_c), s	0.1	1.7		0.9		1.8		
Intersection Summary								
HCM 2010 Ctrl Delay			8.7					
HCM 2010 LOS			A					
Notes								

Intersection							
Int Delay, s/veh	1.4						
Movement	EBT	EBR	WBL	WBT	NBL	NBR	
Lane Configurations	↑↑		↑	↑↑	↑	↑	
Traffic Vol, veh/h	769	19	65	682	11	94	
Future Vol, veh/h	769	19	65	682	11	94	
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	50	
Veh in Median Storage, #	0	-	-	0	0	-	
Grade, %	0	-	-	0	0	-	
Peak Hour Factor	95	95	90	90	79	79	
Heavy Vehicles, %	1	0	2	1	0	1	
Mvmt Flow	809	20	72	758	14	119	

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	829	0	1342	415
Stage 1	-	-	-	-	819	-
Stage 2	-	-	-	-	523	-
Critical Hdwy	-	-	4.14	-	6.8	6.92
Critical Hdwy Stg 1	-	-	-	-	5.8	-
Critical Hdwy Stg 2	-	-	-	-	5.8	-
Follow-up Hdwy	-	-	2.22	-	3.5	3.31
Pot Cap-1 Maneuver	-	-	798	-	146	589
Stage 1	-	-	-	-	399	-
Stage 2	-	-	-	-	565	-
Platoon blocked, %	-	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	798	-	133	589
Mov Cap-2 Maneuver	-	-	-	-	264	-
Stage 1	-	-	-	-	399	-
Stage 2	-	-	-	-	514	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.9	13.4
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	264	589	-	-	798	-
HCM Lane V/C Ratio	0.053	0.202	-	-	0.091	-
HCM Control Delay (s)	19.4	12.7	-	-	10	-
HCM Lane LOS	C	B	-	-	A	-
HCM 95th %tile Q(veh)	0.2	0.8	-	-	0.3	-

Intersection												
Int Delay, s/veh	6.2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↕		↕	↕	↕	↕↔		↕	↕	↕
Traffic Vol, veh/h	1	1	145	13	5	55	150	710	41	21	681	40
Future Vol, veh/h	1	1	145	13	5	55	150	710	41	21	681	40
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	0	-	-	20	100	-	1	100	-	75
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	88	88	88	86	86	86	87	87	87	95	95	95
Heavy Vehicles, %	0	0	1	0	0	0	0	1	1	0	1	0
Mvmt Flow	1	1	165	15	6	64	172	816	47	22	717	42

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1517	1969	717	1946	1945	432	717	0	0	863	0	0
Stage 1	761	761	-	1184	1184	-	-	-	-	-	-	-
Stage 2	756	1208	-	762	761	-	-	-	-	-	-	-
Critical Hdwy	7.3	6.5	6.215	7.3	6.5	6.9	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.5	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.5	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	43.3095		3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	91	63	431	44	66	577	893	-	-	788	-	-
Stage 1	401	417	-	204	265	-	-	-	-	-	-	-
Stage 2	371	258	-	400	417	-	-	-	-	-	-	-
Platoon blocked, %												
Mov Cap-1 Maneuver	62	49	431	22	52	577	893	-	-	788	-	-
Mov Cap-2 Maneuver	62	49	-	22	52	-	-	-	-	-	-	-
Stage 1	324	405	-	165	214	-	-	-	-	-	-	-
Stage 2	259	208	-	240	405	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	19.1	89.9	1.7	0.3
HCM LOS	C	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	893	-	-	55	431	26	577	788	-	-
HCM Lane V/C Ratio	0.193	-	-	0.041	0.382	0.805	0.111	0.028	-	-
HCM Control Delay (s)	10	-	-	73.3	18.4	327.8	12	9.7	-	-
HCM Lane LOS	A	-	-	F	C	F	B	A	-	-
HCM 95th %tile Q(veh)	0.7	-	-	0.1	1.8	2.5	0.4	0.1	-	-

HCM 2010 Signalized Intersection Summary
 1: Whitmore Lake Road/Old US-23 & Grand River Avenue

Future Conditions
 PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	292	525	205	392	613	314	249	439	223	189	336	190
Future Volume (veh/h)	292	525	205	392	613	314	249	439	223	189	336	190
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	1961	1961	2000	1961	1961	2000	1980	1980	1980	1961	1961	1961
Adj Flow Rate, veh/h	314	565	220	422	659	338	268	472	240	201	357	202
Adj No. of Lanes	1	2	0	1	2	0	1	1	1	1	1	1
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	2	2	2	1	1	1	2	2	2
Cap, veh/h	345	645	250	431	662	340	342	504	683	232	407	652
Arrive On Green	0.15	0.25	0.25	0.18	0.28	0.28	0.14	0.25	0.25	0.09	0.21	0.21
Sat Flow, veh/h	1867	2624	1019	1867	2385	1223	1886	1980	1683	1867	1961	1667
Grp Volume(v), veh/h	314	401	384	422	515	482	268	472	240	201	357	202
Grp Sat Flow(s),veh/h/ln	1867	1863	1781	1867	1863	1745	1886	1980	1683	1867	1961	1667
Q Serve(g_s), s	15.1	23.8	23.9	20.4	31.8	31.8	10.6	26.9	0.0	8.3	20.3	0.0
Cycle Q Clear(g_c), s	15.1	23.8	23.9	20.4	31.8	31.8	10.6	26.9	0.0	8.3	20.3	0.0
Prop In Lane	1.00		0.57	1.00		0.70	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	345	458	438	431	517	485	342	504	683	232	407	652
V/C Ratio(X)	0.91	0.88	0.88	0.98	1.00	1.00	0.78	0.94	0.35	0.87	0.88	0.31
Avail Cap(c_a), veh/h	387	517	495	431	517	485	342	516	693	257	511	740
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	46.4	41.8	41.8	44.5	41.5	41.5	45.7	42.0	23.7	50.1	44.2	24.3
Incr Delay (d2), s/veh	23.4	14.2	15.1	37.5	38.2	39.5	11.3	24.6	0.3	23.9	13.3	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	12.0	14.1	13.6	17.9	21.8	20.6	9.2	18.1	5.3	7.8	12.5	4.5
LnGrp Delay(d),s/veh	69.8	56.0	56.9	82.0	79.8	81.1	57.0	66.6	24.0	74.1	57.5	24.6
LnGrp LOS	E	E	E	F	E	F	E	E	C	E	E	C
Approach Vol, veh/h		1099			1419			980			760	
Approach Delay, s/veh		60.2			80.9			53.6			53.1	
Approach LOS		E			F			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	24.0	38.5	22.3	30.4	27.6	34.8	16.9	35.8				
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	17.1	33.8	12.6	22.3	22.4	25.9	10.3	28.9				
Green Ext Time (p_c), s	0.3	0.0	0.0	1.6	0.0	2.4	0.1	0.4				
Intersection Summary												
HCM 2010 Ctrl Delay			64.3									
HCM 2010 LOS			E									
Notes												

HCM 2010 Signalized Intersection Summary
 2: Borderline Drive & Grand River Avenue

Future Conditions
 PM Peak Hour

	→	↘	↙	←	↖	↗		
Movement	EBT	EBR	WBL	WBT	NBL	NBR		
Lane Configurations	↑↑	↑	↓	↑↑	↓	↑		
Traffic Volume (veh/h)	746	138	56	845	206	87		
Future Volume (veh/h)	746	138	56	845	206	87		
Number	2	12	1	6	7	14		
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	1961	2000	1980	1980	2000	1961		
Adj Flow Rate, veh/h	794	147	59	889	226	96		
Adj No. of Lanes	2	1	1	2	1	1		
Peak Hour Factor	0.94	0.94	0.95	0.95	0.91	0.91		
Percent Heavy Veh, %	2	0	1	1	0	2		
Cap, veh/h	2253	1028	459	2691	286	1258		
Arrive On Green	0.60	0.60	0.04	0.72	0.15	0.15		
Sat Flow, veh/h	3824	1700	1886	3861	1905	1667		
Grp Volume(v), veh/h	794	147	59	889	226	96		
Grp Sat Flow(s),veh/h/ln	1863	1700	1886	1881	1905	1667		
Q Serve(g_s), s	9.6	3.4	1.0	7.9	10.3	1.3		
Cycle Q Clear(g_c), s	9.6	3.4	1.0	7.9	10.3	1.3		
Prop In Lane		1.00	1.00		1.00	1.00		
Lane Grp Cap(c), veh/h	2253	1028	459	2691	286	1258		
V/C Ratio(X)	0.35	0.14	0.13	0.33	0.79	0.08		
Avail Cap(c_a), veh/h	2253	1028	669	2691	508	1452		
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	8.9	7.7	5.9	4.8	36.9	2.9		
Incr Delay (d2), s/veh	0.4	0.3	0.1	0.3	6.8	0.0		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	5.0	1.6	0.5	4.2	5.9	2.2		
LnGrp Delay(d),s/veh	9.4	8.0	6.0	5.1	43.7	2.9		
LnGrp LOS	A	A	A	A	D	A		
Approach Vol, veh/h	941			948	322			
Approach Delay, s/veh	9.2			5.2	31.5			
Approach LOS	A			A	C			
Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	60.0	60.5		19.5		70.5		
Change Period (Y+Rc), s	6.1	* 6.1		6.0		* 6.1		
Max Green Setting (Gmax), s	4	* 34		24.0		* 54		
Max Q Clear Time (g_c+I), s	11.6			12.3		9.9		
Green Ext Time (p_c), s	0.1	2.1		1.2		2.1		
Intersection Summary								
HCM 2010 Ctrl Delay			10.7					
HCM 2010 LOS			B					
Notes								

HCM 2010 TWSC
3: Kroger Drive & Grand River Avenue

Future Conditions
PM Peak Hour

Intersection							
Int Delay, s/veh	2.9						
Movement	EBT	EBR	WBL	WBT	NBL	NBR	
Lane Configurations	↑↑		↑	↑↑	↑	↑	
Traffic Vol, veh/h	799	34	174	878	23	223	
Future Vol, veh/h	799	34	174	878	23	223	
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	50	
Veh in Median Storage, #	0	-	-	0	0	-	
Grade, %	0	-	-	0	0	-	
Peak Hour Factor	95	95	95	95	93	93	
Heavy Vehicles, %	2	0	0	1	0	1	
Mvmt Flow	841	36	183	924	25	240	

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	877	0	1687	438
Stage 1	-	-	-	-	859	-
Stage 2	-	-	-	-	828	-
Critical Hdwy	-	-	4.1	-	6.8	6.92
Critical Hdwy Stg 1	-	-	-	-	5.8	-
Critical Hdwy Stg 2	-	-	-	-	5.8	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.31
Pot Cap-1 Maneuver	-	-	779	-	86	569
Stage 1	-	-	-	-	380	-
Stage 2	-	-	-	-	394	-
Platoon blocked, %	-	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	779	-	66	569
Mov Cap-2 Maneuver	-	-	-	-	183	-
Stage 1	-	-	-	-	380	-
Stage 2	-	-	-	-	301	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.8	17
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	183	569	-	-	779	-
HCM Lane V/C Ratio	0.135	0.421	-	-	0.235	-
HCM Control Delay (s)	27.7	15.9	-	-	11	-
HCM Lane LOS	D	C	-	-	B	-
HCM 95th %tile Q(veh)	0.5	2.1	-	-	0.9	-

Intersection

Int Delay, s/veh 14.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑	↑		↑	↑	↑	↑↑		↑	↑	↑
Traffic Vol, veh/h	3	1	224	8	1	44	221	864	30	19	838	76
Future Vol, veh/h	3	1	224	8	1	44	221	864	30	19	838	76
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	0	-	-	20	100	-	1	100	-	75
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	77	77	77	95	95	95	94	94	94
Heavy Vehicles, %	0	0	0	0	0	0	0	1	0	0	2	0
Mvmt Flow	3	1	241	10	1	57	233	909	32	20	891	81

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1853	2338	891	2323	2323	471	891	0	0	941	0	0
Stage 1	932	932	-	1391	1391	-	-	-	-	-	-	-
Stage 2	921	1406	-	932	932	-	-	-	-	-	-	-
Critical Hdwy	7.3	6.5	6.2	7.3	6.5	6.9	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.5	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.5	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	52	37	344	23	38	545	769	-	-	737	-	-
Stage 1	322	348	-	152	211	-	-	-	-	-	-	-
Stage 2	295	208	-	322	348	-	-	-	-	-	-	-
Platoon blocked, %												
Mov Cap-1 Maneuver	34	25	344	~5	26	545	769	-	-	737	-	-
Mov Cap-2 Maneuver	34	25	-	~5	26	-	-	-	-	-	-	-
Stage 1	224	339	-	106	147	-	-	-	-	-	-	-
Stage 2	182	145	-	94	339	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	38.4	\$ 340.9	2.3	0.2
HCM LOS	E	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	769	-	-	31	344	5	545	737	-	-
HCM Lane V/C Ratio	0.303	-	-	0.139	0.7	2.338	0.105	0.027	-	-
HCM Control Delay (s)	11.7	-	-	139	36.5	1946.8	12.4	10	-	-
HCM Lane LOS	B	-	-	F	E	F	B	B	-	-
HCM 95th %tile Q(veh)	1.3	-	-	0.4	5	2.6	0.3	0.1	-	-

Notes

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

HCM 2010 Signalized Intersection Summary
 1: Whitmore Lake Road/Old US-23 & Grand River Avenue

Future Conditions
 SAT Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	207	459	257	212	373	91	255	309	189	131	275	165
Future Volume (veh/h)	207	459	257	212	373	91	255	309	189	131	275	165
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	223	494	276	228	401	98	274	332	203	138	289	174
Adj No. of Lanes	1	2	0	1	2	0	1	1	1	1	1	1
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.95	0.95	0.95
Percent Heavy Veh, %	1	1	1	1	1	1	1	1	1	1	1	1
Cap, veh/h	466	586	326	292	544	132	333	406	634	272	365	481
Arrive On Green	0.17	0.25	0.25	0.10	0.18	0.18	0.10	0.21	0.21	0.08	0.18	0.18
Sat Flow, veh/h	1886	2334	1299	1886	3006	727	1886	1980	1683	1886	1980	1683
Grp Volume(v), veh/h	223	398	372	228	250	249	274	332	203	138	289	174
Grp Sat Flow(s),veh/h/ln	1886	1881	1751	1886	1881	1852	1886	1980	1683	1886	1980	1683
Q Serve(g_s), s	1.8	14.4	14.5	4.5	9.0	9.2	4.6	11.5	0.0	0.2	10.0	0.0
Cycle Q Clear(g_c), s	1.8	14.4	14.5	4.5	9.0	9.2	4.6	11.5	0.0	0.2	10.0	0.0
Prop In Lane	1.00		0.74	1.00		0.39	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	466	472	440	292	341	335	333	406	634	272	365	481
V/C Ratio(X)	0.48	0.84	0.85	0.78	0.73	0.74	0.82	0.82	0.32	0.51	0.79	0.36
Avail Cap(c_a), veh/h	483	524	488	442	524	516	457	524	734	436	524	617
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(l)	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	24.5	25.5	25.6	30.0	27.8	27.8	29.7	27.3	15.9	30.3	28.0	20.4
Incr Delay (d2), s/veh	0.8	11.0	12.1	5.0	3.1	3.3	8.5	7.7	0.3	1.5	5.3	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.9	8.8	8.5	4.8	4.9	4.9	6.0	7.1	2.9	2.6	6.0	2.8
LnGrp Delay(d),s/veh	25.3	36.5	37.7	35.0	30.8	31.1	38.2	35.0	16.1	31.7	33.3	20.9
LnGrp LOS	C	D	D	D	C	C	D	D	B	C	C	C
Approach Vol, veh/h		993			727			809			601	
Approach Delay, s/veh		34.4			32.2			31.3			29.3	
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	18.8	19.5	13.8	19.7	13.8	24.5	12.3	21.2				
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	* 13	* 20	* 12	* 19	* 13	* 20	* 12	* 19				
Max Q Clear Time (g_c+I1), s	3.8	11.2	6.6	12.0	6.5	16.5	2.2	13.5				
Green Ext Time (p_c), s	0.9	1.8	0.6	1.2	0.8	1.5	0.9	1.2				
Intersection Summary												
HCM 2010 Ctrl Delay			32.1									
HCM 2010 LOS			C									
Notes												

HCM 2010 Signalized Intersection Summary
 2: Borderline Drive & Grand River Avenue

Future Conditions
 SAT Peak Hour

								
Movement	EBT	EBR	WBL	WBT	NBL	NBR		
Lane Configurations	↑↑	↑	↑	↑↑	↑	↑		
Traffic Volume (veh/h)	703	165	58	626	192	80		
Future Volume (veh/h)	703	165	58	626	192	80		
Number	2	1	1	6	7	14		
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	2000	2000	2000	1980	2000	1980		
Adj Flow Rate, veh/h	764	179	64	688	202	84		
Adj No. of Lanes	2	1	1	2	1	1		
Peak Hour Factor	0.92	0.92	0.91	0.91	0.95	0.95		
Percent Heavy Veh, %	0	0	0	1	0	1		
Cap, veh/h	2343	1048	479	2742	261	1268		
Arrive On Green	0.62	0.62	0.04	0.73	0.14	0.14		
Sat Flow, veh/h	3900	1700	1905	3861	1905	1683		
Grp Volume(v), veh/h	764	179	64	688	202	84		
Grp Sat Flow(s),veh/h/ln	1900	1700	1905	1881	1905	1683		
Q Serve(g_s), s	8.7	4.1	1.0	5.5	9.2	1.2		
Cycle Q Clear(g_c), s	8.7	4.1	1.0	5.5	9.2	1.2		
Prop In Lane		1.00	1.00		1.00	1.00		
Lane Grp Cap(c), veh/h	2343	1048	479	2742	261	1268		
V/C Ratio(X)	0.33	0.17	0.13	0.25	0.77	0.07		
Avail Cap(c_a), veh/h	2343	1048	688	2742	508	1487		
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00		
Upstream Filter(l)	1.00	1.00	1.00	1.00	1.00	1.00		
Uniform Delay (d), s/veh	8.3	7.4	5.4	4.1	37.5	2.9		
Incr Delay (d2), s/veh	0.4	0.4	0.1	0.2	6.9	0.0		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	4.7	2.0	0.5	2.9	5.3	1.9		
LnGrp Delay(d),s/veh	8.7	7.7	5.5	4.3	44.4	2.9		
LnGrp LOS	A	A	A	A	D	A		
Approach Vol, veh/h	943			752	286			
Approach Delay, s/veh	8.5			4.4	32.2			
Approach LOS	A			A	C			
Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	61.6			18.3		71.7		
Change Period (Y+Rc), s	* 6.1	* 6.1		6.0		* 6.1		
Max Green Setting (Gmax), s	* 34			24.0		* 54		
Max Q Clear Time (g_c+I), s	10.7			11.2		7.5		
Green Ext Time (p_c), s	0.1	1.7		1.1		1.7		
Intersection Summary								
HCM 2010 Ctrl Delay			10.3					
HCM 2010 LOS			B					
Notes								

HCM 2010 TWSC
3: Kroger Drive & Grand River Avenue

Future Conditions
SAT Peak Hour

Intersection

Int Delay, s/veh 2.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↑	↑↑	↑	↑
Traffic Vol, veh/h	756	27	123	670	14	167
Future Vol, veh/h	756	27	123	670	14	167
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	50
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	90	90	79	79
Heavy Vehicles, %	1	0	2	1	0	1
Mvmt Flow	796	28	137	744	18	211

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	824	0	1456	412
Stage 1	-	-	-	-	810	-
Stage 2	-	-	-	-	646	-
Critical Hdwy	-	-	4.14	-	6.8	6.92
Critical Hdwy Stg 1	-	-	-	-	5.8	-
Critical Hdwy Stg 2	-	-	-	-	5.8	-
Follow-up Hdwy	-	-	2.22	-	3.5	3.31
Pot Cap-1 Maneuver	-	-	802	-	123	592
Stage 1	-	-	-	-	403	-
Stage 2	-	-	-	-	489	-
Platoon blocked, %	-	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	802	-	102	592
Mov Cap-2 Maneuver	-	-	-	-	231	-
Stage 1	-	-	-	-	403	-
Stage 2	-	-	-	-	405	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.6	15
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	231	592	-	-	802	-
HCM Lane V/C Ratio	0.077	0.357	-	-	0.17	-
HCM Control Delay (s)	21.9	14.4	-	-	10.4	-
HCM Lane LOS	C	B	-	-	B	-
HCM 95th %tile Q(veh)	0.2	1.6	-	-	0.6	-

HCM 2010 TWSC
 4: Whitmore Lake Road & Victor Street/Shopping Center Drive

Future Conditions
 SAT Peak Hour

Intersection												
Int Delay, s/veh	9.8											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↕		↕	↕	↕	↕↔		↕	↕	↕
Traffic Vol, veh/h	2	1	193	13	5	55	205	696	41	21	671	52
Future Vol, veh/h	2	1	193	13	5	55	205	696	41	21	671	52
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	0	-	-	20	100	-	1	100	-	75
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	88	88	88	86	86	86	87	87	87	95	95	95
Heavy Vehicles, %	0	0	1	0	0	0	0	1	1	0	1	0
Mvmt Flow	2	1	219	15	6	64	236	800	47	22	706	55

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1625	2069	706	2046	2046	424	706	0	0	847	0	0
Stage 1	751	751	-	1295	1295	-	-	-	-	-	-	-
Stage 2	874	1318	-	751	751	-	-	-	-	-	-	-
Critical Hdwy	7.3	6.5	6.215	7.3	6.5	6.9	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.5	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.5	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4.3	3.095	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	76	55	437	37	57	584	902	-	-	799	-	-
Stage 1	406	421	-	175	235	-	-	-	-	-	-	-
Stage 2	315	229	-	406	421	-	-	-	-	-	-	-
Platoon blocked, %												
Mov Cap-1 Maneuver	47	39	437	~ 14	41	584	902	-	-	799	-	-
Mov Cap-2 Maneuver	47	39	-	~ 14	41	-	-	-	-	-	-	-
Stage 1	300	409	-	129	174	-	-	-	-	-	-	-
Stage 2	200	169	-	196	409	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	22.4	160.7	2.3	0.3
HCM LOS	C	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	902	-	-	44	437	17	584	799	-	-
HCM Lane V/C Ratio	0.261	-	-	0.077	0.502	1.231	0.11	0.028	-	-
HCM Control Delay (s)	10.4	-	-	93.6	21.3	615.2	11.9	9.6	-	-
HCM Lane LOS	B	-	-	F	C	F	B	A	-	-
HCM 95th %tile Q(veh)	1	-	-	0.2	2.7	3.1	0.4	0.1	-	-

Notes

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

HCM 2010 Signalized Intersection Summary

Future Conditions W / Improvements

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

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 							
Traffic Volume (veh/h)	292	525	205	392	613	314	249	439	223	189	336	190
Future Volume (veh/h)	292	525	205	392	613	314	249	439	223	189	336	190
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	1961	1961	2000	1961	1961	1961	1980	1980	1980	1961	1961	1961
Adj Flow Rate, veh/h	314	565	220	422	659	338	268	472	240	201	357	202
Adj No. of Lanes	1	2	0	1	2	1	1	1	1	1	1	1
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	2	2	2	1	1	1	2	2	2
Cap, veh/h	472	649	252	403	824	599	345	507	772	232	409	642
Arrive On Green	0.20	0.25	0.25	0.18	0.22	0.22	0.14	0.26	0.26	0.09	0.21	0.21
Sat Flow, veh/h	1867	2624	1019	1867	3725	1667	1886	1980	1683	1867	1961	1667
Grp Volume(v), veh/h	314	401	384	422	659	338	268	472	240	201	357	202
Grp Sat Flow(s),veh/h/ln	1867	1863	1781	1867	1863	1667	1886	1980	1683	1867	1961	1667
Q Serve(g_s), s	11.4	23.4	23.5	20.0	18.9	2.8	10.2	26.4	0.0	8.1	19.9	0.0
Cycle Q Clear(g_c), s	11.4	23.4	23.5	20.0	18.9	2.8	10.2	26.4	0.0	8.1	19.9	0.0
Prop In Lane	1.00		0.57	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	472	460	440	403	824	599	345	507	772	232	409	642
V/C Ratio(X)	0.66	0.87	0.87	1.05	0.80	0.56	0.78	0.93	0.31	0.86	0.87	0.31
Avail Cap(c_a), veh/h	472	527	503	403	1053	701	345	525	787	262	520	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	38.5	40.9	40.9	44.8	41.7	29.2	44.8	41.1	19.3	49.2	43.3	24.3
Incr Delay (d2), s/veh	3.5	13.3	14.2	57.6	3.5	0.8	10.7	23.1	0.2	22.9	12.6	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	9.3	13.7	13.3	19.0	10.1	8.2	9.0	17.7	4.8	7.6	12.2	4.4
LnGrp Delay(d),s/veh	42.0	54.2	55.1	102.3	45.2	30.0	55.5	64.2	19.6	72.2	55.9	24.6
LnGrp LOS	D	D	E	F	D	C	E	E	B	E	E	C
Approach Vol, veh/h		1099			1419			980			760	
Approach Delay, s/veh		51.0			58.6			50.9			51.9	
Approach LOS		D			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	29.4	31.5	22.1	30.1	26.5	34.5	16.7	35.5				
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+1), s	13.4	20.9	12.2	21.9	22.0	25.5	10.1	28.4				
Green Ext Time (p_c), s	1.4	4.1	0.0	1.7	0.0	2.5	0.1	0.6				
Intersection Summary												
HCM 2010 Ctrl Delay			53.7									
HCM 2010 LOS			D									
Notes												

HCM 2010 Signalized Intersection Summary

Future Conditions W / Improvements

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

SAT Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	207	459	257	212	373	91	255	309	189	131	275	165
Future Volume (veh/h)	207	459	257	212	373	91	255	309	189	131	275	165
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	1980	1980	1980	1980	1980	1980	1980
Adj Flow Rate, veh/h	223	494	276	228	401	98	274	332	203	138	289	174
Adj No. of Lanes	1	2	0	1	2	1	1	1	1	1	1	1
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.95	0.95	0.95
Percent Heavy Veh, %	1	1	1	1	1	1	1	1	1	1	1	1
Cap, veh/h	489	588	327	284	592	265	333	407	668	273	366	474
Arrive On Green	0.19	0.25	0.25	0.10	0.16	0.16	0.10	0.21	0.21	0.08	0.18	0.18
Sat Flow, veh/h	1886	2334	1299	1886	3762	1683	1886	1980	1683	1886	1980	1683
Grp Volume(v), veh/h	223	398	372	228	401	98	274	332	203	138	289	174
Grp Sat Flow(s),veh/h/ln	1886	1881	1751	1886	1881	1683	1886	1980	1683	1886	1980	1683
Q Serve(g_s), s	2.3	14.3	14.3	4.5	7.1	3.7	4.5	11.4	0.0	0.2	9.9	0.0
Cycle Q Clear(g_c), s	2.3	14.3	14.3	4.5	7.1	3.7	4.5	11.4	0.0	0.2	9.9	0.0
Prop In Lane	1.00		0.74	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	489	474	442	284	592	265	333	407	668	273	366	474
V/C Ratio(X)	0.46	0.84	0.84	0.80	0.68	0.37	0.82	0.82	0.30	0.51	0.79	0.37
Avail Cap(c_a), veh/h	489	529	493	446	1059	474	462	529	772	441	529	613
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	23.4	25.2	25.2	30.0	28.2	26.8	29.4	26.9	14.7	30.0	27.7	20.5
Incr Delay (d2), s/veh	0.7	10.5	11.6	5.7	1.4	0.9	8.2	7.4	0.3	1.4	5.1	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.7	8.8	8.3	4.8	3.8	1.8	5.9	7.0	2.8	2.6	5.9	2.8
LnGrp Delay(d),s/veh	24.0	35.7	36.8	35.7	29.6	27.6	37.5	34.4	14.9	31.4	32.7	20.9
LnGrp LOS	C	D	D	D	C	C	D	C	B	C	C	C
Approach Vol, veh/h		993			727			809			601	
Approach Delay, s/veh		33.5			31.2			30.6			29.0	
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	20.1	17.7	13.6	19.6	13.4	24.4	12.2	21.1				
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	* 13	* 20	* 12	* 19	* 13	* 20	* 12	* 19				
Max Q Clear Time (g_c+l1), s	4.3	9.1	6.5	11.9	6.5	16.3	2.2	13.4				
Green Ext Time (p_c), s	0.9	2.0	0.6	1.2	0.4	1.6	0.9	1.2				
Intersection Summary												
HCM 2010 Ctrl Delay			31.4									
HCM 2010 LOS			C									
Notes												



FLEIS & VANDENBRINK

TRAFFIC ENGINEERS & SURVEYORS

RECEIVED

AUG 12 2016

August 12, 2016

BRIGHTON TOWNSHIP

VIA EMAIL

Mr. Adam Crane
Kroger Company of Michigan
40399 Grand River Avenue
Novi, MI 48375

RE: **Response to Comments-Brighton Township & LCRC
Proposed Kroger D-638 Expansion, Brighton Township, MI
Traffic Impact Study**

Dear Mr. Crane:

Fleis & VandenBrink (F&V) staff has completed this letter in response to questions and comments provided by both the Brighton Township traffic consultant (OHM Advisors) in their review dated August 1, 2016 and the Livingston County Road Commission (LCRC) in their review dated August 2, 2016. Based on their review, we have the following comments and observations:

OHM Advisor Comments (August 1, 2016)

1. *The site plan reflects an existing Kroger Supermarket (78,668 SFT), demolition of the adjacent retail space (15,529 SFT), and proposed Kroger addition (42,241 SFT). However, the traffic impact study indicates that the proposed Supermarket addition is 27,267 SFT (net change in building area between retail space to be demolished and supermarket addition).*

The traffic study has been revised to reflect the proposed Kroger addition as shown on the current site plan.

2. *Peak-hour factors (PHF) used in the traffic analysis do not match the values from the traffic counts. Although a few values were updated by approach, it appears that a default value of 0.93 was used at most intersections and was not updated.*

The PHFs used in the analysis were reviewed and revised, as necessary, to reflect the traffic count data. The traffic count data and PHFs used in the analysis are attached to the revised report.

LCRC Comments (August 2, 2016)

3. *The study calculated trip generation in part on a 27,267 square-foot expansion of the existing Kroger store. However, OHM has indicated in their review that the actual expansion is 42,241 square feet. Trip generation, therefore, should be recalculated using actual square footage for the expansion less the trip generation for the existing retail. All figures, table and outputs should be revised to reflect the trip generation changes. Also, please submit a current site plan that reflects the size of the proposed expansion.*

The traffic study has been revised to reflect the proposed Kroger addition as shown on the current site plan. The most recent site plan will be provided by LSG Engineers & Surveyors.

4. *Please provide the electronic Synchro files with the resubmittal.*

Noted.

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

June 1, 2016

LIVINGSTON COMMUNITY WATER AUTHORITY

Green Oak Township Hall
10001 Silver Lake Road
Brighton, MI 48116

Attention: Mark St. Charles, Chairperson

**Regarding: Approval of Proposed Water Main Construction Plans
Kroger Marketplace – Brighton Township #0019-16-0021
9968 East Grand River Avenue – Brighton, Michigan**

Dear Mr. St. Charles:

We have reviewed and approved the water main plans for the above-referenced project with respect to the Authority's Water System Design Standards. Plans were prepared by LSG Engineers & Surveyors and have a latest issue date of May 24, 2016.

The plans are in substantial compliance with the Livingston Community Water Authority Water System Design Standards. We will transmit three plan sets under separate cover to the MDEQ for water main permitting.

An LCWA representative is required to be present during water main construction, bacteriological and pressure testing, and at the time of connection to the LCWA water system.

The developer will be responsible for the following items:

- **Prior to the start of water system construction, escrow funds (for observation service) shall be deposited with the LCWA Treasurer based on the estimate provided by the LCWA Engineer. The escrow amount has been calculated to be \$ 37,000 (see attached).** If at any time the balance in the escrow falls below the estimate to complete the project, additional funds are required to be deposited.
- **Fees:** The developer is responsible for all fees and costs associated with connection to the LCWA water system.
- **Insurance:** The contractor must provide insurance certificates to the LCWA to verify that adequate coverage has been obtained.
- **Pre-Construction meeting:** The developer shall notify LCWA of the time and place of the Pre-Construction meeting so that a LCWA representative can be present.
- **Easements:** Water main easements must be recorded by the developer prior to project close-out. LCWA must be provided copies of all recorded easements.
- **Record Plans:** As-built drawings shall be submitted to the LCWA Engineer upon completion of construction, in accordance with as-built requirements.
- **M&G Bond:** A two-year maintenance and guarantee bond will be required prior to project close-out in an amount equal to 50% of the cost of water main construction.

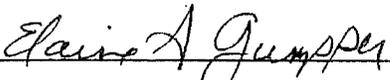


Attached are two copies of the approved plans for your records.

If you have any questions regarding this review feel free to contact us at (734) 522-6711 or elaine.gumpper@ohm-advisors.com.

Sincerely,

OHM ADVISORS



Elaine A. Gumpper, P.E.

cc: Alan Boyer, LSG Engineers & Surveyors, 3135 Pine Tree Road, Lansing, MI 48911 (one set of plans)
Anthony Dowson, Highland Treatment, 938 N. Milford Road, Highland, MI 48357 (one set of plans)
Jacob Rushlow, Brighton Township Engineer (via email) (one set of plans)
Brian Vick, Brighton Township (via email)
Rick Boisvert, Brighton Area Fire Authority (via email)
Wayne Jewell, Green Oak Building Official
Vicki Putala, LCWA Engineer (via email)
Chris Donajkowski, OHM (via email)

August 12, 2016

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

RECEIVED
AUG 17 2016
BRIGHTON TOWNSHIP

RE: Site Plan Resubmittal for Kroger D-638
9968 E. Grand River Avenue
Brighton, Michigan

Dear Kelly:

We received OHM's comment letter dated July 25, 2016; the Brighton Area Fire Authority's comment letter dated July 25, 2016, and your Site Plan review dated July 12, 2016 and offer the following responses.

OHM Comments

Site Plan Review #1, OHM Job Number 0024-16-1081
Special Land Use #1, OHM Job Number 0024-16-1084

GENERAL

The existing site is located at 9968 East Grand River Avenue. The project site is comprised of an existing 78,668 square foot Kroger grocery store with parking lot, along with an attached 1-story commercial building comprises of 7 retail units. The site also includes a detention pond, two private wells for water supply, and a 90,000-gallon water storage tank. The site is located on two Parcels, #4712-32-300-061 and #4712-31-300-062, and both are zoned B-1. Parcel one (#4712-32-300-061) has an area of 12.99 acres and Parcel two (#4712-31-300-062) has an area of 1.31 acres for a combined area of 14.3 acres. The Kroger Company is proposing to demolish the 1-story commercial retail building and construct a 42,241 square foot addition to the current supermarket. Included with this project are various site improvements necessary to accommodate the building addition.

Please note that the existing Kroger building is 63,110 square feet and the existing retail is 15,559 square feet. The 78,668 is the total existing building area. Plans have been revised to provide clarification. The expansion area has been reduced to 40,782 square feet.

SPECIAL LAND USE

The applicant is requesting special land use for retail establishments & shopping centers greater than 30,000 square feet, drive-thru pharmacy, and outdoor seasonal sales. The existing grocery store is approximately 78,668 square feet with a proposed 42,241 square

feet addition. Considering the existing use and available space on the property, we take no exception to the request for retail establishments & shopping centers greater than 30,000 square feet. The proposed drive-thru pharmacy provides four (4) stacking spaces and is situated at a location that would not impede the normal traffic flow around the store or parking lot. As such we take no exception to the request for a drive-thru pharmacy. The proposed outdoor sales area is shown on the plans near the east entrance into the grocery store as well as a proposed outdoor seating area near the west entrance to the new building addition. We take no exception to the proposed outdoor seasonal sales conditional on the sales areas being situated such that the sidewalk and walkways are not impeded and maintain a minimum aisle width of 4 feet meeting applicable ADA requirements for accessibility.

Areas have been revised per the comments in the general section above. Sheet C1.1 has been revised to show the outdoor seasonal sales area and the required 4' aisle width.

UTILITIES

Water supply is currently provided by an on-site private well system consisting of two wells and one 90,000-gallon storage tank. The applicant proposes to remove this private system and install a looped water main system connected to the LCWA public water main on Whitmore Lake Road. The existing water supply system will be removed once the proposed water main loop has been installed, tested, and connected. We understand that LCWA has already reviewed and approved the water main construction plans and the plans are currently under review by the MDEQ for permitting. We note that the water main plan and profile sheets were omitted from the site plan. These plans shall be included for reference.

Wastewater is conveyed into the Brighton Township public sanitary sewer system. No improvements have been proposed to the existing sanitary sewer system and the applicant proposes to continue using the existing sanitary sewer lead from the existing store. Currently, 36 REUs are allocated to the property (30 for the Kroger Store and 6 for the commercial retail building units). Based on the additional square footage proposed for the building addition it is anticipated that additional REU's will need to be assigned to the property. At this time, we understand the Township has requested some additional information on the proposed building addition and REU calculations will be completed upon receipt of that information.

Water main plans are included for reference. It is understood that additional REUs may be required based on Township calculations.

PAVING/ACCESS/PARKING

Access to the site is provided by private easements along Victor Drive to both East Grand River Ave. and Whitmore Lake Road, and along Borderline Drive via three (3) drive approaches. There is also an ingress/egress easement on the south side of the site providing access to the neighboring American Compounding Spec LLC site.

Parking is provided by a total of 427 parking spaces, of which 16 are designated handicap accessible, along with an additional 72 future parking spaces on the south side of the site for a total of 499 parking spaces. Aisle widths throughout the parking lot vary from 23 feet to 25 feet. We note that the minimum aisle width per ordinance is 24 feet. The plans shall be revised to meet this standard or a variance may be required for the aisle widths of 23 feet.

Please note that the 72 spaces are proposed as part of the expansion, not as future spaces. A variance application was submitted on July 25, 2016 for the standard aisle width and the request has been noted on sheet C1.1.

A majority of the existing asphalt pavement (parking lot and drives) is proposed to be milled and resurfaced with two inches of new HMA pavement. Borderline Drive, on the west side of the site, will also be milled and overlaid with two inches of HMA. Also proposed is an additional future parking lot consisting of 72 parking spaces located in the southwest corner of the site. Additionally, in the same corner as the parking lot, the plans propose realignment and reconstruction of the drive to the American Compounding Spec LLC building.

Please note that the 72 spaces are proposed as part of the expansion, not as future spaces.

We note that all barrier free parking and pedestrian site access shall be in compliance with current ADA guidelines. Spot elevations will be required on the site plan to verify compliance.

Additional spot elevations have been included on the grading plan, Sheet C1.2 near the accessible parking areas.

We defer to the Brighton Area Fire Authority (BAFA) in regards to emergency vehicle access and circulation.

Comment noted.

TRAFFIC

A draft traffic impact study, dated July 7, 2016, was received by this office with the site plan submittal. Prior to that submittal, the applicant requested a TIS scope review by OHM and the LCRC, and comments were provided. Upon cursory review, it became apparent that the draft TIS did not address the scope comments provided by neither OHM nor LCRC. Considering the draft nature of the TIS and the outstanding scope comments, we have not performed a review of the TIS at this time. Once a complete TIS is received it will be reviewed and comments will be provided under a separate cover.

Comment noted.

DRAINAGE/GRADING

Existing grades and proposed grades are shown via contour lines and spot elevations on the site plan.

Additional spot elevations will be required to verify site accessibility is compliant with ADA standards.

Additional spot elevations have been included on the grading plan, Sheet C1.2 near the accessible parking areas and building sidewalk.

The existing surface drainage patterns shall be included on the plans. The majority of the paved areas appear to flow into the underground storm sewer system and are conveyed to the south into the detention pond located in the southeast corner of the site. The detention pond outlets into an underground storm water system that discharges into the offsite Appian Way Drain and ultimately into a closed wetland. The plans propose several changes to the existing storm water management system. They propose to convert a portion of the detention basin into a sediment forebay connected to the pond via outlet control structure. Also proposed are two catch basins servicing the proposed parking lot and a set of roof drains servicing the building extension. We note that approval from the LCDC is required for discharge of stormwater into the offsite county drain.

Sheet C1.2.2 had been revised to include arrows indicating existing surface drainage patterns. An e-mail providing LCDC's preliminary review is attached.

PERMITS AND OTHER AGENCY APPROVALS

Copies of all permits, letters of approvals, and/or letters of waiver, obtained to date, shall be forwarded to this office and other outside regulatory agencies. The current status of all necessary permits should be included on the cover sheet. At a minimum, the following permits and other agency approvals should be obtained before final approval:

- LCWA and MDEQ for construction of public water main

LCWA has approved the water main plans and forwarded them to MDEQ.

MDEQ provided preliminary comments on the water main plans. The water main plans in this set include the revisions sent to MDEQ on 8/10/16.

- Livingston County Drain Commission for SESC and stormwater discharge

LCDC's preliminary approval is attached.

- Livingston County Road Commission for any work in the public road ROW

LCRC's preliminary comments are attached. The revised study was e-mailed on 8/12/16.

- Livingston County Building Department

Livingston County Building Department has indicated they will not review plans prior to a contractor having been selected.

- Brighton Area Fire Authority

The Brighton Area Fire Department's preliminary comments are addressed within this letter.

RECOMMENDATIONS

As submitted, the Special Land Use appears to be in substantial compliance with The Charter Township of Brighton requirements and we recommend the Planning Commission consider approval, conditional on the site plan being approved.

As submitted, the site plan does not appear to be in substantial compliance with The Charter Township of Brighton requirements. We take the following exceptions to the proposed site plan and recommend that the Planning Commission defer consideration for approval of the site plan until the following comments have been addressed and the applicant has resubmitted for further review.

1. On the Topographic and ALTA/ACSM Land Title Survey (Sheet CD1.1), parcel #4712-32-300-019 is shown "pending demolition & construction" and depicts the former bank site. This plan sheet shall be updated to reflect current conditions at the time the site plan was submitted.

Sheet CD1.1 was revised to show the current conditions.

2. The diameter of the two existing sanitary sewers servicing Kroger and the 1-story attached building shall be labeled on the Utility Plan Sheet.

Sheet C1.3 has been revised to show that the size of the existing sanitary sewers is 6".

3. Include the water main plan and profile sheets with the site plan for reference.

Water main plan and profile sheets have been included for reference.

4. It appears that the bankfull outlet calculations are labeled as first flush for outlet storage (depth), outlet size (area), and outlet size (diameter). These labels shall be revised as appropriate.

Sheet C1.2.1 has been revised to correct the labels.

5. Existing surface drainage patterns shall be identified on the plans.

Sheet C1.2.2 had been revised to include arrows indicating existing surface drainage patterns.

6. Submittal of a complete traffic impact study is required with the site plan and shall be submitted for review.

The revised Traffic Impact Study is attached. The revised study, responses to OHM and LCRC comments, and the Synchro files were e-mailed to Jacob Rushlow and Mike Goryl on 8/12/16.

7. Additional spot elevations shall be provided along accessible routes, sidewalk, and ramps to verify compliance with ADA standards.

Additional spot elevations have been included on the grading plan, Sheet C1.2 near the proposed accessible parking areas, sidewalks, and ramps.

8. A dimensioned truck turning plan shall be included to verify that site circulation can adequately accommodate a standard fire apparatus or the largest truck anticipated to traverse the site.

Sheet C1.1 has been revised to include dimensions for the WB-67 truck.

9. On the landscape plan, it appears that on the northwest corner of the site, trees are proposed over the proposed water main. Trees are also proposed over sanitary sewer on the east and west sides of the proposed parking lot. Trees are not permitted to be constructed within these public utility easements.

Greenspace on site is limited. The plan was created to show compliance with the requirements of the landscaping ordinance per Article 14. The applicant will discuss this with the Planning Commission.

10. Brighton Township Standard Detail Sheets shall be included with the plans for storm sewer and sanitary sewer.

Brighton Township Standard Detail Sheets have been include in the revised submittal.

Brighton Area Fire Authority Comments

The Brighton Area Fire Department has reviewed the above mentioned site plan. The plans were received for review on July 8, 2016 and the drawings are dated June 3, 2016. The project is a site plan for the proposed addition of 42,241 sq ft. to an existing 78,668 sq ft. structure for a total size of 105,935 sq ft. The existing structure is a mercantile occupancy and will remain as such. The property will also be connection to the local municipal water system for domestic and fire protection, including fire hydrants (previously approved). The plan review is based on the requirements of the International Fire Code (IFC) 2015 edition.

Please note that the existing Kroger building is 63,110 square feet and the existing retail is 15,559 square feet. The 78,668 is the total existing building area. Plans have been revised to provide clarification. The expansion area has been reduced to 40,782 square feet, for a total proposed area of 104,637 square feet.

1. All fire hydrant locations and spacing meet or exceed the minimum requirements. Fire hydrant model shall be an EJIW 5BR in accordance with LCWA requirement. Hydrant steamers shall be oriented to face the roadway when placed into service. IFC 912.2.

Sheet C5.3.2 references the fire hydrant model and detail.

2. The building shall be provided with an automatic sprinkler system in accordance with NFPA 13, *Standard for the Installation of Automatic Sprinkler Systems*. IFC 903.

Comment noted and forwarded to Kroger to be incorporated in the fire protection design.

A. The proposed FDC location is approved where proposed on the drawing.

Comment noted.

B. The location of the fire protection lead does not correspond with the location of the existing fire pump/riser room.

Comment noted. The plan reflects the original design location of the fire lead. The actual location will be determined during construction.

3. The building shall include the address number a **minimum of 6"** high and of contrasting colors. Numbers shall be clearly visible from the street (Grand River). The location and size shall be verified prior to installation. Location shall be on the upper right (northwest) corner of Front building elevation. IFC505.1

Note added to sheet C1.1.1 to provide the address.

4. All access drives in and through the site meet or exceeds the minimum 26' width requirement. With a width of 26' wide the building side of the drives shall be marked as a fire lane. Fire lane signs shall be placed at maximum every 50' around the structure. 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. There is a detail for Heavy Duty asphalt, however it does not appear that it is proposed along the perimeter of the structure. The fire lane around the structure shall be constructed of HD asphalt or engineer documentation indicating the proposed has the capability to support 84,000 pounds. IFC D 103.6, IFC D103.1, IFC D 102.1, IFC D 103.3

Sheet C1.1.1 has been revised to show the locations of fire lane signs and the detail has been added to Sheet C5.1.1. Sheet CD1.4 was revised to include a note requiring access roads. The asphalt around the structure is existing and will be resurfaced during construction.

5. Turning radii for all drive entrances and turns shall be 50' outside and 30' inside. IFC 503.2.4.

Sheet C1.1 was revised to include a detail for the truck turn.

6. A minimum vertical clearance of 13 ½ feet shall be maintained at all times along the fire lanes. The landscape plan indicates trees that may impede upon this over time. A means of preventing the overhang of the canopy of the trees must be provided such as species, location or a widened lane along the front of the building. IFC 503.2.1

Sheet L1.1 was revised to provide Columnar English Oak trees in the islands along the drive at the front of the building. This species is not expected to become large enough to overhang the drive.

7. A knox box shall be provided at the new "Vestibule A" Entrance. The location of the knox box shall be indicated on future submittals. The Knox box will be located adjacent to the door of the structure and installed in accordance with the manufacturer's instructions. Go to www.knoxbox.com to order. IFC 506.1

Sheet C1.1.1 was revised to include a note referencing installation of the Knox Box.

8. The building shall be evaluated for emergency responder radio coverage. If coverage is found to be deficient, a system to amplify the radio signal strength of responders shall be installed where necessary to meet minimum radio frequency levels. IFC 510.

Comment noted and forwarded to Kroger to be incorporated in the fire protection design.

9. Provide names, addresses, phone numbers, emails of owner or owner's agent, contractor, architect, on-site project supervisor.

Names and contact information for the owner and architect are listed on the cover sheet (C0). The contractor and on-site project supervisor have not been selected yet. Contact information will be provided to the Brighton Area Fire Authority once a contractor has been selected.

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.

Comment noted.

Site Plan Review Comments SP16/05

A special land use permit (SLUP) application for a 42,241 sq. ft. addition (26,682 sq. ft. addition and 15,559 sq. ft. expansion into adjacent retail businesses) to the existing store for a total of 105,935 sq. ft. is planned. Additionally, a drive-thru pharmacy and open air business (outside display) is planned. The business is located at 9968 E. Grand River and 5771 Borderline, on the south side of E. Grand River, west of Whitmore Lake Rd. The special land use permits are in a B-2 (general business) zoning district. The sewer and water REU's for grocery stores is .5 per 1,000 sq. ft. Existing sewer REU's are thirty (30) REU's for the grocery store and six (6) REU's for the retail stores. Additional sewer and water REU's are required for the addition.

Please note that the existing Kroger building is 63,110 square feet and the existing retail is 15,559 square feet. The 78,668 is the total existing building area. Plans have been revised to provide clarification. The expansion area has been reduced to 40,782 square feet, for a total proposed area of 104,637 square feet. REU comments noted.

SITE PLAN DISCUSSION

This site plan has been reviewed utilizing the standards in Article 18 Site Plan Review. Based on the review of the plans and a visit to the site, the following comments are outlined for your review.

1. Use. The proposed retail business greater than 30,000 sq. ft., drive-thru pharmacy, and open air business (outdoor display) are special land uses in the B-2 zoning district per Article 6, Section 6-02. The area for the open air business (outside display) must be clearly marked on the site plan per the special land use permit (SLUP) requirements.

The proposed outdoor seasonal sales area is labeled on Sheet C1.1. Special land uses are also listed on that sheet.

2. Site Layout. The site has been reviewed in accordance with the area and bulk requirements described in Article 6, Section 6-03.

	Required	Provided	Comments
Building Height	45 ft./3 stories	27 - 38.8 ft./1 story	In compliance
Front Yard Setback - E. Grand River North	30 ft.	635 ft.	In compliance
Front Yard Setback - Victor Dr. East	30 ft.	30 ft.	In compliance
Front Yard Setback - Borderline West	30 ft.	25 ft.	Not in compliance
Rear Yard Setback South	20 ft.	262 ft. min. - varies	In compliance
Parking Lot Setback (Front) North	20 ft.	11 ft. min.	Not in compliance; existing
Parking Lot Setback (East - Victor Dr.)	20 ft.	0 ft.	Not in compliance; existing
Parking Lot Setback (Rear) South	10 ft.	22 ft.	In compliance
Parking Lot Setback (West - Borderline Drive)	20 ft.	30 ft.	In compliance
Minimum Lot Area (sq. ft.)	40,000	14 acres	In compliance
Minimum Lot Width (ft.)	150	66 ft. (E. Grand River)	Not in compliance;

			existing
Maximum Lot Coverage	50%	17%	In compliance

The plan had been revised to reduce the size of the expansion and provide the required 30 foot front setback along Borderline Drive. All other items noted are either existing or in compliance.

3. Loading/Unloading. An existing loading/unloading area (truck well) is depicted in the rear which meets the requirements of Sec. 15-02. The size is thirty-nine (39) ft. wide by sixty-five (65) ft. in length for a total of 2,535 sq. ft. The minimum is ten (10) ft. by 200 ft. for 2,000 sq. ft. (Minimum requirements are four (4) ten (10) ft. by fifty (50) ft. (2,000 sq. ft.) loading areas so the amount proposed exceeds the minimum).

Comment noted.

4. Vehicular and Pedestrian Circulation.

a. The proposed access is via three (3) entrances. One off of Whitmore Lake Rd., one off of E. Grand River (Victor Dr.), and one off of Borderline Drive off E. Grand River.

b. A five (5) ft. sidewalk was recently constructed in front of the gas station site as required per Sec. 16-08 of the Zoning Ordinance and the Pathways Plan.

Comments noted.

5. Parking. The proposed parking was reviewed in accordance with Article 15, Section 15-01 as described in the following table.

	Required	Provided	Comments
Parking Spaces Retail/Shopping Centers- One (1) parking space per 200 SF of usable (76,086/200) = 380 usable plus 1 space per employee (118 employees on largest shift)	498	498	In compliance
Parking Spaces Outdoor Commercial Display and Sales – One (1) space per each 500 sq. ft. of land (1/___) plus 1/employee - need specific square			Need detailed sq. footage depicted to determine

footage area defined			
Parking Spaces Stacking Spaces for Drive-Thru Pharmacy - requires 4 spaces	4	4	In compliance
Barrier-Free Spaces - Must be identified on site plan	9	16	In compliance
Parking Space Dimensions	9 ft. by 20 ft.	9.5 ft. by 20 ft.	In compliance
Aisle Width	24 ft. for 2 way traffic	23 ft. min for two way traffic	Not in compliance

Sheet C1.1 has been revised to list the square footage of the outdoor sales area and to show revised parking calculations due to the change in building size and addition of parking for the outdoor sales area. An application was submitted to the Zoning Board of Appeals on July 25, 2016 to address the aisle width concern as noted on Sheet C1.1. All other items noted are either existing or in compliance.

Asphalt pavement and concrete curbing and gutter exists as is required per Section 15- 01(e)(5). The proposed sidewalks abutting parking spaces must be a minimum seven (7) ft. wide and the existing and proposed are more than seven (7) ft. wide along the front of the building and connecting from the parking area.

Comment noted.

6. Signage. Two (2) existing freestanding ground signs exist for the grocery store; one at each entrance to the store (along Whitmore Lake Rd. and off of Victor Drive off of E. Grand River) which are identified on the site plan. No signage exists off of Borderline Drive or off of E. Grand River. Additionally, there is a ground sign located on E. Grand River for the gas station. The existing wall signage exceeds the Zoning Ordinance requirements. If additional wall signage is planned, it must be submitted for review and will require a ZBA variance. Details on “handicap parking” and traffic control and click list signs are depicted on the site plan.

An application has been submitted to the Zoning Board of Appeals on July 25, 2016 to address the sign concerns as noted on Sheet C1.1.

7. Building Materials. Article 14, Section 14-01(c)(1) depicts the building materials required. Per Table 14-01, each wall has a percentage of coverage of the various building materials. A table must be provided by the applicant depicting the total percentage of proposed materials for all four (4) walls and each elevation must comply with the stated percentages.

Calculations are provided on the elevation drawing.

The applicant plans to leave the existing portion of the building the same as it is existing and the addition will match the existing. The plans are for brick, EIFS cornice, ceramic tile accents, and split face block. All roof materials must also be identified on the site plan including the existing standing seam metal roof.

Materials are identified on the elevation drawing.

Per Sec. 14-01(c)(5), colors are to be earth tone colors and be compatible with the surrounding area. The existing and proposed brick is an orange/beige color. Additionally, samples of all materials must be brought to the Planning Commission meeting for review.

Material samples will be provided for review at the Planning Commission meeting.

A floor plan has been submitted which depicts the layout of the proposed facility. Additionally, per Sec. 14-01 (c)(4), when walls are greater than one hundred (100) ft. in length, design variations must be applied per the suggestions in that section. Per Sec. 14-01(c)(4) interest is supposed to be added to the walls so there are not large blank walls such as ten (10) ft. recesses. The frontage is mainly a large blank wall with a few recesses. The Planning Commission will have to discuss this issue.

Comment noted.

8. Landscaping. A landscape plan has been submitted and has been reviewed in accordance with Article 14, Section 14-02 as follows. Due to the uses being proposed being special uses, additional landscaping beyond the minimum is suggested for the site.

	Required	Provided
Greenbelt - Borderline Western Property Line 20 ft. with 1 decid. per 30 lineal ft. (916 ft.)	31 trees	31 trees; in compliance
Buffer along Southern Property Line - to industrial 20 ft. with 1 decid., 1 evergreen and 4 shrubs per 30 lineal ft. (751 ft.) and wall/fence/berm	25 decid., 25 evergreen, and 100 shrubs.	19 decid., 26 evergreen in rear, 70 shrubs are elsewhere on site; not in compliance *
Buffer along Northern Property Line - to commercial 10 ft. buffer with 1 decid. or 1 evergreen or 4 shrubs per 20 ft. (560 ft.) No berm/wall required	28 trees or 112 shrubs	6 trees and 37 shrubs; not in compliance **
Buffer along Eastern Property Line - to	42 decid., 42	11 trees; not in

residential use 20 ft. buffer with 1 decid, 1 evergreen and 4 shrubs per 30 ft. (1,245 ft.) A berm/wall fence required	evergreen and 166 shrubs	compliance ***
Detention/Retention Ponds/Basins - 1 tree and 10 shrubs per 50 linear ft. of detention basin perimeter. Reconfiguration of existing pond with proposed chain link fencing around pond. 1,071 l.f.	22 trees and 215 shrubs	22 trees and 215 shrubs; in compliance
Parking Lot - 498 spaces Required for parking lots of 20 spaces or more - 1 canopy tree for each 10 parking spaces, in no case less than 2 trees shall be provided and a continuous row of shrubs along the front of the parking lot. A min. 1/3rd of the trees shall be placed in islands (min. size of islands specified in ordinance).	50 trees and continuous row of shrubs in front; 17 trees in islands	50 trees and 37 trees in islands; in compliance

Per section 14-02(b)(6) of the ordinance, where an existing building or parking area is increased less than twenty-five percent, the extent of the new landscaping shall be equal to four percent compliance for every one percent of increase. Sheet L1.3 has been added to provide calculations of the expansion area and the required landscaping. These calculations demonstrate compliance with the overall number of plants required.

***There is an existing chain link fence along the eastern portion of the south property line along the detention basin. There is a sanitary line along the entire southern property line, making it difficult to install a wall or fence.**

****The existing narrow greenbelt, existing vegetation, and water main make it difficult to install all of the required landscaping.**

***** The Victor Drive easement limits adding greenbelt plantings to the east.**

Only thirty-three percent (33%) of plant material should be utilized of any one plant material. All existing trees must specify sizes and type so that it can be determined if they meet the Zoning Ordinance requirements. As a note, trees and shrubs must be setback ten (10) ft. from the edge of a road and five (5) ft. from sidewalks. Additionally,

the method of irrigation must be specified on the site plan. The sizes of proposed materials must meet the Zoning Ordinance.

Existing tree sizes are noted on the landscape plans. Trees are set back from roads and sidewalks. Material sizes were proposed based on the ordinance requirements. Irrigation notes have been added to the landscape plan (L1.1).

9. Lighting. The existing lighting includes sixteen (16) light poles approximately twenty-seven and a half (27.5) ft. in height. Additionally there are eleven (11) existing building mounted lights. A detail for the wall lights must be depicted on the site plan. An as-built photometric plan has been submitted which includes the gas station and grocery sites. The grocery site does not meet the photometric requirements per Article 14, Section 14-03. The applicant received an exception for the grocery store lighting at a meeting on 6/30/97 when the original store was approved. Light output exceeds ten (10) foot candles within the site and is higher than one foot candle at the property lines. Additionally, the light poles are higher than fifteen (15) ft. high. Four (4) new pole lights are proposed for the new rear parking lot area. The new light poles are too high: twenty-five (25) ft. and must be revised to meet the Zoning Ordinance requirements of fifteen (15) ft. high. Additionally seven (7) new wall mounted lights are proposed for the addition which will be mounted at fifteen (15) ft. high. The proposed photometrics for the new lighting meets the Zoning Ordinance requirements. As-built photometric plans will be required after the light pole in front is relocated and after the new pole lighting in the rear has been installed.

Sheet E1.7.3 includes details for the wall lights. Proposed light poles have been revised to comply with the 15 foot height requirement as shown on E1.7.1.

10. Waste Receptacle. The applicant has an existing trash compactor located in the rear of the building and does not identify any waste receptacles on the site plan. All waste receptacles are located inside of the building. An existing waste receptacle behind the retail portion of the building will be removed.

Comment noted.

11. Mechanical and Electrical Equipment. Existing transformers are located in the rear of the building which must be screened per the Zoning Ordinance. A proposed transformer is depicted on the east side of the building. All equipment must be screened according to the Zoning Ordinance. All mechanical equipment must be screened per Section 14-05. All roof mounted equipment must be screened per Section 14-01(d)(3).

Equipment will be screened as shown on the elevation drawing.

12. Agency Approvals. Copies of all applicable County, State, and Agency approvals need to be submitted to the Township prior to site plan approval, including but not limited to:

- a. Livingston County Drain Commissioner
- b. Township Engineer
- c. Livingston County Road Commission

d. Livingston County Public Health Department

e. Michigan Department of Transportation

f. The Brighton Area Fire Department

LCDC's preliminary approval is attached.

OHM's initial comments are addressed within this letter.

LCRC's preliminary comments are attached.

LCPHD's reply is attached. They require the well to be abandoned prior to final approval.

MDOT does not have jurisdiction over this site.

The Brighton Area Fire Department's preliminary comments are addressed within this letter.

LCWA has approved the water main plans and forwarded them to MDEQ.

MDEQ provided preliminary comments on the water main plans. The water main plans in this set include the revisions sent to MDEQ on 8/10/16.

Should you have any questions or comments, please contact me at 517-393-2902 ext. 270.

Sincerely,

Michelle Shumaker

Michelle Shumaker, PE

Attachments:

Revised Plans (15 Sets)

Revised Elevations (15 Sets)

Revised Traffic Impact Study

Responses to OHM and LCRC comments on Traffic Study

LCDC Review E-mail, dated 7/19/16

LCRC review

LCPHD review

LCWA review

Cc: File

L:\1379 (Kroger D-638 Brighton)\C\14 Outgoing Correspondence\ltr-TWPC01.doc

LETTER OF TRANSMITTAL

L**S****G** Engineers
& Surveyors

Date: August 12, 2016	Job No. 1379
Re: Kroger D-638	Sent Via: Hand Delivered

TO:

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

WE ARE SENDING YOU: Site Plan Resubmittal

THESE ARE BEING TRANSMITTED FOR THE PURPOSE OF: Review and Approval

Quantity	Description
15	Site Plans
15	Floor Plan and Building Elevations
15	Existing Building Photos (11x17)
15	Fixture Plan
1	Traffic Study
1	Review Letters: Livingston County Water Authority Livingston County Drain Commissioner's Office Livingston County Road Commission Livingston County Department of Public Health
1	Response Letter – Township, OHM, and Brighton Area Fire Authority Comments
1	Response Letter – OHM and LCRC Traffic Study Comments

REMARKS:

RECEIVED

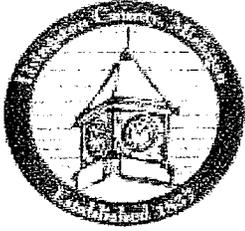
AUG 12 2016

BRIGHTON TOWNSHIP

CC: 1379 File

BY

Michelle Shumaker, PE



Livingston County Health Department-Environmental Health Division

2300 E. Grand River, Suite 102
Howell, MI 48843-7850
517.546.9858 * 517.546.9853 FAX
http://co.livingston.mi.us/health

Review #: REV2016-00443
APPLIED: 7/20/2016
ISSUED: 7/22/2016

Building Review

SITE ADDRESS: 9968 GRAND RIVER BRIGHTON 48116
PARCEL NO.: 12-32-300-061
TOWNSHIP: Brighton Township
DIRECTIONS TO SITE
BRIGHTON TWP SEC 32 ON THE SOUTH SIDE OF GRAND RIVER WEST OF OLD US 23



OWNER

KROGER COMPANY OF MICHIGAN
40939 GRAND RIVER AVE
NOVI MI 48375

BUILDER

LSG ENGINEERS & SURVEYORS
3135 PINE TREE RD STE D
LANSING MI 48911

PRIMARY :248-536-1500

PRIMARY :517-393-2902 X270

Environmental Sanitarian: Beau C. Forgett

Issued Date: July 22, 2016

PROJECT DESCRIPTION

EXPANSION OF KROGER STORE

Review Type: Well

Information:

Use: Commercial Food
Type Sewage Disposal: Municipal
Water Supply: Municipal

Demolition:
Accessory Structure: No
Structure Type: Other

Number of Bedrooms: 0 to 0
Amount of Fixtures:
Type of Fixtures: 0

Comments:

Issue Perm 7/22/16

Prior to final approval all wells associated with the project shall be properly abandoned by a licensed Michigan well driller and proper paperwork shall be submitted to LCDPH.

RECEIVED

AUG 12 2016

BRIGHTON TOWNSHIP

APPROVED

Environmental Sanitarian:

Final Date:

BRIGHTON 32
9968
GRAND RIVER
REV2016-00443

LCRC Review Comments (August 2, 2016)

Traffic Impact Study
Proposed Kroger Expansion – Brighton Township

Below are LCRC comments with respect to the traffic impact study prepared by Fleis & VandenBrink, dated July 22, 2016, for the proposed Kroger expansion located near the southwest quadrant of Grand River Avenue and Old US 23 / Whitmore Lake Road in Brighton Township.

Trip Generation

The study calculated trip generation in part on a 27,267 square-foot expansion of the existing Kroger store. However, OHM has indicated in their review that the actual expansion is 42,241 square feet. Trip generation, therefore, should be recalculated using actual square footage for the expansion less the trip generation for the existing retail. All figures, table and outputs should be revised to reflect the trip generation changes.

Also, please submit a current site plan that reflects the size of the proposed expansion.

Trip Distribution

Trip distribution is acceptable.

Other Comments

With the exception of trip generation issues associated with expansion size, the data, methodologies and procedures used to prepare the remainder of the report are acceptable to the LCRC.

Recommendations

Please revise the trip generation calculations per the above comments and revise and resubmit the study. Please provide a current site plan with the revised study. Also, please provide the electronic Synchro files with the resubmittal.

RECEIVED

AUG 12 2016

BRIGHTON TOWNSHIP

Michelle Shumaker

From: Ken Recker <KRecker@livgov.com>
Sent: Tuesday, July 19, 2016 9:24 AM
To: Kelly Mathews (planner@brightontwp.com)
Cc: Michelle Shumaker; Jacob Rushlow (jacob.rushlow@ohm-advisors.com); Michelle LaRose; Todd Cox
Subject: FW: Kroger Brighton expansion - Site Plans

Kelly,

We've previously met with Al Boyer and Michelle Shumaker of LSG Engineers regarding the aforementioned project. The work proposed in their most recent plan set will require a commercial soil erosion and sedimentation control permit.

Due to the redevelopment nature of the site work, the impact of the proposed improvements on the Appian Way Drain, which serves as the ultimate outlet, should be minimal. I have not reviewed any calculations, but the proposed reconfiguration of the detention area proposed appears acceptable.

If you need anything further from our office please let me know.

Sincerely,

Kenneth E. Recker, II, P.E.
Chief Deputy Drain Commissioner

From: Michelle Shumaker [mailto:shumaker@lsg-es.com]
Sent: Friday, July 15, 2016 3:46 PM
To: Ken Recker <KRecker@livgov.com>
Subject: Kroger Brighton expansion - Site Plans

RECEIVED

AUG 12 2016

BRIGHTON TOWNSHIP

Ken,
The attached plans are being forwarded at the request of Kelly Mathews, Brighton Township Planner. We submitted plans to her for site plan approval for the expansion of the Kroger store at 9968 East Grand River. At this point we have submitted only for site plan approval. Detail engineering plans will be submitted at a later date. I believe you had previously indicated to Alan Boyer that your office did not necessarily review site plans until engineering plans are submitted. Kelly would like some confirmation that the Livingston County Drain Commissioner has been given the opportunity to review the plans.

Please let me know if you need any additional information or hard copies of these plans to complete your site plan review.

Thank you,
Michelle Shumaker, PE
LSG Engineers & Surveyors
3135 Pine Tree Rd. Suite D
Lansing, MI 48911
Phone: 517-393-2902 x270



September 2, 2016

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

RE: Site Plan Resubmittal for Kroger D-638
9968 E. Grand River Avenue
Brighton, Michigan

RECEIVED

SEP 02 2016

BRIGHTON TOWNSHIP

Dear Kelly:

We received the Brighton Area Fire Authority's comment letter dated August 24, 2016, your comment letters dated August 25, 2016, and OHM/s comment letter dated September 1, 2016 and offer the following responses.

Please note that the monument sign at the Grand River entrance will be removed permanently as part of the expansion. This will eliminate the need to return to the ZBA to discuss the height and location of the sign. Sign removal is shown on the attached plans.

Per your e-mail dated September 1, 2016, the location of the temporary Clicklist spaces has been revised to match the plan you received from Jeffery A. Scott architects. Matt will be revising his submittal to show that existing parking spaces will be used for temporary Clicklist pickup without restriping. The temporary spaces will return to regular parking spaces once the front Clicklist is constructed as part of the expansion.

Township Comments

SU16/05

A special land use permit (SLUP) application for a 40,872 sq. ft. addition (25,313 sq. ft. addition and 15,559 sq. ft. expansion into adjacent retail businesses) to the existing store for a total of 104,637 sq. ft. with a small mezzanine is planned. Additionally, a drive-thru pharmacy and open air business (outside display) is planned. The business is located at 9968 E. Grand River and 5771 Borderline, on the south side of E. Grand River, west of Whitmore Lake Rd. The special land use permits are in a B-2 (general business) zoning district. The sewer and water REU's for grocery stores is .5 per 1,000 sq. ft. Existing sewer REU's are thirty (30) REU's for the grocery store and six (6) REU's for the retail stores. Additional sewer and water REU's are required for the addition.

It is understood that additional REUs may be required based on Township calculations.

1. Use. The proposed retail business greater than 30,000 sq. ft., drive-thru pharmacy, and open air business (outdoor display) are special land uses in the B-2 zoning district per Article 6, Section 6-02. The area for the open air business (outside display) is clearly marked on the site plan per the special land use permit (SLUP) requirements.

Comment noted.

2. Site Layout. The site has been reviewed in accordance with the area and bulk requirements described in Article 6, Section 6-03.

	Required	Provided	Comments
Building Height	45 ft./3 stories	27 - 38.8 ft./1 story	In compliance
Front Yard Setback - E. Grand River North	30 ft.	635 ft.	In compliance
Front Yard Setback - Victor Dr. East	30 ft.	30 ft.	In compliance
Front Yard Setback - Borderline West	30 ft.	25 ft.	In compliance
Rear Yard Setback South	20 ft.	262 ft. min. - varies	In compliance
Parking Lot Setback (Front) North	20 ft.	11 ft. min.	Not in compliance; existing
Parking Lot Setback (East - Victor Dr.)	20 ft.	0 ft.	Not in compliance; existing
Parking Lot Setback (Rear) South	10 ft.	22 ft.	In compliance
Parking Lot Setback (West - Borderline Drive)	20 ft.	30 ft.	In compliance
Minimum Lot Area (sq. ft.)	40,000	14 acres	In compliance
Minimum Lot Width (ft.)	150	66 ft. (E. Grand River)	Not in compliance; existing
Maximum Lot	50%	17%	In compliance

Coverage			
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Comment noted.

3. Loading/Unloading. An existing loading/unloading area (truck well) is depicted in the rear which meets the requirements of Sec. 15-02. The size is thirty-nine (39) ft. wide by sixty-five (65) ft. in length for a total of 2,535 sq. ft. The minimum is ten (10) ft. by 200 ft. for 2,000 sq. ft. (Minimum requirements are four (4) ten (10) ft. by fifty (50) ft. (2,000 sq. ft.) loading areas so the amount proposed exceeds the minimum).

Comment noted.

4. Vehicular and Pedestrian Circulation.

a. The proposed access is via three (3) entrances. One off of Whitmore Lake Rd., one off of E. Grand River (Victor Dr.), and one off of Borderline Drive off E. Grand River.

b. A five (5) ft. sidewalk was recently constructed in front of the gas station site as required per Sec. 16-08 of the Zoning Ordinance and the Pathways Plan.

Comment noted.

5. Parking. The proposed parking was reviewed in accordance with Article 15, Section 15-01 as described in the following table.

	Required	Provided	Comments
Parking Spaces Retail/Shopping Centers- One (1) parking space per 200 SF of usable (74,923/200) = 375 usable plus 1 space per employee (118 employees on largest shift)	493	494	In compliance
Parking Spaces Outdoor Commercial Display and Sales – One (1) space per each 500 sq. ft. of land (1/2,370) plus 1/employee	5	5	In compliance
Parking Spaces Stacking Spaces for Drive-Thru Pharmacy -	4	4	In compliance

requires 4 spaces			
Barrier-Free Spaces	9	16	In compliance
Parking Space Dimensions	9 ft. by 20 ft.	9.5 ft. by 20 ft.	In compliance
Aisle Width	24 ft. for 2 way traffic	23 ft. min for two way traffic	Rec'd. ZBA variance on 8/24/16

Asphalt pavement and concrete curbing and gutter exists as is required per Section 15-01(e)(5). The proposed sidewalks abutting parking spaces must be a minimum seven (7) ft. wide and the existing and proposed are more than seven (7) ft. wide along the front of the building and connecting from the parking area. Eight (8) spaces are proposed in the front for click list which is where you can order your groceries on-line and pick them up at the store. During construction, there will be two (2) temporary click list parking spaces located in the rear of the building.

Plans have been revised to show four temporary Clicklist parking spaces at the rear, which will return to regular parking after the expansion.

6. Signage. Two (2) existing freestanding ground signs exist for the grocery store; one at each entrance to the store (along Whitmore Lake Rd. and off of Victor Drive off of E. Grand River) which are identified on the site plan. No signage exists off of Borderline Drive off of E. Grand River. Additionally, there is a ground sign located on E. Grand River for the gas station. The existing wall signage exceeds the Zoning Ordinance requirements. The applicant received ZBA variances on 8/24/16 for wall signage as depicted on the preliminary site plan. Details on "handicap parking" and traffic control and click list signs are depicted on the site plan.

The sign at Grand River will be removed. The sign at Whitmore Lake will be removed and replaced to conform to height and setback requirements. The revised elevations included in this set show the reduction of existing signage on the east building wall and remove all previously proposed signage from the west wall as approved by the ZBA on 8/24/16

7. Building Materials. Article 14, Section 14-01(c)(1) depicts the building materials required. Per Table 14-01, each wall has a percentage of coverage of the various building materials. A table has been provided by the applicant depicting the total percentage of proposed materials for all four (4) walls and each elevation must comply with the stated percentages. The front elevation is sixty-four (64%) which is less than the seventy-five (75%) required on a front elevation and the rear elevation has ninety-four (94%) concrete block, more than the twenty-five (25%) allowable. The Planning Commission can waive strict compliance with Sec. 14-01(c)(1) if the Planning Commission feels the intent is met as described in Sec. 14-01(c)(2).

The applicant plans to leave the existing portion of the building the same as it is existing and the addition will match the existing. The plans are for brick, EIFS cornice, ceramic

tile accents, and split face block. All roof materials must also be identified on the site plan including the existing standing seam metal roof.

Per Sec. 14-01(c)(5), colors are to be earth tone colors and be compatible with the surrounding area. The existing and proposed brick is an orange/beige color. Additionally, samples of all materials must be brought to the Planning Commission meeting for review.

A floor plan has been submitted which depicts the layout of the proposed facility. Additionally, per Sec. 14-01 (c)(4), when walls are greater than one hundred (100) ft. in length, design variations must be applied per the suggestions in that section. Per Sec. 14-01(c)(4) interest is supposed to be added to the walls so there are not large blank walls such as ten (10) ft. recesses. The frontage is mainly a large blank wall with a few recesses. The Planning Commission will have to discuss this issue.

The roof plan has been added to the set to identify roof materials. Material samples will be provided at the Planning Commission meeting.

8. Landscaping. A landscape plan has been submitted and has been reviewed in accordance with Article 14, Section 14-02 as follows. Due to the uses being proposed being special uses, additional landscaping beyond the minimum is suggested for the site.

	Required	Provided
Greenbelt - Borderline Western Property Line 20 ft. with 1 decid. per 30 lineal ft. (916 ft.)	31 trees	31 trees; in compliance
Buffer along Southern Property Line - to industrial 20 ft. with 1 decid., 1 evergreen and 4 shrubs per 30 lineal ft. (751 ft.) and wall/fence/berm	25 decid., 25 evergreen, and 100 shrubs.	19 decid., 26 evergreen in rear, 70 shrubs are elsewhere on site; in compliance due to bldg. and parking lot increase
Buffer along Northern Property Line - to commercial 10 ft. buffer with 1 decid. or 1 evergreen or 4 shrubs per 20 ft. (560 ft.) No berm/wall required	28 trees or 112 shrubs	6 trees and 37 shrubs; in compliance due to size of bldg. and parking lot

		increase
Greenbelt - Victor Eastern Property Line 20 ft. with 1 decid. per 30 lineal ft. (1,275 ft.)	42 decid.	19 trees and 56 shrubs; in compliance due to size of bldg. and parking lot increase
Detention/Retention Ponds/Basins - 1 tree and 10 shrubs per 50 linear ft. of detention basin perimeter. Reconfiguration of existing pond with proposed chain link fencing around pond. 1,071 l.f.	22 trees and 215 shrubs	22 trees and 215 shrubs; in compliance
Parking Lot - 498 spaces Required for parking lots of 20 spaces or more - 1 canopy tree for each 10 parking spaces, in no case less than 2 trees shall be provided and a continuous row of shrubs along the front of the parking lot. A min. 1/3rd of the trees shall be placed in islands (min. size of islands specified in ordinance).	50 trees and continuous row of shrubs in front; 17 trees in islands	50 trees and 37 trees in islands; in compliance

The building and parking lot increase is 13.56% so that requires 54.24% compliance with the landscaping requirements of the Zoning Ordinance. Additionally, the applicant has restrictions on the eastern and southern portions of the property which make it difficult to fully comply with the landscaping requirements. The applicant meets the Zoning Ordinance as far as the percentage increase of landscaping required per the size of the proposed addition as depicted in Sec. 14-02(b)(6) of the Zoning Ordinance. Only thirty-three percent (33%) of plant material should be utilized of any one plant material. All existing trees have specified sizes and types. As a note, trees and shrubs are setback ten (10) ft. from the edge of a road and five (5) ft. from sidewalks as required. And, the method of irrigation has been specified on the site plan which is automatic underground systems.

Comment noted.

9. Lighting. The existing lighting includes sixteen (16) light poles approximately twenty-seven and a half (27.5) ft. in height. Additionally there are eleven (11) existing building mounted lights. A detail for the wall lights has been depicted on the site plan. An as-built photometric plan has been submitted which includes the gas station and grocery sites. The grocery site does not meet the photometric requirements per Article 14, Section 14-03. The applicant received an exception for the grocery store lighting at a meeting on 6/30/97 when the original store was approved which includes light output exceeding ten (10) foot candles within the site and exceeding one foot candle at the property lines per the original exception granted on 6/30/97. Additionally, the existing light poles are higher than fifteen (15) ft. high per the exception granted on 6/30/97.

Eight (8) new pole lights are proposed for the new rear parking lot area. The new light poles meet the Zoning Ordinance requirements of fifteen (15) ft. high. The rear four (4) light poles have cut-off shields. The proposed number of light squares for the light poles must be depicted on the site plan. Additionally seven (7) new wall mounted lights are proposed for the addition which will be mounted at fifteen (15) ft. high. The proposed photometrics for the new lighting meets the Zoning Ordinance requirements. As-built photometric plans will be required after the light pole in front is relocated and after the new pole lighting in the rear has been installed.

Sheet E1.7.2 has been revised to note that the proposed number of light squares per pole is four.

10. Waste Receptacle. The applicant has an existing trash compactor located in the rear of the building and does not identify any waste receptacles on the site plan. All waste receptacles are located inside of the building. An existing waste receptacle behind the retail portion of the building will be removed.

Comment noted.

11. Mechanical and Electrical Equipment. Existing transformers are located in the rear of the building and a new one proposed on the east side of the building which must be screened per the Zoning Ordinance. Landscaping is proposed to screen the easterly transformer. A detail must be provided of the screening for the rear transformers. All mechanical equipment must be screened per Section 14-05. All roof mounted equipment must be screened per Section 14-01(d)(3).

Equipment will be screened as shown on the elevation drawing and dimensioned on the floor plan drawing.

12. Agency Approvals. Copies of all applicable County, State, and Agency approvals need to be submitted to the Township prior to site plan approval, including but not limited to:

- a. Livingston County Drain Commissioner
- b. Township Engineer

- c. Livingston County Road Commission
- d. Livingston County Public Health Department
- e. The Brighton Area Fire Department

LCDC's preliminary approval was included with the August 12, 2016 submittal.

OHM's comments are addressed within this letter.

LCRC's preliminary comments were attached to the August 12, 2016 submittal.

LCPHD's reply was attached to the August 12, 2016 submittal. They require the well to be abandoned prior to final approval.

The Brighton Area Fire Department's comments are attached.

LCWA has approved the water main plans.

MDEQ has approved the water main plans. A copy of the permit is attached.

OHM Comments

Site Plan Review #2, OHM Job Number 0024-16-1081

Special Land Use #2, OHM Job Number 0024-16-1084

RECOMMENDATIONS

1. A dimensioned truck turning plan shall be included to verify that site circulation can adequately accommodate a standard fire apparatus or the largest truck anticipated to traverse the site. This shall include the proposed fire routes and illustration that a standard fire apparatus can adequately access the location of the proposed fire hydrants.

Sheet C1.1.2 was added to the plan set to show fire routes and the path of the fire truck. Comments received August 24, 2016 from the Brighton Area Fire Authority indicate that the proposed configuration is sufficient. The comment letter is attached.

2. On the landscape plan, it appears that on the northwest corner of the site, trees are proposed over the proposed water man. Trees are also proposed over sanitary sewer on the east and west sides of the proposed parking lot. Trees are not permitted to be constructed within these public utility easements and must be relocated.

Greenspace on site is limited. The plan was created to show compliance with the requirements of the landscaping ordinance per Article 14. The applicant will discuss this with the Planning Commission and seek to provide an acceptable compromise.

Should you have any questions or comments, please contact me at 517-393-2902 ext. 270.

Sincerely,

Michelle Z. Stumaker

Michelle Shumaker, PE

Attachments:

Revised Plan Sheets (15 Sets)

Revised Elevations (15 Sets)

Brighton Area Fire Authority's Comments

MDEQ Water Permit

Cc: File

L:\1379 (Kroger D-638 Brighton)\C\14 Outgoing Correspondence\ltr-TWPC01.doc

LCRC Review Comments (September 8, 2016)

Traffic Impact Study
Proposed Kroger Expansion – Brighton Township

Below are LCRC comments with respect to the revised traffic impact study prepared by Fleis & VandenBrink, dated August 12, 2016, for the proposed Kroger expansion located near the southwest quadrant of Grand River Avenue and Old US 23 / Whitmore Lake Road in Brighton Township.

Comments

Overall, we agree with the study methodology and findings. The report is well-written and the study results are reported in accordance with accepted practice.

However, our one concern is whether the true level of delay is accurately reported for the intersection of Old US 23 and Grand River Avenue. More specifically, there are limitations in Synchro and the Highway Capacity Manual in calculating delay at an intersection like Old US 23 and Grand River. Factors like left-turn storage length have no effect on the amount of delay in Synchro, but have a significant effect within SimTraffic. Similarly, adjacent intersections, like Weber to the north or Victor to the south, have no effect on calculated Synchro delay but certainly do within SimTraffic. We don't dispute the reporting of delay values calculated by Synchro. The comparison of Synchro delays between existing, background and future conditions is helpful and in accordance with current practice. The only question is whether SimTraffic delays would give a more accurate representation of field delays over Synchro calculations. The report does a good job of describing the network simulations and the long vehicle queues observed on the westbound and northbound approaches, but stops short of reporting measured delay from SimTraffic.

Subsequently, for comparative purposes, we ran 10 simulations for each model and averaged the results. Also, for each model we made a few changes to allow for more accurate simulation results. We lengthened the east leg from 600 feet to approximately 2700 feet, since queues routinely exceeded the model's link length and a longer link will produce more accurate delay results. We also lengthened the left-turn storage length on the west leg to 300 feet, the south leg to 375 feet and the north leg to 400 feet. Average results of the 10 simulations are shown in red on the attached sheets, to the right side of the calculated Synchro delays. It's most apparent that the calculated delays in SimTraffic are much higher in all of the models for the NB and WB approaches, as well as overall for the intersection. Whereas Synchro calculates the difference in overall intersection delay at 3.5 seconds between the background and future models, SimTraffic computes 18 seconds of additional delay.

Recommendations

LCRC is not requiring that the traffic study be revised to include an in-depth analysis of Synchro vs. SimTraffic results. We ran the simulations and provided the comparison as a way of showing that the existing limitations at the intersection probably result in more field delay than what Synchro calculates.

We agree with the report recommendation that construction of a WB right-turn lane on Grand River Avenue will improve traffic operations. Both Synchro and SimTraffic calculations show that such an improvement will mitigate the impacts of the proposed Kroger expansion. We recommend that Brighton Township consider the need for such a mitigation measure in their approval process of the Kroger site. We're also open to reviewing any other measure that might mitigate traffic impacts of the proposed Kroger site to background delay levels at Old US 23 and Grand River Avenue.

The peak hour volumes for each intersection were utilized for this study and the volumes were balanced upward through the study network. In general, the peak hours of existing network traffic were identified to occur between 4:45 PM to 5:45 PM and 12:00 PM to 1:00 PM. The traffic volume data are attached and summarized in the attached Figure 2.

At the time these traffic counts were collected, the Michigan Department of Transportation (MDOT) had commenced with a construction project at the I-96/US-23 interchange located approximately 1/2 mile from the study area. Comparison of counts collected in February, 2015 (prior to construction) and the existing counts indicate that peak hour volumes at the intersection of Grand River Avenue & Whitmore Lake Road / Old US-23 have increased 16%. This increase is significant and likely related to construction activities associated with the I-96/US-23 interchange improvements.

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

Intersection	Control	Approach	PM Peak Delay		SAT Peak Delay	
			(s/veh)	LOS	(s/veh)	LOS
1. Grand River Avenue & Whitmore Lake Road / Old US-31	Signalized	EB	55.2	51 E	31.5	C
		WB	67.8	129 E	31.3	C
		NB	51.5	89 D	30.0	C
		SB	51.6	47 D	28.7	C
		Overall	57.9	81 E	30.5	C
2. Grand River Avenue & Borderline Drive	Signalized	EB	7.9	A	7.2	A
		WB	4.3	A	3.5	A
		NB	30.5	C	30.6	C
		Overall	9.1	A	8.6	A
3. Grand River Avenue & Kroger Drive	STOP (Minor)	EB	Free		Free	
		WB LT	10.4	B	9.9	A
		NB	14.9	B	13.2	B
4. Whitmore Lake Road & Victor Street / Shopping Center Drive	STOP (Minor)	EB	29.3	D	18.7	C
		WB	138.7	F	82.0	F
		NB LT	11.0	B	9.9	A
		SB LT	10.0	B	9.6	A

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 PM and Saturday (SAT) peak periods with the exception of the following:

- The signalized intersection of Grand River Avenue & Whitmore Lake Road / Old US-23 which currently operates at an overall LOS E during the PM peak period with several approaches and movements operating at a LOS E.

Therefore, an annual growth rate of 0.75% was applied to the 2016 traffic volumes for two years to calculate the 2018 traffic volumes for the analysis of background conditions *without the proposed development*.

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 background conditions analysis are attached and summarized in Table 3.

Table 3: Background Intersection Operations

Intersection	Control	Approach	PM Peak Delay		SAT Peak Delay	
			(s/veh)	LOS	(s/veh)	LOS
1. Grand River Avenue & Whitmore Lake Road / Old US-31	Signalized	EB	57.1	51 E	32.9	C
		WB	73.0	172 E	31.9	C
		NB	53.5	97 D	31.0	C
		SB	52.9	57 D	29.4	C
		Overall	60.8	98 E	31.5	C
2. Grand River Avenue & Borderline Drive	Signalized	EB	8.0	A	7.3	A
		WB	4.3	A	3.6	A
		NB	30.5	C	30.7	C
		Overall	9.2	A	8.7	A
3. Grand River Avenue & Kroger Drive	STOP (Minor)	EB	Free	Free		
		WB LT	10.5	B	10.0	A
		NB	15.1	C	13.4	B
4. Whitmore Lake Road & Victor Street / Shopping Center Drive	STOP (Minor)	EB	30.8	D	19.1	C
		WB	153.0	F	89.9	F
		NB LT	11.2	B	10.0	A
		SB LT	10.1	B	9.7	A

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. 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 with long vehicle queues at the intersection of Grand River Avenue & Whitmore Lake Road / Old US-23 during the PM peak hour.

Site Trip Generation and Assignment

The number of PM and SAT peak hour vehicle trips that would be generated by the Kroger expansion was forecast based on data published by ITE in *Trip Generation, 9th Edition* and the *Trip Generation Handbook, 3rd Edition*. The existing 15,559 SF of retail space adjacent to Kroger is currently generating peak hour traffic volumes that are included in the existing peak hour traffic counts; therefore, in order to determine the potential impact of the proposed Kroger expansion, the net increase in vehicle trips associated with the change in land use and occupancy was calculated.

The ITE description for Specialty Retail Center (Land Use 826) was determined to best fit the existing uses and sizes of the retail space; however, this land use does not provide trip generation for the Saturday peak hour. Therefore, the ITE Shopping Center Land Use was utilized during the Saturday peak hour. Due to the relatively small size of the proposed retail use as compared to the ITE Shopping Center dataset, the average trip generation rate was referenced as opposed to the fitted curve equation.

As is typical of retail and supermarket uses, a portion of the site-generated trips are already present on the adjacent road network and are interrupted to visit the site. These trips are known as "pass-by" trips and account for a percentage of the total site-generated traffic. Pass-by trips result in turning movements at the

The site-generated vehicle trips were assigned to the study road network based on this trip distribution model and as shown on the attached Figure 4. New site generated trips were assigned at the off-site study intersections based on existing turning movement patterns. The site-generated trips were added to the background traffic volumes shown on the attached Figure 3 to calculate the future peak hour traffic volumes shown on the attached Figure 5.

Future Conditions

Future peak hour vehicle delays and LOS were calculated at the study intersections based on the existing lane use and traffic control shown on the attached Figure 1, the future peak hour traffic volumes shown on the attached Figure 5, and the methodologies presented in the HCM. The results of the future conditions analysis are attached and summarized in Table 6.

Table 6: Future Intersection Operations

Intersection	Control	Approach	PM Peak		SAT Peak	
			Delay (s/veh)	LOS	Delay (s/veh)	LOS
1. Grand River Avenue & Whitmore Lake Road / Old US-31	Signalized	EB	60.2	61 E	34.4	C
		WB	80.9	225 F	32.2	C
		NB	53.6	68 D	31.3	C
		SB	53.1	52 D	29.3	C
		Overall	64.3	116 E	32.1	C
2. Grand River Avenue & Borderline Drive	Signalized	EB	9.2	A	8.5	A
		WB	5.2	A	4.4	A
		NB	31.5	C	32.2	C
		Overall	10.7	B	10.3	B
3. Grand River Avenue & Kroger Drive	STOP (Minor)	EB	Free		Free	
		WB LT	11.0	B	10.4	B
		NB	17.0	C	15.0	C
4. Whitmore Lake Road & Victor Street / Shopping Center Drive	STOP (Minor)	EB	38.4	E	22.4	C
		WB	340.9	F	160.7	F
		NB LT	11.7	B	10.4	B
		SB LT	10.0	B	9.6	A

The results of the future conditions analysis indicate that the proposed expansion will not have a significant impact on the adjacent road network. At the signalized intersection of Grand River Avenue & Whitmore Lake Road / Old US-23, overall vehicle delays at the intersection will increase by 3.5 and 0.6 seconds during the PM and SAT peak periods, respectively, which will not be discernable to existing network traffic. Additionally, the proposed expansion will increase traffic at the intersection by approximately 2% and 3% during the PM and SAT peak periods, which is not significant.

At the intersection of Whitmore Lake Road & Victor Street / Shopping Center Drive, the minor street eastbound and westbound left turn movements will continue to operate at LOS F during the peak periods, while the eastbound right turn movement from Victor Street will operate at a LOS E. At this intersection, the predominant driveway movements are the northbound left turn and eastbound right turn (Kroger shopping center traffic entering and exiting to the south on Whitmore Lake Road). Review of network simulations indicates that the signalized intersection of Grand River Avenue & Whitmore Lake Road / Old US-23 creates gaps in the southbound Whitmore Lake Road traffic stream to help facilitate these movements. Additionally, egress site-generated traffic to the north on Old US-23 and east on Grand River Avenue can be accommodated via the Kroger Driveway to Grand River Avenue.



Review of network simulations indicates future traffic operations which are similar to background conditions. During the PM peak hour, long vehicle queues are continued to be observed for several approaches and movements at the intersection of Grand River Avenue & Old US-23 / Whitmore Lake Road which lasts throughout the duration of the peak periods and exceed available storage lengths.

Future Improvements

In order to mitigate future traffic operations at the signalized intersection of Grand River Avenue & Old US-23 / Whitmore Lake Road back to background conditions, improvements to the study network were investigated. The results of this analysis indicate that with the construction of a westbound right turn lane all approaches and movement would operate in an improved manner as compared to existing conditions; however, some approaches and movements will continue to operate at a LOS E during the PM peak hour as shown in Table 7.

Table 7: Future Intersection Operations with Improvements

Intersection	Control	Approach	PM Peak		SAT Peak	
			Delay (s/veh)	LOS	Delay (s/veh)	LOS
1. Grand River Avenue & Whitmore Lake Road / Old US-31	Signalized	EB	51.0	51 D	33.5	C
		WB	58.6	105 E	31.2	C
		NB	50.9	111 D	30.6	C
		SB	51.9	50 D	29.0	C
		Overall	53.7	75 D	31.4	C

Conclusions

The conclusions of this Traffic Impact Study are as follows:

1. Currently, the signalized intersection of Grand River Avenue & Whitmore Lake Road / Old US-23 operates at an overall LOS E during the PM peak hour and requires geometric improvements to mitigate currently unacceptable traffic operations.
2. The minor street eastbound and westbound left turn movements at the intersection of Whitmore Lake Road & Victor Street / Shopping Center Drive currently operate at a LOS F during the peak periods; however, review of network simulations indicate acceptable traffic operations during both peak periods as a result of the low traffic demand for the STOP controlled egress left turn movements.
3. Background conditions were evaluated which includes a traffic growth rate of 0.75% per year to the project buildout year of 2018.
4. Under background traffic conditions *without the proposed development*, all study intersections will operate in a manner similar to existing conditions with minor increases in vehicle delays and LOS.
5. The analysis of future conditions *with the proposed development* indicates that the proposed expansion will not have a significant impact on the adjacent road network. At the intersection of Grand River Avenue & Old US-23 / Whitmore Lake Road overall vehicle delays will increase by less than two seconds during the peak periods which will not be discernable.
6. The proposed expansion will increase traffic at the intersection of Grand River Avenue & Old US-23 / Whitmore Lake Road by less than 2% during both peak periods, which is not significant.
7. With the recommended improvements below, all study intersection approaches and movements will operate in an improved manner as compared to existing conditions.
 - a. Construct right turn lane on the westbound approach at the intersection of Grand River Avenue & Old US-23 / Whitmore Lake Road.
 - b. Provide corresponding right turn overlap phase.



Kroger Expansion #D-638

Revision Fixture Plan

Dated July 21, 2016

Available for viewing in the
Planning and Clerk's Department

Kroger Expansion #D-638

Elevation Drawings

Dated September 1, 2016

Available for viewing in the
Planning and Clerk's Department

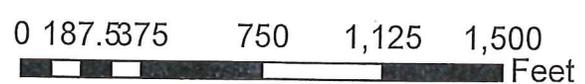
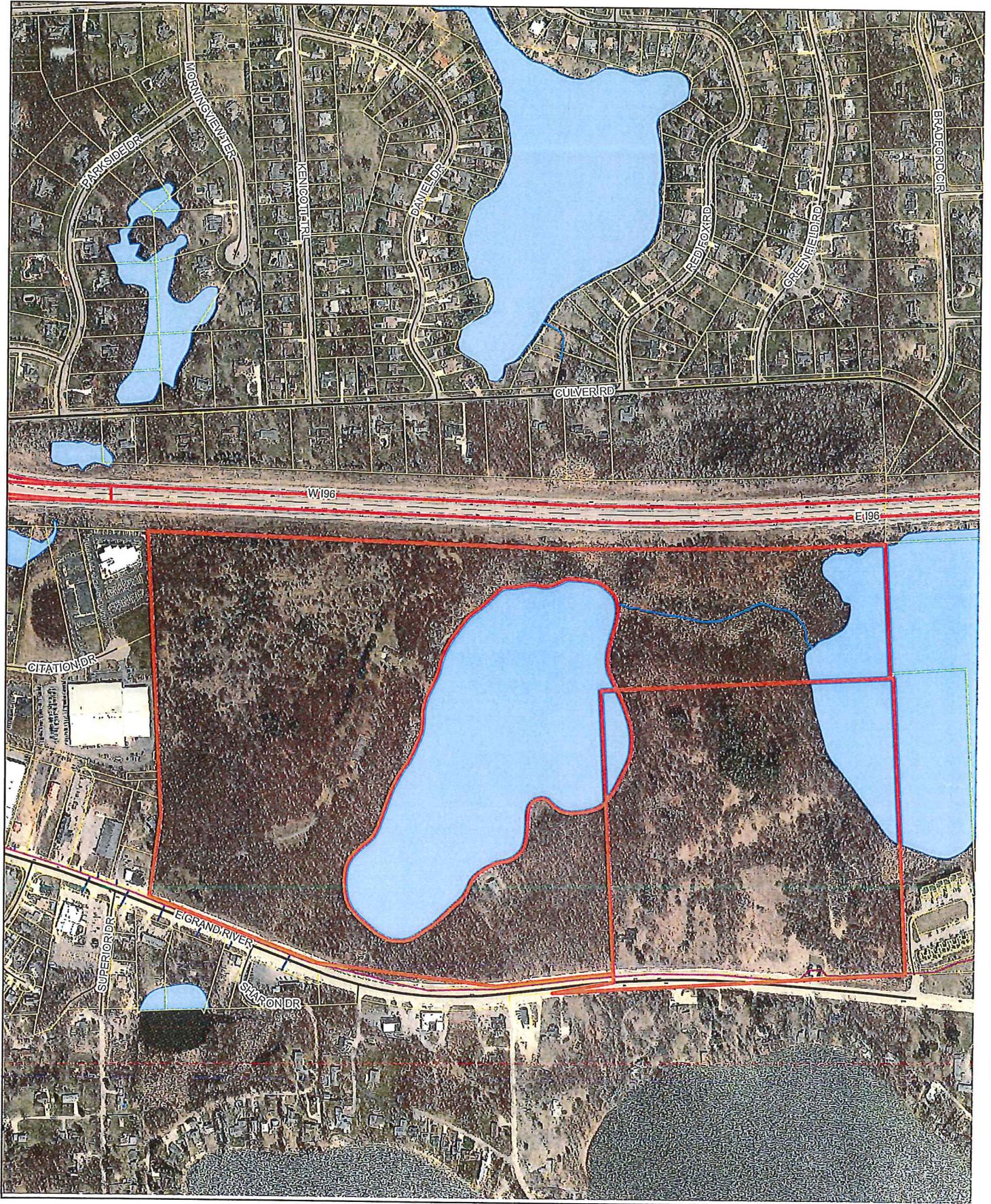
Amended Pages For Construction Of
Kroger Store #D-638 Expansion
Dated September 2, 2016

Available for viewing in the
Planning and Clerk's Department

Plans For Construction Of
Kroger Store #D-638 Expansion
Dated August 12, 2016

Available for viewing in the
Planning and Clerk's Department

Encore Village





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

RECEIVED

AUG 26 2016

BRIGHTON TOWNSHIP

ENCORE VILLAGE

SUMMARY OF REVISIONS

DATE: 8-26-16

The submission package to Brighton Township from Boss Engineering regarding the Encore Village project contains revisions to the plan set previously submitted on July 22nd, 2016. Revisions were based upon comments from the township and to update changes to the project since the previous submission. The revisions and additions to the submittal package are as follows:

- Sheet 2: ADDED- Significant trees and tag numbers
- Sheet 3: ADDED- Significant tree inventory list, significant trees and tag numbers, plot areas on site, notes regarding significant trees, notes regarding tree plot areas, and tree calculations
- Sheet 4: ADDED- Updated layout surrounding multi-story assisted living facility, updated site data information to reflect proposed layout
- Sheet 5: ADDED- Updated notes to reflect new multi-story assisted living facility unit quantities, updated layout surrounding multi-story assisted living facility, updated site data information to reflect proposed layout
- Sheet 5A: ADDED- Updated layout surrounding multi-story assisted living facility, added dimensions from wetland boundary to building edge throughout the site
- Sheet 5B: ADDED- Dimensions from wetland boundary to building edge throughout site
- Sheet 6: ADDED- Updates to open space calculations, updated layout surrounding multi-story assisted living facility, updated delineated open space areas on site
- Sheet 7: ADDED- Updated layout surrounding multi-story assisted living facility, updated spot elevations surrounding multi-story assisted living facility
- Sheet 7B: ADDED- Updated layout surrounding multi-story assisted living facility, updated spot elevations surrounding assisted living facility
- Sheet 8: ADDED- Updated layout surrounding multi-story assisted living facility, updated utilities surrounding multi-story assisted living facility
- Sheet 8B: ADDED- Updated layout surrounding multi-story assisted living facility, updated utilities surrounding multi-story assisted living facility
- Conditional Conceptual Zoning Agreement Document: NOTE- A new document draft has not been received but the following changes should be made:
 - Section 4, sub-section F, number shall read "...note less than *twenty* feet (20') in total"
 - Section 4, sub-section H shall read "... no more than *162 units* and shall be *three stories in height.*"
 - Comments from planner will be addressed at a later time
- Natural Features Assessment & Site Analysis: ADDED-Supplement to Natural Features Assessment (includes significant tree information and tree quantities)

Please see attached submittal documents for further details and contact Boss Engineering with any questions or concerns.

MEMO

VIA EMAIL

To: **Mr. Michael Furnari**
The Fairview Companies

From: **Michael J. Labadie, PE**
Julie M. Kroll, PE, PTOE
Steven J. Russo, E.I.T.
Fleis & VandenBrink

Date: **July 19, 2016**

Re: **Proposed Multi-Family Residential Community**
Brighton Township, Michigan
Traffic Impact Study

RECEIVED

AUG 05 2016

BRIGHTON TOWNSHIP

Introduction

This memorandum presents the results of a Traffic Impact Study (TIS) for the proposed 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 411 apartment units and 104 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, 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. 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.

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

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

Intersection	Control	Approach	AM Peak		PM Peak	
			Delay (s/veh)	LOS	Delay (s/veh)	LOS
1. Grand River Avenue & Old US-23 / Whitmore Lake Road	Signalized	EB	28.0	C	55.9	E
		WB	27.8	C	59.4	E
		NB	24.7	C	47.4	D
		SB	<u>27.8</u>	<u>C</u>	<u>51.0</u>	<u>D</u>
		Overall	27.0	C	54.2	D
2. Old US-23 & Spencer Road West	Signalized	EB	25.1	C	25.8	C
		NB	6.3	A	9.1	A
		SB	<u>15.6</u>	<u>B</u>	<u>14.1</u>	<u>B</u>
		Overall	16.6	B	15.6	B
3. Grand River Avenue & Pleasant Valley Road	STOP (Minor)	EB LT	8.3	A	11.2	B
		WB LT	8.7	A	7.9	A
		NB	0.0	A	593.6	F
		SB	21.3	C	29.3	D

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

Intersection	Control	Approach	AM Peak		PM Peak	
			Delay (s/veh)	LOS	Delay (s/veh)	LOS
1. Grand River Avenue & Old US-23 / Whitmore Lake Road	Signalized	EB	22.1	C	35.2	C
		WB	24.8	C	33.7	C
		NB	24.6	C	34.1	C
		SB	<u>26.9</u>	<u>C</u>	<u>35.7</u>	<u>D</u>
		Overall	24.6	C	34.5	C
3. Grand River Avenue & Pleasant Valley Road	Signalized	EB	6.4	A	14.7	B
		WB	16.5	B	19.8	B
		NB	0.0	A	28.8	C
		SB	<u>17.6</u>	<u>B</u>	<u>22.7</u>	<u>C</u>
		Overall	9.7	A	18.4	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 Brighton Township, no background developments were identified within the study area.

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.

Table 3: Background Intersection Operations

Intersection	Control	Approach	AM Peak		PM Peak	
			Delay (s/veh)	LOS	Delay (s/veh)	LOS
1. Grand River Avenue & Old US-23 / Whitmore Lake Road	Signalized	EB	29.1	C	60.3	E
		WB	28.6	C	68.9	E
		NB	25.0	C	50.0	D
		SB	<u>28.8</u>	<u>C</u>	<u>53.8</u>	<u>D</u>
		Overall	27.8	C	59.6	E
2. Old US-23 & Spencer Road West	Signalized	EB	25.0	C	25.9	C
		NB	6.6	A	9.4	A
		SB	<u>15.6</u>	<u>B</u>	<u>14.2</u>	<u>B</u>
		Overall	16.6	B	15.7	B
3. Grand River Avenue & Pleasant Valley Road	STOP (Minor)	EB LT	8.3	A	11.5	B
		WB LT	8.7	A	7.9	A
		NB	0.0	A	706.8	F
		SB	23.3	C	32.3	D

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.

Site Trip Generation and Assignment

A comparison of the trip generation potential of the subject parcel was 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 4 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 4: Site Trip Generation

Land Use	ITE Code	Amount	Units	Average Daily Traffic	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	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	230	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
CHANGE IN NEW TRIPS FOR SITE				-6,288	-1,253	-9	-1,262	-90	-1,169	-1,259

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. The site trip distribution model outlined in Table 5 was applied to assign the future traffic volumes.

Table 5: 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 6.

Table 6: Future Intersection Operations

Intersection	Control	Approach	AM Peak		PM Peak	
			Delay (s/veh)	LOS	Delay (s/veh)	LOS
1. Grand River Avenue & Old US-23 / Whitmore Lake Road	Signalized	EB	29.5	C	62.4	E
		WB	29.9	C	81.8	F
		NB	25.0	C	49.7	D
		SB	<u>29.0</u>	<u>C</u>	<u>59.1</u>	<u>E</u>
		Overall	28.3	C	65.3	E
2. Old US-23 & Spencer Road West	Signalized	EB	25.0	C	25.8	C
		NB	6.6	A	9.4	A
		SB	<u>15.7</u>	<u>B</u>	<u>14.3</u>	<u>B</u>
		Overall	16.6	B	15.7	B
3. Grand River Avenue & Pleasant Valley Road	STOP (Minor)	EB LT	8.6	A	12.6	B
		WB LT	8.9	A	8.0	A
		NB	0.0	A	3488.7	F
		SB	36.5	E	50.1	F
4. Grand River Avenue & Assisted Living Drive	STOP (Minor)	EB LT	8.2	A	10.2	B
		WB	Free		Free	
		SB	12.2	B	16.7	C
5. Grand River Avenue & W. Residential Site Drive	STOP (Minor)	EB LT	8.2	A	10.5	B
		WB	Free		Free	
		SB	13.7	B	18.6	C
6. Grand River Avenue & Middle Residential Site Drive	STOP (Minor)	EB LT	8.1	A	10.8	B
		WB	Free		Free	
		SB	14.4	B	22.2	C
7. Grand River Avenue & E. Residential Site Drive	STOP (Minor)	EB LT	0.0	A	10.4	B
		WB	Free		Free	
		SB	15.7	C	20.4	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 during the peak 30 minute period 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 proposed site access points to Grand River Avenue, all approaches and movements will operate acceptably at a LOS C 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 and movements would operate acceptably at a LOS D or better during both peak periods, as shown in Table 7. Review of network simulations also indicates acceptable traffic operations and vehicle queues are observed to be acceptably processed.

Table 7: Future Intersection Operations with Improvements

Intersection	Control	Approach	AM Peak		PM Peak	
			Delay (s/veh)	LOS	Delay (s/veh)	LOS
1. Grand River Avenue & Old US-23 / Whitmore Lake Road	Signalized	EB	22.3	C	39.5	D
		WB	26.1	C	40.2	D
		NB	24.9	C	39.8	D
		SB	<u>28.7</u>	<u>C</u>	<u>42.6</u>	<u>D</u>
		Overall	25.5	C	40.3	D
3. Grand River Avenue & Pleasant Valley Road	Signalized	EB	7.2	A	18.8	B
		WB	16.9	B	21.0	C
		NB	0.0	A	28.8	C
		SB	<u>17.6</u>	<u>B</u>	<u>29.5</u>	<u>C</u>
		Overall	10.2	B	22.0	C

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 W=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.
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 movements 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 C 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.

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
Turn Lane Warrants

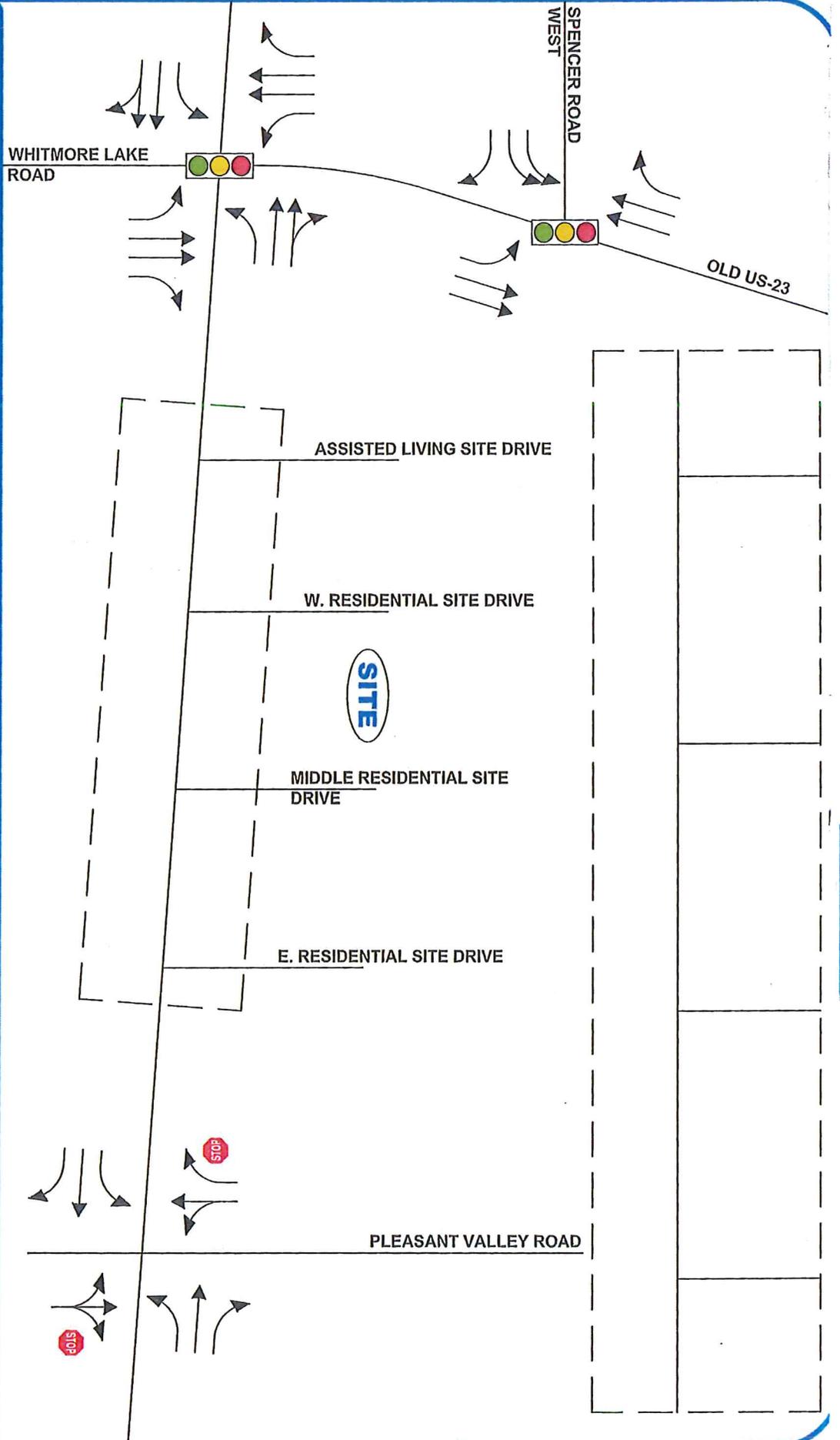
SJR:mjl



LANE USE AND TRAFFIC CONTROL

MULTI-FAMILY RESIDENTIAL COMMUNITY - BRIGHTON TOWNSHIP, MI

FIGURE 1



LEGEND

- SIGNALIZED INTERSECTION
- UNSIGNALIZED INTERSECTION
- ROADS
- LANE USE



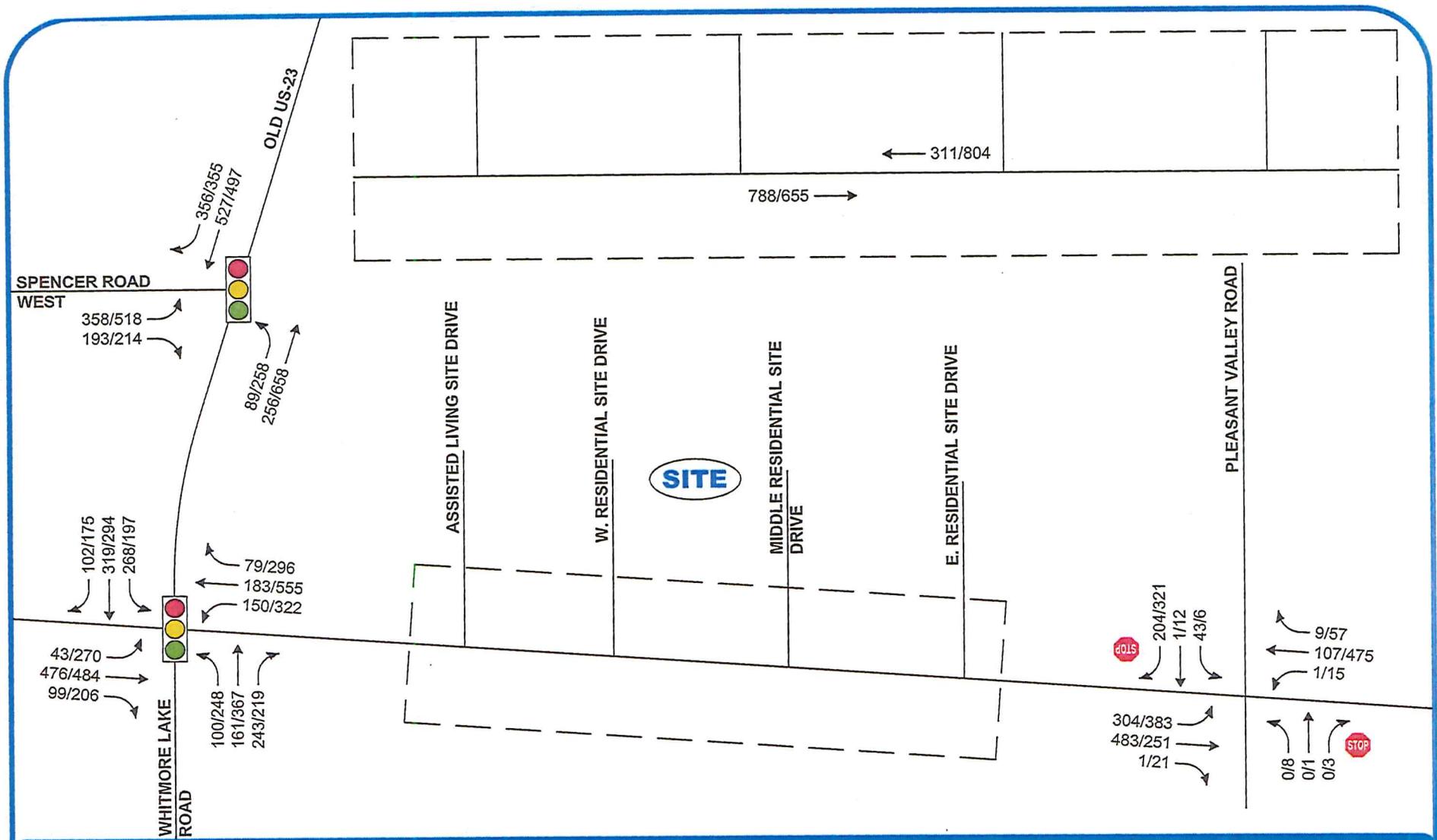


FIGURE 2
EXISTING TRAFFIC VOLUMES
 MULTI-FAMILY RESIDENTIAL COMMUNITY - BRIGHTON TOWNSHIP, MI

LEGEND

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



NORTH
 SCALE: NOT TO SCALE

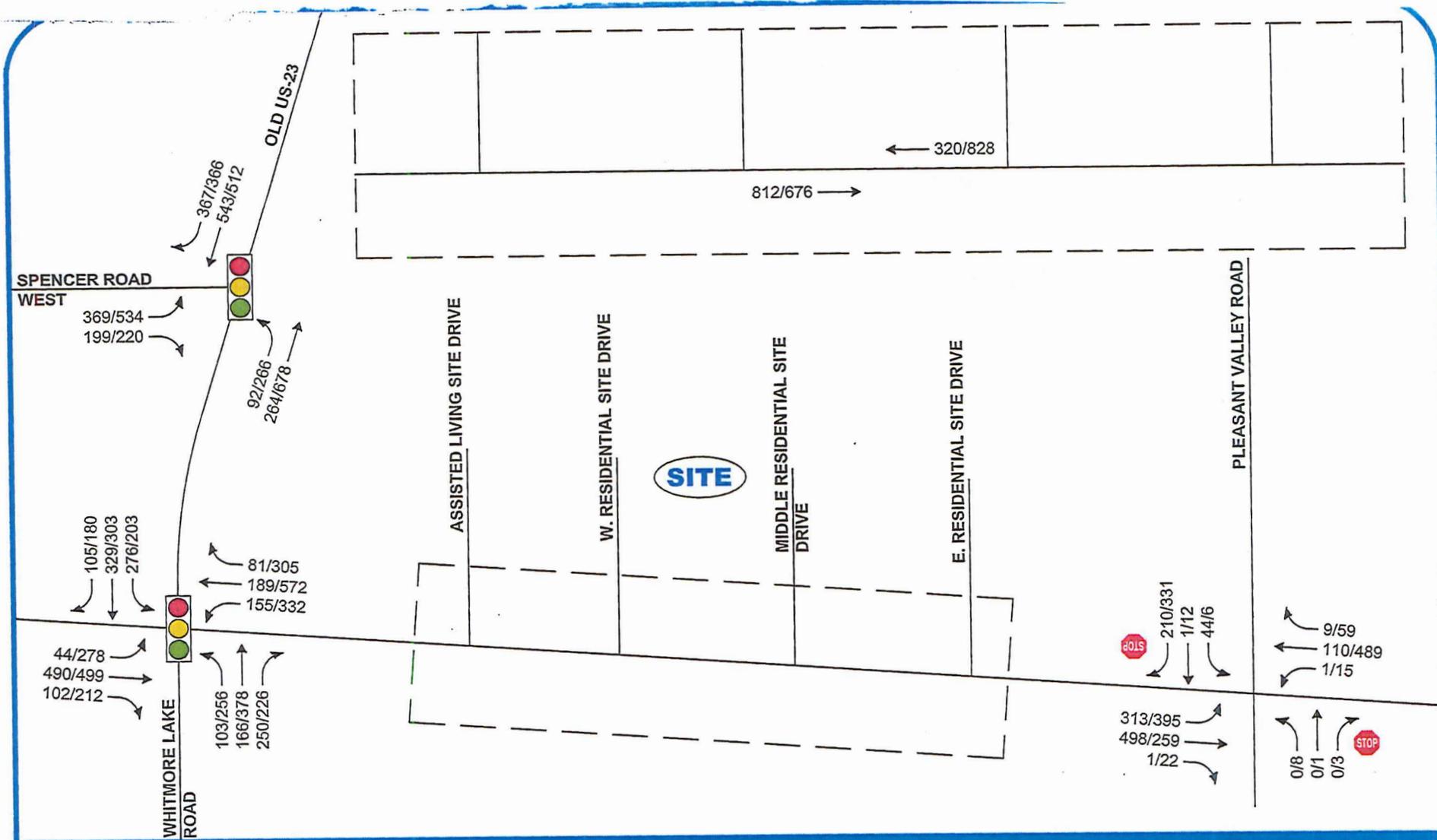


FIGURE 3
BACKGROUND TRAFFIC VOLUMES
 MULTI-FAMILY RESIDENTIAL COMMUNITY - BRIGHTON TOWNSHIP, MI

LEGEND

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



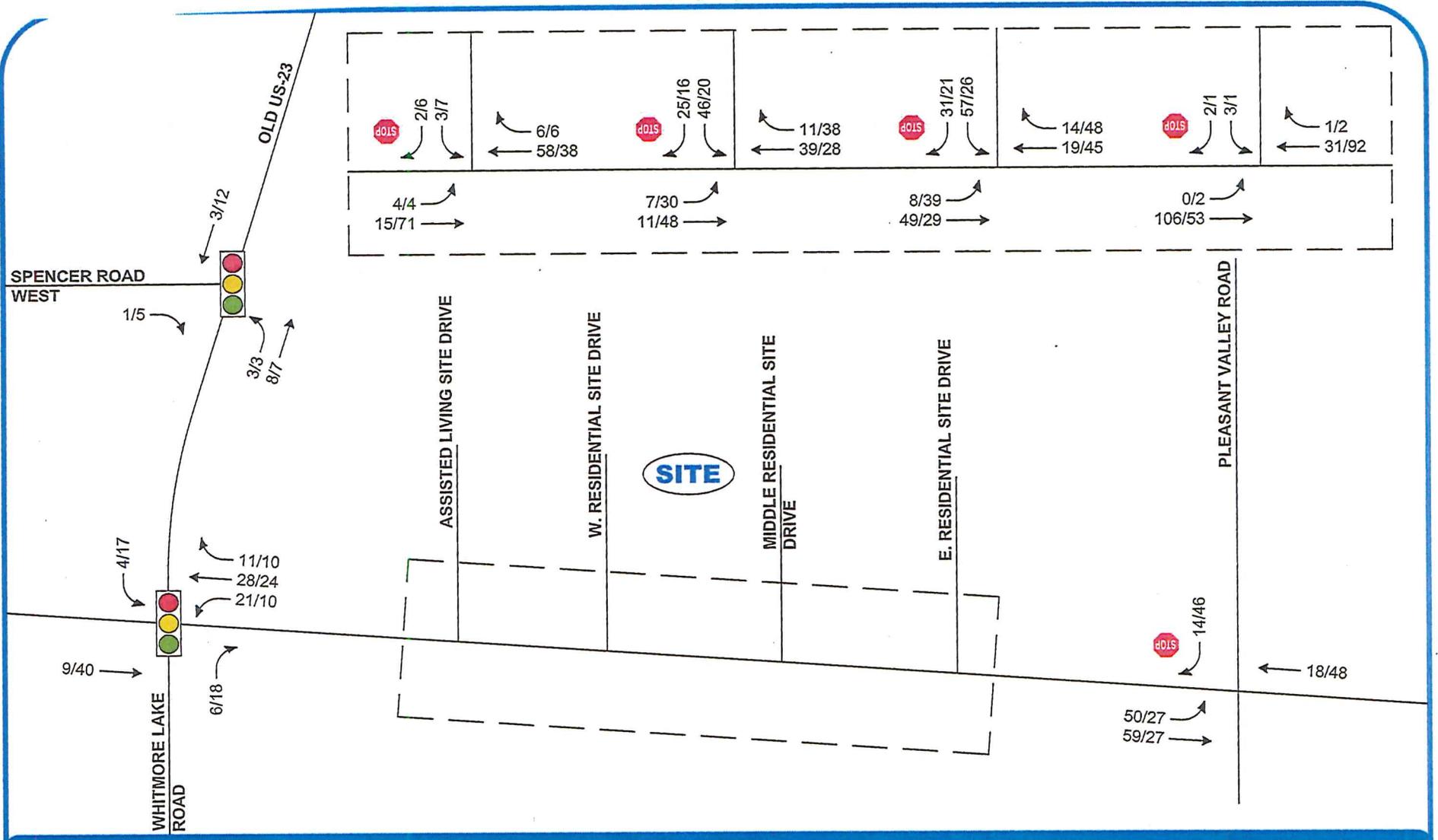


FIGURE 4
SITE-GENERATED TRAFFIC VOLUMES
 MULTI-FAMILY RESIDENTIAL COMMUNITY - BRIGHTON TOWNSHIP, MI

LEGEND

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



NORTH
 SCALE: NOT TO SCALE

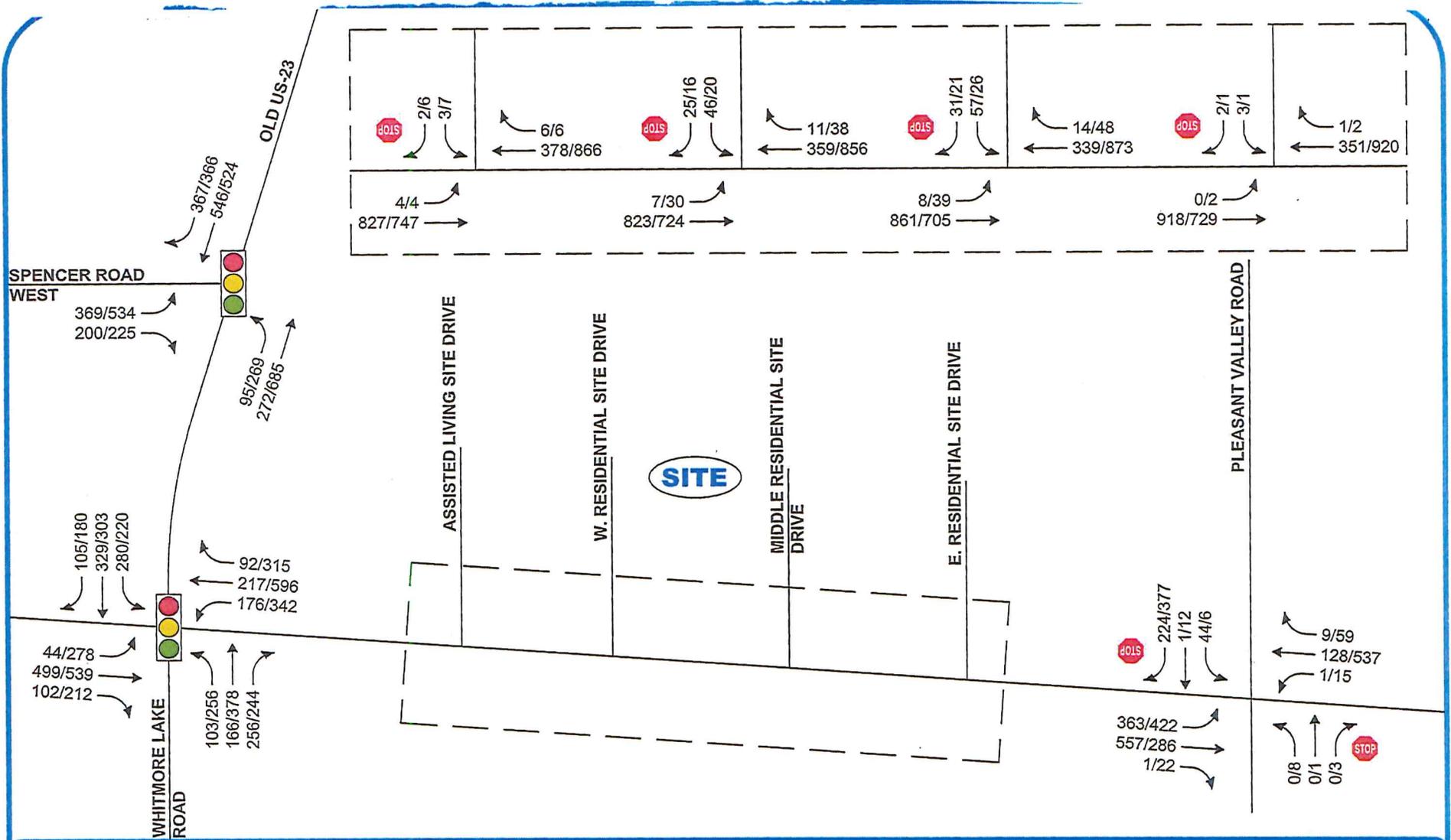


FIGURE 5
FUTURE TRAFFIC VOLUMES
 MULTI-FAMILY RESIDENTIAL COMMUNITY - BRIGHTON TOWNSHIP, MI

LEGEND

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



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

Start Time	Old US-23 Hwy. Southbound					Westbound					Old US-23 Hwy. Northbound					West Spencer Road Eastbound					Int. Total
	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. 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
Approch %	40.2	59.8	0	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

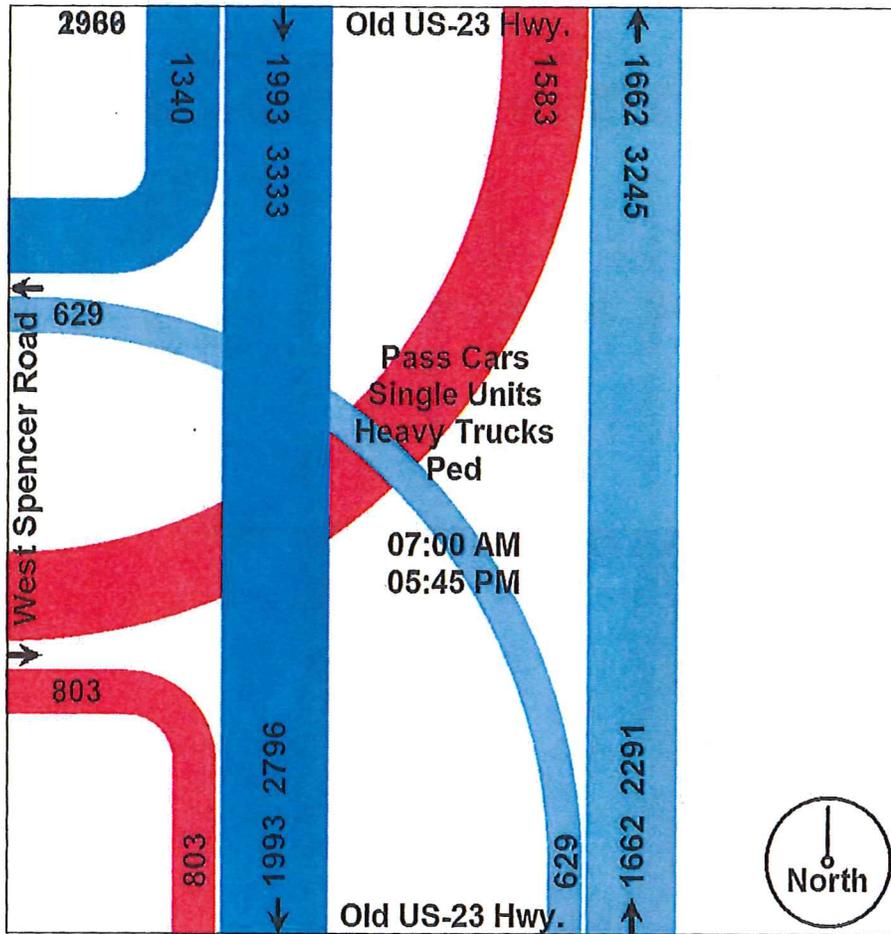
Traffic Study Performed For:

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:

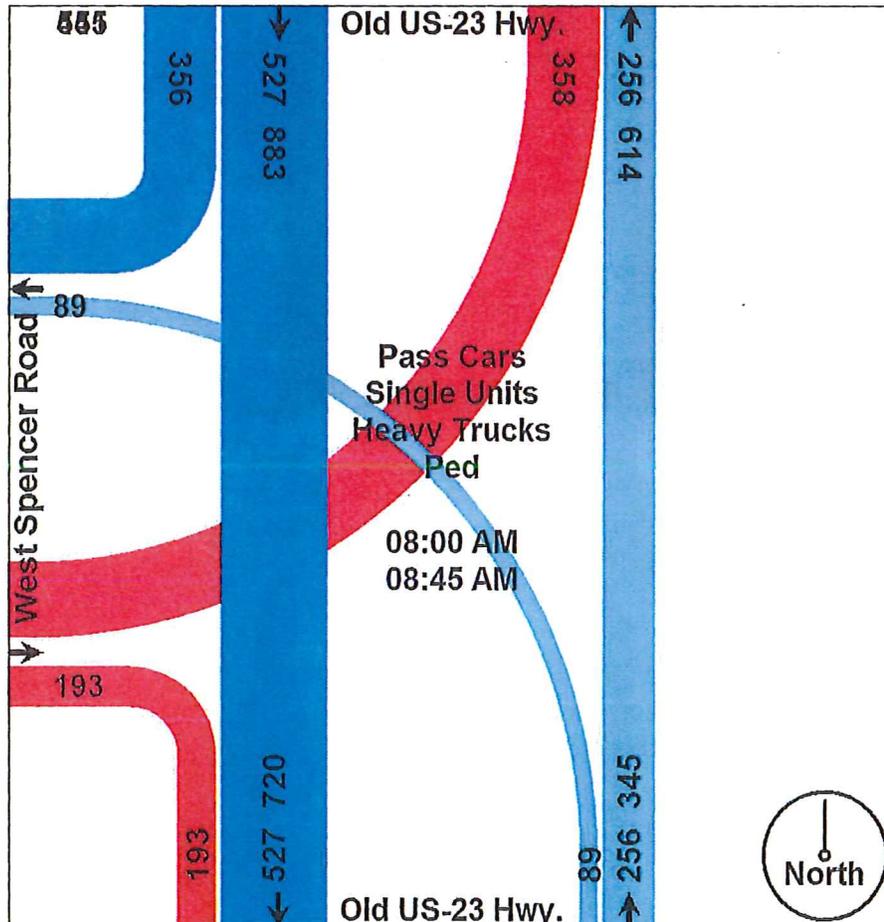
Fleis & VandenBrink



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

Start Time	Old US-23 Hwy. Southbound				Westbound				Old US-23 Hwy. Northbound				West Spencer Road Eastbound				Int. Total
	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. 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)

tdcounts.com

Phone: (586) 786-5407

Traffic Study Performed For:

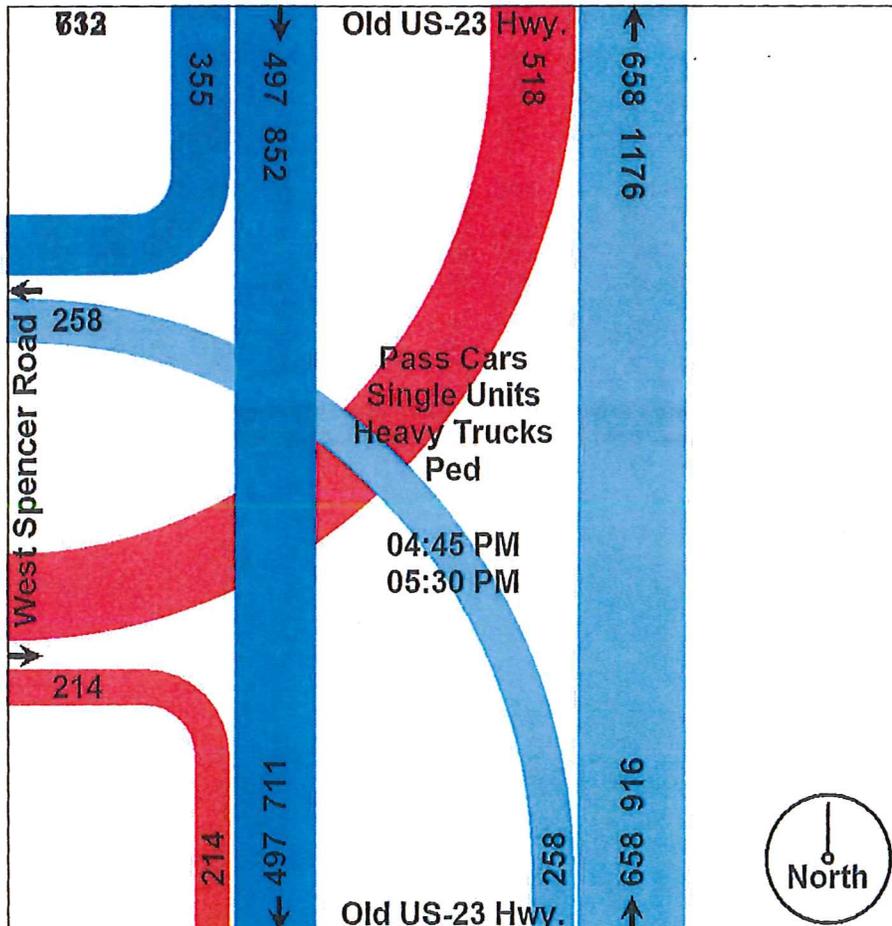
Fleis & VandenBrink



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

Start Time	Old US-23 Hwy. Southbound				Westbound				Old US-23 Hwy. Northbound				West Spencer Road Eastbound				Int. Total
	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. 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	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

Start Time	Old US-23 Hwy. Southbound					Grand River Road Westbound					Old US-23 Hwy. Northbound					Grand River Road Eastbound					Int. Total
	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. 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	84	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

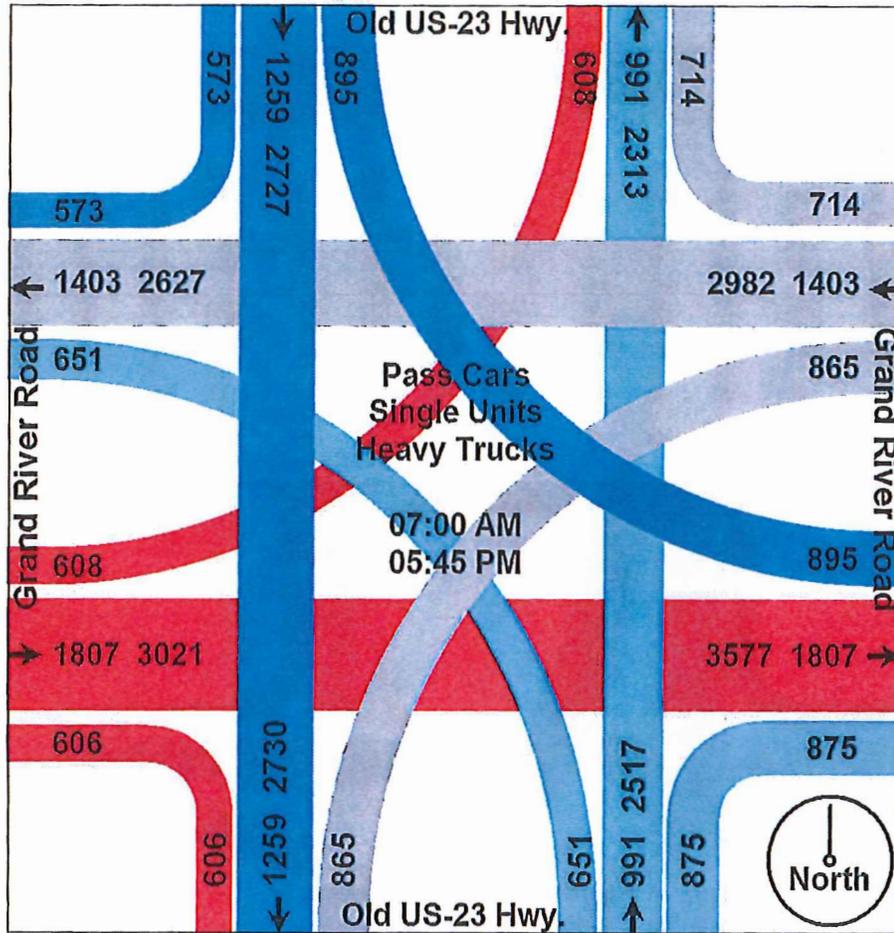
Traffic Study Performed For:

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:

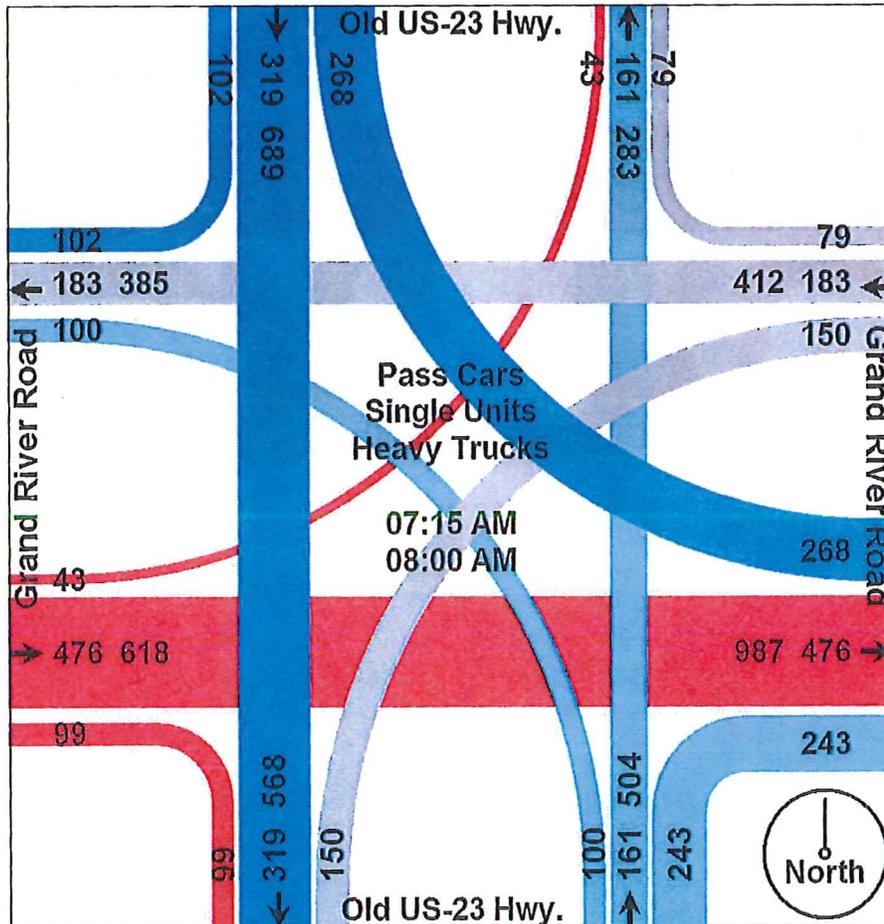
Fleis & VandenBrink



Project: Brighton Twp. Traffic Study
 Type: 4 Hr. Video Turning Movement Count
 Weather: Pf. 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

Start Time	Old US-23 Hwy. Southbound				Grand River Road Westbound				Old US-23 Hwy. Northbound				Grand River Road Eastbound				Int. Total
	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. 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)

tdcounts.com

Phone: (586) 786-5407

Traffic Study Performed For:

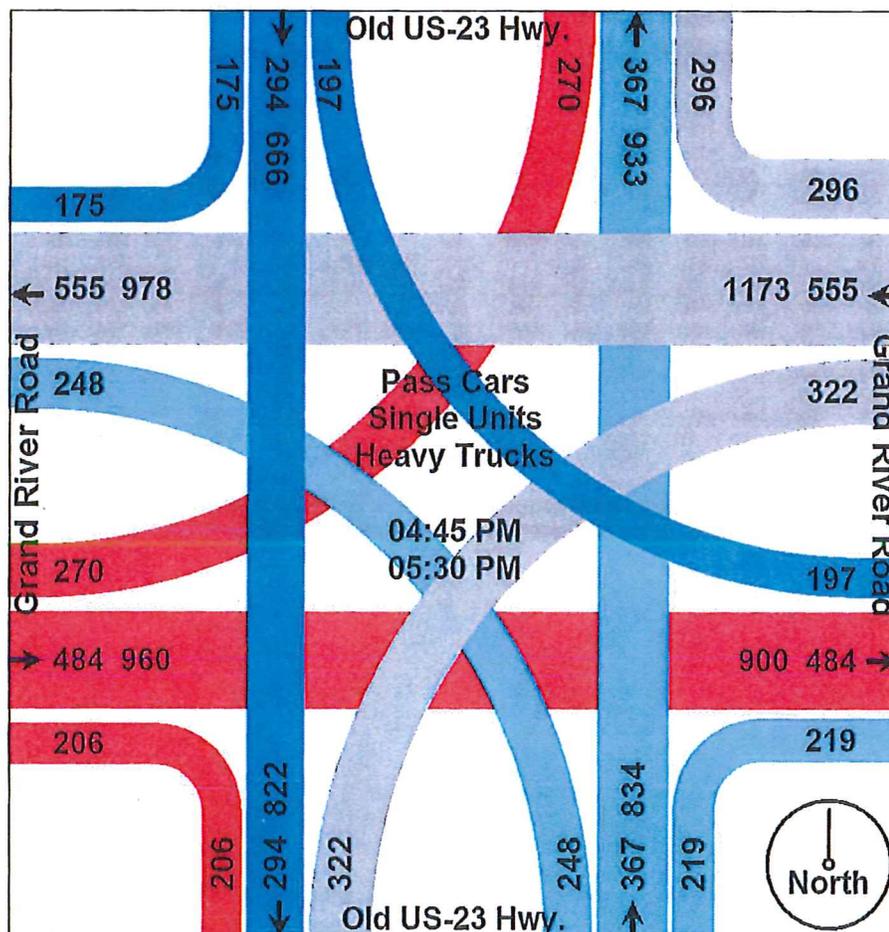
Fleis & VandenBrink



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

Start Time	Old US-23 Hwy. Southbound				Grand River Road Westbound				Old US-23 Hwy. Northbound				Grand River Road Eastbound				Int. Total
	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. 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)

tdcounts.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

Start Time	Pleasant Valley Road Southbound					Grand River Road Westbound					Bar None Restaurant Northbound					Grand River Road Eastbound					Int. Total
	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. 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

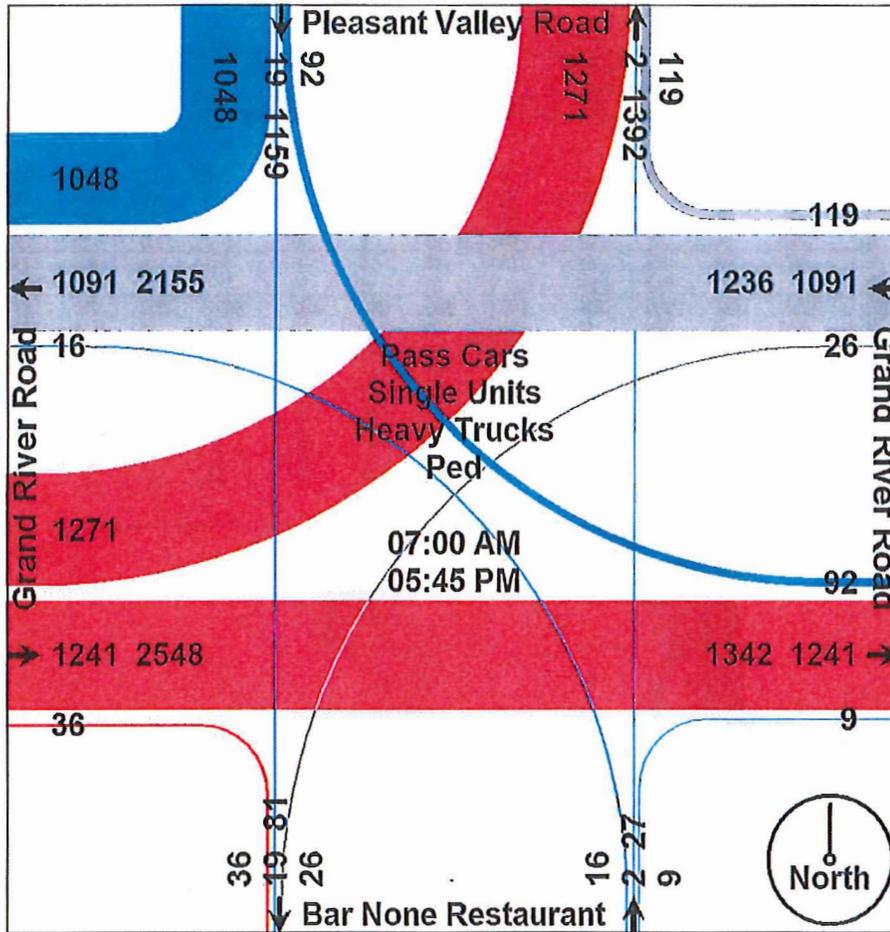
Traffic Study Performed For:

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:

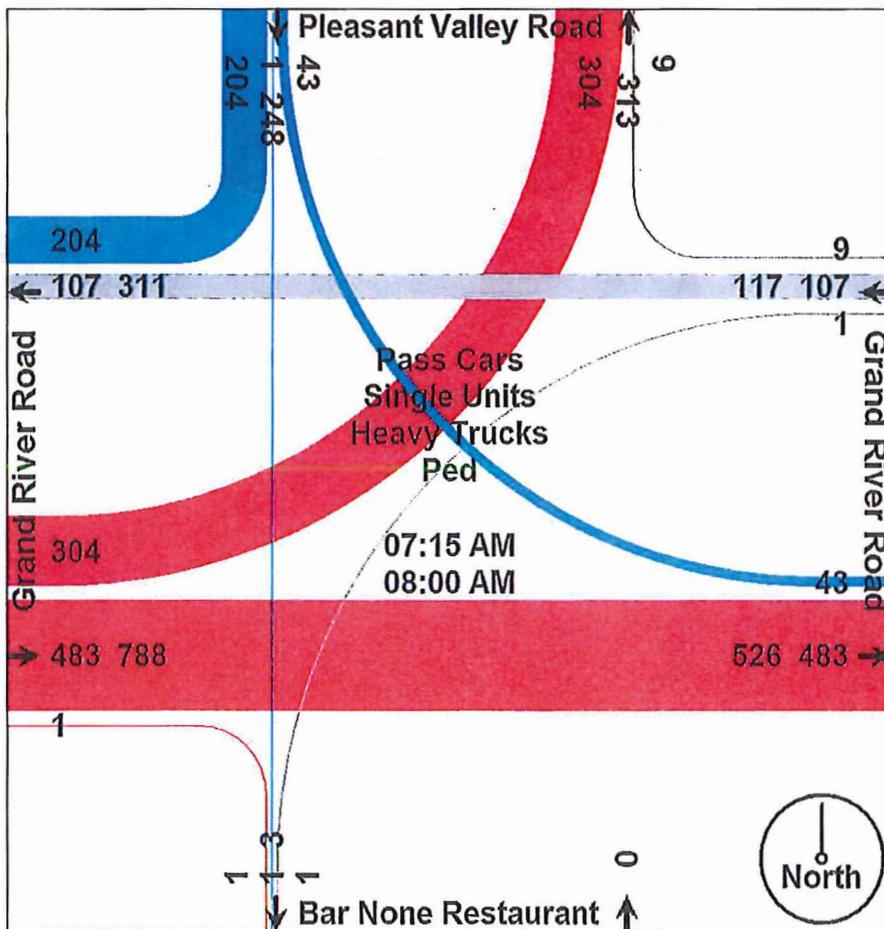
Fleis & VandenBrink



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

Start Time	Pleasant Valley Road Southbound				Grand River Road Westbound				Bar None Restaurant Northbound				Grand River Road Eastbound				Int. Total
	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. 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	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:

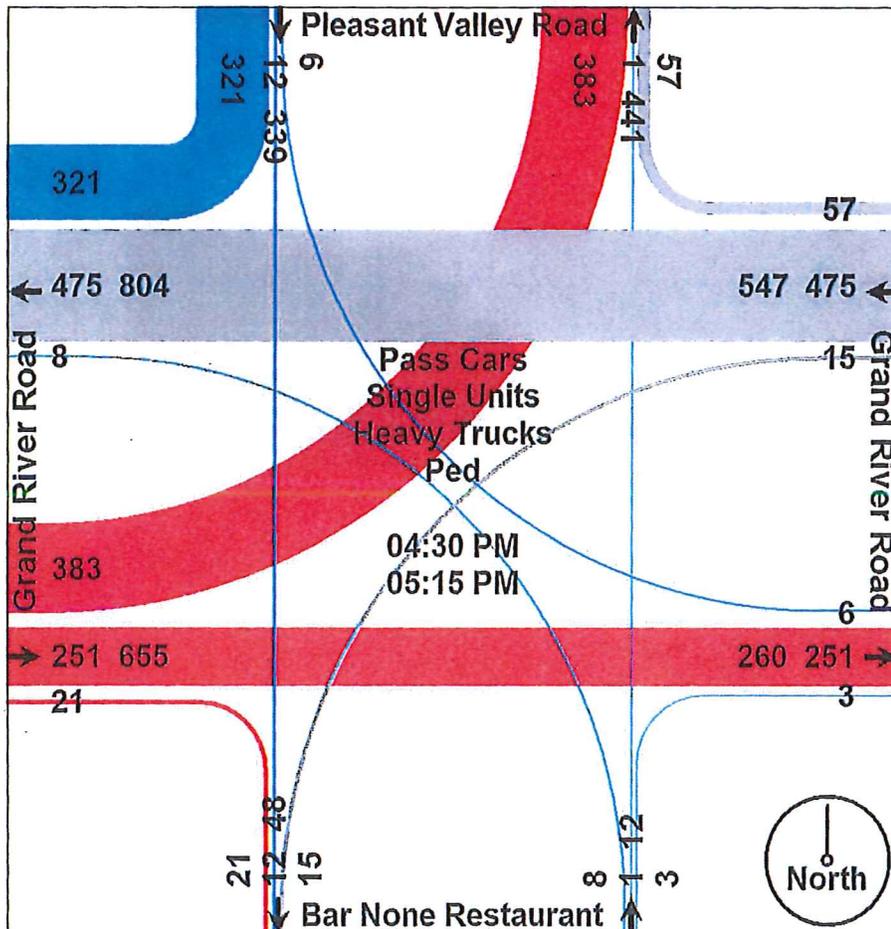
Fleis & VandenBrink



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

Start Time	Pleasant Valley Road Southbound				Grand River Road Westbound				Bar None Restaurant Northbound				Grand River Road Eastbound				Int. Total
	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. 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	.760	.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



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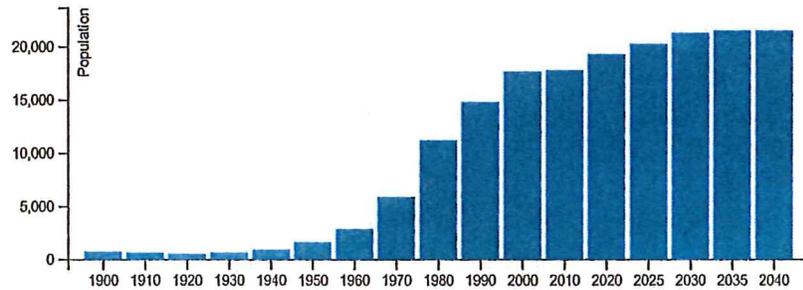


Census 2010 Population:
17,791
Area: 34.6 square miles

Population and Households

Link to American Community Survey (ACS) Profiles: 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.	Source: Michigan Department of Community Health Vital Statistics U.S. Census Bureau, and SEMCOG.
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	

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

HCM 2010 Signalized Intersection Summary
 1: Whitmore Lake Road/Old US-23 & Grand River Avenue

Existing Conditions
 AM Peak Hour

Movement												
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(l)	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

HCM 2010 Signalized Intersection Summary
 2: Old US-23 & Spencer Road West

Existing Conditions
 AM Peak Hour

								
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+l1), 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					

HCM 2010 TWSC
 3: Bar None Drive/Pleasant Valley Road & Grand River Avenue

Existing Conditions
 AM Peak Hour

Intersection

Int Delay, s/veh 6.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
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									
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

HCM 2010 Signalized Intersection Summary
 1: Whitmore Lake Road/Old US-23 & Grand River Avenue

Existing Conditions
 PM Peak Hour

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

HCM 2010 Signalized Intersection Summary
2: Old US-23 & Spencer Road West

Existing Conditions
PM Peak Hour

								
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+l1), 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					

HCM 2010 TWSC
 3: Bar None Drive/Pleasant Valley Road & Grand River Avenue

Existing Conditions
 PM Peak Hour

Intersection
 Int Delay, s/veh 15.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
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									
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

HCM 2010 Signalized Intersection Summary

Existing Conditions W / Improvements

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

AM Peak Hour

												
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												

HCM 2010 Signalized Intersection Summary
 3: Bar None Drive/Pleasant Valley Road & Grand River Avenue

Existing Conditions W / Improvements
 AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	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	4.4	0.0	0.0	1.8	0.1	0.0	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												

HCM 2010 Signalized Intersection Summary
 1: Whitmore Lake Road/Old US-23 & Grand River Avenue

Existing Conditions W / Improvements
 PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	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												

HCM 2010 Signalized Intersection Summary

Existing Conditions W / Improvements

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

PM Peak Hour

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(l)	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												

HCM 2010 Signalized Intersection Summary
 1: Whitmore Lake Road/Old US-23 & Grand River Avenue

Background Conditions
 AM Peak Hour

Movement												
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	44	490	102	155	189	81	103	166	250	276	329	105
Future Volume (veh/h)	44	490	102	155	189	81	103	166	250	276	329	105
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	49	551	115	165	201	86	137	221	333	297	354	113
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	468	702	146	250	385	159	251	315	523	403	426	488
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	3042	633	1832	2523	1043	1849	1942	1650	1849	1942	1650
Grp Volume(v), veh/h	49	333	333	165	144	143	137	221	333	297	354	113
Grp Sat Flow(s),veh/h/ln	1849	1845	1830	1832	1827	1739	1849	1942	1650	1849	1942	1650
Q Serve(g_s), s	0.0	11.1	11.2	1.7	4.7	5.0	0.6	7.0	1.2	4.3	11.4	0.0
Cycle Q Clear(g_c), s	0.0	11.1	11.2	1.7	4.7	5.0	0.6	7.0	1.2	4.3	11.4	0.0
Prop In Lane	1.00		0.35	1.00		0.60	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	468	426	422	250	279	266	251	315	523	403	426	488
V/C Ratio(X)	0.10	0.78	0.79	0.66	0.51	0.54	0.55	0.70	0.64	0.74	0.83	0.23
Avail Cap(c_a), veh/h	521	535	531	446	530	505	534	534	709	580	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	20.8	23.6	23.7	28.1	25.5	25.6	28.0	25.9	19.1	25.0	24.4	17.4
Incr Delay (d2), s/veh	0.1	5.9	6.1	3.0	1.5	1.7	1.8	2.8	1.3	2.9	8.8	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	6.3	6.4	3.0	2.5	2.5	2.4	4.0	5.2	5.3	7.1	1.5
LnGrp Delay(d),s/veh	20.9	29.5	29.8	31.1	27.0	27.3	29.8	28.8	20.4	27.9	33.2	17.7
LnGrp LOS	C	C	C	C	C	C	C	C	C	C	C	B
Approach Vol, veh/h		715			452			691			764	
Approach Delay, s/veh		29.1			28.6			25.0			28.8	
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	16.6	16.5	11.5	20.9	11.5	21.6	15.2	17.1				
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+l1), s	2.0	7.0	2.6	13.4	3.7	13.2	6.3	9.0				
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			27.8									
HCM 2010 LOS			C									

Notes

HCM 2010 Signalized Intersection Summary
 2: Old US-23 & Spencer Road West

Background Conditions
 AM Peak Hour

Movement	EBL	EBR	NBL	NBT	SBT	SBR		
Lane Configurations								
Traffic Volume (veh/h)	369	199	92	264	543	367		
Future Volume (veh/h)	369	199	92	264	543	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	326	631	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	680	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	326	631	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	2.2	10.2	12.4		
Cycle Q Clear(g_c), s	9.0	0.0	0.0	2.2	10.2	12.4		
Prop In Lane	1.00	1.00	1.00			1.00		
Lane Grp Cap(c), veh/h	654	741	680	2620	1438	920		
V/C Ratio(X)	0.65	0.31	0.17	0.12	0.44	0.46		
Avail Cap(c_a), veh/h	1076	935	680	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	14.5	3.7	17.4	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	5.1	1.7	1.2	5.2	8.3		
LnGrp Delay(d),s/veh	31.1	13.7	14.7	3.8	18.4	11.6		
LnGrp LOS	C	B	B	A	B	B		
Approach Vol, veh/h	653			440	1058			
Approach Delay, s/veh	25.0			6.6	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		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		4.2		11.0	2.0	14.4		
Green Ext Time (p_c), s		2.6		1.9	1.2	4.8		
Intersection Summary								
HCM 2010 Ctrl Delay			16.6					
HCM 2010 LOS			B					

HCM 2010 TWSC
 3: Bar None Drive/Pleasant Valley Road & Grand River Avenue

Background Conditions
 AM Peak Hour

Intersection

Int Delay, s/veh 6.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Traffic Vol, veh/h	313	498	1	1	110	9	0	0	0	44	1	210
Future Vol, veh/h	313	498	1	1	110	9	0	0	0	44	1	210
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									
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	364	579	1	1	128	10	0	0	0	46	1	221

Major/Minor	Major1	Major2	Minor1	Minor2								
Conflicting Flow All	128	0	0	579	0	0	1438	1437	579	1437	1437	128
Stage 1	-	-	-	-	-	-	1307	1307	-	130	130	-
Stage 2	-	-	-	-	-	-	131	130	-	1307	1307	-
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	1452	-	-	970	-	-	111	133	515	110	133	919
Stage 1	-	-	-	-	-	-	196	230	-	871	787	-
Stage 2	-	-	-	-	-	-	873	789	-	195	228	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1452	-	-	970	-	-	67	100	515	89	100	919
Mov Cap-2 Maneuver	-	-	-	-	-	-	67	100	-	89	100	-
Stage 1	-	-	-	-	-	-	147	172	-	653	786	-
Stage 2	-	-	-	-	-	-	661	788	-	146	171	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	3.2	0.1	0	23.3
HCM LOS			A	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	-	1452	-	-	970	-	-	89	919
HCM Lane V/C Ratio	-	0.251	-	-	0.001	-	-	0.532	0.241
HCM Control Delay (s)	0	8.3	-	-	8.7	-	-	84.3	10.2
HCM Lane LOS	A	A	-	-	A	-	-	F	B
HCM 95th %tile Q(veh)	-	1	-	-	0	-	-	2.4	0.9

HCM 2010 Signalized Intersection Summary
 1: Whitmore Lake Road/Old US-23 & Grand River Avenue

Background Conditions
 PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	278	499	212	332	572	305	256	378	226	203	303	180
Future Volume (veh/h)	278	499	212	332	572	305	256	378	226	203	303	180
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	323	580	247	373	643	343	284	420	251	226	337	200
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	355	655	278	428	665	355	356	466	657	256	390	636
Arrive On Green	0.15	0.25	0.25	0.18	0.28	0.28	0.14	0.24	0.24	0.10	0.20	0.20
Sat Flow, veh/h	1886	2574	1094	1886	2372	1266	1886	1980	1683	1886	1980	1683
Grp Volume(v), veh/h	323	424	403	373	510	476	284	420	251	226	337	200
Grp Sat Flow(s),veh/h/ln	1886	1881	1787	1886	1881	1757	1886	1980	1683	1886	1980	1683
Q Serve(g_s), s	15.3	24.7	24.8	16.4	30.6	30.6	10.9	23.5	0.0	9.6	18.8	0.0
Cycle Q Clear(g_c), s	15.3	24.7	24.8	16.4	30.6	30.6	10.9	23.5	0.0	9.6	18.8	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	355	479	455	428	527	492	356	466	657	256	390	636
V/C Ratio(X)	0.91	0.89	0.89	0.87	0.97	0.97	0.80	0.90	0.38	0.88	0.86	0.31
Avail Cap(c_a), veh/h	393	527	501	428	527	492	356	520	702	261	520	746
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	41.0	41.0	43.0	40.6	40.6	44.9	42.4	25.0	49.0	44.4	25.1
Incr Delay (d2), s/veh	23.5	15.4	16.3	17.5	30.9	32.2	12.0	17.6	0.4	27.7	11.0	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	12.3	14.9	14.3	13.4	20.4	19.2	9.7	15.1	5.7	9.0	11.5	4.5
LnGrp Delay(d),s/veh	69.3	56.4	57.3	60.5	71.5	72.8	57.0	60.0	25.3	76.7	55.4	25.4
LnGrp LOS	E	E	E	E	E	E	E	E	C	E	E	C
Approach Vol, veh/h		1150			1359			955			763	
Approach Delay, s/veh		60.3			68.9			50.0			53.8	
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	24.2	38.5	22.5	29.0	27.1	35.6	18.2	33.4				
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	* 32	* 12	* 30	* 20	* 32	* 12	* 30				
Max Q Clear Time (g_c+I1), s	17.3	32.6	12.9	20.8	18.4	26.8	11.6	25.5				
Green Ext Time (p_c), s	0.3	0.0	0.0	1.7	0.4	2.2	0.0	1.4				

Intersection Summary

HCM 2010 Ctrl Delay	59.6
HCM 2010 LOS	E

Notes

HCM 2010 Signalized Intersection Summary
 2: Old US-23 & Spencer Road West

Background Conditions
 PM Peak Hour

								
Movement	EBL	EBR	NBL	NBT	SBT	SBR		
Lane Configurations	 		 	 	 			
Traffic Volume (veh/h)	534	220	266	678	512	366		
Future Volume (veh/h)	534	220	266	678	512	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	753	557	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	671	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	753	557	398		
Grp Sat Flow(s),veh/h/ln	1829	1683	1905	1900	1881	1683		
Q Serve(g_s), s	11.4	0.0	0.0	6.3	8.3	9.9		
Cycle Q Clear(g_c), s	11.4	0.0	0.0	6.3	8.3	9.9		
Prop In Lane	1.00	1.00	1.00			1.00		
Lane Grp Cap(c), veh/h	786	778	671	2594	1510	1012		
V/C Ratio(X)	0.71	0.30	0.44	0.29	0.37	0.39		
Avail Cap(c_a), veh/h	992	873	671	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	19.3	5.0	16.8	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	3.3	4.5	7.3		
LnGrp Delay(d),s/veh	30.9	13.6	19.9	5.3	17.5	9.5		
LnGrp LOS	C	B	B	A	B	A		
Approach Vol, veh/h	794			1049	955			
Approach Delay, s/veh	25.9			9.4	14.2			
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		8.3		13.4	2.0	11.9		
Green Ext Time (p_c), s		7.3		1.7	4.0	4.5		
Intersection Summary								
HCM 2010 Ctrl Delay			15.7					
HCM 2010 LOS			B					

HCM 2010 TWSC
3: Bar None Drive/Pleasant Valley Road & Grand River Avenue

Background Conditions
PM Peak Hour

Intersection

Int Delay, s/veh 17.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Traffic Vol, veh/h	395	259	22	15	489	59	8	1	3	6	12	331
Future Vol, veh/h	395	259	22	15	489	59	8	1	3	6	12	331
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									
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	454	298	25	17	569	69	13	2	5	7	13	360

Major/Minor	Major1	Major2	Minor1	Minor2								
Conflicting Flow All	569	0	0	298	0	0	1816	1809	298	1812	1809	569
Stage 1	-	-	-	-	-	-	1206	1206	-	603	603	-
Stage 2	-	-	-	-	-	-	610	603	-	1209	1206	-
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	1003	-	-	1263	-	-	61	80	746	61	79	524
Stage 1	-	-	-	-	-	-	226	259	-	488	490	-
Stage 2	-	-	-	-	-	-	485	492	-	224	258	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1003	-	-	1263	-	-	~ 10	43	746	38	43	524
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 10	43	-	38	43	-
Stage 1	-	-	-	-	-	-	124	142	-	267	483	-
Stage 2	-	-	-	-	-	-	146	485	-	120	141	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	6.7	0.2	\$ 706.8	32.3
HCM LOS			F	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	15	1003	-	-	1263	-	-	41	524
HCM Lane V/C Ratio	1.333	0.453	-	-	0.014	-	-	0.477	0.687
HCM Control Delay (s)	\$ 706.8	11.5	-	-	7.9	-	-	156	25.6
HCM Lane LOS	F	B	-	-	A	-	-	F	D
HCM 95th %ile Q(veh)	3.1	2.4	-	-	0	-	-	1.7	5.2

Notes

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

HCM 2010 Signalized Intersection Summary
 1: Whitmore Lake Road/Old US-23 & Grand River Avenue

Future Conditions
 AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	44	499	102	176	217	92	103	166	256	280	329	105
Future Volume (veh/h)	44	499	102	176	217	92	103	166	256	280	329	105
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	49	561	115	187	231	98	137	221	341	301	354	113
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	456	709	145	249	385	158	251	316	526	404	426	488
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	3053	624	1832	2527	1040	1849	1942	1650	1849	1942	1650
Grp Volume(v), veh/h	49	338	338	187	165	164	137	221	341	301	354	113
Grp Sat Flow(s),veh/h/ln	1849	1845	1832	1832	1827	1740	1849	1942	1650	1849	1942	1650
Q Serve(g_s), s	0.0	11.3	11.4	2.5	5.5	5.8	0.6	7.1	1.4	4.4	11.4	0.0
Cycle Q Clear(g_c), s	0.0	11.3	11.4	2.5	5.5	5.8	0.6	7.1	1.4	4.4	11.4	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	456	428	425	249	278	265	251	316	526	404	426	488
V/C Ratio(X)	0.11	0.79	0.79	0.75	0.59	0.62	0.55	0.70	0.65	0.75	0.83	0.23
Avail Cap(c_a), veh/h	505	534	530	445	529	504	532	532	710	581	532	578
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	21.5	23.7	23.7	28.4	25.9	26.0	28.0	26.0	19.2	25.1	24.5	17.5
Incr Delay (d2), s/veh	0.1	6.3	6.6	4.5	2.0	2.3	1.9	2.8	1.4	3.1	8.9	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	6.5	6.5	3.6	3.0	3.0	2.5	4.0	5.3	5.4	7.1	1.6
LnGrp Delay(d),s/veh	21.6	30.0	30.3	32.9	27.9	28.4	29.9	28.8	20.5	28.2	33.3	17.7
LnGrp LOS	C	C	C	C	C	C	C	C	C	C	C	B
Approach Vol, veh/h		725			516			699			768	
Approach Delay, s/veh		29.5			29.9			25.0			29.0	
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	20.9	11.5	21.7	15.2	17.2				
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	* 12	* 19	* 15	* 18	* 12	* 19	* 15	* 18				
Max Q Clear Time (g_c+I1), s	2.0	7.8	2.6	13.4	4.5	13.4	6.4	9.1				
Green Ext Time (p_c), s	0.4	1.3	1.0	1.0	0.4	1.9	0.9	1.6				
Intersection Summary												
HCM 2010 Ctrl Delay			28.3									
HCM 2010 LOS			C									
Notes												

HCM 2010 Signalized Intersection Summary
 2: Old US-23 & Spencer Road West

Future Conditions
 AM Peak Hour

								
Movement	EBL	EBR	NBL	NBT	SBT	SBR		
Lane Configurations	 			 	 			
Traffic Volume (veh/h)	369	200	95	272	546	367		
Future Volume (veh/h)	369	200	95	272	546	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	117	336	635	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	684	2619	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	117	336	635	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	10.3	12.4		
Cycle Q Clear(g_c), s	9.0	0.0	0.0	2.3	10.3	12.4		
Prop In Lane	1.00	1.00	1.00			1.00		
Lane Grp Cap(c), veh/h	654	741	684	2619	1438	920		
V/C Ratio(X)	0.65	0.31	0.17	0.13	0.44	0.46		
Avail Cap(c_a), veh/h	1076	935	684	2619	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	30.0	13.5	14.5	3.7	17.4	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	5.1	1.8	1.2	5.3	8.3		
LnGrp Delay(d),s/veh	31.1	13.7	14.7	3.8	18.4	11.6		
LnGrp LOS	C	B	B	A	B	B		
Approach Vol, veh/h	654			453	1062			
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+l1), 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			16.6					
HCM 2010 LOS			B					

HCM 2010 TWSC
 3: Bar None Drive/Pleasant Valley Road & Grand River Avenue

Future Conditions
 AM Peak Hour

Intersection

Int Delay, s/veh 9.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Traffic Vol, veh/h	363	557	1	1	128	9	0	0	0	44	1	224
Future Vol, veh/h	363	557	1	1	128	9	0	0	0	44	1	224
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									
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	422	648	1	1	149	10	0	0	0	46	1	236

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	149	0	0	648	0	0	1644	1643	648	1643	1643	149
Stage 1	-	-	-	-	-	-	1492	1492	-	151	151	-
Stage 2	-	-	-	-	-	-	152	151	-	1492	1492	-
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	1426	-	-	914	-	-	80	100	470	79	99	895
Stage 1	-	-	-	-	-	-	154	187	-	849	770	-
Stage 2	-	-	-	-	-	-	850	772	-	153	186	-
Platoon blocked, %												
Mov Cap-1 Maneuver	1426	-	-	914	-	-	45	70	470	61	70	895
Mov Cap-2 Maneuver	-	-	-	-	-	-	45	70	-	61	70	-
Stage 1	-	-	-	-	-	-	108	132	-	598	769	-
Stage 2	-	-	-	-	-	-	625	771	-	108	131	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	3.4	0.1	0	36.5
HCM LOS			A	E

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	-	1426	-	-	914	-	-	61	895
HCM Lane V/C Ratio	-	0.296	-	-	0.001	-	-	0.777	0.263
HCM Control Delay (s)	0	8.6	-	-	8.9	-	-	165.9	10.5
HCM Lane LOS	A	A	-	-	A	-	-	F	B
HCM 95th %tile Q(veh)	-	1.2	-	-	0	-	-	3.4	1.1

HCM 2010 TWSC
4: Grand River Avenue & Assisted Living Site Drive

Future Conditions
AM Peak Hour

Intersection

Int Delay, s/veh 0

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Traffic Vol, veh/h	4	827	378	6	3	2
Future Vol, veh/h	4	827	378	6	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, %	3	3	4	4	2	2
Mvmt Flow	5	962	406	6	3	2

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	413	0	900
Stage 1	-	-	410
Stage 2	-	-	490
Critical Hdwy	4.16	-	6.84
Critical Hdwy Stg 1	-	-	5.84
Critical Hdwy Stg 2	-	-	5.84
Follow-up Hdwy	2.23	-	3.52
Pot Cap-1 Maneuver	1135	-	278
Stage 1	-	-	638
Stage 2	-	-	581
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	1135	-	277
Mov Cap-2 Maneuver	-	-	403
Stage 1	-	-	638
Stage 2	-	-	578

Approach	EB	WB	SB
HCM Control Delay, s	0	0	12.2
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1135	-	-	-	503
HCM Lane V/C Ratio	0.004	-	-	-	0.011
HCM Control Delay (s)	8.2	-	-	-	12.2
HCM Lane LOS	A	-	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0

HCM 2010 TWSC
 5: Grand River Avenue & W. Residential Site Drive

Future Conditions
 AM Peak Hour

Intersection

Int Delay, s/veh 0.8

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Traffic Vol, veh/h	7	823	359	11	46	25
Future Vol, veh/h	7	823	359	11	46	25
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, %	3	3	4	4	2	2
Mvmt Flow	8	957	386	12	50	27

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	398	0	887
Stage 1	-	-	392
Stage 2	-	-	495
Critical Hdwy	4.16	-	6.84
Critical Hdwy Stg 1	-	-	5.84
Critical Hdwy Stg 2	-	-	5.84
Follow-up Hdwy	2.23	-	3.52
Pot Cap-1 Maneuver	1150	-	284
Stage 1	-	-	652
Stage 2	-	-	578
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	1150	-	282
Mov Cap-2 Maneuver	-	-	406
Stage 1	-	-	652
Stage 2	-	-	574

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)	1150	-	-	-	492
HCM Lane V/C Ratio	0.007	-	-	-	0.157
HCM Control Delay (s)	8.2	-	-	-	13.7
HCM Lane LOS	A	-	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.6

HCM 2010 TWSC
6: Grand River Avenue & Middle Residential Site Drive

Future Conditions
AM Peak Hour

Intersection

Int Delay, s/veh 1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Traffic Vol, veh/h	8	861	339	14	57	31
Future Vol, veh/h	8	861	339	14	57	31
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, %	3	3	4	4	2	2
Mvmt Flow	9	1001	365	15	62	34

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	380	0	891
Stage 1	-	-	372
Stage 2	-	-	519
Critical Hdwy	4.13	-	6.63
Critical Hdwy Stg 1	-	-	5.43
Critical Hdwy Stg 2	-	-	5.83
Follow-up Hdwy	2.227	-	3.519
Pot Cap-1 Maneuver	1173	-	297
Stage 1	-	-	696
Stage 2	-	-	563
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	1173	-	295
Mov Cap-2 Maneuver	-	-	415
Stage 1	-	-	696
Stage 2	-	-	559

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	14.4
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1173	-	-	-	480
HCM Lane V/C Ratio	0.008	-	-	-	0.199
HCM Control Delay (s)	8.1	-	-	-	14.4
HCM Lane LOS	A	-	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.7

HCM 2010 TWSC
7: Grand River Avenue & E. Residential Site Drive

Future Conditions
AM Peak Hour

Intersection

Int Delay, s/veh 0.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Traffic Vol, veh/h	0	918	351	1	3	2
Future Vol, veh/h	0	918	351	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	200	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	86	86	93	93	92	92
Heavy Vehicles, %	3	3	4	4	2	2
Mvmt Flow	0	1067	377	1	3	2

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	378	0	378
Stage 1	-	-	-
Stage 2	-	-	1067
Critical Hdwy	4.13	-	6.22
Critical Hdwy Stg 1	-	-	5.42
Critical Hdwy Stg 2	-	-	5.42
Follow-up Hdwy	2.227	-	3.318
Pot Cap-1 Maneuver	1175	-	669
Stage 1	-	-	693
Stage 2	-	-	331
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	1175	-	669
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	693
Stage 2	-	-	331

Approach	EB	WB	SB
HCM Control Delay, s	0	0	15.7
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1175	-	-	-	343
HCM Lane V/C Ratio	-	-	-	-	0.016
HCM Control Delay (s)	0	-	-	-	15.7
HCM Lane LOS	A	-	-	-	C
HCM 95th %tile Q(veh)	0	-	-	-	0

HCM 2010 Signalized Intersection Summary
 1: Whitmore Lake Road/Old US-23 & Grand River Avenue

Future Conditions
 PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗	↗	↖	↗	↗
Traffic Volume (veh/h)	278	539	212	342	596	315	256	378	244	220	303	180
Future Volume (veh/h)	278	539	212	342	596	315	256	378	244	220	303	180
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	323	627	247	384	670	354	284	420	271	244	337	200
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	359	691	272	410	661	349	361	465	661	259	390	623
Arrive On Green	0.16	0.26	0.26	0.17	0.28	0.28	0.14	0.24	0.24	0.10	0.20	0.20
Sat Flow, veh/h	1886	2639	1039	1886	2381	1258	1886	1980	1683	1886	1980	1683
Grp Volume(v), veh/h	323	447	427	384	529	495	284	420	271	244	337	200
Grp Sat Flow(s),veh/h/ln	1886	1881	1797	1886	1881	1758	1886	1980	1683	1886	1980	1683
Q Serve(g_s), s	15.5	26.5	26.5	17.9	32.0	32.0	10.9	23.7	0.0	11.0	19.0	0.0
Cycle Q Clear(g_c), s	15.5	26.5	26.5	17.9	32.0	32.0	10.9	23.7	0.0	11.0	19.0	0.0
Prop In Lane	1.00		0.58	1.00		0.72	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	359	493	471	410	522	488	361	465	661	259	390	623
V/C Ratio(X)	0.90	0.91	0.91	0.94	1.01	1.01	0.79	0.90	0.41	0.94	0.86	0.32
Avail Cap(c_a), veh/h	390	522	499	411	522	488	361	516	703	259	516	730
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	45.9	41.2	41.2	44.7	41.6	41.6	45.1	42.8	25.3	49.7	44.8	26.0
Incr Delay (d2), s/veh	22.0	18.9	19.7	28.7	42.7	44.1	11.1	18.0	0.4	40.4	11.4	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	12.2	16.4	15.7	15.3	22.7	21.4	9.7	15.3	6.2	10.6	11.6	4.6
LnGrp Delay(d),s/veh	67.9	60.0	60.9	73.5	84.3	85.7	56.2	60.8	25.8	90.2	56.2	26.2
LnGrp LOS	E	E	E	E	F	F	E	E	C	F	E	C
Approach Vol, veh/h		1197			1408			975			781	
Approach Delay, s/veh		62.4			81.8			49.7			59.1	
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	24.6	38.5	22.9	29.2	26.4	36.7	18.5	33.6				
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	*20	*32	*12	*30	*20	*32	*12	*30				
Max Q Clear Time (g_c+I1), s	17.5	34.0	12.9	21.0	19.9	28.5	13.0	25.7				
Green Ext Time (p_c), s	0.7	0.0	0.0	1.7	0.0	1.7	0.0	1.4				

Intersection Summary

HCM 2010 Ctrl Delay	65.3
HCM 2010 LOS	E

Notes

HCM 2010 Signalized Intersection Summary
2: Old US-23 & Spencer Road West

Future Conditions
PM Peak Hour

								
Movement	EBL	EBR	NBL	NBT	SBT	SBR		
Lane Configurations								
Traffic Volume (veh/h)	534	225	269	685	524	366		
Future Volume (veh/h)	534	225	269	685	524	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	761	570	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	674	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	761	570	398		
Grp Sat Flow(s),veh/h/ln	1829	1683	1905	1900	1881	1683		
Q Serve(g_s), s	11.4	0.0	0.0	6.4	8.6	9.9		
Cycle Q Clear(g_c), s	11.4	0.0	0.0	6.4	8.6	9.9		
Prop In Lane	1.00	1.00	1.00			1.00		
Lane Grp Cap(c), veh/h	787	778	674	2593	1510	1012		
V/C Ratio(X)	0.71	0.30	0.44	0.29	0.38	0.39		
Avail Cap(c_a), veh/h	992	873	674	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	19.2	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	5.2	5.2	3.4	4.6	7.3		
LnGrp Delay(d),s/veh	30.9	13.7	19.9	5.3	17.6	9.5		
LnGrp LOS	C	B	B	A	B	A		
Approach Vol, veh/h	799			1060	968			
Approach Delay, s/veh	25.8			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	2.0	11.9		
Green Ext Time (p_c), s		7.4		1.7	4.0	4.6		
Intersection Summary								
HCM 2010 Ctrl Delay			15.7					
HCM 2010 LOS			B					

HCM 2010 TWSC
 3: Bar None Drive/Pleasant Valley Road & Grand River Avenue

Future Conditions
 PM Peak Hour

Intersection

Int Delay, s/veh 48.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Traffic Vol, veh/h	422	286	22	15	537	59	8	1	3	6	12	377
Future Vol, veh/h	422	286	22	15	537	59	8	1	3	6	12	377
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									
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	485	329	25	17	624	69	13	2	5	7	13	410

Major/Minor	Major1	Major2	Minor1	Minor2								
Conflicting Flow All	624	0	0	329	0	0	1965	1958	329	1961	1958	624
Stage 1	-	-	-	-	-	-	1299	1299	-	659	659	-
Stage 2	-	-	-	-	-	-	666	659	-	1302	1299	-
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	957	-	-	1231	-	-	48	64	717	48	64	487
Stage 1	-	-	-	-	-	-	200	234	-	454	462	-
Stage 2	-	-	-	-	-	-	452	464	-	199	233	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	957	-	-	1231	-	-	~3	31	717	27	31	487
Mov Cap-2 Maneuver	-	-	-	-	-	-	~3	31	-	27	31	-
Stage 1	-	-	-	-	-	-	99	115	-	224	456	-
Stage 2	-	-	-	-	-	-	69	458	-	96	115	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	7.3	0.2	\$ 3488.7	50.1
HCM LOS			F	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	4	957	-	-	1231	-	-	30	487
HCM Lane V/C Ratio	5	0.507	-	-	0.014	-	-	0.652	0.841
HCM Control Delay (s)	\$ 3488.7	12.6	-	-	8	-	-	250.1	40.5
HCM Lane LOS	F	B	-	-	A	-	-	F	E
HCM 95th %tile Q(veh)	3.9	2.9	-	-	0	-	-	2.1	8.5

Notes

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

HCM 2010 TWSC
 4: Grand River Avenue & Assisted Living Site Drive

Future Conditions
 PM Peak Hour

Intersection

Int Delay, s/veh 0.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Traffic Vol, veh/h	4	747	866	6	7	6
Future Vol, veh/h	4	747	866	6	7	6
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, %	1	1	1	1	2	2
Mvmt Flow	5	859	984	7	8	7

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	991	0	1427
Stage 1	-	-	988
Stage 2	-	-	439
Critical Hdwy	4.12	-	6.84
Critical Hdwy Stg 1	-	-	5.84
Critical Hdwy Stg 2	-	-	5.84
Follow-up Hdwy	2.21	-	3.52
Pot Cap-1 Maneuver	699	-	126
Stage 1	-	-	321
Stage 2	-	-	617
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	699	-	125
Mov Cap-2 Maneuver	-	-	242
Stage 1	-	-	321
Stage 2	-	-	613

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	16.7
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	699	-	-	-	321
HCM Lane V/C Ratio	0.007	-	-	-	0.044
HCM Control Delay (s)	10.2	-	-	-	16.7
HCM Lane LOS	B	-	-	-	C
HCM 95th %tile Q(veh)	0	-	-	-	0.1

HCM 2010 TWSC
5: Grand River Avenue & W. Residential Site Drive

Future Conditions
PM Peak Hour

Intersection

Int Delay, s/veh 0.6

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Traffic Vol, veh/h	30	724	856	38	20	16
Future Vol, veh/h	30	724	856	38	20	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	200	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	87	87	88	88	92	92
Heavy Vehicles, %	1	1	1	1	2	2
Mvmt Flow	34	832	973	43	22	17

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	1016	0	1479
Stage 1	-	-	994
Stage 2	-	-	485
Critical Hdwy	4.12	-	6.84
Critical Hdwy Stg 1	-	-	5.84
Critical Hdwy Stg 2	-	-	5.84
Follow-up Hdwy	2.21	-	3.52
Pot Cap-1 Maneuver	684	-	116
Stage 1	-	-	319
Stage 2	-	-	585
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	684	-	110
Mov Cap-2 Maneuver	-	-	230
Stage 1	-	-	319
Stage 2	-	-	556

Approach	EB	WB	SB
HCM Control Delay, s	0.4	0	18.6
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	684	-	-	-	304
HCM Lane V/C Ratio	0.05	-	-	-	0.129
HCM Control Delay (s)	10.5	-	-	-	18.6
HCM Lane LOS	B	-	-	-	C
HCM 95th %tile Q(veh)	0.2	-	-	-	0.4

HCM 2010 TWSC
6: Grand River Avenue & Middle Residential Site Drive

Future Conditions
PM Peak Hour

Intersection

Int Delay, s/veh 0.8

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Traffic Vol, veh/h	39	705	873	48	26	21
Future Vol, veh/h	39	705	873	48	26	21
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, %	1	1	1	1	2	2
Mvmt Flow	45	810	992	55	28	23

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	1047	0	1514
Stage 1	-	-	1019
Stage 2	-	-	495
Critical Hdwy	4.11	-	6.63
Critical Hdwy Stg 1	-	-	5.43
Critical Hdwy Stg 2	-	-	5.83
Follow-up Hdwy	2.209	-	3.519
Pot Cap-1 Maneuver	668	-	121
Stage 1	-	-	347
Stage 2	-	-	579
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	668	-	113
Mov Cap-2 Maneuver	-	-	241
Stage 1	-	-	347
Stage 2	-	-	540

Approach	EB	WB	SB
HCM Control Delay, s	0.6	0	22.2
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	668	-	-	-	260
HCM Lane V/C Ratio	0.067	-	-	-	0.196
HCM Control Delay (s)	10.8	-	-	-	22.2
HCM Lane LOS	B	-	-	-	C
HCM 95th %tile Q(veh)	0.2	-	-	-	0.7

HCM 2010 TWSC
7: Grand River Avenue & E. Residential Site Drive

Future Conditions
PM Peak Hour

Intersection

Int Delay, s/veh 0

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Traffic Vol, veh/h	2	729	920	2	1	1
Future Vol, veh/h	2	729	920	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	200	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	87	87	88	88	92	92
Heavy Vehicles, %	1	1	1	1	2	2
Mvmt Flow	2	838	1045	2	1	1

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	1048	0	1890
Stage 1	-	-	1047
Stage 2	-	-	843
Critical Hdwy	4.11	-	6.42
Critical Hdwy Stg 1	-	-	5.42
Critical Hdwy Stg 2	-	-	5.42
Follow-up Hdwy	2.209	-	3.518
Pot Cap-1 Maneuver	668	-	77
Stage 1	-	-	338
Stage 2	-	-	422
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	668	-	77
Mov Cap-2 Maneuver	-	-	206
Stage 1	-	-	338
Stage 2	-	-	421

Approach	EB	WB	SB
HCM Control Delay, s	0	0	20.4
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	668	-	-	-	236
HCM Lane V/C Ratio	0.003	-	-	-	0.009
HCM Control Delay (s)	10.4	-	-	-	20.4
HCM Lane LOS	B	-	-	-	C
HCM 95th %tile Q(veh)	0	-	-	-	0

HCM 2010 Signalized Intersection Summary
 1: Whitmore Lake Road/Old US-23 & Grand River Avenue

Future Conditions W / Improvements
 AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	44	499	102	176	217	92	103	166	256	280	329	105
Future Volume (veh/h)	44	499	102	176	217	92	103	166	256	280	329	105
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	49	561	115	187	231	98	137	221	341	301	354	113
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	480	806	582	268	570	383	257	317	502	410	427	491
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	49	561	115	187	231	98	137	221	341	301	354	113
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	9.0	0.0	1.9	3.6	0.0	0.5	6.9	2.6	4.1	11.1	0.0
Cycle Q Clear(g_c), s	0.0	9.0	0.0	1.9	3.6	0.0	0.5	6.9	2.6	4.1	11.1	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	480	806	582	268	570	383	257	317	502	410	427	491
V/C Ratio(X)	0.10	0.70	0.20	0.70	0.41	0.26	0.53	0.70	0.68	0.73	0.83	0.23
Avail Cap(c_a), veh/h	552	1295	801	454	1283	701	473	530	683	522	530	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	19.4	23.1	14.4	27.4	24.4	20.0	27.3	25.3	19.6	24.4	23.9	17.0
Incr Delay (d2), s/veh	0.1	1.1	0.2	3.3	0.5	0.3	1.7	2.8	1.6	3.9	8.8	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	4.6	1.4	3.4	1.9	1.5	2.4	3.9	5.2	5.4	7.0	1.5
LnGrp Delay(d),s/veh	19.5	24.2	14.6	30.7	24.8	20.3	29.0	28.1	21.2	28.3	32.7	17.2
LnGrp LOS	B	C	B	C	C	C	C	C	C	C	C	B
Approach Vol, veh/h		725			516			699			768	
Approach Delay, s/veh		22.3			26.1			24.9			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	15.5	16.5	11.5	20.6	11.5	20.5	15.1	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	* 23	* 13	* 18	* 12	* 23	* 13	* 18				
Max Q Clear Time (g_c+I1), s	2.0	5.6	2.5	13.1	3.9	11.0	6.1	8.9				
Green Ext Time (p_c), s	0.4	1.5	0.9	0.9	0.4	3.0	0.7	1.6				
Intersection Summary												
HCM 2010 Ctrl Delay			25.5									
HCM 2010 LOS			C									
Notes												

HCM 2010 Signalized Intersection Summary

Future Conditions W / Improvements

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

AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (veh/h)	363	557	1	1	128	9	0	0	0	44	1	224	
Future Volume (veh/h)	363	557	1	1	128	9	0	0	0	44	1	224	
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	422	648	1	1	149	10	0	0	0	46	1	236	
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	984	1407	1196	266	649	552	0	195	0	245	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	782	1869	1589	0	1961	0	1439	43	1650	
Grp Volume(v), veh/h	422	648	1	1	149	10	0	0	0	47	0	236	
Grp Sat Flow(s),veh/h/ln	1849	1942	1650	782	1869	1589	0	1961	0	1482	0	1650	
Q Serve(g_s), s	0.0	9.7	0.0	0.1	4.0	0.3	0.0	0.0	0.0	2.0	0.0	0.0	
Cycle Q Clear(g_c), s	0.0	9.7	0.0	9.7	4.0	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	984	1407	1196	266	649	552	0	195	0	249	0	653	
V/C Ratio(X)	0.43	0.46	0.00	0.00	0.23	0.02	0.00	0.00	0.00	0.19	0.00	0.36	
Avail Cap(c_a), veh/h	984	1407	1196	266	649	552	0	235	0	280	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	10.2	4.0	2.7	21.9	16.2	15.0	0.0	0.0	0.0	29.3	0.0	14.9	
Incr Delay (d2), s/veh	0.3	1.1	0.0	0.0	0.8	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	6.4	5.5	0.0	0.0	2.2	0.1	0.0	0.0	0.0	0.9	0.0	3.3	
LnGrp Delay(d),s/veh	10.5	5.1	2.7	21.9	17.0	15.1	0.0	0.0	0.0	29.7	0.0	15.2	
LnGrp LOS	B	A	A	C	B	B				C		B	
Approach Vol, veh/h	1071						160		0		283		
Approach Delay, s/veh	7.2						16.9		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	11.7		4.1		2.0	11.7	0.0						
Green Ext Time (p_c), s	6.0		0.4		5.0	0.5	0.0						
Intersection Summary													
HCM 2010 Ctrl Delay			10.2										
HCM 2010 LOS			B										
Notes													

HCM 2010 Signalized Intersection Summary
 1: Whitmore Lake Road/Old US-23 & Grand River Avenue

Future Conditions W / Improvements
 PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	278	539	212	342	596	315	256	378	244	220	303	180
Future Volume (veh/h)	278	539	212	342	596	315	256	378	244	220	303	180
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	323	627	247	384	670	354	284	420	271	244	337	200
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	400	786	547	434	832	635	401	478	679	291	399	632
Arrive On Green	0.16	0.21	0.21	0.17	0.22	0.22	0.16	0.24	0.24	0.12	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	323	627	247	384	670	354	284	420	271	244	337	200
Grp Sat Flow(s),veh/h/ln	1886	1881	1683	1886	1881	1683	1886	1980	1683	1886	1980	1683
Q Serve(g_s), s	11.3	15.9	0.0	14.1	16.9	1.0	8.3	20.5	0.0	8.8	16.4	0.0
Cycle Q Clear(g_c), s	11.3	15.9	0.0	14.1	16.9	1.0	8.3	20.5	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	400	786	547	434	832	635	401	478	679	291	399	632
V/C Ratio(X)	0.81	0.80	0.45	0.89	0.81	0.56	0.71	0.88	0.40	0.84	0.84	0.32
Avail Cap(c_a), veh/h	519	995	641	529	995	708	417	563	751	382	563	771
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	38.1	37.6	26.7	37.9	37.0	24.6	37.4	36.6	21.3	41.7	38.5	22.2
Incr Delay (d2), s/veh	7.1	3.6	0.6	14.3	4.2	0.8	5.2	13.1	0.4	12.0	8.1	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	9.3	8.6	5.4	12.0	9.2	7.6	7.8	12.9	5.3	7.5	9.9	3.9
LnGrp Delay(d),s/veh	45.2	41.3	27.3	52.1	41.2	25.4	42.6	49.7	21.6	53.7	46.6	22.5
LnGrp LOS	D	D	C	D	D	C	D	D	C	D	D	C
Approach Vol, veh/h		1197			1408			975			781	
Approach Delay, s/veh		39.5			40.2			39.8			42.6	
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	22.7	28.7	22.1	26.7	23.9	27.4	18.1	30.7				
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	* 23	* 27	* 17	* 29	* 23	* 27	* 17	* 29				
Max Q Clear Time (g_c+I1), s	13.3	18.9	10.3	18.4	16.1	17.9	10.8	22.5				
Green Ext Time (p_c), s	1.6	3.2	0.9	1.8	1.3	3.1	0.9	1.8				
Intersection Summary												
HCM 2010 Ctrl Delay			40.3									
HCM 2010 LOS			D									
Notes												

HCM 2010 Signalized Intersection Summary

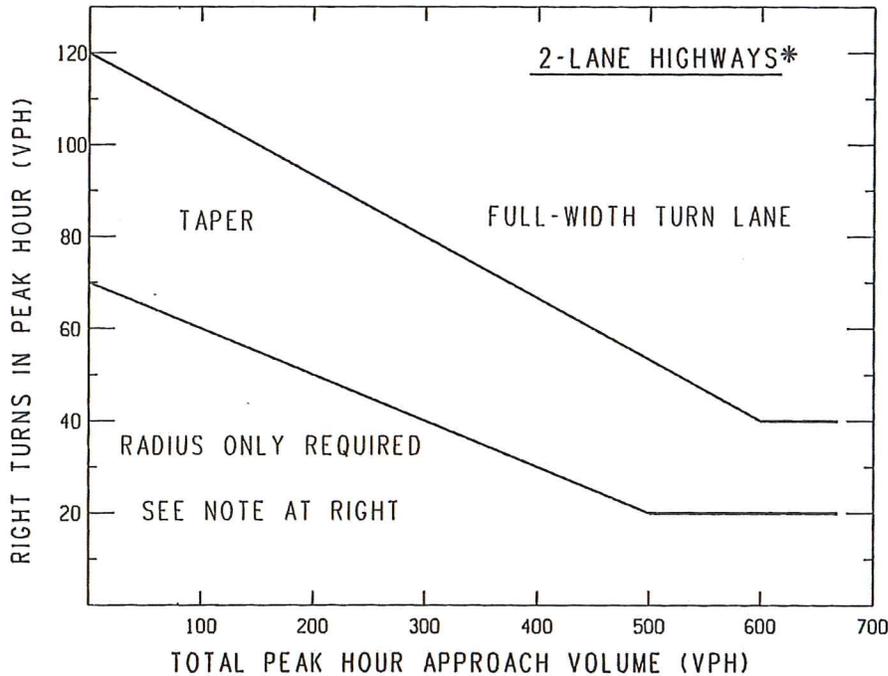
Future Conditions W / Improvements

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

PM Peak Hour

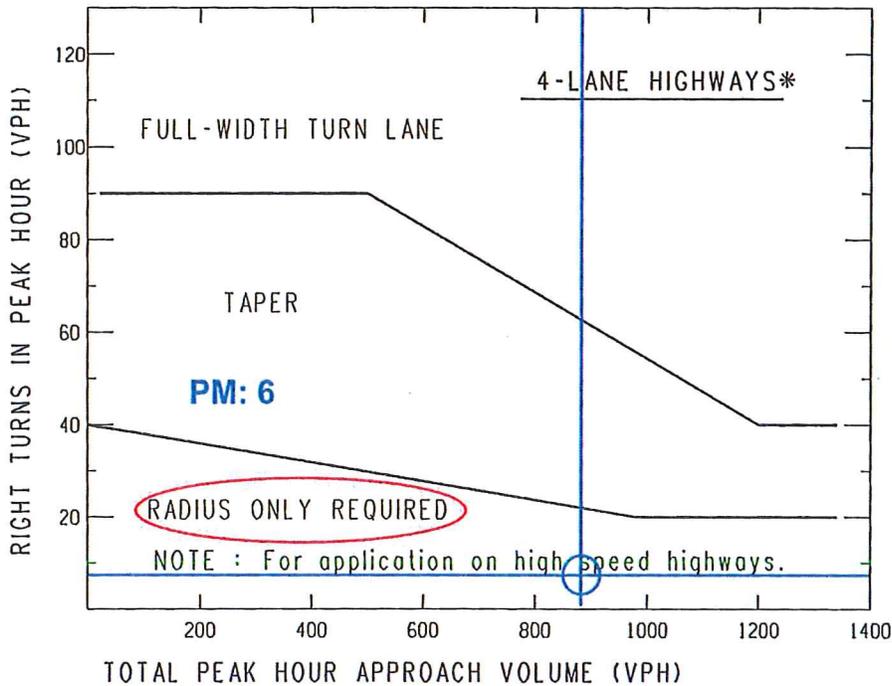
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	422	286	22	15	537	59	8	1	3	6	12	377
Future Volume (veh/h)	422	286	22	15	537	59	8	1	3	6	12	377
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	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	485	329	25	17	624	69	13	2	5	7	13	410
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	605	1420	1207	509	849	721	152	32	33	106	150	522
Arrive On Green	0.21	0.72	0.72	0.43	0.43	0.43	0.10	0.10	0.10	0.10	0.10	0.10
Sat Flow, veh/h	1867	1961	1667	1077	1961	1667	668	318	329	365	1496	1683
Grp Volume(v), veh/h	485	329	25	17	624	69	20	0	0	20	0	410
Grp Sat Flow(s),veh/h/ln	1867	1961	1667	1077	1961	1667	1314	0	0	1861	0	1683
Q Serve(g_s), s	8.6	3.9	0.3	0.7	18.5	1.7	0.0	0.0	0.0	0.0	0.0	0.9
Cycle Q Clear(g_c), s	8.6	3.9	0.3	4.6	18.5	1.7	0.7	0.0	0.0	0.6	0.0	0.9
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	605	1420	1207	509	849	721	216	0	0	255	0	522
V/C Ratio(X)	0.80	0.23	0.02	0.03	0.74	0.10	0.09	0.00	0.00	0.08	0.00	0.79
Avail Cap(c_a), veh/h	605	1420	1207	509	849	721	223	0	0	266	0	531
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	22.3	3.2	2.7	13.8	16.5	11.7	28.7	0.0	0.0	28.6	0.0	22.0
Incr Delay (d2), s/veh	7.6	0.4	0.0	0.1	5.6	0.3	0.2	0.0	0.0	0.1	0.0	7.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	2.2	0.1	0.2	11.2	0.8	0.4	0.0	0.0	0.4	0.0	8.2
LnGrp Delay(d),s/veh	29.9	3.6	2.7	13.9	22.1	12.0	28.8	0.0	0.0	28.8	0.0	29.6
LnGrp LOS	C	A	A	B	C	B	C			C		C
Approach Vol, veh/h		839			710			20			430	
Approach Delay, s/veh		18.8			21.0			28.8			29.5	
Approach LOS		B			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	20.4	36.0		13.6				
Change Period (Y+Rc), s		* 5.7		* 6.6	* 5.7	* 5.7		* 6.6				
Max Green Setting (Gmax), s		* 50		* 7.4	* 14	* 30		* 7.4				
Max Q Clear Time (g_c+I1), s		5.9		2.9	10.6	20.5		2.7				
Green Ext Time (p_c), s		3.6		0.7	1.3	2.9		0.8				
Intersection Summary												
HCM 2010 Ctrl Delay			22.0									
HCM 2010 LOS			C									
Notes												

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: 872

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.



TRAFFIC AND SAFETY NOTE

TRAFFIC VOLUME GUIDELINES FOR RIGHT-TURN LANES AND TAPERS

DRAWN BY: MTS

08/05/2004

604A

SHEET 2 OF 2

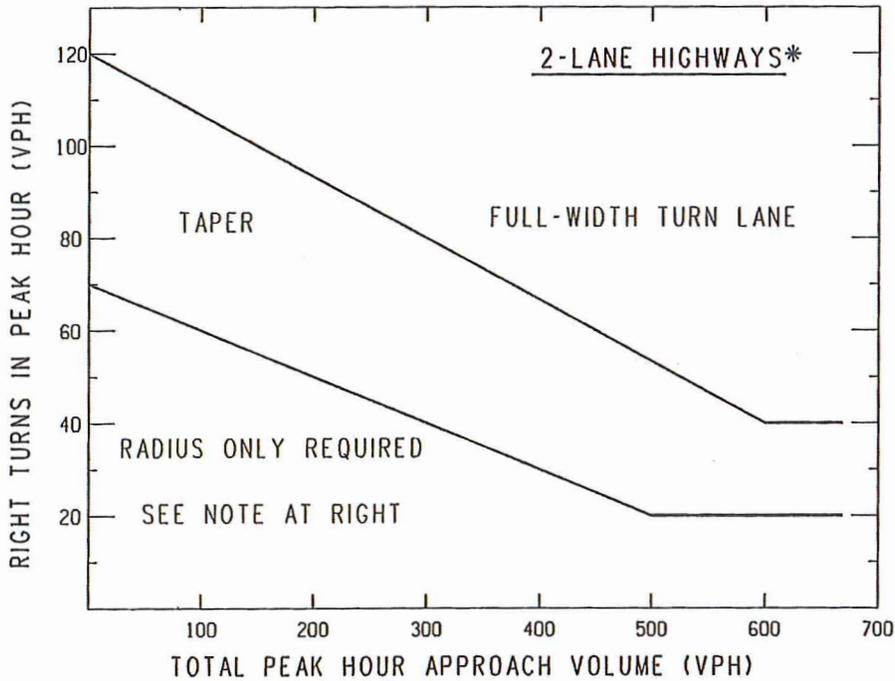
CHECKED BY: JAT

PLAN DATE:

FILE: K:/DGN/ts notes/Note604A tsn.dgn

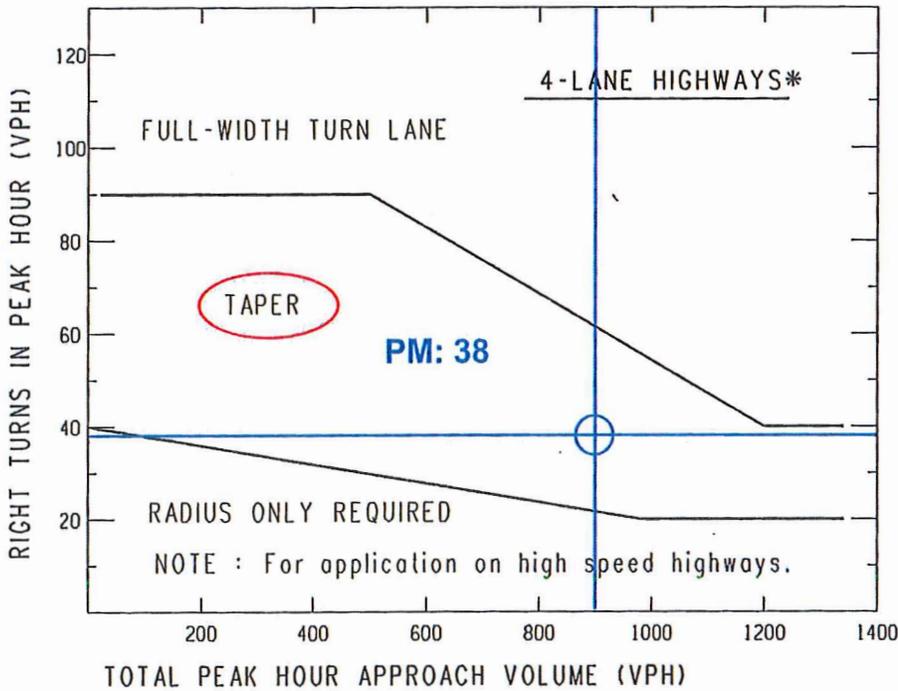
REV. 08/05/2004

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.

PM: 894

Sample Problem:

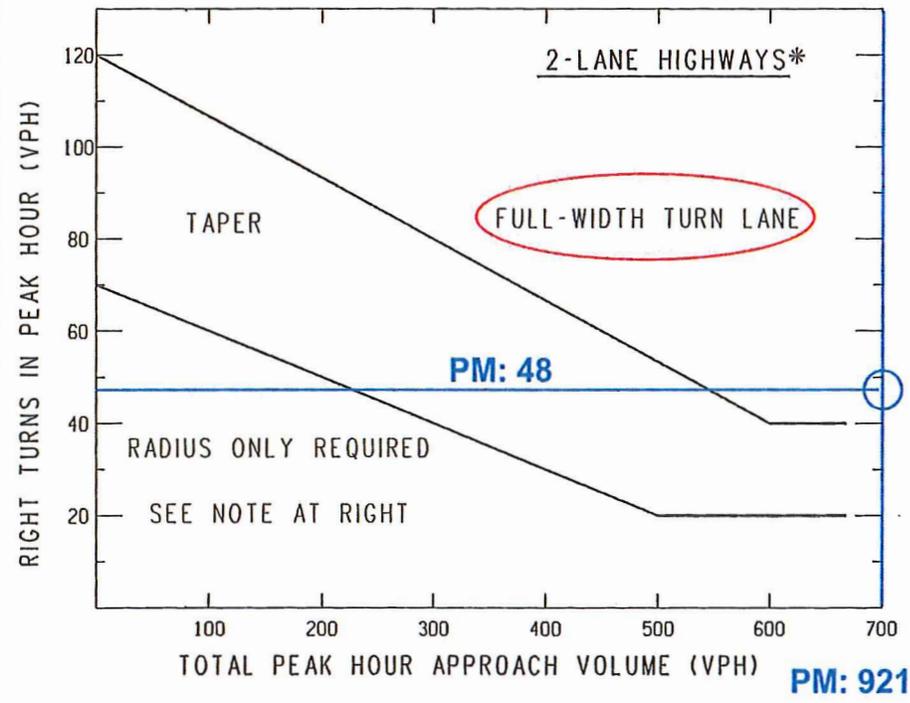
The Design Speed is 55 mph. The Peak Hour Approach Volume is 300 vph. The Number of Right Turns in the Peak Hour is 100 vph. Determine if a right turn lane is recommended.

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.

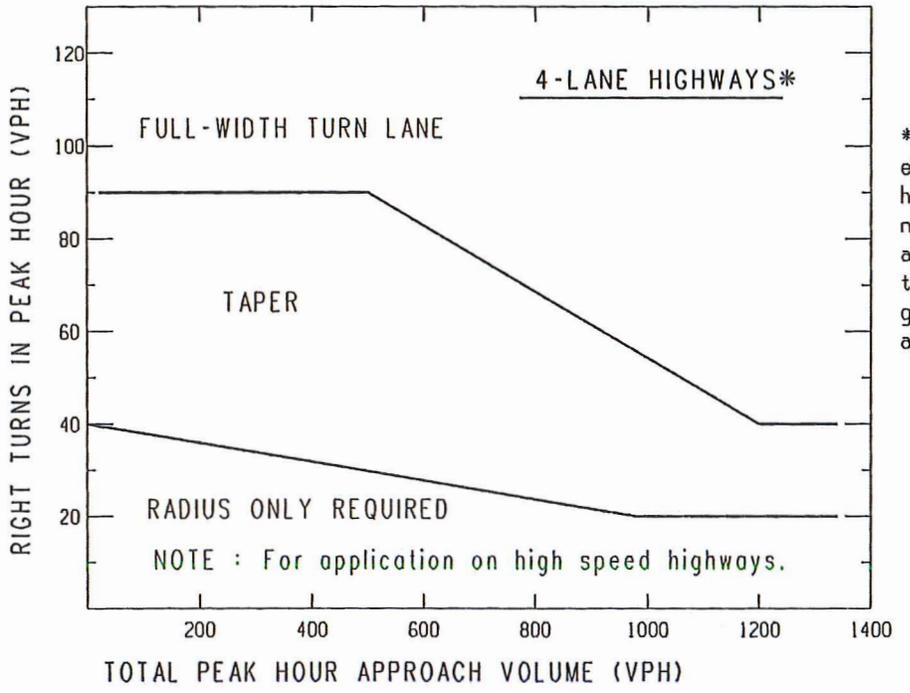
<p>TRAFFIC AND SAFETY NOTE</p>	<p>TRAFFIC VOLUME GUIDELINES FOR RIGHT-TURN LANES AND TAPERS</p>	
	<p>DRAWN BY: MTS</p> <p>CHECKED BY: JAT</p> <p>FILE: K:/DGN/1s notes/Note604A tsn.dgn</p>	<p>08/05/2004</p> <p>PLAN DATE:</p>

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



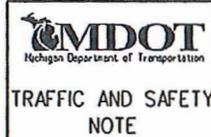
*If a center left-turn lane exists (i.e. 3 or 5 lane highway), subtract the number of left turns in approach volume from the total approach volume to get an adjusted total approach volume.

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:

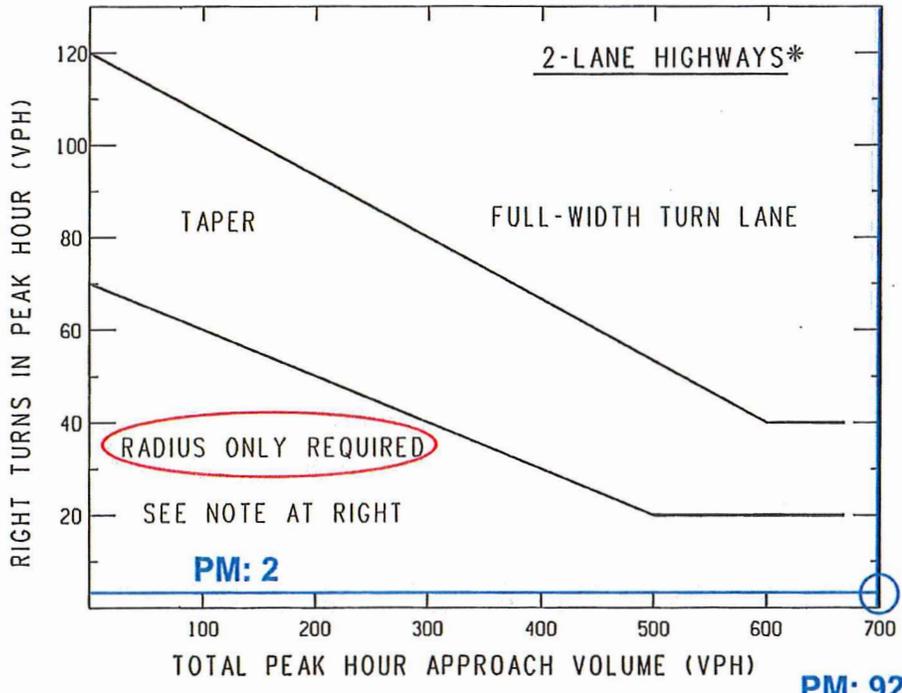
Figure indicates that the intersection of 300 vph and 100 vph is located above the upper trend line; thus, a right-turn lane may be recommended.



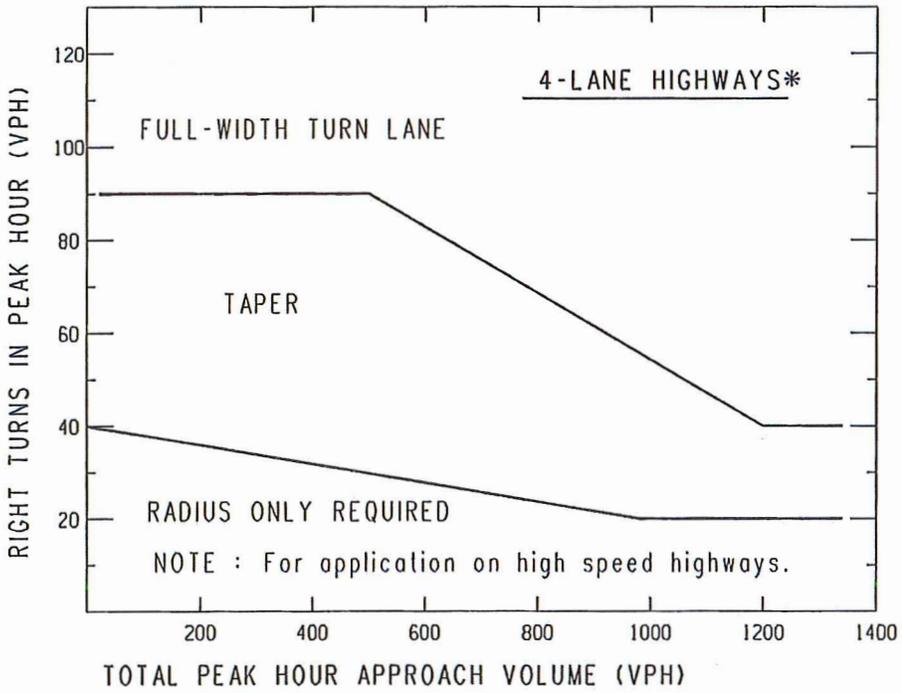
TRAFFIC VOLUME GUIDELINES FOR RIGHT-TURN LANES AND TAPERS

DRAWN BY: MTS	08/05/2004	604A	SHEET 2 OF 2
CHECKED BY: JAT	PLAN DATE:		
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.

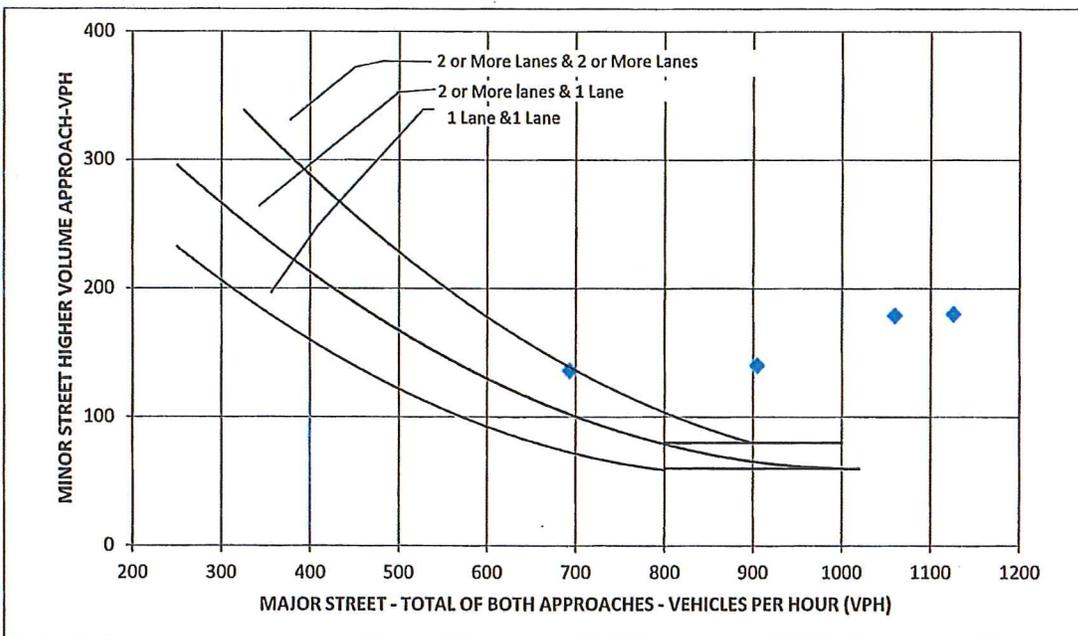
Solution:
 Figure indicates that the intersection of 300 vph and 100 vph is located above the upper trend line; thus, a right-turn lane may be recommended.

<p>MDOT Michigan Department of Transportation</p> <p>TRAFFIC AND SAFETY NOTE</p>		<p>TRAFFIC VOLUME GUIDELINES FOR RIGHT-TURN LANES AND TAPERS</p>	
<p>REV. 08/05/2004</p>			

**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

proposed
Encore Village West
 active living residential community

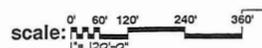
I-96 Highway



proposed
First Man
 assisted living - memory care

landscape concept plan for
Encore Village a planned active living residential community

proposed
Encore Village East
 active living residential community



note
 preliminary plan for inspection purposes only and in no way
 official or approved for record purposes.



**FELINA A. PASCUAL
 and ASSOCIATES**
 Community Land Planner and
 registered Landscape Architect
 2433 Orchard Lake Rd. Suite C
 Farmington Hills, MI 48336
 ph. (248) 557-5388
 fax. (248) 557-5416



client:
**MANCHESTER
 BRIGHTON L.L.C.**
 1700 W Big Beaver, Suite 120
 Troy, MI 48064

project:
**ENCORE
 VILLAGE**
 a planned active living
 residential community

project location:
 Brighton Township,
 Michigan
 Grand River Avenue

sheet title:
**STREET TREE
 PLANTING**

job no./issue/revision date:
 LP16.027/08 REVIEW #20-2016

drawn by:
 JP, KM, CS
 checked by:
 FP
 date:

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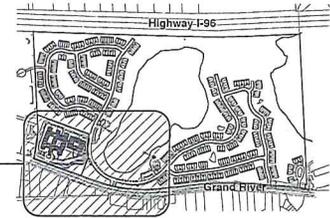
3 WITNESSES
 BEFORE YOU DIG
 CALL MISS DIG
 1-800-482-7171
 For the location of all utility lines

The location and elevation of existing
 utilities and other above ground
 obstructions are shown on this
 drawing and only if approved by the
 responsible authority. The contractor shall be
 responsible for determining the
 exact location and elevation prior to the start
 of construction.

project no:

sheet no:
LS-1

PROPOSED ADJACENT LANDSCAPE PLANTINGS. SEE SHEET LS-2 FOR DETAILS.



location map
NO SCALE

landscape legend

- deciduous trees
(Oak, Elm, Carya, etc.)
- ornamental trees
(Magnolia, Camellia, etc.)
- evergreen trees
(White Pine, Austrian Pine, Spruce)
- deciduous shrubs
(Viburnum, Spirea, etc.)
- evergreen shrubs
(Juniper, Yew, Holly, etc.)
- perennials and/or seasonal flowers
(Roses, etc.)

PROPOSED COMMUNITY FACILITY - SEE ARCHITECTURAL PLANS FOR DETAILS

PROPOSED DECK LARGE OVERLOOK - SEE ARCHITECTURAL PLANS FOR DETAILS

DISTURBED LAND AREAS TO RECEIVE HYDROSEED ON FINISH GRADES. PROVIDE POSITIVE DRAINAGE. SEE ENGINEERING PLAN FOR DETAILS.

Pickerele Lake

PROPOSED BOAT DOCK - SEE SITE ARCHITECTURAL PLANS FOR DETAILS

PROPOSED ATTACHED RESIDENTIAL UNITS - SEE ARCHITECTURAL PLANS FOR FLOOR PLANS, ELEVATIONS AND DETAILS

EXISTING HOODS AND VEGETATION TO REMAIN

PROPOSED DECORATIVE STONE ENTRY MONUMENT - SEE SHEET LS-1 FOR DETAILS

PROPOSED RETAINING WALL - SEE ENGINEERING PLAN FOR DETAILS

PROPOSED UNDERGROUND UTILITIES - SEE ENGINEERING PLAN FOR FINAL LOCATION, SIZES, TYPES, ELEVATIONS AND DETAILS

PROPOSED UNDERGROUND UTILITIES - SEE ENGINEERING PLAN FOR FINAL LOCATION, SIZES, TYPES, ELEVATIONS AND DETAILS

PROPOSED UNDERGROUND UTILITIES - SEE ENGINEERING PLAN FOR FINAL LOCATION, SIZES, TYPES, ELEVATIONS AND DETAILS

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PROPOSED UNDERGROUND UTILITIES - SEE ENGINEERING PLAN FOR FINAL LOCATION, SIZES, TYPES, ELEVATIONS AND DETAILS

3A landscape planting detail
SCALE: 1" = 60'-0"

(Encore Village)

PROPOSED ADJACENT LANDSCAPE PLANTINGS. SEE SHEET LS-2 FOR DETAILS.

PROPOSED DECORATIVE STONE ENTRY MONUMENT. SEE SHEET LS-1 FOR DETAILS

FP A
FELINO & PASQUALI ASSOCIATES
 Community Land Planner and
 Registered Landscape Architect
 2433 Orchard Lake Rd., Suite C
 Farmington Hills, MI 48336
 ph. (248) 557-5388
 fax. (248) 557-5416



client:
MANCHESTER BRIGHTON L.L.C.
 1700 W Big Beaver, Suite 120
 Troy, MI 48064

project:
ENCORE VILLAGE
 a planned active living residential community

project location:
 Brighton Township,
 Michigan
 Grand River Avenue

sheet title:
LANDSCAPE PLANTING DETAIL

Job no./Issue/revision date:
 1P16.027.08 REVIEW 8-29-2016

drawn by:
J.P. KM, CS
 checked by:
 FP
 date:
 2-19-2016

notice:
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 or visit us at www.wss.com

The location and accuracy of existing underground utilities as shown on this drawing are only approximate and are not to be relied upon. Contractors shall be responsible for determining the exact location and elevation prior to the start of construction.

project no:
 LS16.027.05

sheet no:
LS-3 of 8

Pickrel Lake

LAND AREAS TO RECEIVE IRRIGATION LEAD OFF FROM PLANS FOR GRADES, POSITIVE DRAINAGE, SEE ENGINEERING PLANS FOR GRADES, SEE ENGINEERING PLANS FOR GRADES.

POSITIVE DRAINAGE TO REMAIN POSITIVE DRAINAGE, SEE ENGINEERING PLANS FOR GRADES.

LAND AREAS TO RECEIVE IRRIGATION LEAD OFF FROM PLANS FOR GRADES, POSITIVE DRAINAGE, SEE ENGINEERING PLANS FOR GRADES.

Preserved Wooded Area



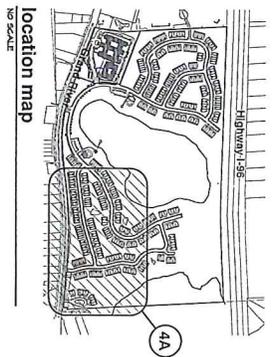
Grand River Avenue

4A landscape planting detail

SCALE: 1" = 60'-0"

(East Encore Village)

LAND AREAS TO RECEIVE IRRIGATION LEAD OFF FROM PLANS FOR GRADES, POSITIVE DRAINAGE, SEE ENGINEERING PLANS FOR GRADES.



landscape legend

- deciduous trees**
 - White Oak, Red Oak, Yellow Oak, Black Oak, Chestnut, Maple, Sycamore, etc.
- ornamental trees**
 - Eastern Redbud, Crape Myrtle, Flowering Dogwood, etc.
- evergreen trees**
 - Eastern White Pine, Spruce, Fir, etc.
- deciduous shrubs**
 - Boxwood, Hydrangea, etc.
- evergreen shrubs**
 - Juniper, Yew, etc.
- perennials and/or annual flowers**
 - Various symbols for different plant types.
- grass**
 - Symbol for lawn areas.



FPA
 FERRIS PROFESSIONAL ASSOCIATES
 Community Land Planning and
 24330 Grand Island Rd. #435
 Brighton Hills, MI 48315
 Tel: (248) 572-5416
 Fax: (248) 572-5416

DATE: MANCHESTER
 BRIGHTON LLC
 1701 W. Big Beaver, Suite 120
 Troy, MI 48069

PROJECT: ENCORE VILLAGE
 a planned active living residential community

PROJECT LOCATION: Brighton Township, Michigan
 Grand River Avenue

PREPARED BY: FERRIS PROFESSIONAL ASSOCIATES
 1701 W. Big Beaver, Suite 120
 Troy, MI 48069

DESIGNED BY: [Blank]

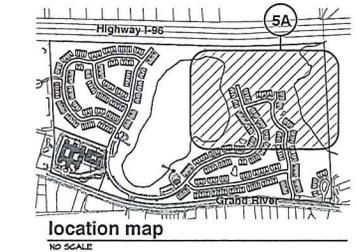
DATE: 11/07/2016 REVIEW: 12/29/2016

PROJECT NO: 1316.027.05

SHEET NO: **LS-4** of 8

general landscape notes:

- LANDSCAPE CONTRACTOR SHALL VISIT THE SITE, INSPECT EXISTING CONDITIONS, REVIEW PROPOSED PLANTING AND RELATED WORK, CONTACT THE OWNER AND/OR LANDSCAPE ARCHITECT WITH ANY CONCERNS OR DISCREPANCY BETWEEN THE PLAN, PLANT MATERIAL LIST, AND/OR SITE CONDITIONS.
- PRIOR TO BEGINNING OF CONSTRUCTION ON ANY WORK, CONTRACTORS SHALL VERIFY LOCATIONS OF ALL ON SITE UTILITIES: GAS, ELECTRIC, TELEPHONE, CABLE TO BE LOCATED BY CONTRACTOR PRIOR TO ANY PLANTING OR INTERUPTION OF SERVICES. SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR COORDINATE ALL RELATED WORK ACTIVITIES WITH OTHER TRADES AND REPORT ANY UNACCEPTABLE JOB CONDITIONS TO OWNER PRIOR TO COMMENCEMENT.
- NUMERICAL VALUE ON THE LANDSCAPE QUANTITIES SPECIFIED ON THE PLAN TAKE PRECEDENCE OVER GRAPHIC REPRESENTATION, VERIFY ANY CONCERN/DISCREPANCY WITH LANDSCAPE ARCHITECT.
- ALL CONSTRUCTION AND PLANT MATERIAL LOCATION TO BE ADJUSTED ON SITE IF NECESSARY.
- ALL SUBSTITUTIONS OR DEVIATIONS FROM THE LANDSCAPE PLAN MUST BE APPROVED BY DRIGHTON TOWNSHIP AND LANDSCAPE ARCHITECT.
- ALL LARGE TREES AND EVERGREENS TO BE STAKED, GUIED AND WRAPPED AS DETAIL SHOWN ON PLAN.
- PLANT BEDS TO BE DRESSED WITH MIN 3" OF FINELY DOUBLE SHREDDED HARDBARK MULCH.
- DO SHRUB PITS 1' LARGER THAN SHRUB ROOT BALLS AND TREE PITS 2' LARGER THAN ROOT BALL. BACK FILL WITH ONE PART TOP SOIL AND ONE PART SOIL FROM EXCAVATED PLANTING HOLE.
- REMOVE ALL STUMP, WIRE AND SURLAP FROM TREE AND SHRUB BIRTH BALLS, AND FROM TREE TRUNKS.
- NATURAL COLOR FINELY SHREDDED HARDWOOD BARK MULCH REQUIRED FOR ALL PLANTINGS. 4" THICK DARK MULCH FOR TREES IN 4" DIA. CIRCLE WITH 3" PULLED AWAY FROM TRUNK. 3" THICK DARK MULCH FOR SHRUBS AND 2" THICK DARK MULCH FOR PERENNIALS.
- PLANT MATERIAL QUALITY & INSTALLATION SHALL BE IN ACCORDANCE WITH THE CURRENT AMERICAN ASSOCIATION OF NURSERYMEN LANDSCAPE STANDARDS.
- PROVIDE PEAT SOIL FOR ALL NEW AND DISTURBED LAWN AREAS UNLESS NOTED OTHERWISE.
- ALL PLANTING AREAS TO BE PREPARED WITH APPROPRIATE SOIL MIXTURES AND FERTILIZER BEFORE PLANT INSTALLATION.
- PLANT TREES AND SHRUBS GENERALLY NO CLOSER THAN THE FOLLOWING DISTANCES FROM IRREGULAR CURBS AND PARKING STALLS:
 - a1. SHADE TREES _____ 9 FT.
 - a2. ORNAMENTAL AND EVERGREEN TREES _____ 9 FT.
 - a3. SHRUBS MAY BE LESS THAN 1 FOOT TALL _____ 3 FT.
 - a4. SHRUBS MAY BE LESS THAN 1 FOOT TALL _____ 3 FT.
- NO TREES OR EVERGREENS TO BE INSTALLED OVER ANY PROPOSED OR EXISTING UTILITY LINES AS SHOWN ON THE OVERALL LANDSCAPE PLAN SEE ENGINEERING PLAN FOR LOCATION AND DETAILS.
- ALL LAWN AREAS AND LANDSCAPE BEDS TO BE FULLY IRRIGATED WITH A AUTOMATIC UNDERGROUND SYSTEMS, IRRIGATION SYSTEM TO HAVE SEPARATE ZONES FOR LAWN AREAS, PARKING ISLANDS, AND SHRUB BEDS WITH DIFFERENT CONTROL, POSITION, LEVEL ADJUSTMENT PER ZONE AS REQUIRED.
- UNLESS NOTED OTHERWISE, LANDSCAPE BEDS ADJACENT TO LAWN TO RECEIVE EROSION EROSION SHALL BE 4" X 18" METAL FINISH BLACK OR GREEN OR APPROVED EQUAL AND TO BE INSTALLED WITH HORIZONTAL PETAL STAGES AT 37° D/C. ON PER MANUFACTURERS SPECIFICATION.
- ALL NEW PARKING ISLANDS AND LANDSCAPE BEDS ADJACENT AND NEXT TO BUILDING SHALL BE EXCAVATED TO ALL BUILDING MATERIALS AND FLOOR BOLS A MIN. 18" DEPTH, BACK FILL WITH GOOD, FRESH TEXTURED PLANTING SOILS, ADD A MIN. 4" OF TOPSOIL OVERLIE TO FINISH GRADE, PROVIDE POSITIVE DRAINAGE.
- BATTERING OF ALL PLANTS AND TREES TO BE PROVIDED IMMEDIATELY AND PULPING WITHIN 24 HOURS AFTER INSTALLATION.
- ALL TREE PITS TO BE TESTED FOR PROPER DRAINAGE PRIOR TO TREE PLANTING, PROVIDE APPROPRIATE DRAINAGE SYSTEM AS REQUIRED IF THE TREE PIT DOES NOT DRAIN SUFFICIENTLY.
- THE LANDSCAPE CONTRACTOR SHALL GUARANTEE ALL LANDSCAPE PLANT MATERIALS AND IRRIGATION INSTALLATION FOR A PERIOD OF TWO YEAR BEGINNING AFTER THE COMPLETION OF LANDSCAPE INSTALLATION DATE APPROVED BY THE CITY OR LANDSCAPE ARCHITECT. THE CONTRACTOR SHALL REPLACE DURING AND AT THE END OF THE GUARANTEE PERIOD, ANY DEAD OR UNACCEPTABLE PLANTS AS DETERMINED BY THE CITY OR LANDSCAPE ARCHITECT, WITHOUT COST TO THE OWNER.



landscape legend

- deciduous trees**
(Maple, Ginkgo, etc.)
- ornamental trees**
(Eastern Redbud, Crab, Hawthorn, etc.)
- evergreen trees**
(White Pine, Austrian Pine, Spruce)
- deciduous shrubs**
(Nornum, Rose, etc.)
- evergreen shrubs**
(English Yew, Holly, etc.)
- perennials and/or seasonal flowers**
(Daylily, Salvia, etc.)



5A landscape planting detail
SCALE: 1" = 60'-0"

FP A
FELINO A. PASQUALI
and ASSOCIATES
Community Land Planner and
Residential Landscape Architect
24333 Orchard Lake Rd. Suite C
Farmington Hills, MI 48336
ph. (248) 557-5588
fax. (248) 557-5416

Client:
**MANCHESTER
BRIGHTON LLC.**
1700 W Big River, Suite 120
Troy, MI 48064

Project:
**ENCORE
VILLAGE**
a planned active living
residential community

Project location:
Brighton Township,
Michigan
Grand River Avenue

Sheet title:
**LANDSCAPE
PLANTING DETAIL**

Job no./Issue/revision date:
LP16.027.08 REVIEW 8/20/2016

Drawn by:
J.P. KM, CS
Checked by:
FP
Date:
2-19-2016

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for the name of your site.

The location and dimensions of existing underground utilities as shown on this drawing are only approximate. The purchaser is either required to employ or the employment of a utility contractor shall be exclusively responsible for determining the exact location and clearance prior to the start of construction.

Project no:
LS16.027.05

Sheet no:
LS-5 of 8

client:
MANCHESTER BRIGHTON L.L.C.
 1700 W Big Beaver, Suite 120
 Troy, MI 48064

project:
ENCORE VILLAGE
 a planned active living residential community

project location:
 Brighton Township,
 Michigan
 Grand River Avenue

sheet title:
 Site Amenity

Job no./issue/revision date:
 LP16027/08 REVIEW & 20-2016

drawn by:
 JP, KM, CS

checked by:
 FP

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 2-19-2016

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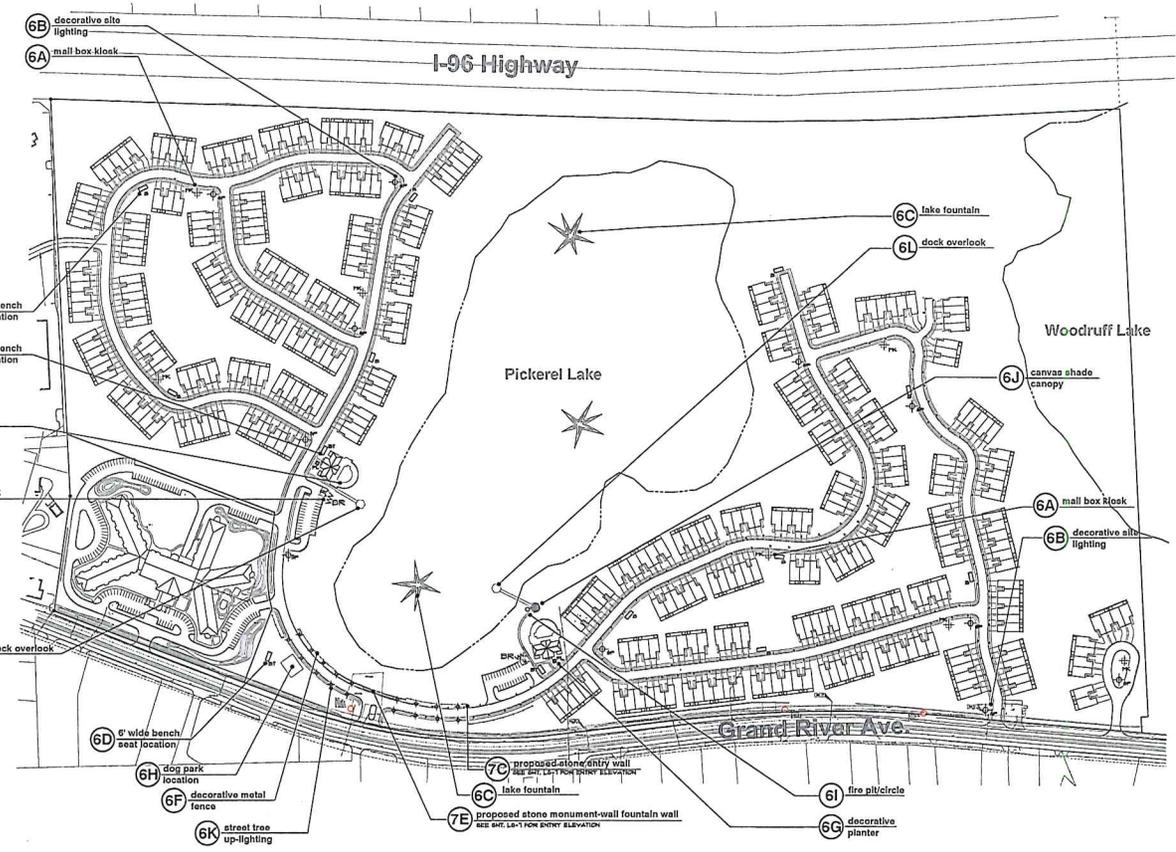
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3 WEEKS DATE BEFORE YOU BIG CALL MISS US 1-800-482-7171 for the location of Able City Inc.

The location and placement of existing underground utilities as shown on this drawing are not approximate. Installation is to be verified by a utility contractor who is not the contractor responsible for determining the exact location and placement prior to the start of construction.

project no.:
 LS16.027.05

sheet no.:
LS-6 of 8



site amenity reference location map
 SCALE 1/8"=1'-0"



6A mailbox kiosk
 (7-LOCATIONS)
 BLACK METAL DECORATIVE MAILBOX KIOSK TO US POSTAL SERVICE STANDARDS.



6B decorative light & pole
 (14-CONDITIONS)
 DECORATIVE SITE FIXTURE LIGHTS AND ALUMINUM POLE. SEE PHOTOGRAPHIC PREPARED BY STRATEGIC ENERGY SOLUTIONS, INC. FOR FINAL LOCATION AND CITY.



6C decorative lake fountain
 (3-CONDITIONS)



6D typical bench seating
 (1-CONDITIONS)
 PARK BENCH WITH ARMS AND FOOTINGS BY DUMOR OR SIMILAR. TRASH RECEPTACLE BY DUMOR OR SIMILAR TO COORDINATE WITH BENCH SEATING.
 BT-BENCH SEAT WITH TRASH RECEPTACLE
 B-BENCH SEAT ONLY

6D 6' wide bench seat location

6D 6' wide bench seat location

6I gas fire pit/circle

6M bike rack location

6E dock overlook

6D 6' wide bench seat location

6H dog park location

6F decorative metal fence

6K street tree up-lighting



6E scenic outlook deck
 (1-CONDITION)
 OVERLOOK DECK TO BE STICK BUILT OR PRESSURE TREATED OR COMPOSITE DECKING TO ADA STANDARDS.



6F decorative fence
 BLACK METAL OR WROUGHT IRON DECORATIVE RAILINGS/FENCE



6G decorative planter
 (6-CONDITIONS)
 DECORATIVE WOODEN OR METAL PLANTER BY DUMOR OR SIMILAR.



6H dog park
 (1-CONDITION)
 ENCLOSED DOG PARK/RUN FOR COMMUNITY DOGS ONLY. MAY INCLUDE BENCH SEATING AND OTHER ACCESSORIES.



6J canvas shade canopy
 (1-CONDITION)
 CANVAS OR FABRIC AND STEEL CANOPY TO BE BUILT BY MANUFACTURER STANDARDS

6C lake fountain

6L dock overlook

6J canvas shade canopy

6A mailbox kiosk

6B decorative site lighting

6I fire pit/circle

6G decorative planter



6N decorative street signage
 DECORATIVE STREET SIGNAGE TO BE TO BRIGHTON TWP. OR GENOA COUNTY STANDARDS.



6M bicycle rack
 (2-CONDITIONS)
 BIKE RACK BY DUMOR, INC. MODEL NO. 130-20 (5-2 SURFACE PLATE MOUNT) 2 3/8" O.D. BLACK POWDER-COATED LOOP OR EQUAL.



6L outlook dock
 (1-CONDITION)
 5' WIDE STICK BUILT OR PRESSURE TREATED WOOD DOCK TO BE BUILT AT ADA STANDARDS.



6K landscape street tree uplighting
 PROVIDED ALONG STREET TREE PLANTINGS AT ENTRANCE TO CLUB HOUSE FACILITY



6I gas fire circle
 (2-CONDITION)
 GAS LINE SOURCED FIRE PIT TO BE ENCLOSED BY DECORATIVE STONE OR LANDSCAPING STONE. TO BE BUILT AT BRIGHTON TWP. AND/OR GENOA COUNTY FIRE SAFETY STANDARDS.



client:
MANCHESTER BRIGHTON I.L.C.
 1700 IV Big Beaver, Suite 120
 Troy, MI 48064

project:
ENCORE VILLAGE
 planned active living residential community

project location:
 Brighton Township, Michigan
 Grand River Avenue

sheet title:
ENTRANCE MONUMENT AND SIGN

Job no./issue/revision date:

drawn by:
JP, KM, CS
 checked by:
FP
 date:
2-19-2016

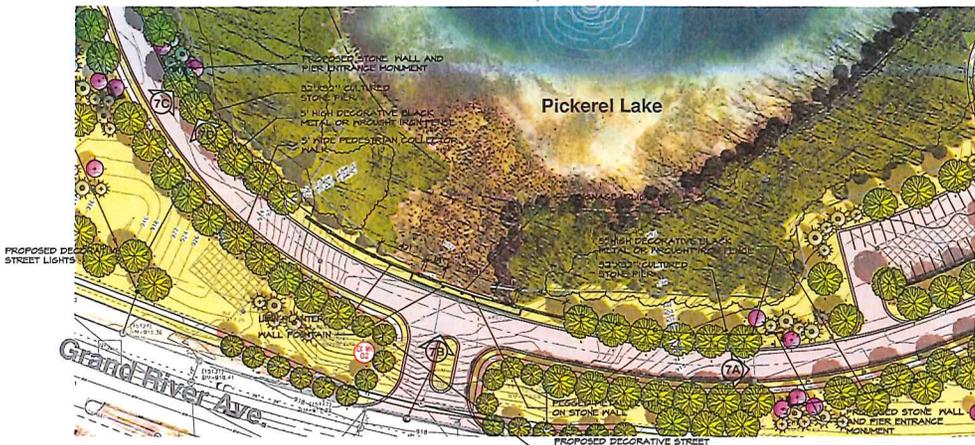
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Do Not scale drawings. Use figured dimensions only.
 3 WEEKS BEFORE YOU DIG
 CALL MISS DIG
 1-800-482-7171
 for the week of each city.

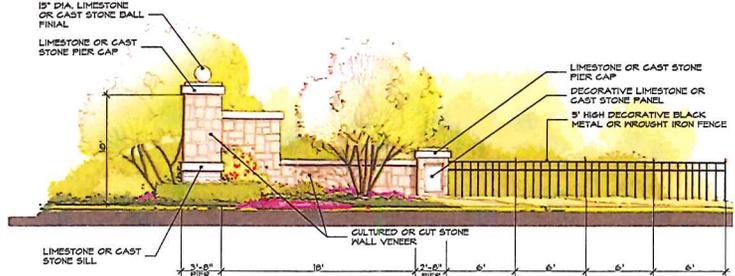
The location and dimensions of existing underground utilities as shown on this drawing are only approximate. No guarantee is either expressed or implied as to the completeness or accuracy. Contractor shall be responsible for determining the exact location and depths prior to the start of construction.

project no:
LS16.027.05

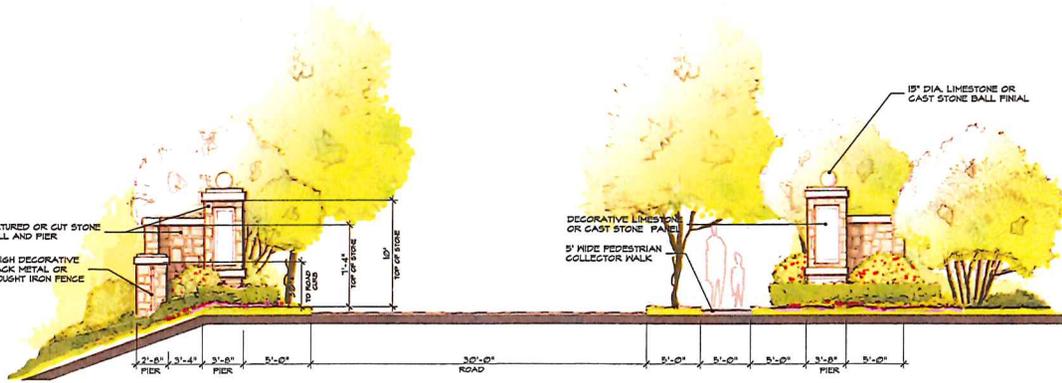
sheet no:
LS7 of 8



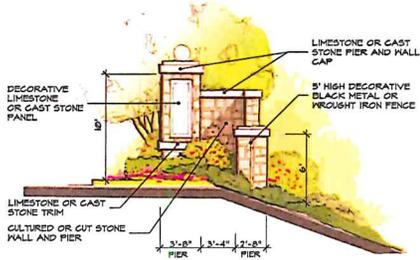
7A entry wall monument plan view
 SCALE: 1/4"=1'-0"



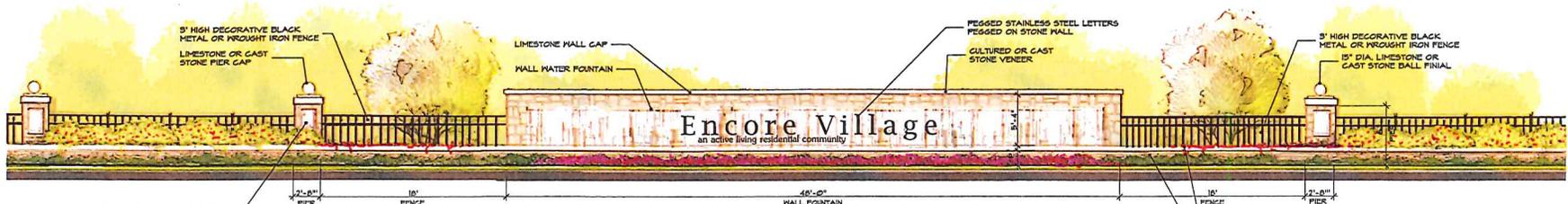
7B entry wall monument elevation view
 SCALE: 1/4"=1'-0"



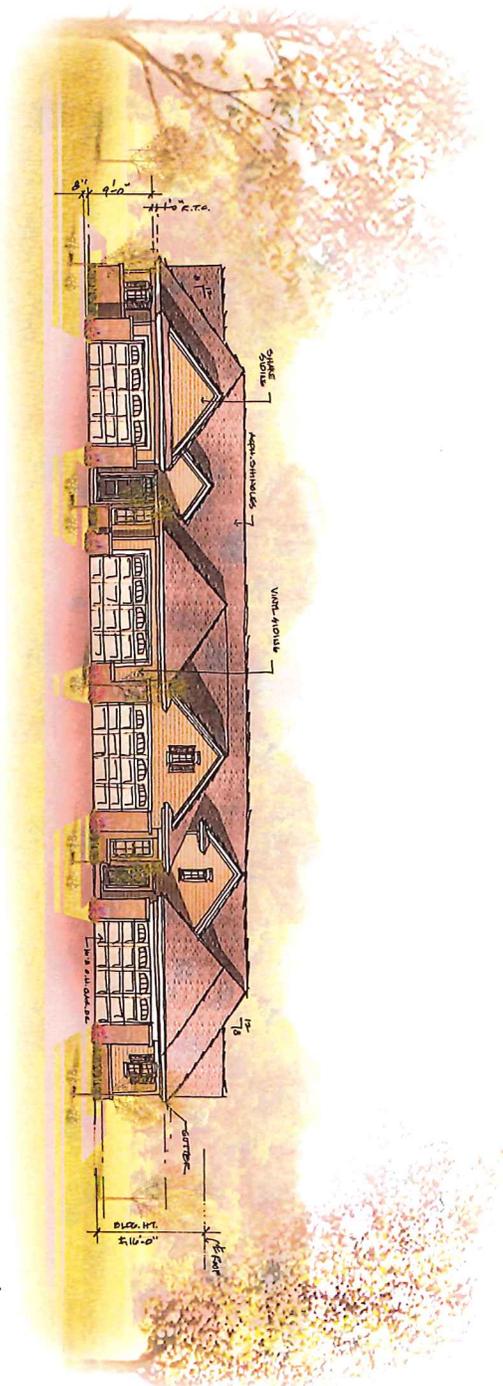
7C entry wall monument elevation view
 SCALE: 1/4"=1'-0"



7D entry wall monument elevation view
 SCALE: 1/4"=1'-0"



7E Grand River Ave entry wall monument elevation view
 SCALE: 1/4"=1'-0"



FRONT ELEVATION A

SCALE: 1/8" = 1'-0"

Alexander V. Bogaerts + Associates, P.C. • Architecture • Planning • Interior Design

DRAWN BY MAM
CHECKED BY MAM
DATE 1/27
SCALE AS SHOWN
PROJECT ENCORE VILLAGE
DATE 7-27-16

PROJECT ENCORE VILLAGE
DATE 7-27-16

PROJECT ENCORE VILLAGE
DATE 7-27-16

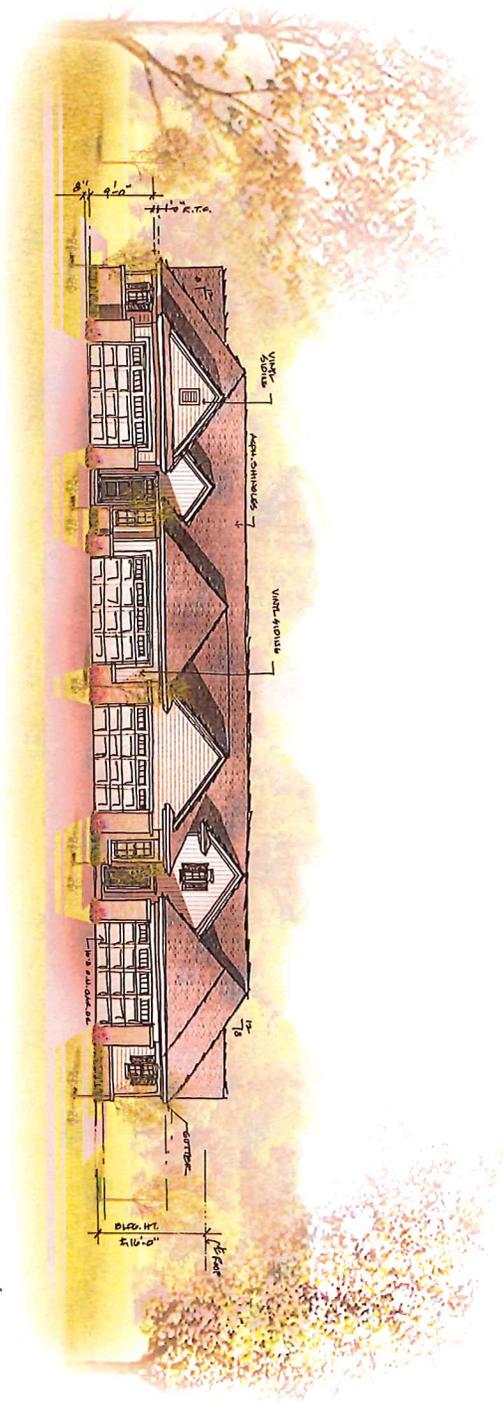
PROJECT ENCORE VILLAGE
DATE 7-27-16

CLIENT/PROJECT MANCHESTER BRIGHTON LLC. ENCORE VILLAGE MULTI-FAMILY COMMUNITY BRIGHTON, MICHIGAN
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PROJECT FILE FRONT ELEVATION A
PRELIMINARY

2445 Franklin Road Bloomfield Hills, MI 48302 248 • 334 • 5000
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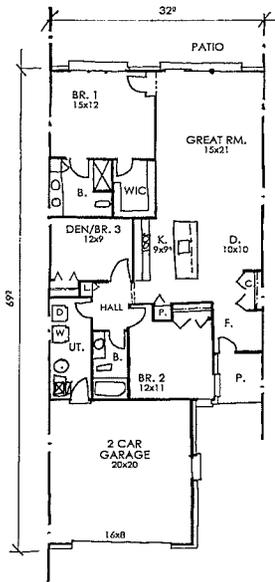




FRONT ELEVATION C

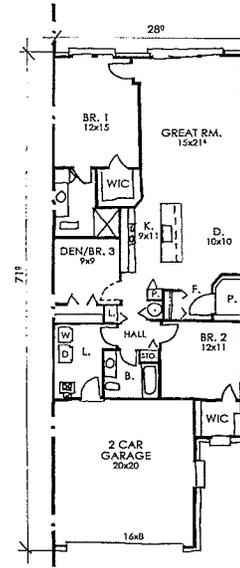
SCALE: 1/8" = 1'-0"

Alexander V. Bogaerts + Associates, P.C. • Architecture • Planning • Interior Design		2445 Franklin Road Bloomfield Hills, MI 48302 248 • 334 • 5000	
PROJECT: MANCHESTER BRIGHTON LLC. ENCORE VILLAGE MULTI-FAMILY COMMUNITY BRIGHTON, MICHIGAN			
DRAWN BY: AM CHECKED BY: AM DATE: 1/27	PROJECT: 2/A DATE: 7-27-16	SHEET TITLE: FRONT ELEVATION C PRELIMINARY	PROJECT NO.: 16-001 DATE: 7-27-16



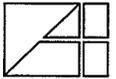
FLOOR PLAN - INTERIOR UNIT FOR ALL BUILDINGS
 2 BEDROOM, 2 BATH, DEN
 1486 SQ. FT.

SCALE: 1/8" = 1'-0"



FLOOR PLAN - END UNIT FOR ALL BUILDINGS
 2 BEDROOM, 2 BATH, DEN
 1441 SQ. FT.

SCALE: 1/8" = 1'-0"



Alexander V. Boggerts + Associates, P.C. • Architecture • Planning • Interior Design
 2445 Franklin Road
 Bloomfield Hills, MI 48302
 248 • 334 • 5000

PROJECT: UNIT PLANS
 PRELIMINARY

BY: MANCHESTER BRIGHTON LLC.
 FOR: THE HIGHLY COMMUNITY
 BRIGHTON, MICHIGAN

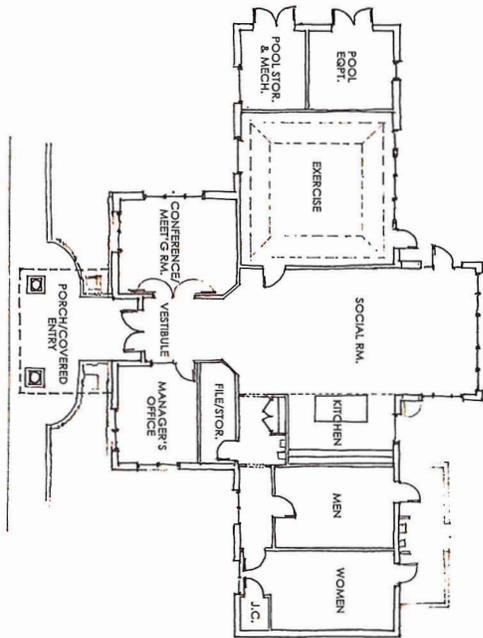
DATE: 7-27-16
 PREPARED BY: 7-27-16
 CHECKED BY: MAA
 JOB NUMBER: 1627
 DATE: 7-27-16

DESIGNED BY: AM
 CHECKED BY: MAA
 JOB NUMBER: 1627
 DATE: 7-27-16
 SHEET NUMBER: AS



FRONT ELEVATION

SCALE 1/8" = 1'-0"



FLOOR PLAN

SCALE 1/8" = 1'-0"

Alexander V. Bogaerts + Associates, P.C. • Architecture • Planning • Interior Design

OWNER	MAN
ARCHITECT	MAN
DATE	1/27
PROJECT NUMBER	
SHEET NUMBER	AS

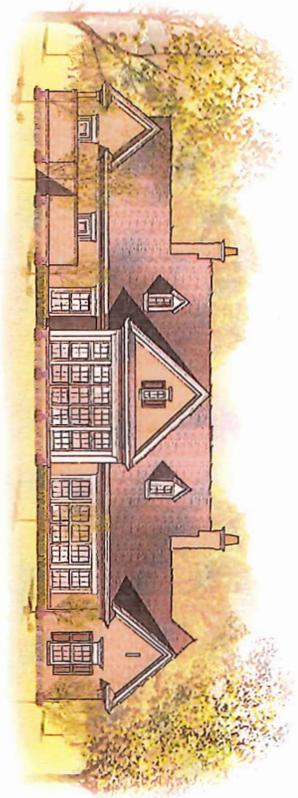
DATE	7-27-16
PROJECT	ENCORE VILLAGE
DATE	7-27-16

MANCHESTER BRIGHTON LLC.
ENCORE VILLAGE
MULTI-FAMILY COMMUNITY
BRIGHTON, MICHIGAN

CLUBHOUSE ELEVATION & FLOOR PLAN
PRELIMINARY

2445 Franklin Road
 Bloomfield Hills, MI 48302
 248 • 334 • 5000





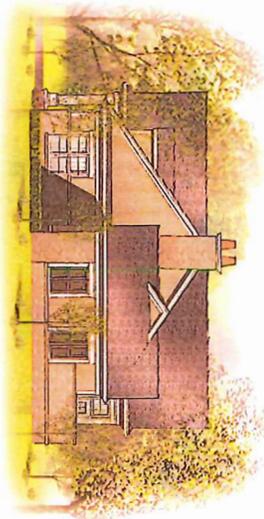
REAR ELEVATION

SCALE: 1/8" = 1'-0"



LEFT ELEVATION

SCALE: 1/8" = 1'-0"



RIGHT ELEVATION

SCALE: 1/8" = 1'-0"

Alexander V. Bogaerts + Associates, P.C. • Architecture • Planning • Interior Design

DATE: 11/14	DATE: 11/14
DRAWN BY: A.V.	CHECKED BY: A.V.
SCALE: 1/8" = 1'-0"	SCALE: 1/8" = 1'-0"
PROJECT NAME: ENCORE VILLAGE	PROJECT NO: 1027

OWNER: MANCHESTER BRIGHTON LLC.
PROJECT NO: 7-27-14
DATE: 7-27-14
PROJECT NAME: ENCORE VILLAGE
PROJECT NO: 1027

MANCHESTER BRIGHTON LLC. ENCORE VILLAGE MULTI-FAMILY COMMUNITY BRIGHTON, MICHIGAN
--

CLUBHOUSE ELEVATIONS
PRELIMINARY

2445 Franklin Road
Bloomfield Hills, MI 48302
248 • 334 • 5000







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

Date: September 1, 2016

To: Charter Township of Brighton Planning Commission

From: Kelly Mathews

Subject: **Conditional Rezoning for Encore Village**
Sheets 1-5A, 6-7, 7B, 8 8B dated 8/26/16; the rest of the sheets dated 7/22/16;
sheets LS1-8 dated 8/20/16; 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.

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 Agreement	Township Board review	Township Board

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

- 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. It 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.

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

September 8, 2016

CHARTER TOWNSHIP OF BRIGHTON

4363 Buno Road
Brighton, MI 48114

Attention: Kelly Mathews, Township Planner

**Regarding: Encore Village
Conditional Rezoning Review #1
OHM Job Number: 0024-16-1098**

Dear Ms. Mathews:

We have reviewed the material, received by this office on August 30, 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 August 26, 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: 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
- Phase 3: 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

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. This particular location also indicates on the concept plan that an existing stormwater drainage easement exists, which will need to be further vetted during the site plan review process. We also note that the submitted Natural Feature Assessment and Site Analysis does not indicate methods for intended preservation of natural features.

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. We also note that the following building spacing dimensions are missing: between Building 38-Building 39, Building 55-Building 56, and Building 56-Building 57.

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 do not indicate if the roads are proposed to be public or private and right-of-way lines have not been indicated.

There is also a proposed gated emergency access point 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 150 parking spaces, of which 3 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 July 19, 2016, was received by this office on August 1, 2016 with the conditional rezoning submittal. This TIS was prepared and submitted for review prior to the most recent concept plan dated August 26, 2016 and the TIS will need to be updated to reflect the current proposed concept plan. A review of the TIS was performed and a review letter dated August 30, 2016 was provided under separate cover.

DRAINAGE/GRADING

A stormwater narrative was included 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.

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 seven (7) locations throughout the proposed development. These retaining walls vary in height from 6 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. Topographic survey shall be extended 200 feet beyond property lines.
2. Boundaries and overall property dimensions shall be included on the concept plans.
3. Information on adjacent properties shall be included on the concept plans.
4. Preservation method of the natural features shall be included in the Natural Feature Assessment and Site Analysis.
5. Dimensions indicating the distance between all proposed buildings and property lines shall be included on the concept plans.
6. Indicated the intention for ownership of the internal road network (public or private) on the concept plans.
7. Provide an updated traffic impact study based on the most recent concept plan and number of units.

8. Easements for the proposed utilities shall be indicated on the concept plans.

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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ARCHITECTS. ENGINEERS. PLANNERS.

August 30, 2016

CHARTER TOWNSHIP OF BRIGHTON

4363 Buno Road
Brighton, MI 48114

Attention: Kelly Mathews

Regarding: Encore Village - Traffic Impact Study
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 July 19, 2016 and was received by this office on August 1, 2016. As submitted, we are in general agreement with the study methodology. However, we understand that the developer presented proposed site plan revisions at the August 22, 2016 Planning Commission meeting that will add additional units and the TIS will need to be updated to reflect the current proposed site plan. 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 (411 apartment units & a 104-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 TIS indicates that the ITE Land Use code for Apartments was used, but incorrectly reflects the ITE Code Number as 230. The corresponding ITE Land Use code for Apartments is 220.
2. The site plan indicates that the apartment portion of the site will be designated "active adult living", which more closely matches ITE Land Use 252 (Senior Adult Housing- Attached), instead of ITE Land Use 220 (Apartments). Although Senior Housing typically generates less traffic than traditional residential developments, limited trip generation data is available. Additionally, we have not found any information in the submitted documents that limits the apartment leases based on age of tenants. Therefore, we concur with the more conservative estimates used in the study.
3. There appears to be a discrepancy in the number of apartment units on the Overall Site Plan (Sheet 5, showing 411 residential units in the parking calculations but only 393 units in the detailed building breakdown). We note that the study used the higher of the two values. We also understand that this number is likely to be increased with a revised TIS based on the information presented at the August 22, 2016 Planning Commission meeting.
4. The study indicates that 1,292,208 SF² 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.

TRIP DISTRIBUTION

The report does not specify how the site-generated trip volumes for the apartment units was split between the two main residential drives. It appears that approximately 45% was assigned to the West residential drive, with the remaining 55% using the middle residential drive. Based on the proposed site layout, some of the buildings nearest the east clubhouse may be more likely to use the westerly driveway, resulting in a split closer to 50/50. However, this change would not substantially change the study findings.

SYNCHRO ANALYSIS

1. The Synchro files were not provided, so we were unable to verify observations from network simulations, such as vehicle queues that exceed available storage length.
2. The report states that a Level of Service (LOS) D is considered to be the minimum acceptable condition. However, in rural settings, such as near Pleasant Valley Rd, the threshold for acceptable is generally considered a LOS C. We defer to the Livingston County Road Commission for the minimum acceptable LOS.

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 does not appear to be in substantial compliance with the Charter Township of Brighton requirements, and at this time we recommend that the following comments be addressed prior to approval:

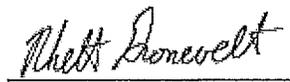
1. Update Table 4 (Site Trip Generation) to reflect ITE Land Use code 220, instead of 230, for Apartments.
2. Provide Synchro/SimTraffic models for verification.
3. Provide queue analysis with recommendation for required right turn lane storage length at the middle residential site drive.
4. Revise the TIS to reflect the most current site plan incorporating the additional units proposed for the multi-story assisted living building.

Once the above-noted comments have been addressed, the applicant should update trip distributions, figures, traffic models, and report accordingly and resubmit for further review. 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)

August 30, 2016
Charter Township of Brighton
Encore Village Traffic Review #1
Page 3 of 3



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)
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RECEIVED

SEP 06 2016



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
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



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,

A handwritten signature in black ink, appearing to read "R. Boisvert".

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

August 19, 2016

Kelly Mathews, Planner
Charter Township of Brighton
Building and Planning
4363 Buno Road
Brighton, MI 48114

RE: First and Main/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 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 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 411 attached multi-family dwelling units, two clubhouses and a 104-Bed 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. Provide the size of the water mains and gate valve locations on the utility plan.
2. 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 and will be provided with this document.
3. Future project submittals shall include the project specific address and street name of the project in the title block.
4. 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.
5. 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.

IFC 105.4.2

IFC 505.1

IFC D 102.1

IFC D 103.6



6. 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).

IFC 506.1
IFC D103.6

7. Access around building shall provide emergency vehicles with a turning radius of 50' outside and 30' inside.
8. A minimum vertical clearance of 13½ feet over the access road shall be maintained through the project.
9. 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.

IFC D 103.4

10. Cul-de-sac at Buildings 78-80 require minimum dimensions of 26', inside turning radii of 30' and an outside radii of 50'.
11. 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.
12. Provide names, addresses, phone numbers, emails of owner or owner's agent, contractor, architect, on-site project supervisor.

IFC 506.1

First and Main Assisted Living

The proposed Phase 1 of the project is for a 104-bed Assisted Living Facility. Details are unknown regarding building construction and size of the structure.

13. Provide the size of water mains, gate valve locations on the utility plan.
14. Provide the size of fire protection lead, gate valve locations and connection on the utility plan.
15. 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 and will be provided with this document.
16. The building shall be provided with an automatic sprinkler system in accordance with NFPA 13, *Standard for the Installation of Automatic Sprinkler Systems*.

IFC 903

- A. The FDC shall be located on the front of the building (East Grand River).
- B. A hydrant shall be located within 100' of the fire department connection. Location shall be approved by the fire authority.

IFC 912.2



17. Future project submittals shall include the address and street name of the project in the title block.

IFC 105.4.2

18. 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.

IFC 505.1

19. 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.

IFC D 102.1

IFC D 103.6

20. Access around building shall provide emergency vehicles with a turning radius of 50' outside and 30' inside.

21. A minimum vertical clearance of 13½ feet over the access road shall be maintained through the project.

22. 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.

IFC 506.1

23. Provide names, addresses, phone numbers, emails of owner or owner's agent, contractor, architect, on-site project supervisor.

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 810-229-6640.

Respectfully,

Capt. Rick Boisvert, CFPS
Fire Inspector



BRIGHTON AREA FIRE AUTHORITY

August 19, 2016

Page 4

*First and Main/Encore Village
10675, 11065, 10723 Grand River
Site Plan Review*

cc:Jacob Rushlow - OHM Advisors

Planner

From: john <john.harris@harrisandlitski.com>
Sent: Tuesday, September 06, 2016 8:58 AM
To: Planner
Cc: Manager
Subject: Encore Village

Kelly:

I have reviewed Manchester Brighton, LLC's ("Developer's") Conditional Conceptual Zoning Agreement ("CCZA"). Per your direction, I will not address whether this project should be developed as a Conditional Rezoning request, but will simply review the CCZA against the requirements of the Township's Conditional Rezoning ordinance.

- a) In the Recitals, section V., the Developer refers to Exhibit 2, which is a list of the Enumerated Conditions of Rezoning. There are no enumerated conditions listed. I believe this to be an integral part of the rezoning request so I would ask the Developer to specify the limitations.
- b) In the Recitals, section V., paragraph A., The Developer provides that at "... the southwest corner of the property consisting of approximately 8 acres may be developed as an assisted living facility comprising no more than 104 beds." Just recognize this is not a commitment to do so.
- c) Paragraph 1 of the CCZA on page 2 references the conditions of rezoning set forth in Exhibit 2. Again, this is an integral part of the CCZA.
- d) Paragraph 4 of the CCZA identifies specific conditions of the rezoning. I will leave to you whether those conditions are acceptable to the Township. I would remind the Township that the Conditional Rezoning ordinance requires regulations that would be "... equally or more restrictive than the regulations that would normally apply under the proposed zoning district."
- e) Paragraph 3 of the CCZA, line 2, the word "Plan" is missing the letter "n". In addition, I would recommend adding an additional condition to acting in a manner that is consistent with Exhibits 2 and 3. I suggest adding the "CCZA" as an additional condition.
- f) In paragraph 9 of the CCZA, I recommend adding the "CCZA" as an additional condition the Developer must comply with. This is similar to paragraph e) above.
- g) In paragraph 13, I recommend there be a requirement that the CCZA be recorded with Livingston County Register of Deeds, and that it be at the cost of the Developer.
- h) The Conditional Rezoning ordinance (sub-paragraph f.) requires an acknowledgement 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." This requirement is perhaps implied in the CCZA but I would like to see a definitive statement in a separate paragraph.

I have no other comments. If you have any questions or need clarification, 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

RECEIVED

SEP 08 2016

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 411 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 161 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 411 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 71 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 161 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 setback 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.

DRAFT

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: _____

EXHIBIT 1

LEGAL DESCRIPTION

DRAFT

EXHIBIT 2

CONCEPTUAL SITE PLAN dated _____ 2016

4845-1768-9653.2
112920\000002

DRAFT

Significant Tree Study & Approximate Tree Quantities

Significant Tree Summary

As part of the Brighton Township Ordinance Boss Engineering has conducted a tree inventory for the Encore Village project site. For this inventory “significant” was defined as “*Any tree species considered in good form, either fair to good condition, above 24” DBH, and in the development area.*”

Boss Engineering walked the project site on 8/24/16 and 8/25/16 locating and identifying significant trees per the definition provided. It is important to note that other significant trees exist on site but, if they did not meet the criteria of the definition they were not included. From the inventory 159 significant trees were located and tagged, of those 159 approximately 145 of them are estimated being removed due to the proposed development (See Figure 1.1). The majority of significant tree species were Oaks and Maples, predominately Red Oak (*Quercus rubra*), White Oak (*Quercus alba*), and Silver Maple (*Acer saccharinum*). Red Oaks accounted for approximately 29% of all significant trees with Silver Maple contributing 23% and White Oaks contributing 21%. Other species of note included the following:

- White Pine (*Pinus strobus*)
- Sugar Maple (*Acer saccharum*)
- Hickory species (*Carya*)
- Cottonwood (*Populus deltoids*)

Approximate Tree Quantities

In order to determine and approximate quantity of trees on the site without performing an actual count due to the high density of tree coverage and size of the property, a count was determined through tree sampling. Tree sample plots were taken in different portions of the site based upon habitat types identified through analyzing aerial images. Each tree sample plot was sized at 100’ x 100’ and the trees contained within that plot were noted (trees under 2” caliper were not included in counts). In total five different habitat types were identified on the site and they are as follows:

- Wetland:** *muck soils, hydrophyte plant presence, hydrology presence*
- Evergreen/Hardwood Forest:** *forested area containing a mixture of coniferous and deciduous trees*
- Mixed Hardwood Forest:** *forested area containing only deciduous trees*
- Mature Upland:** *presence of upland grasses, scattered mature trees and native vegetation*
- Juvenile Upland:** *presence of upland grasses, scattered small trees and shrub scrub brush*

Aerial images were then analyzed to determine percent coverage of the site excluding the open bodies of water of Pickerel and Woodruff Lake (147 total acres – approximately 35 acres of water = 112 acres). The following percentages were derived:

- Wetland:** 11%
- Evergreen/Hardwood Forest:** 10%
- Mature Upland:** 17%

- Mixed Hardwood Forest: 45%
- Juvenile Upland: 17%

A tree sample plot was set up in each of the different habitat types identified and the following results came from each sampling:

Wetland – 7 trees (species included mostly *Populus tremuloides*-Quaking Aspen)
Evergreen/Hardwood Forest – 62 trees (species of note include *Pinus strobus* – White Pine, *Pinus resinosa* – Red Pine, and *Acer saccharum* – Sugar Maple)

Mature Upland- 6 trees (trees include *Quercus* – Oak species, *Sassafras albidum* - Sassafras)

Mixed Hardwood Forest- 37 trees (trees included *Prunus serotina* – Black Cherry, *Quercus alba* – White Oak, *Betula lenta* – Sweet Birch, *Ulmus*- Elm species, and *Carya* – Hickory species)

Juvenile Upland- 6 trees (trees included *Prunus* – Cherry species, *Malus* – Apple species, and *Acer negundo* – Box Elder)

After the information was gathered the formula below was used to extrapolate the tree sample plot quantities across the respective habitat type on the site to determine the approximated amount of tree on the site.

$$\frac{\text{\# OF TREES IN SAMPLE AREA}}{\text{PLOT SIZE IN ACRES (.23)}} = \frac{X}{\%COVER \times \text{TOTAL SITE ACRES}}$$

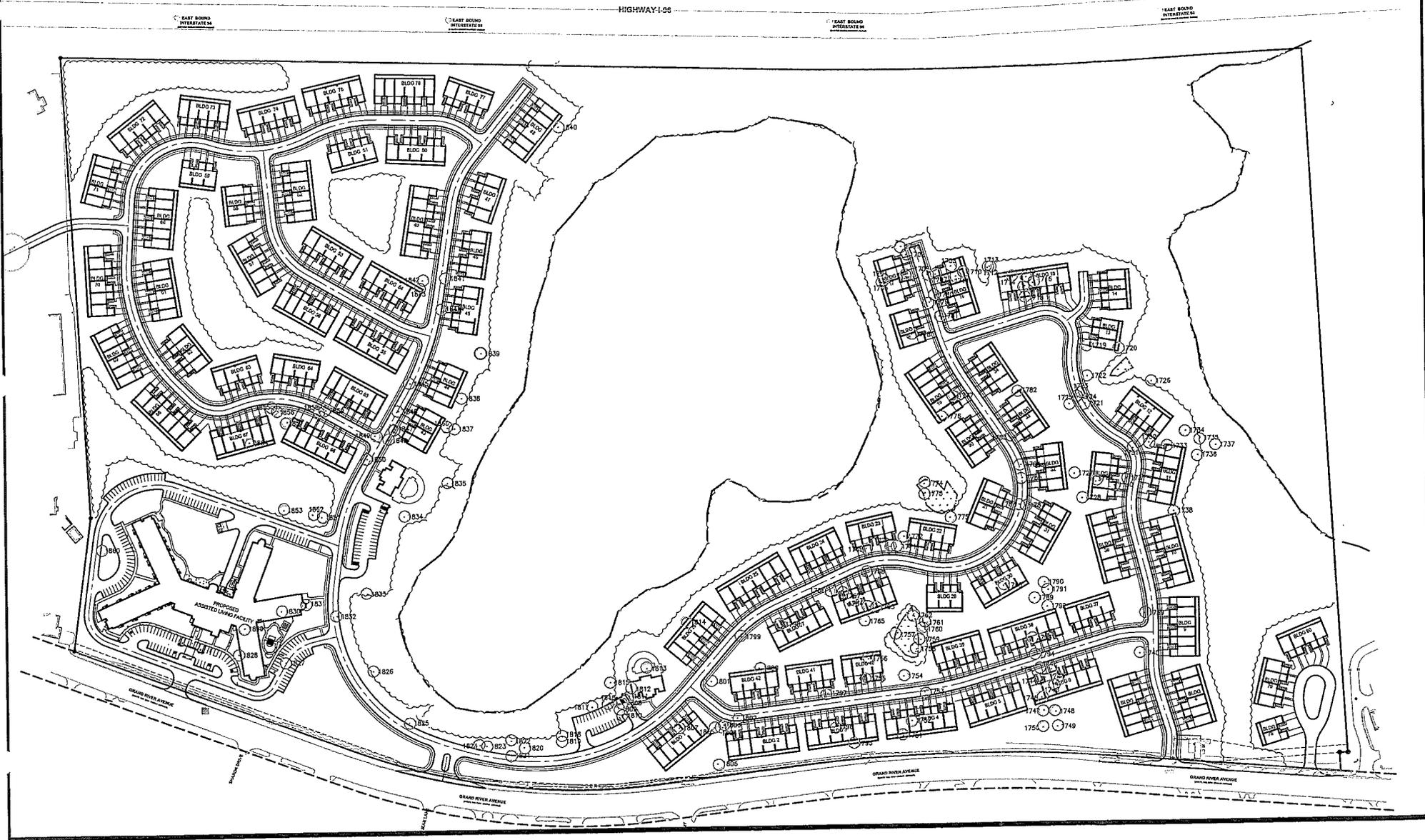
The following tree totals for each habitat type were computed:

- Wetland: 374 trees
- Evergreen/Hardwood Forest: 3,019 trees
- Mature upland: 497 trees
- Mixed Hardwood Forest: 8,107 trees
- Juvenile Upland: 497 trees
- Total= 12,494 trees**

Using the 19.37 acres of preserved woodlands and adding the 16.75 acres of preserved wetlands presented on Sheet 6 of the plan set and dividing that number by the 112 acres used for the tree sampling calculations (36.12 acres preserved / 112 total acres) we can determine the percentage of trees that will be saved which, is approximately 32%.

Significant Tree Location Related to Development

Figure 1.1



Natural Feature Assessment & Site Analysis

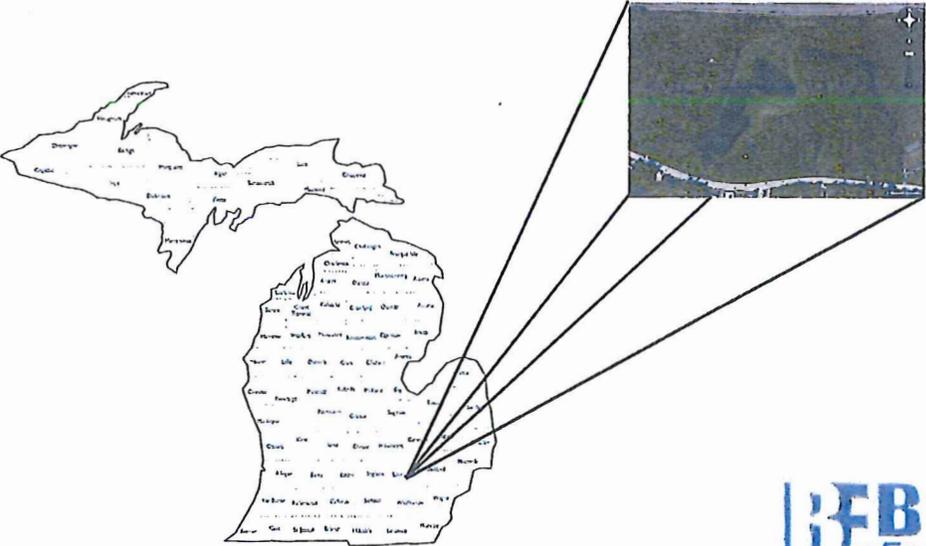
Pickrel Lake Development Site

Site Assessment Date: March 9, 2016

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Location Map



The 147+/- acre site is located between the north side of Grand River Avenue and the south side of I-96 surrounding Pickerel Lake in Brighton Township in Livingston County. A site analysis was performed on the site on March 9, 2016 by Boss Engineering. A desk top analysis of the property was also performed to confirm the findings collected during the field analysis. Resources utilized for that study included aerial photos from Google Earth, a web soil survey prepared by the USDA, and Wetlands Inventory Maps prepared by the MDEQ as well as resources prepared by the United States Fish & Wildlife Service.

The soils on site consist of loam, sandy loam, loamy sand and muck. The soils map provided with this report (Appendix A) as compiled by the USDA is consistent with the field assessment of the different areas found on site. The areas indicated on the soils map are also indicative of the land cover identified in the field which consist of some impervious surfaces, wetland, woodland including sparsely wooded, and grassy upland areas. The steeper slopes found in the Boyer-Oshtemo and Fox-Boyer series such as BtE and FrE (see Appendix A) have severe rating for erodibility. As the site currently exists, erosion was not noted but, this could be because of the vegetative cover helping to hold sediment in place.

Topography on the site ranges from low depressions at the wetland edges and valleys found primarily on the eastern side of the property to high areas found on the northern and eastern sides. The property's east and west side topography vary greatly from each other. The western side is undulating but relatively flat except along a ridgeline which then has a steep slope of 1:3 down to the water's edge of Pickerel Lake. The eastern side contains hills and valleys ranging in slopes from 1:3 to 1:8 until they gradually lessen out towards the southern end of the site by Grand River. Wetlands predominate the northern portion of the site but, there is a hilltop that helps define the wetland border adjacent to I-96.

The land cover found in the field consisted of five different types; impervious surface (asphalt/concrete, building), wetland, open water, wooded area including sparsely wooded, and grassy upland areas. These types can be broken down further into the following approximate areas:

Total Site Area: 147 acres
Impervious: +/- 1 acre
Wetland: +/- 18 acres
Open Water: +/- 35 acres
Woodland: +/- 64 acres
Grassy Upland: +/- 31 acres

There is some overlap between wetland to woodland, and woodland to grassy upland areas

Included on the site are (4) four abandoned houses accompanied by 5 accessory buildings which comprise of a barn, garage, (2) sheds, and a pump/well house.

The vegetation identified in the woodland areas during the field assessment appear to constitute a southern dry-mesic deciduous forests which consists of the following plant species:

<u>Hardwoods</u>	<u>Herbaceous</u>	<u>Shrub</u>
Swamp White Oak	Wild Grape Vine	Staghorn Sumac
White Oak	Periwinkle	Shrubby Rubus (varieties)
Black Locust	Wild Ginger	American Bittersweet
Large-Tooth Aspen	Poison Ivy	

Other deciduous trees noted included Black Cherry, Shagbark Hickory, Cottonwood, Black Willow and Sugar Maple. The site did feature a good mix of evergreen trees which included but, not limited to Scotch Pine, Red Pine, Eastern Red Cedar, and Black Spruce. Due to the mature nature of some of the forests found onsite, understory shrubs and groundcovers were scarce. Large trees ranging in caliper size from 6"-24"+ can be found throughout the site, some of which (in larger caliper sizes) can perhaps be saved as signature or landmark trees. A large majority of the trees however, may not be considered signature or landmark quality but are still relatively large specimens that may be preserved in groups to keep some canopy cover and character of the existing site.

The grassy upland areas are reminiscent of an oak barren type of plant community. Different species of Panicum grasses appear to be growing along with some sedges and other native upland plants. These areas are located towards the southeastern part of the site along Grand River Ave. and in the upper half of the western side of the site.

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. There is another wetland classified as a Shrub/Scrub Wetland located on the southeastern side of the site adjacent to Woodruff lake and an existing residential community. 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. There are also two smaller wetlands found in the central part of the eastern side which can also be

considered Shrub/Scrub Wetlands. A wetland delineation was performed by King & McGregor Environmental previously to 3/9/16 site analysis by Boss Engineering.

Mammal species which were evident to inhabit the site include deer, rabbit, and squirrel. Different birds were seen during the 3/9/16 site visit which included robins, cardinals, sparrows, geese, and falcon. Another species of note is the garter snake. During the site analysis multiple game paths were crossed that were created primarily by deer (see attached Appendix E for locations). The canopy cover in the woodland areas provided nesting opportunity for birds as well as squirrels. The patches of conifer trees provide a place for deer to bed down in addition to the upland grassy areas. The transition areas between the woodlands and grassy areas provide a perch for birds of prey such as the falcon for hunting. The site appears to be a well-balanced ecosystem with a healthy ecology to support the different species which inhabit the site.

This 147 acre property surrounding Pickerel Lake is unique given its varying topography and mature forested areas. It features easy access to major thoroughfares and is located within close proximity to Brighton's downtown area. The site provides scenic views of two different lakes and contains different animal life and land covers that contribute to its individual character.



1. United States. Department of Agriculture. Web Soil Survey. 10 March 2016 < <http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm>>

Ho - Houghton Muck

Consists of deep poorly drained soils comprised of organic materials creating anaerobic soil conditions. Common native vegetation is marsh grasses, cattails, sedges, reeds, and some water tolerant trees.

Landform: Drainage-ways, wetlands, moraines, depressions on outwash plains

Depth to Restrictive Feature: More than 80 inches

Natural Drainage Class: Very Poorly Drained

Frequency of Ponding: Frequent

Slope: 0-1 percent

Gd- Gilford Sandy Loam

Consists of deep poorly drained soils formed in loamy over sandy sediments. Native vegetation is primarily herbaceous wetland plants such as False Aster and Swamp Milkweed.

Landform: Glacial drainage channels

Depth to Restrictive Feature: More than 80 inches

Natural Drainage Class: Poorly Drained

Frequency of Ponding: Frequent

Depth to Water Table: 0-1 foot

Slope: 0-2 percent

By- Brookston Loam

Consists of deep poorly drained soils formed of silty material and underlying loamy till. Native vegetation is deciduous forests, sedges, and marsh grasses.

Landform: Depressions on till plains

Depth to Restrictive Feature: More than 80 inches

Natural Drainage Class: Poorly Drained

Frequency of Ponding: Frequent

Depth to Water Table: 0-1 foot

Slope: 0-2 percent

FrD & FrE- Fox Boyer Complex

This complex combines the Fox soil series and the Boyer soil series. The Fox series consists of deep well drained soil which are comprised of calcareous sandy outwash. Native vegetation for the Fox series includes deciduous forest trees such as White Oak Black Cherry, and Sugar Maple. The Boyer series consists of deep well drained soils formed in sandy and loamy drift underlain by gravelly sand outwash. Native vegetation is similar to the Fox series and includes deciduous forest trees.

Landform: Outwash plains and moraines

Depth to Restrictive Feature: More than 80 inches

Natural Drainage Class: Well Drained

Frequency of Ponding: None

Depth to Water Table: More than 80 inches

Slope FrD: 12-18 percent

Slope FrE: 18-25 percent

FoA, FoB, & FoC- Fox Sandy Loam

The Fox series consists of deep well drained soil which are comprised of calcareous sandy outwash. Native vegetation for the Fox series includes deciduous forest trees such as White Oak, Black Cherry, and Sugar Maple.

Landform: Valley trains, outwash plains, and moraines

Depth to Restrictive Feature: More than 80 inches

Natural Drainage Class: Well Drained

Frequency of Ponding: None

Depth to Water Table: More than 80 inches

Slope FoA: 0-2 percent

Slope FoB: 2-6 percent

Slope FoC: 6-12 percent

BtA, BtB, BtC, BtD, & BtE - Boyer Oshtemo Loamy Sand

This soil combines the Oshtemo soil series and the Boyer soil series. The Oshtemo series consists of deep well drained soil which are formed in stratified loamy and sandy deposits on valley trains. Native vegetation for the Oshtemo series includes deciduous forest trees such as Oak and Maple but, also pasture land. The Boyer series consists of deep well drained soils formed in sandy and loamy drift underlain by gravelly sand outwash. Native vegetation is similar to the Fox series and includes deciduous forest trees.

Landform: Moraines and outwash plains

Depth to Restrictive Feature: More than 80 inches

Natural Drainage Class: Well Drained

Frequency of Ponding: None

Depth to Water Table: More than 80 inches

Slope BtA: 0-2 percent

Slope BtB: 2-6 percent

Slope BtC: 6-12 percent

Slope BtD: 12-18 percent

Slope BtE: 18-25 percent



The large wetland located to the north side of the site (shown in purple in Appendix B) is classified by the United States Fish and Wildlife Service as a Freshwater Emergent Wetland. Specifically a PEMC which when decoded means the following:

P- Stands for Palustrine System which includes all non tidal wetlands dominated by trees, emergents, and shrubs.

EM- Stands for the class which is Emergent. Emergent classed wetlands feature rooted herbaceous perennial hydrophytes which are present for most of the growing season.

C- Stands for the water regime which in this case means seasonally flooded.

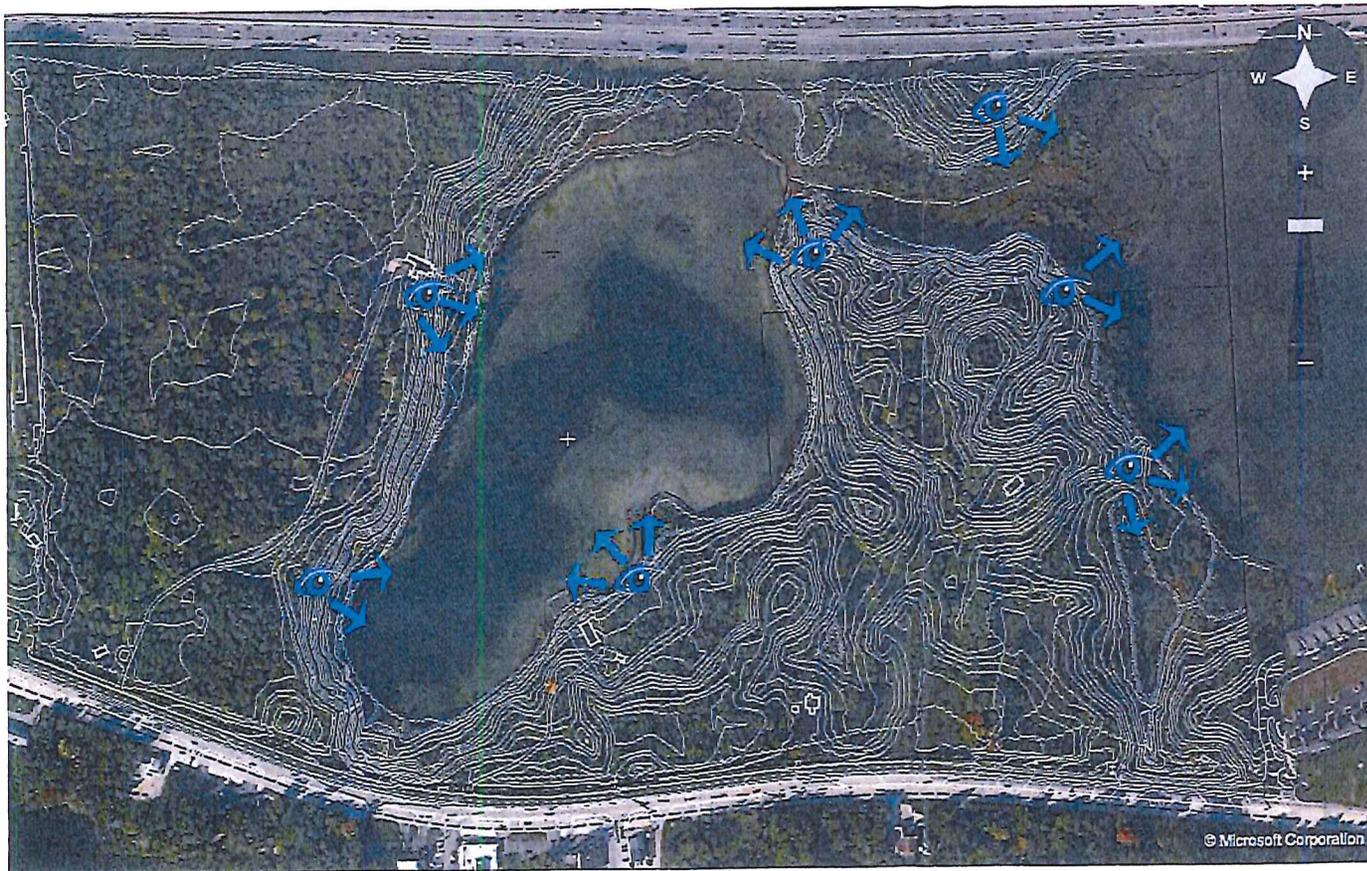
The wetlands shown in Appendix B as an orange color are Shrub/Scrub Wetlands according to the United State Fish and Wildlife Service. These wetlands are dominated by woody vegetation less than 20ft in height. Saplings of surrounding trees and tree shrubs are common species types that can be found within this type of wetland. Water levels in this type of wetland can vary throughout the year and after the site analysis by Boss Engineering conducted on 3/9/16 it is suspected that the two smaller wetlands central to the site will continue to exhibit standing water (depending on annual precipitation) as the growing season progresses.

The green colored wetlands are not mapped on the the Fish and Wildlife Service page but, could be considered wetlands based upon some environmental markers.

Appendix C- Topographic Overlay Map with Slopes

Pickereel Lake Development





During the site analysis conducted on 3/9/16 by Boss Engineering different, outlook points or viewing stations were noted. Depicted to the left is a map of these locations and the direction in which the best views can be found.

This site has a varying topography which lends itself the opportunity to create outlook vantage points or viewing windows which capture interest and create a calm and relaxed feeling.



During the Boss Engineering site analysis conducted on 3/9/16, some game paths were discovered on the site. Given the strong evidence of deer on the site, it is likely that these paths were created by deer from routinely traveling to the same areas. There are likely other game trails which exist onsite but, the ones indicated to the left were the main ones noted during the site analysis. Any type of development is bound to be disruptive to the animals that inhabit this site but, preserving certain areas on site could minimize the level of disruption. For instance trying to preserve or maintain some of the areas around the game paths and preserving large spaces as a place of refuge for the animals should minimize some of the effects developing the site could have.



Areas to Preserve

The graphic shown to the left are suggested areas to be preserved based upon the natural features of the site and other information presented in this report including soil type, land cover, and slope. Some areas are proposed to be preserved in an effort to retain some of the site character and create forested corridors within the site that tie back into preserved areas. The effort behind this proposal stems from the potential for mass grading activities. Depending on the proposed development, these forested corridors provide the opportunity to create not only visual interest but separate spaces for different uses.

This preservation plan has included the wetland areas found on site and many of the steep slopes found near the waters edge. These areas seem the most logical areas to try and preserve due to regulations and from a constructibility standpoint.

Despite some of the green areas overlapping the buildings onsite, they should be taken down. However, there is an opportunity to perhaps salvage some of the materials and reuse them as a feature element in either the landscape or architecture



- Areas to Preserve
- 100 ft Buffer from Wetland
- 25 ft Buffer from Wetland

This graphics intention is to show areas in which buffer spaces may be required.

In Article 10 Section 6 of the Charter Township of Brighton Zoning Ordinance there is a setback requirement of 100 ft from natural feature protection areas. The wetlands onsite fall under these regulations and are depicted to the left. The yellow areas indicate approximately the 100 ft setback mark. There is a potential to reduce the setback requirement to 25 ft per the permission of the Planning Commission and those areas are shown in red.

From an aesthetic point of view, some visual and noise buffers may be something to consider near I-96 and towards Grand River due to the noise and view. The west side of the site does not contain much noise pollution but does have commercial/office uses adjacent from it which provides an opportunity for a visual buffer.

Overall Site Picture Key



Depicted above is a key for the locations and view direction for site photographs taken by Boss Engineering during the 3/9/16 site analysis.

Each number represents an individual photograph which will follow in the subsequent pages.

The intent of these pictures is to display some of the natural features and ecology of the site to help better understand potential future use and development plans.



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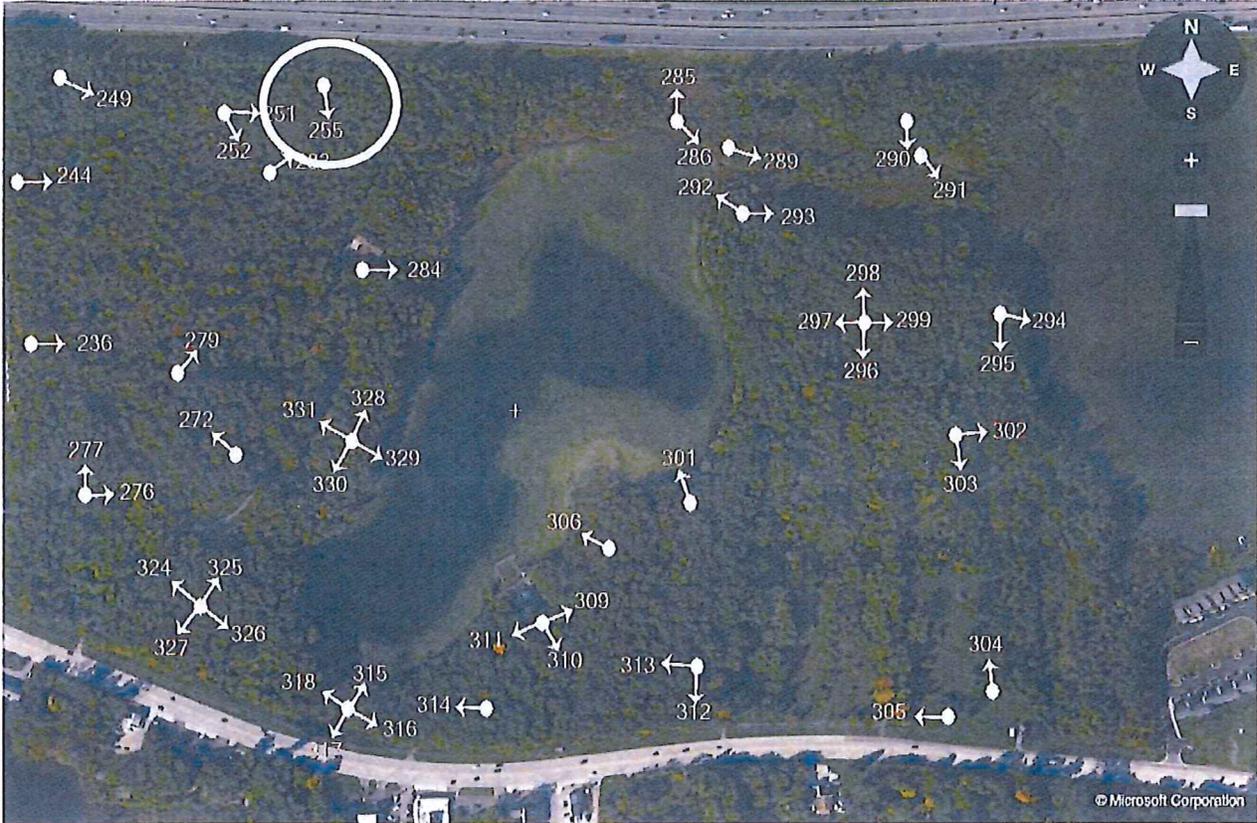
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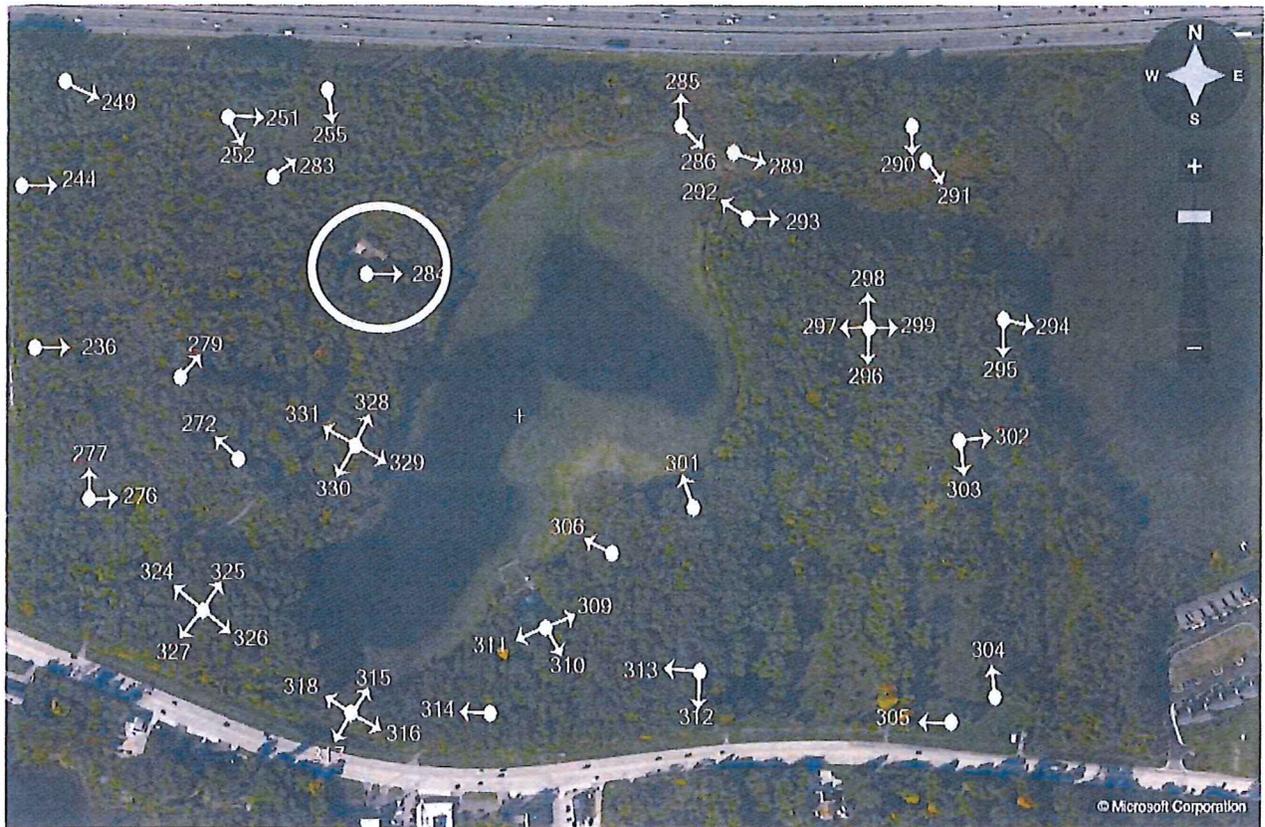
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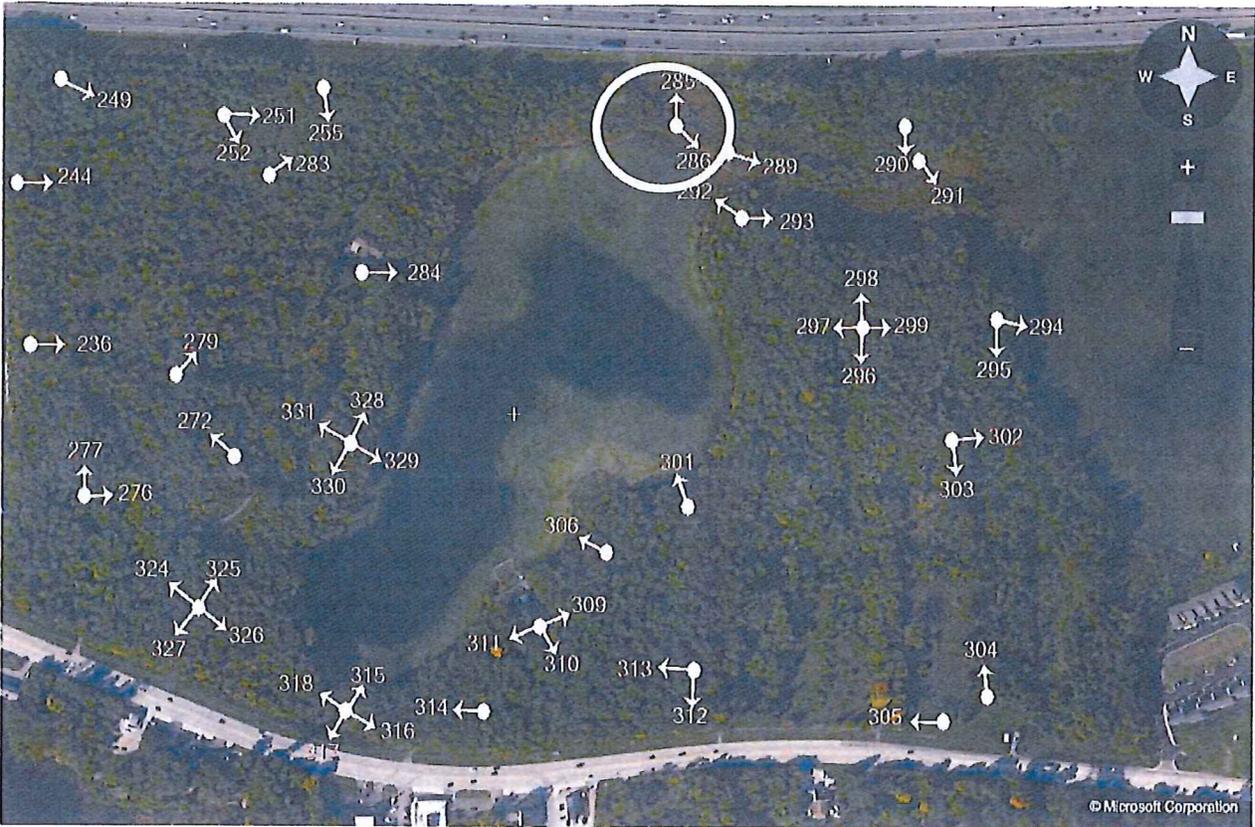
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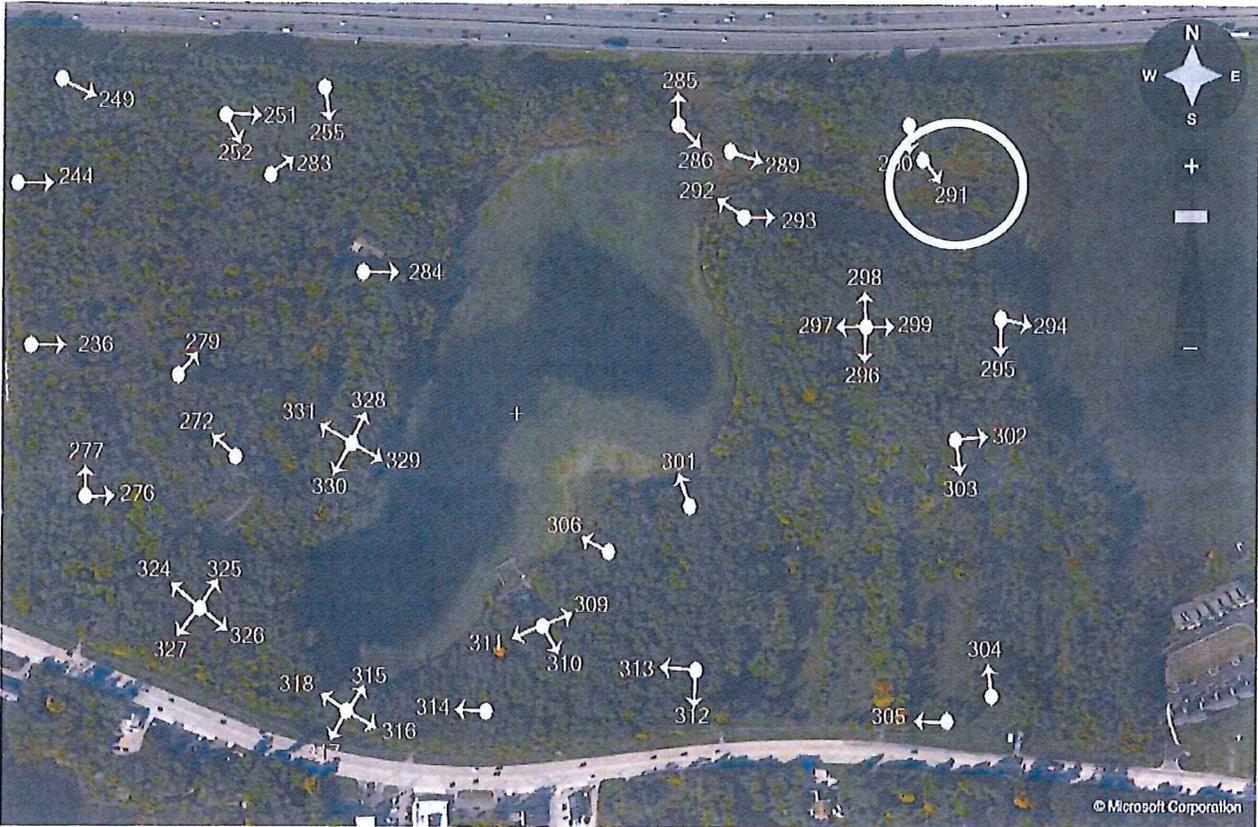
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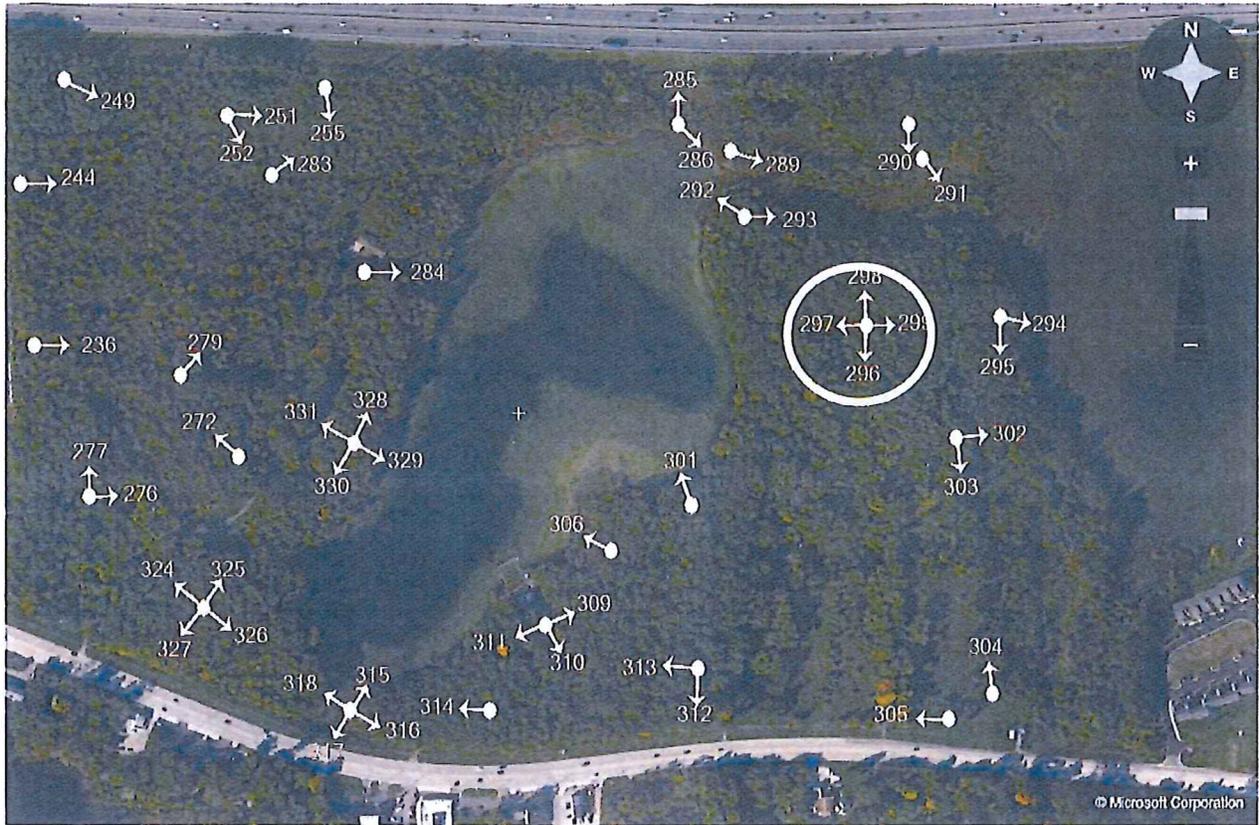
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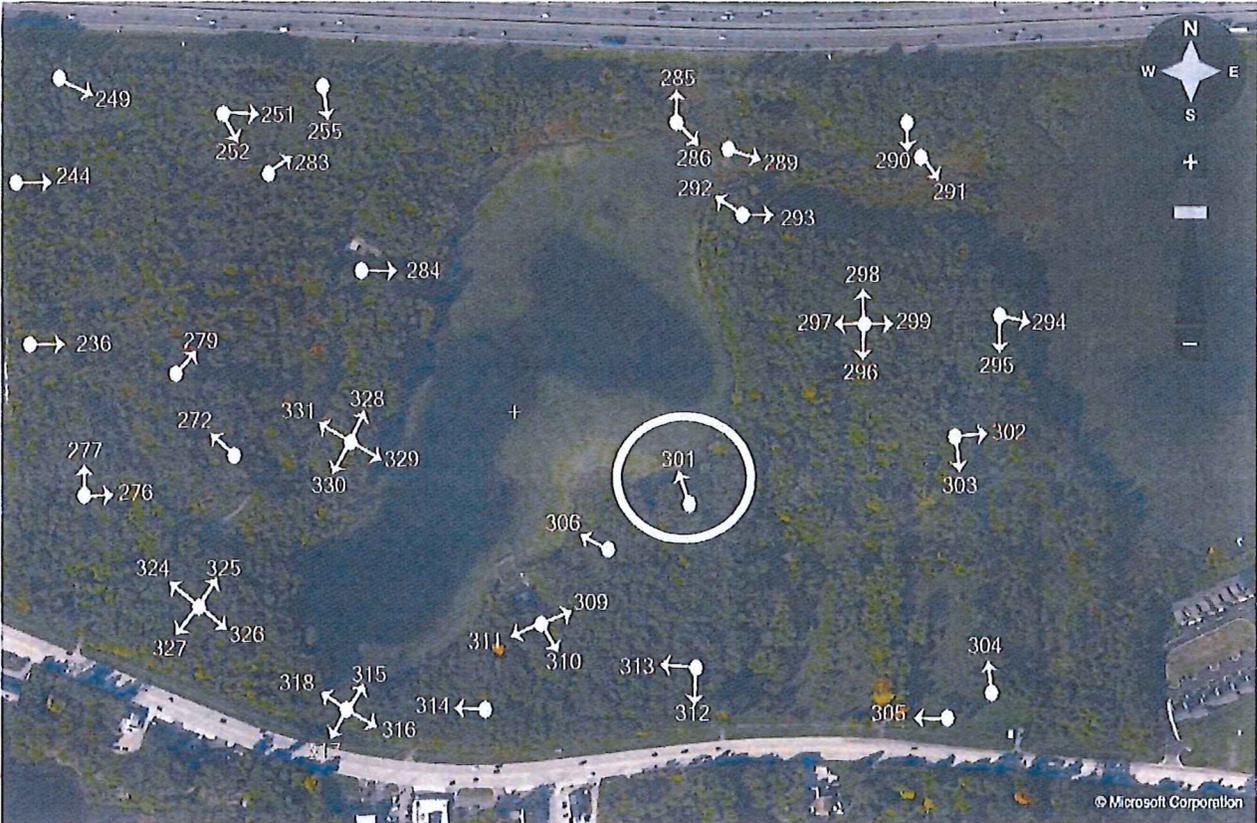
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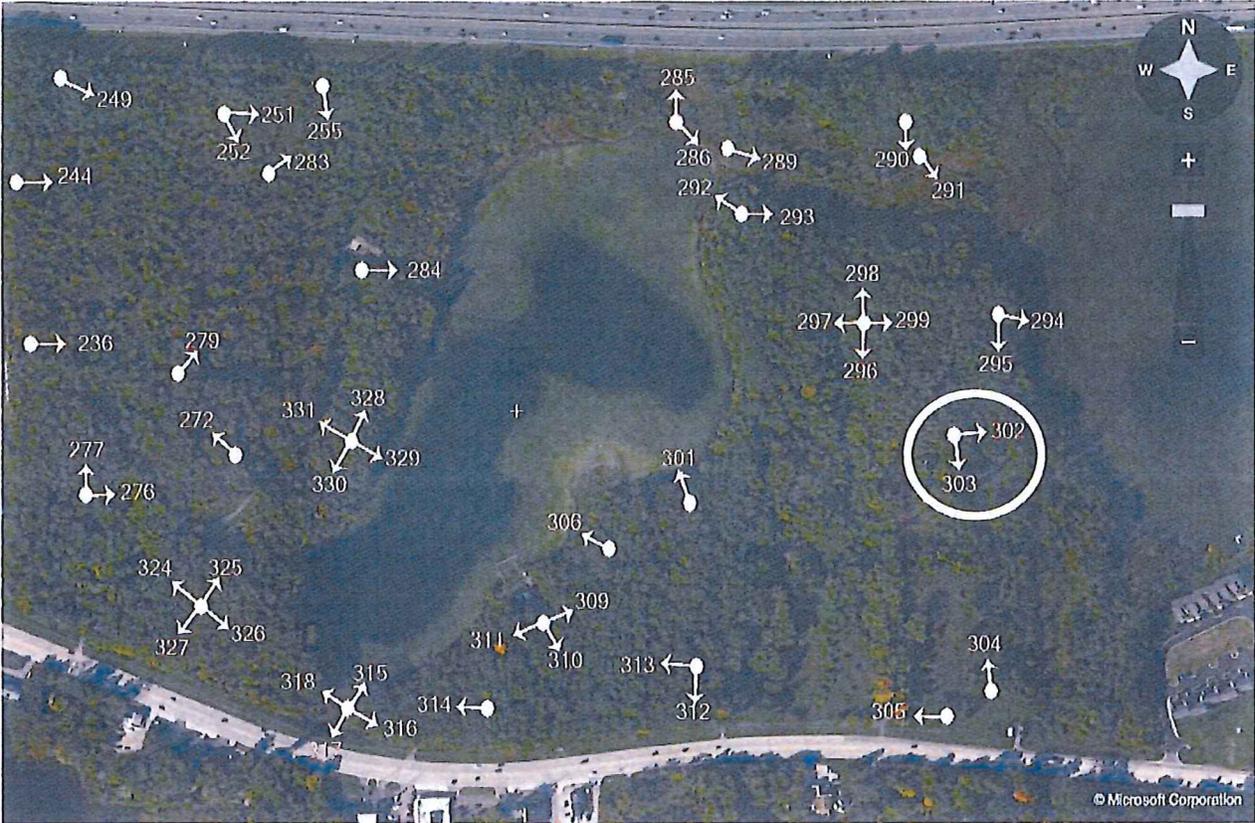
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Site Plan For Encore Village

Dated August 26, 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