



**AGENDA**  
CHARTER TOWNSHIP OF MERIDIAN  
PLANNING COMMISSION – REGULAR MEETING  
June 12, 2023 6:30 PM

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1. CALL MEETING TO ORDER
2. ROLL CALL
3. PUBLIC REMARKS
4. APPROVAL OF AGENDA
5. APPROVAL OF MINUTES
  - A. May 22, 2023
6. COMMUNICATIONS
  - A. None
7. PUBLIC HEARINGS
  - A. SUP #23012 – The W. Investment Holdings – 1614 W. Grand River Avenue
8. UNFINISHED BUSINESS
  - A. None
9. OTHER BUSINESS
  - A. None
10. MASTER PLAN UPDATE
11. REPORTS AND ANNOUNCEMENTS
  - A. Township Board update.
  - B. Liaison reports.
12. PROJECT UPDATES
  - A. Project Report
13. PUBLIC REMARKS
14. ADJOURNMENT

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Individuals with disabilities requiring auxiliary aids or services should contact: Director of Community Planning and Development  
Timothy R. Schmitt, 5151 Marsh Road, Okemos, MI 48864 or 517.853.4506 - Ten Day Notice is Required.  
Meeting Location: 5151 Marsh Road, Okemos, MI 48864



**TENTATIVE PLANNING COMMISSION AGENDA**  
**June 26, 2023**

1. PUBLIC HEARINGS
  - A. None
  
2. UNFINISHED BUSINESS
  - A. SUP #23012 – The W. Investment Holdings – 1614 W. Grand River Avenue
  
3. OTHER BUSINESS
  - A. None

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Individuals with disabilities requiring auxiliary aids or services should contact: Director of Community Planning and Development  
Timothy R. Schmitt, 5151 Marsh Road, Okemos, MI 48864 or 517.853.4506 - Ten Day Notice is Required.  
Meeting Location: 5151 Marsh Road, Okemos, MI 48864

Providing a safe and welcoming, sustainable, prime community.



**CHARTER TOWNSHIP OF MERIDIAN  
PLANNING COMMISSION  
REGULAR MEETING MINUTES**

**May 22, 2023**

**5151 Marsh Road, Okemos, MI 48864-1198**

**517.853.4000, Town Hall Room, 6:30 P.M.**

**PRESENT: Chair Blumer, Vice-Chair Trezise, Commissioners Brooks, McConnell, McCurtis, Scales, Shrewsbury, Richards, Snyder**

**ABSENT: None**

**STAFF: Senior Planner Brian Shorkey; Land Stewardship Coordinator Emma Campbell**

**1. CALL MEETING TO ORDER**

Chair Blumer called the regular meeting to order at 6:30 pm.

**2. ROLL CALL**

Chair Blumer called the roll of the Planning Commission. All were present.

**3. PUBLIC REMARKS**

None

**4. APPROVAL OF AGENDA**

**Vice-Chair Trezise moved to approve the agenda. Seconded by Commissioner McCurtis.**

VOICE VOTE: Motion approved unanimously.

**5. APPROVAL OF MINUTES**

A. May 8th, 2023 Regular Meeting

**Commissioner McConnell moved to approve the minutes of May 8<sup>th</sup>, 2023 as amended. Seconded by Commissioner Snyder.**

Commissioner McConnell noted a missed comment in Section 10, Subsection A. The missed information was from Commissioner Snyder, who asked out of the 375 residentially zoned parcels, how many of those are inside and outside of the Urban Service Boundary.

**VOICE VOTE: Motion approved unanimously with friendly amendments.**

**6. COMMUNICATIONS**

A. Email from Lynn Page re: SUP #23013

## 7. PUBLIC HEARINGS

A. None

## 8. UNFINISHED BUSINESS

A. SUP #23013 – Green Peak Innovations (Skymint) – Vacant Northwind Parcel

Senior Planner Shorkey outlined the packet presented to the Commission.

Commissioner Richards questioned whether there was a time limited to act on this SUP.

Senior Planner Shorkey noted that there is, but he would have to review the timeframe to give an answer.

Commissioner Richards noted his opposition to the SUP and why, and further noted that he will recommend not sending it to the Township Board.

Chair Blumer also noted his opposition to the SUP and why.

Senior Planner Shorkey noted that this is a C2 site, and this is one of the designated landing areas for a medical marijuana business according to the Master Plan & the future land-use map.

Commissioner Scales questioned why the Planning Commission can't require a performance bond for this SUP, while they can for other SUPs.

Senior Planner Shorkey noted the two year clock that every SUP has, as well as an option for a one year extension (with Planning Commission approval).

Commissioner Scales stated that with this information, he can support this SUP.

Commissioner Shrewsbury noted that this was approved by the Township Board once, and that this was specifically about the land-use. She also noted that she has trust in the Planning and Community Development staff when they state that there are other checks and balances further along the process, so she can support this SUP.

**Commissioner McConnell moved for the adoption of recommending approval for SUP #23010. Seconded by Commissioner Scales.**

Commissioner Richards reiterated his concern for the approval of this SUP.

Chair Blumer noted that Subsection 5 'of the appropriate ordinance' states that "...the project should not be detrimental to the economic welfare to the surrounding properties or the community." He further noted that the company in question, Green Peak Innovations, is unquestionably in the process of going bankrupt.

Commissioner Shrewsbury noted that this property is already owned by the applicant, and that denying them the access to build what they intended to build on this property may be even more detrimental to their financial health.

Commissioner Scales reiterated Senior Planner Shorkey's point that this Commission's role is to approve or deny based on their rules and regulations, and he stated that he believed that there are more reasons to vote yes than to vote no for this SUP.

Commissioner McCurtis confirmed with Senior Planner Shorkey that this will still move forward regardless if the vote is yes or no. Shorkey replied that the Planning Commission is making a recommendation to the Township Board, so it will move forward with either recommendation.

Vice-Chair Trezise stated that he believed that Subsection 5 didn't apply to this project, and that from a strictly land-use standpoint that this should qualify for a yes vote.

Chair Blumer noted that since Green Peak Innovations is currently under receivership, they aren't technically in control of the property. He questioned what happens if the guardian in charge of the receivership decides that it is financially best to sell the property.

Senior Planner Shorkey noted that the license will not transfer with sale of the property.

ROLL CALL VOTE: YEAS: Commissioners Snyder, Brooks, Scales, McConnell, Shrewsbury, Vice-Chair Trezise

NAYS: Commissioners Richards, McCurtis; Chair Blumer

Results: 6-3

## **9. OTHER BUSINESS**

### **A. Section 61 Review – Land Preservation Acquisition – Cornell/Sweetwood Property**

Stewardship Coordinator for Meridian Township Parks and Recreation Emma Campbell outlined her case for land preservation acquisition of the Cornell/Sweetwood property.

Vice-Chair Trezise questioned that, since this property had a lot of wetland on it, would it be buildable.

Coordinator Campbell stated that the Land Preservation Board discussed this, and their final answer was that it was buildable, but it would be difficult.

Vice-Chair Trezise inquired on the price that has been negotiated for this portion of land.

Coordinator Campbell stated that it was \$62k.

Vice-Chair Trezise noted that the township has already exceeded its projected land preservation quota, of which Coordinator Campbell confirmed.

Commissioner Scales inquired about the specific purpose for this portion of land.

Coordinator Campbell stated that this portion of land would primarily be used as a seed bank and an educational piece for native plant species and wetlands, respectively.

**Commissioner Shrewsbury moved for recommending approval for Section 61 Review #23018. Seconded by Commissioner Scales.**

ROLL CALL VOTE: YEAS: Commissioners Snyder, Brooks, Scales, McConnell, Shrewsbury, Richards, McCurtis; Vice-Chair Trezise; Chair Blumer

NAYS: None

Results: 9-0

B. Starbucks Drive Through Signs

Senior Planner Shorkey outlined the case.

**Commissioner Scales moved to approve Meridian Crossing Starbucks drive through sign updates. Seconded by Commissioner McCurtis.**

VOICE VOTE: Motion approved unanimously.

**10. MASTER PLAN UPDATE**

A. None

**11. REPORTS AND ANNOUNCEMENTS**

A. Township Board Update

None

B. Liaison Reports

Senior Planner Shorkey spoke on Meridian Township's first Pride Event, on August 26<sup>th</sup>.

Commissioner Brooks stated that there was supposed to be a CIA meeting, however it was canceled.

Commissioner McCurtis attended the Transportation Commission Committee on Thursday May 18<sup>th</sup>, and they had a full quorum. He spoke on our improvements with traffic.

Commissioner Scales spoke on the Juneteenth 2023 events, on June 9<sup>th</sup>, 16<sup>th</sup> & June 18<sup>th</sup>.

Vice-Chair Trezise attended the Zoning Board of Appeals May 17<sup>th</sup>, and they had a quorum. He spoke on the case the ZBA approved.

**12. PROJECT UPDATES**

None

**13. PUBLIC REMARKS**

Chair Blumer opened public remarks at 7:55 pm.

NONE

Chair Blumer closed public remarks at 7:55 pm.

**14. ADJOURNMENT**

**Chair Blumer moved to adjourn.**

VOICE VOTE: Motion approved unanimously.

**Chair Blumer adjourned the regular meeting at 7:55 pm.**



**To: Planning Commission**

**From: Brian Shorkey, Senior Planner**

**Date: June 8, 2023**

**Re: Special Use Permit #23012 (The W. Investment Holdings), to construct a medical marijuana provisioning center at 1614 West Grand River**

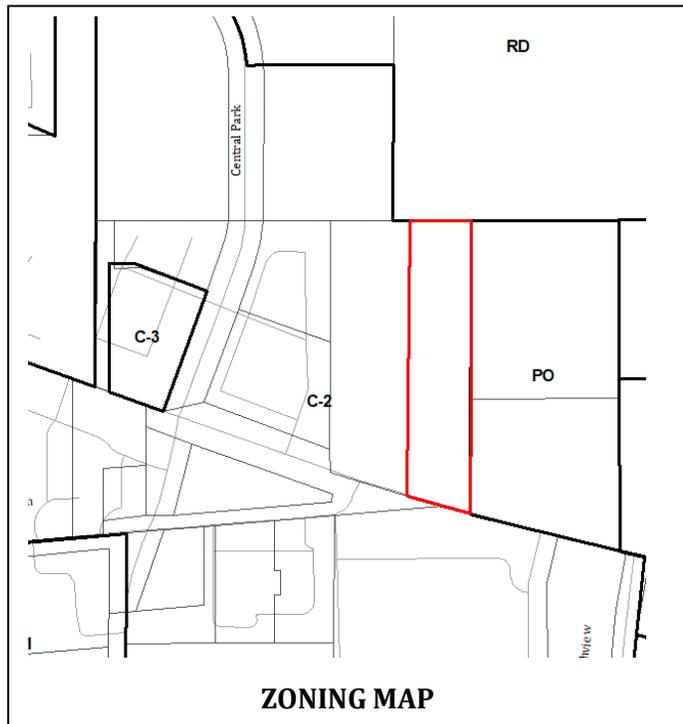
The W. Investment Holdings (Applicant) has submitted a Special Use Permit (SUP) application for the construction of a 4,000 square foot medical marijuana provisioning center at 1614 West Grand River, Okemos, MI 48864 (Subject Property). The Subject Property is approximately 2.4 acres in size and is zoned C-2 – Commercial.

Sec. 40-30 (e)(3) of the Township Code of Ordinances requires a successful medical marijuana applicant to apply for a special use permit, as provided in Sec. 86-124, within 60 days or issuance of a conditional approval for a medical marijuana facility permit. This SUP application fulfills that requirement and is identical to the SUP application that the Planning Commission reviewed and recommended for approval in 2019 (SUP #19131).

#### **Zoning and Future Land Use**

The proposed project is located in the C-2 – Commercial zoning district. A provisioning center is permitted subject to approval of a special use permit reviewed by the Planning Commission and approved by the Township Board.

The C-2 district requires a minimum of 100 feet of lot frontage and 4,000 square feet of lot area. The Subject Property is 2.4 acres in size and has 150 feet of frontage along Grand River Avenue, exceeding the ordinance standards.



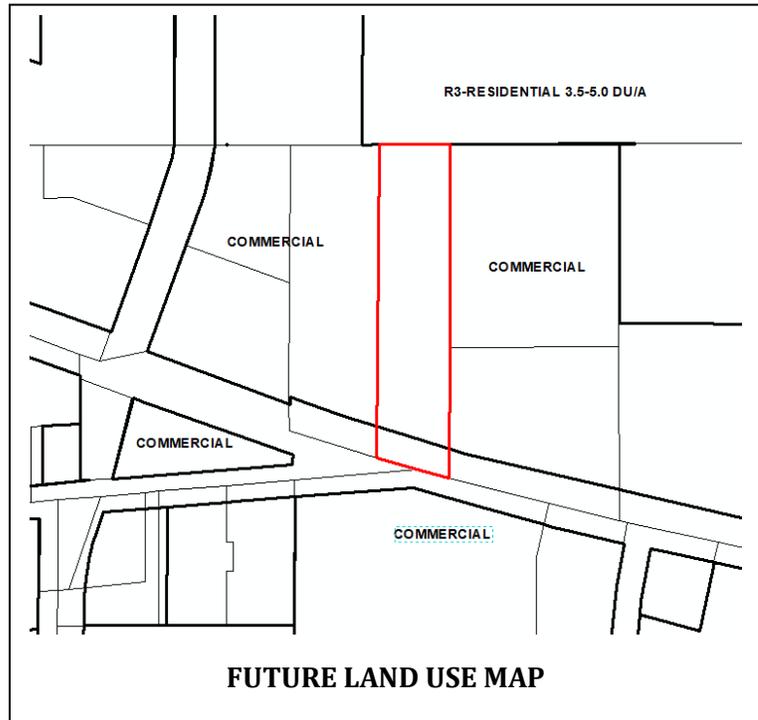
**Special Use Permit #23012 (The W. Investment Holdings)**  
**Planning Commission (June 12, 2023)**  
**Page 2**

The 2017 Master Plan designates the subject site as Commercial. This designation applies to the properties adjacent to the north, south, and east. The property to the north is shown as R3 – Single-Family Residential and is part of the Grand Reserve project that was approved by the Township earlier this year.

**Staff Analysis**

The site is currently undeveloped. The site was previously occupied by a single-family house that was demolished in early 2019.

Applications for special land use permits are reviewed under Sec. 86-126 in the Zoning Ordinance. Based on that review, Staff has the following comments:



1. The Subject Property lies within Medical Marijuana Overlay District 5. This has been approved of one of only seven areas in the Township where medical marijuana facilities are allowed. The proposed use conforms with this.
2. The proposed medical marijuana dispensary is a commercial use and conforms with the Subject Property's commercial zoning and Future Land Use designations.
3. The material attached to the medical marijuana application, approved on January 23, 2023, detailed the safety and odor control that was being proposed by the Applicant. The safety and odor control systems meet the Township's requirements.
4. Municipal water and sanitary sewer are available in the vicinity to serve the subject site. The location and capacity of utilities will be reviewed in detail during site plan review if the special use permit is approved, although there are no indications that the current system cannot handle a new retail use.
5. The original traffic study was reevaluated by the Applicant's traffic engineer and found to still be valid, as shown in the attached traffic study. The traffic study indicated that the existing roads are capable of handling the expected traffic, although it did suggest an optimization of traffic signal timing at the intersection of Grand River Avenue and Central Park Drive. This will be reviewed by the Michigan Department of Transportation (MDOT) during the site plan review phase.
6. The applicant is proposing to close an existing driveway and create a new driveway along Grand River Avenue to access the site. In accordance with MDOT, the Township has developed access management criteria for use in evaluating proposed access driveways along Grand River Avenue. The access management criteria for the proposed driveway are

**Special Use Permit #23012 (The W. Investment Holdings)**  
**Planning Commission (June 12, 2023)**  
**Page 3**

summarized in the study provided by the applicant's traffic consultant. Based on the study, the traffic consultant noted that waivers for the spacing between adjacent driveways will be required to facilitate the development of the proposed provisioning center. This criteria will be reviewed during the site plan review process and all curb cuts on Grand River are subject to MDOT review and approval.

7. The Flood Insurance Rate Map (FIRM) for Meridian Township indicates the property is not located in a floodplain. The Township Greenspace Plan shows no special designation on the site.
8. There are two wetlands located on the Subject Property. Both wetlands are located within 30 feet of a 2-acre pond and are therefore regulated by the State of Michigan and Meridian Township. Based on the submitted plans, the Applicant is not proposing any impacts to the wetlands and the 20-foot wetland buffer is being observed.
9. A sign plan was submitted as required by Sec. 40-30. The proposed signage meets the requirements of the Township sign ordinance.

Based on the information provided by the Applicant, Staff has identified wetlands and access management as potential concerns while reviewing the proposed Special Use Permit. The attached site drawings show that the Applicant is aware of the wetlands and is working around them in accordance with the Township's wetland ordinances. The traffic study and the proposed driveway relocation will be reviewed in detail during the site plan review phase.

If the project is approved by the Planning Commission and the Township Board, the applicant will be required to submit for Site Plan Review and building permits before work on the project can begin. Site Plan Review is a detailed staff-level analysis of the project which includes reviews of storm water, utilities, landscaping, grading, and other issues to ensure compliance with all applicable ordinances as well as confirmation of approvals from local agencies such as the Ingham County Drain Commissioner's Office and Road Department.

Prior to operations, the applicant will need to receive a medical marijuana license from the State of Michigan, Department of Licensing and Regulatory Affairs, approvals from any other State agencies, and final approval of the local permit for a commercial medical marijuana facility.

**Planning Commission Options**

The Planning Commission has the option to recommend approval, approval with conditions, or denial of Special Use Permit #23012. A resolution will be provided at a future meeting.

**Attachments**

1. SUP permit application with attachments, dated March 23, 2023 and received by the Township on April 28, 2023.
2. Site concept drawing, prepared by Rogvoy Architects, dated August 2, 2019 and received by the Township on April 28, 2023.
3. Traffic Impact Study prepared by Fleis & Vandenbrink Engineering, Inc. dated January 21, 2020, with memo dated April 27, 2023, and received by the Township on April 28, 2023.

**CHARTER TOWNSHIP OF MERIDIAN  
DEPARTMENT OF COMMUNITY PLANNING AND DEVELOPMENT  
5151 MARSH ROAD, OKEMOS, MI 48864  
PLANNING DIVISION PHONE: (517) 853-4560, FAX: (517) 853-4095**

**SPECIAL USE PERMIT APPLICATION**

Before submitting this application for review, an applicant may meet with the Director of Community Planning and Development to discuss the requirements for a special use permit and/or submit a conceptual plan for review to have preliminary technical deficiencies addressed prior to submittal of the application. If the property or land use is located in the following zoning districts RD, RC, RCC, RN then the applicant must meet with the Planning Director to discuss technical difficulties before filing a formal application.

**Part I**

- A. Applicant The W. Investment Holdings - Ammar W. Alkhafji  
 Address of Applicant 29580 Northwestern Highway  
 Telephone - Work 248.559.5555 Home \_\_\_\_\_ Fax \_\_\_\_\_ Email ammar@investorsgroup.com  
 Interest in property (circle one): Owner Tenant Option Other  
 (Please attach a list of all persons with an ownership interest in the property.)
- B. Site address / location / parcel number 1614 W. Grand River / 33-02-22-426-001 / Parcel 3  
 Legal description (please attach if necessary) Attached  
 Current zoning C2 - Commercial District  
 Use for which permit is requested / project name Commercial  
 Corresponding ordinance number \_\_\_\_\_
- C. Developer (if different than applicant) Same as above  
 Address \_\_\_\_\_  
 Telephone – Work \_\_\_\_\_ Home \_\_\_\_\_ Fax \_\_\_\_\_
- D. Architect, Engineer Planner or Surveyor responsible for design of project if different from applicant:  
 Name Nowak and Fraus Engineers Rogvov Architects  
 Address 46777 Woodward, Pontiac, MI 48342 32500 Telegraph, Bingham Farms, MI 48025  
 Telephone – Work 248.332.7931 Home \_\_\_\_\_ ~~Fax~~ Tel. 248.540.7700
- E. Acreage of all parcels in the project: Gross 2.40 Net \_\_\_\_\_
- F. Explain the project and development phases:
- G. Total number of:  
 Existing: structures 1 bedrooms unknown offices N/A parking spaces N/A carports N/A garages 1  
 Proposed: structures 1 bedrooms N/A offices N/A parking spaces 53 carports N/A garages N/A
- H. Square footage: existing buildings 2,161 proposed buildings 4,000  
 Usable Floor area: existing buildings 2,161 proposed buildings 4,000
- I. If employees will work on the site, state the number of full time and part time employees working per shift and hours of operation: It is expected that there will be 3 employees on site. Hours of operation is anticipated to be from 8 am to 7 pm
- J. Existing Recreation: Type N/A Acreage \_\_\_\_\_  
 Proposed Recreation: Type N/ Acreage \_\_\_\_\_  
 Existing Open Space: Type Residential Lawn Acreage 2.28  
 Proposed Open Space: Type Commercial Lawn Acreage 1.60



- M. Any other information specified by the Director of Community Planning and Development which is deemed necessary to evaluate the application.
- N. In addition to the above requirements, for zoning districts, **RD, RC, RCC, RN, and CV** and **Group Housing Residential Developments** the following is required:
1. Existing and proposed contours of the property at two foot intervals based on United States Geological Survey (USGS) data.
  2. Preliminary engineering reports in accordance with the adopted Township water and sewer standards, together with a letter of review from the Township Engineer.
  3. Ten copies of a report on the intent and scope of the project including, but not limited to: Number, size, volume, and dimensions of buildings; number and size of living units; basis of calculations of floor area and density and required parking; number, size, and type of parking spaces; architectural sketches of proposed buildings.
  4. Seven copies of the project plans which the Township shall submit to local agencies for review and comments.
- O. In addition to the above requirements, a special use application in zoning district **RP** requires the following material as part of the site plan:
1. A description of the operations proposed in sufficient detail to indicate the effects of those operations in producing traffic congestion, noise, glare, air pollution, water pollution, fire hazards or safety hazards or the emission of any potentially harmful or obnoxious matter or radiation.
  2. Engineering and architectural plans for the treatment and disposal of sewerage and industrial waste tailings, or unusable by-products.
  3. Engineering and architectural plans for the handling of any excessive traffic congestion, noise, glare, air pollution, or the emission of any potentially harmful or obnoxious matter or radiation.
- P. In addition to the above requirements, a special use application for a use in the Floodway Fringe of zoning district **CV** requires the following:
1. A letter of approval from the State Department of Environmental Quality.
  2. A location map including existing topographic data at two-foot interval contours at a scale of one inch representing 100 feet.
  3. A map showing proposed grading and drainage plans including the location of all public drainage easements, the limits, extent, and elevations of the proposed fill, excavation, and occupation.
  4. A statement from the County Drain Commissioner, County Health Department, and Director of Public Works and Engineering indicating that they have reviewed and approved the proposal.
- Q. In addition to the above requirements, a special use application for a use in the Groundwater Recharge area or zoning district **CV** requires the following:
1. A location map including existing topographic data at two-foot interval contours.
  2. A map showing proposed grading and drainage plans including the location of all public drainage easements, the limits and extent of the proposed fill, excavation, and occupation.
  3. A statement from the County Drain Commissioner, County Health Department, and Director of Public Works and Engineering indicating that they have reviewed and approved the proposal.
- R. In addition to the above requirements, the Township Code of Ordinances, Article VI, should be reviewed for the following special uses: group housing residential developments, mobile home parks, nonresidential structures and uses in residential districts, planned community and regional shopping center developments, sand or gravel pits and quarries, sod farms, junk yards, sewage treatment and disposal installations, camps and clubs for outdoor sports and buildings greater than 25,000 square feet in gross floor area.

Part II

SUP REQUEST STANDARDS  
Township Code of Ordinances, Section 86-126

Applications for Special Land Uses will be reviewed with the standards stated below. An application that complies with the standards stated in the Township Ordinance, conditions imposed pursuant to the Ordinance, other applicable Ordinances, and State and Federal statutes will be approved. Your responses to the questions below will assist the Planning Commission in its review of your application.

- (1) The project is consistent with the intent and purposes of this chapter.
- (2) The project is consistent with applicable land use policies contained in the Township's Master Plan of current adoption.
- (3) The project is designed, constructed, operated, and maintained so as to be harmonious and appropriate in appearance with the existing or intended character of the general vicinity and that such a use will not change the essential character of the same area.
- (4) The project will not adversely affect or be hazardous to existing neighboring uses.
- (5) The project will not be detrimental to the economic welfare of surrounding properties or the community.
- (6) The project is adequately served by public facilities, such as existing roads, schools, stormwater drainage, public safety, public transportation, and public recreation, or that the persons or agencies responsible for the establishment of the proposed use shall be able to provide any such service.
- (7) The project is adequately served by public sanitation facilities if so designed. If on-site sanitation facilities for sewage disposal, potable water supply, and storm water are proposed, they shall be properly designed and capable of handling the longterm needs of the proposed project.
- (8) The project will not involve uses, activities, processes, materials, and equipment and conditions of operation that will be detrimental to any persons, property, or the general welfare by reason of excessive production of traffic, noise, smoke, fumes, glare, or odors.
- (9) The project will not directly or indirectly have a substantial adverse impact on the natural resources of the Township, including, but not limited to, prime agricultural soils, water recharge areas, lakes, rivers, streams, major forests, wetlands, and wildlife areas.

Part III

I (we) hereby grant permission for members of the Charter Township of Meridian's Boards and/or Commissions, Township staff member(s) and the Township's representatives or experts the right to enter onto the above described property (or as described in the attached information) in my (our) absence for the purpose of gathering information including but not limited to the taking and the use of photographs.

Yes     No    (Please check one)

By the signature(s) attached hereto, I (we) certify that the information provided within this application and accompanying documentation is, to the best of my (our) knowledge, true and accurate

  
\_\_\_\_\_  
Signature of Applicant

3/23/23  
\_\_\_\_\_  
Date

Ammar Alkhafaji  
\_\_\_\_\_  
Type/Print Name

Fee: \_\_\_\_\_

Received by/Date: \_\_\_\_\_



CIVIL ENGINEERS  
LAND SURVEYORS  
LAND PLANNERS

## LEGAL DESCRIPTION

### PARCEL 3

The East 145 feet of the following description: Beginning at a point 1123.75 feet West of the East quarter post of Section 22, Town 4 North, Range 1 West, thence West 351 feet, thence South 748 feet to the center of Grand River Road, thence Easterly along center of said road 351 feet; thence North 746 feet to beginning, Meridian Township, Ingham County, Michigan.

Address: 1614 W. Grand River Avenue  
Tax ID No.: 33-02-02-22-426-001

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NOWAK & FRAUS ENGINEERS

46777 WOODWARD AVENUE  
PONTIAC, MI 48342-5032

[WWW.NOWAKFRAUS.COM](http://WWW.NOWAKFRAUS.COM)

VOICE: 248.332.7931  
FAX: 248.332.8257



CIVIL ENGINEERS  
LAND SURVEYORS  
LAND PLANNERS

March 15, 2023

**Meridian Township**  
5151 Marsh Road  
Okemos, Michigan 48864

Attention: **Department of Community Planning and Development**

Regarding: **Parcel 3 – 1614 W. Grand River 33-02-22-426-001**  
**Special Land Use**

To All:

The W. Investment Holdings – Ammar W. Alkhafaji desires to construct a retail business on the referenced parcel/property. Parcel 3 is 2.20 acres of a larger property that will be developed in the future by the Owner listed above. The proposed retail is planned to be a 4,000 square foot building with a total 34 parking spaces.

1. The site noted above is zoned C-2 Commercial District. The minimum lot area is 4,000 square feet. The lot/ parcel 3 is 2.40 acres. The lot width is 144 feet. The proposal meets the setback requirements.

The proposed use is a provisioning center. At the suggestion of the Township and in accordance with Section 86-404 the applicant is submitting this project for a special use.

2. The Township Master Plan identifies the subject parcel zoned as commercial use. The proposed use as a provisioning center will be harmonious with the surrounding properties. The property to the east of this project is a medical office. The property to the west of the site is commercial. Long term plans are to develop Parcel 2 as a commercial retail site. The provisioning center is consistent with applicable land use policies contained in the Township's Master Plan of current adoption as our property has been chosen via the township's "lottery" for District 5.
3. As provided on the attached plans, the propose development fits seamlessly on the site and has been designed to meet the standards of the Meridian Township Zoning Ordinance. As indicated above the proposed development will be harmonious with the surrounding properties and will serve as a transition between the medical office to the east and the commercial operation to the west. The hours of operation will conform with the township's requirement and will not exceed what is allowed by the township. All precautionary measures will be taken in regard to the security of the operation along with the wellbeing of the community and surrounding vicinity. Building will be constructed following all Township and Michigan building code standards. The design will be appropriate with the existing general vicinity and its intended character and will not change the essential character of that area.
4. The proposed development will be a transition between the surrounding properties and will be harmonious with those properties. It will **not** adversely affect or be hazardous to existing neighboring uses. Our facility will include an odor plan including a carbon filtration system to make sure there is no

NOWAK & FRAUS ENGINEERS

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PONTIAC, MI 48342-5032

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smell giving a negative effect to our neighbors and surrounding community. We will also be having full security on the property during business hours to ensure safety to our clientele and the community at large.

5. It is anticipated that the proposed provisioning center will slightly increase the amount of commercial activity in this area. The provisioning center will be replacing existing an existing residential property. It is likely that the patrons for this project will also utilize the other nearby properties. This project will **not** be detrimental to the economic welfare of surrounding properties and community, and in fact will have a positive effect to the economic welfare of surrounding properties and community.
6. The subject parcel has frontage onto West Grand River Avenue. Pedestrian access currently exists along Grand River Avenue. Public utilities such as sewer, water and storm water are available to the site.
7. The site is served by public water and sanitary sewer services. All of which will be properly designed to fit this project and will be adequately capable of handling all long term needs for the proposed project.
8. The proposed project will not involve any uses or activities, processes, materials, equipment or conditions that will be detrimental to any persons, property or general welfare through the excessive generation of traffic, noise, smoke, fumes, glare or odor. A traffic generation report along with traffic study is provided to show support of that. We have also provided an odor plan in the provisioning center application to show all preventative measures of eliminating odor to surrounding area. There will be no conduct in the place of business to create excessive noise, smoke or fumes. All lighting of the property will be conforming to townships ordinance.
9. The proposed provisioning center project will not directly or indirectly have an adverse impact on the natural resources of the Township, the agricultural soils, water recharge areas, lakes, rivers, streams, major forests, wetlands and wildlife areas.

The proposed project is located within the existing commercial area of the Township.

Please call us if there are any questions pertaining to the above.

Respectfully,  
Nowak and Fraus Engineers

Michael D. Peterson, P.E.

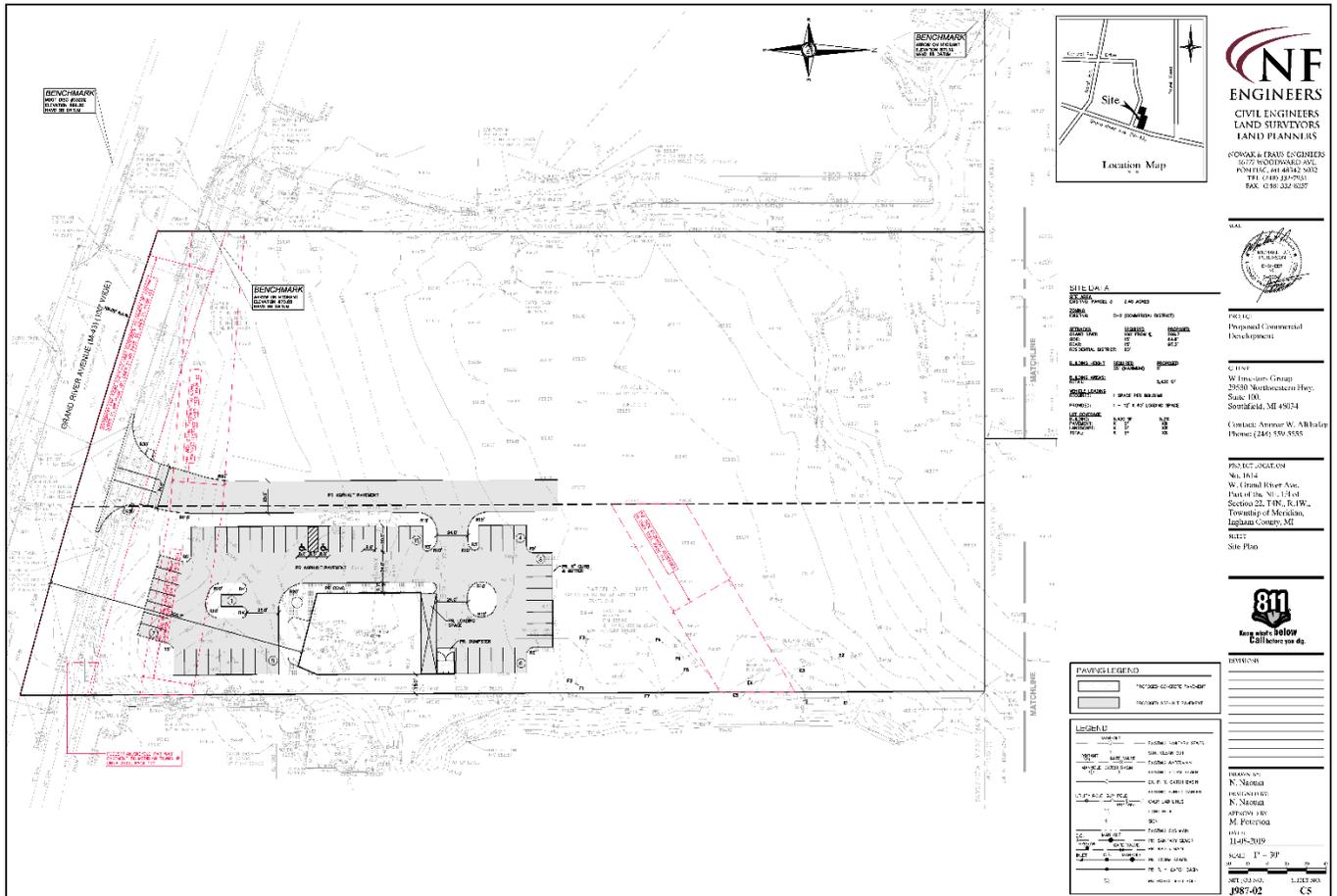
March 15, 2023

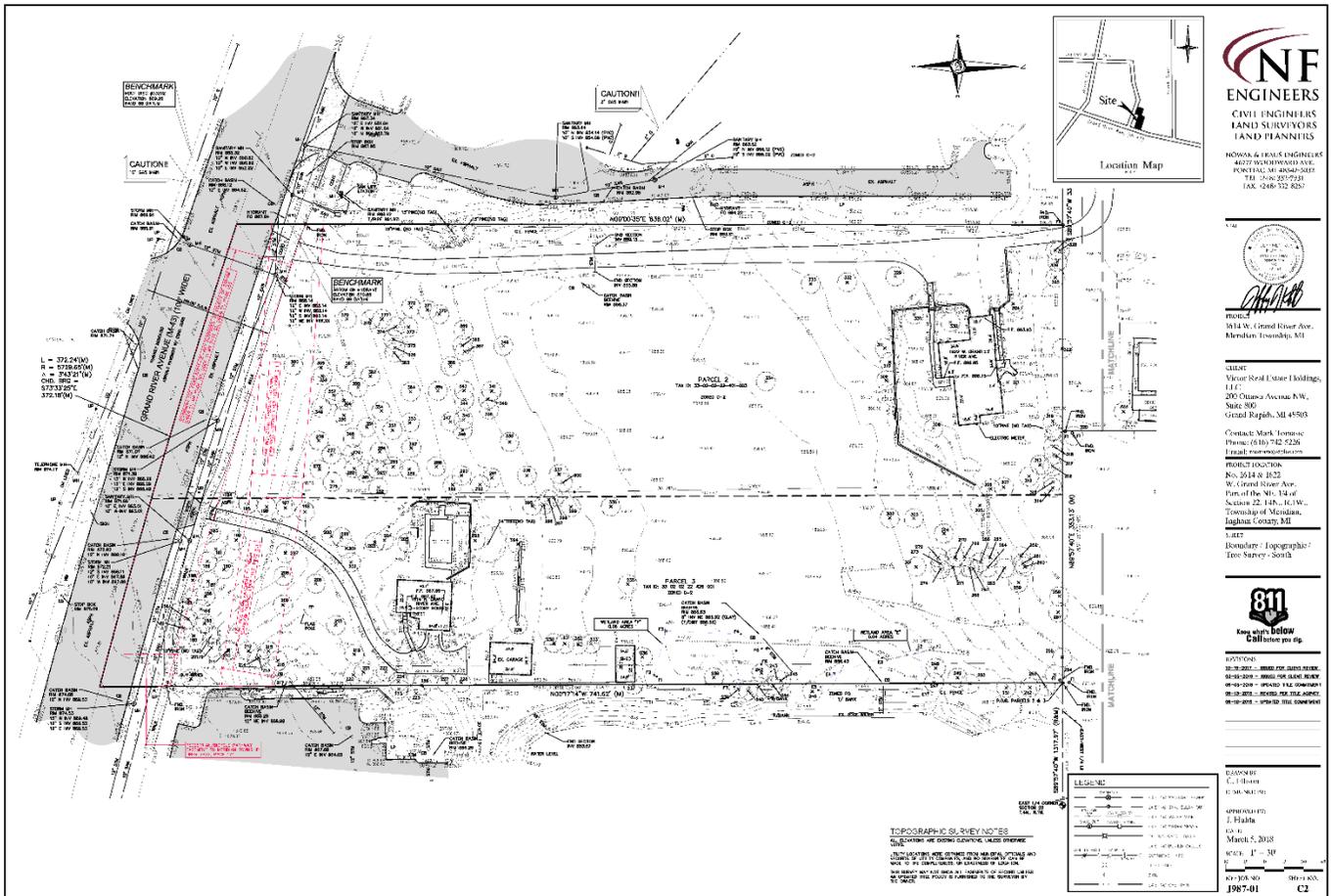
Natural Features Assessment  
 1614 Grand River Ave. - Meridian Township

The site is located at 1614 Grand River Avenue in Meridian Township. The proposed project will be on what is designated as parcel 3. Parcel 3 is 2.4 acres in size. The proposed project will be part of a larger project that will be developed in the future.

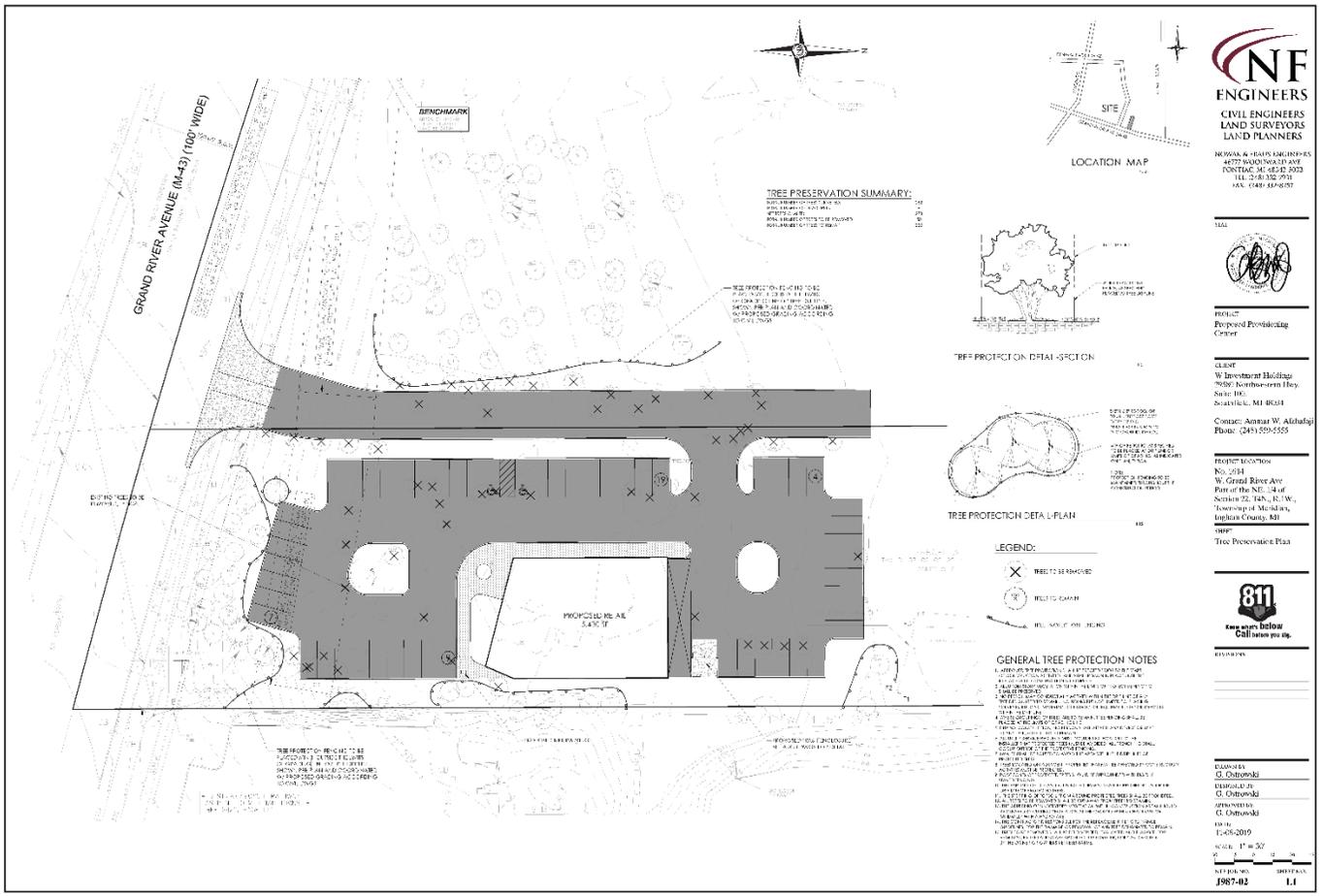
Access for the site will be from Grand River Avenue and is proposed to be a 3-lane ingress/egress.

The site is zoned C-2 – Commercial District. The owners are proposed to place a dispensary on the site.









**NF ENGINEERS**  
 CIVIL ENGINEERS  
 LAND SURVEYORS  
 LAND PLANNERS

NOWAK & FRAUS ENGINEERS  
 46777 WOODWARD AVE  
 PONTIAC, MI 48342-5032  
 TEL: 248.332.7931  
 FAX: 248.332.8257

**PROJECT:**  
 Proposed Proving Ground

**CLIENT:**  
 W. Investment Holding  
 9500 Southwestern Hwy  
 Suite 100  
 Southfield, MI 48034

**Contact:** Anna W. Altkamp  
 Phone: (248) 559-5555

**PROJECT LOCATION:**  
 No. 2314  
 W. Grand River Ave  
 Part of the SEC. 34 of  
 Section 22, T4N., R.1W.,  
 Township of Meridian,  
 Ingham County, MI

**DATE:**  
 Tree Preservation Plan

**811**  
 Know what's below  
 Call before you dig.

**DESIGNED BY:**  
 G. Ostrowski

**DRAWN BY:**  
 G. Ostrowski

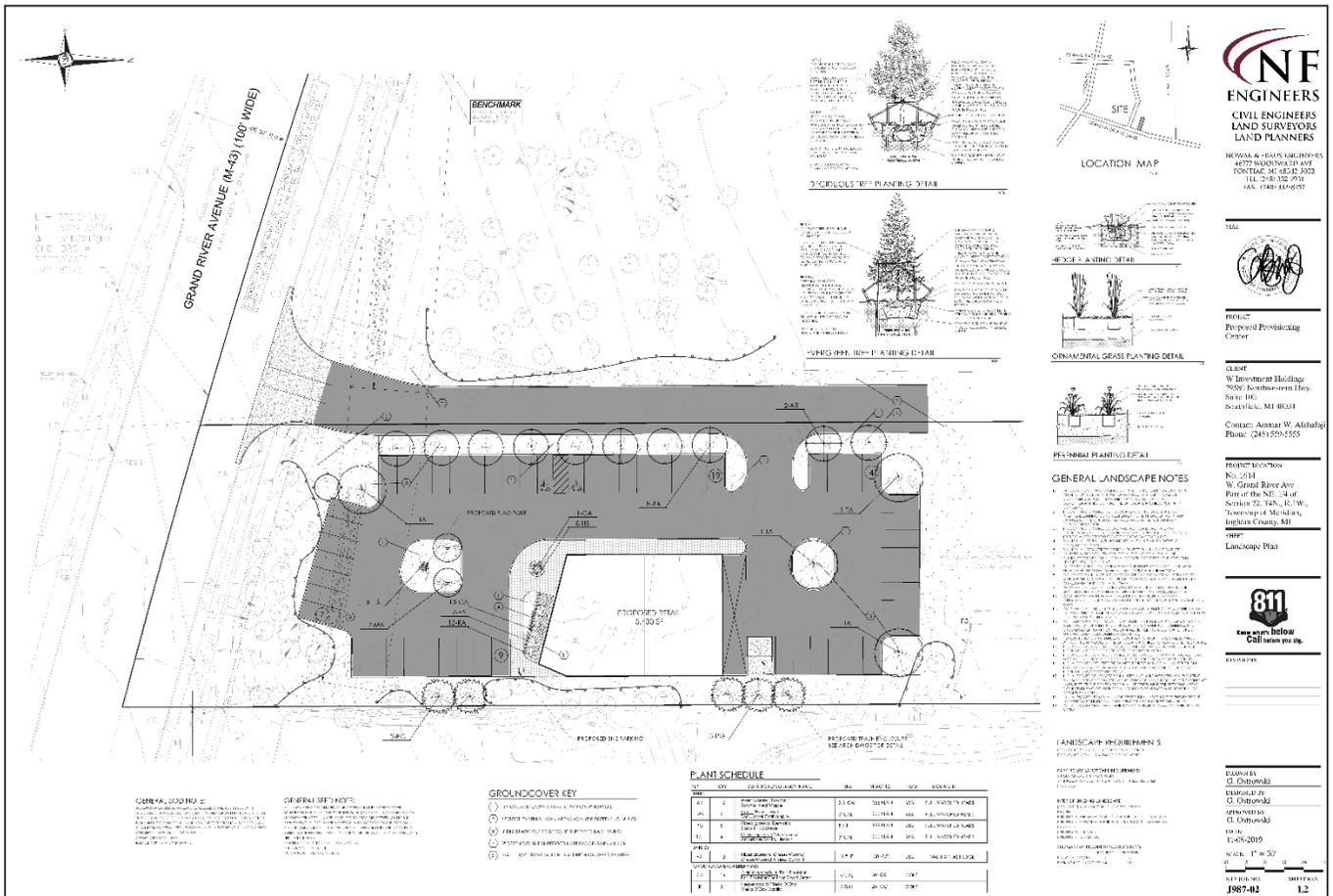
**CHECKED BY:**  
 G. Ostrowski

**DATE:**  
 3-15-2023

**SCALE:**  
 1" = 20'

**PROJECT NO.:**  
 J987-02

**SHEET NO.:**  
 1.1



If there are any questions pertaining to the above, please call us at (248) 332-7931.

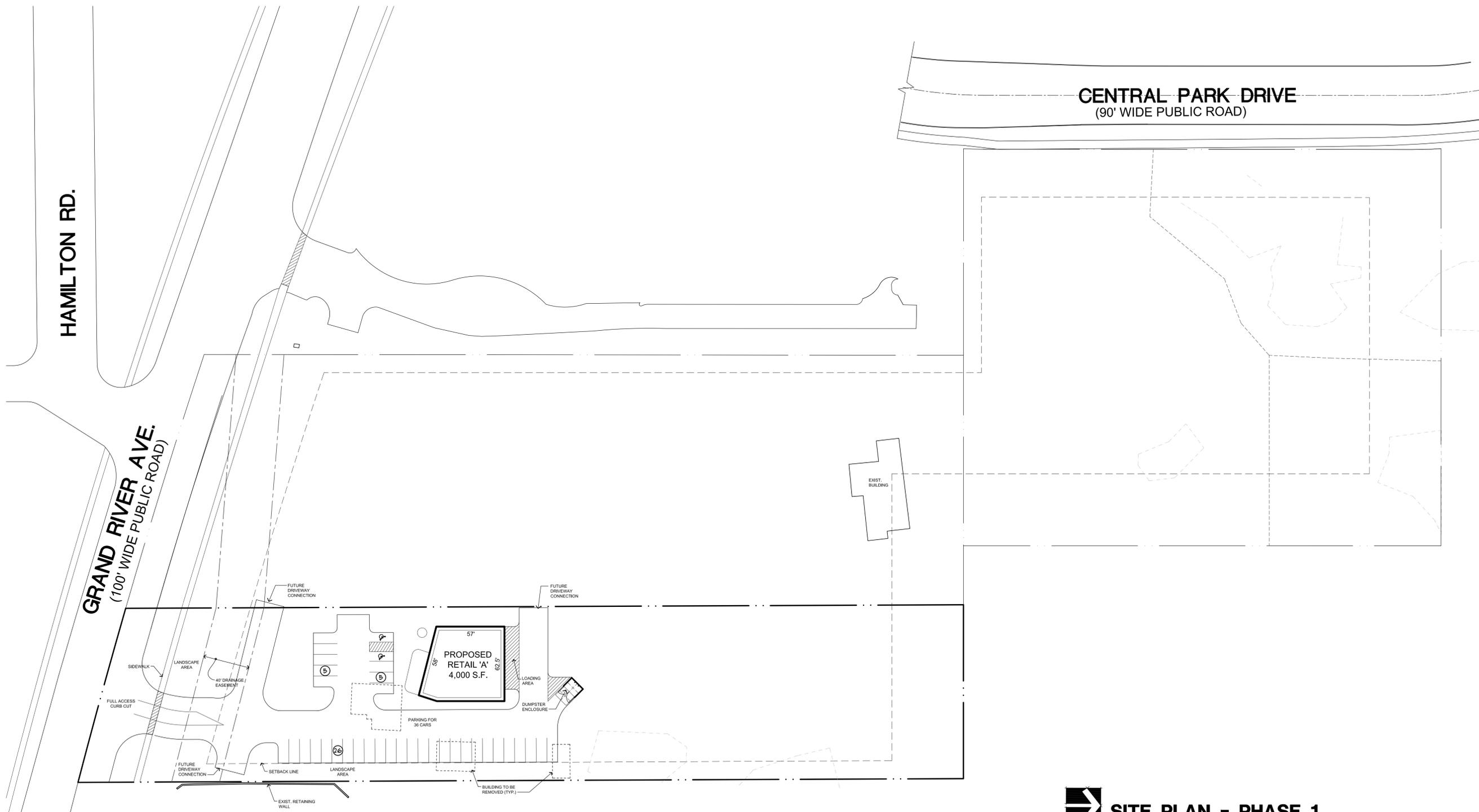
Respectfully,  
 Nowak and Fraus Engineers

Michael D. Peterson, P.E.  
 Principal

LAND/ BUILDING/ PARKING DATA :	
<b>PHASE 1</b>	
<b>LAND DATA :</b>	
OVERALL LAND AREA :	2.4 ACRES
<b>BUILDING DATA :</b>	
PROPOSED RETAIL 'A' :	4,000 S.F.
<b>PARKING REQUIRED :</b> 20 SPACES	
<b>RETAIL :</b> 5 SPACES/ 1,000 GFA (4,000/ 1000 = 4 X 5 = 20 SPACES)	
<b>PARKING PROVIDED :</b> 36 SPACES	

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 OWNER REVIEW: 17 JAN. 2020  
 OWNER REVIEW: 22 JAN. 2020

project:



Proposed for  
**Commercial Development**  
 Grand River Ave.  
 Meridian Twp., MI

**ROGVOY**  
 ARCHITECTS  
 32500 TELEGRAPH ROAD  
 SUITE 250  
 BINGHAM FARMS, MICHIGAN  
 48025-2404  
 PH 248.540.7700 FX 248.540.2710  
 www.rogvoy.com

drawing:  
**Conceptual Site Plan Phase 1**  
 DO NOT SCALE DRAWING  
 issue date: 02 AUG. 2019  
 drawn: KS/KL  
 checked: MD  
 approved: MD

file number: 19030  
 sheet:

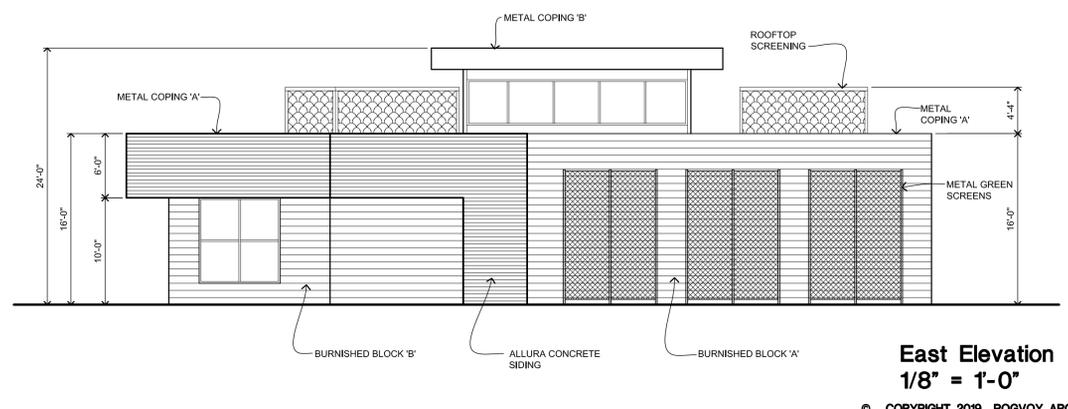
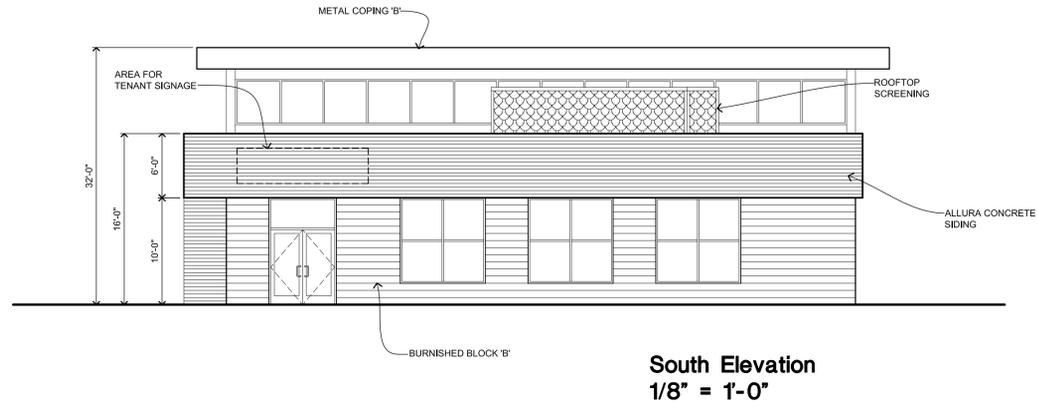
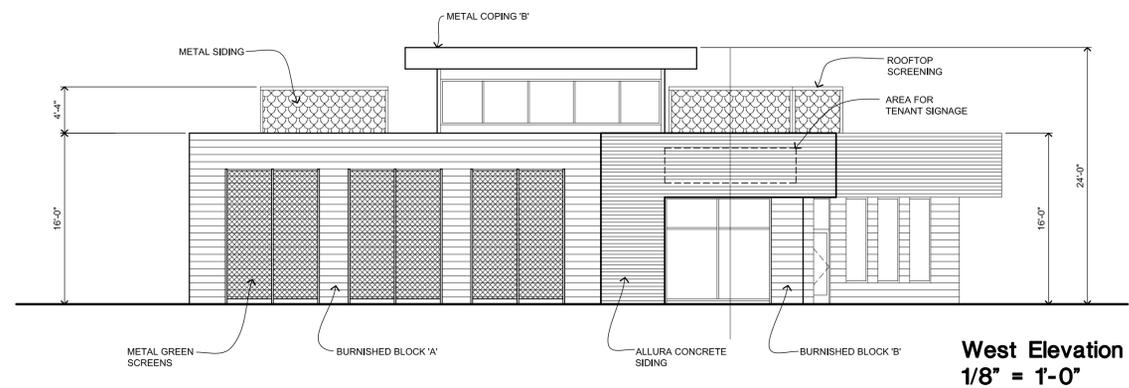
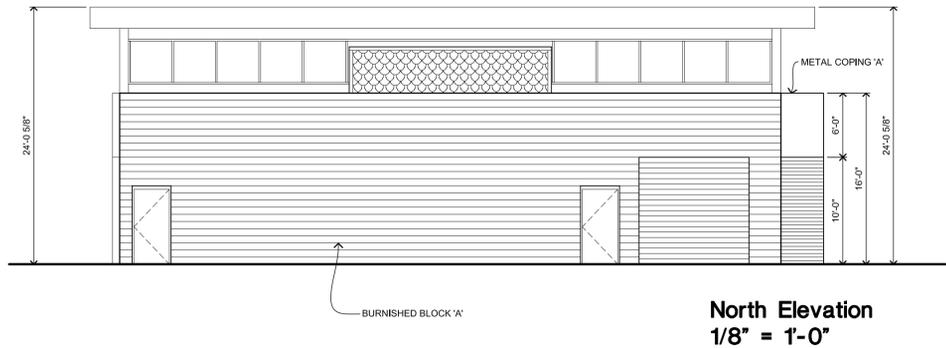
**SITE PLAN - PHASE 1**  
 SCALE: 1"=40'-0"

**SP-1A**

project:

Proposed for  
**Commercial Development**

Grand River Ave.  
 Meridian, MI



32600 TELEGRAPH ROAD  
 SUITE 250  
 BINGHAM FARMS, MICHIGAN  
 48025-2404  
 PH 248.540.7700 FX 248.540.2710  
 www.rogvooy.com

drawing:

**Conceptual  
 Floor Plan**

DO NOT SCALE DRAWING

issue date: 02 AUG. 2019  
 drawn: BDB  
 checked: MD  
 approved: MD

file number: **19030**

sheet:

**ELEV**

# MEMO

VIA EMAIL [Dominic@bacallgroupllc.com](mailto:Dominic@bacallgroupllc.com)

**To:** W. Investment Holdings, LLC

**From:** Jacob Swanson, PE  
Fleis & VandenBrink Engineering

**Date:** April 27, 2023

**Re:** 1614 W. Grand River Avenue – Provisioning Center Development  
Resubmission, April 2023  
Traffic Volume & Trip Generation Comparisons

## 1 INTRODUCTION

This memorandum presents the results of the traffic volume comparison and trip generation analysis for the proposed provisioning center site, located at 1614 W. Grand River Avenue, in Meridian Township, Michigan. Fleis & VandenBrink (F&V) previously completed a Traffic Impact Study (TIS) for the proposed development, dated January 21, 2020. Since this study was completed, the site plan has been revised and the traffic volumes utilized in the study were over five (5) years old at this time. Therefore, the Township has requested a comparison of the 2018 traffic volumes utilized in the TIS to the available current traffic volume data and a comparison between the trip generation calculations associated with the previous TIS and the currently proposed development plans for this site.

The scope of the study was developed based on Fleis & VandenBrink’s (F&V) understanding of the development program, accepted traffic engineering practice, information provided by Meridian Township, and methodologies published by the Institute of Transportation Engineers (ITE).

## 2 TRAFFIC VOLUME COMPARISON

The previous 2020 TIS utilized turning movement count data that was collected by Traffic Engineering Associates (TEA) in 2018. Therefore, a comparison with current traffic volume data was evaluated, in order to verify the accuracy of the previous analyses. The MDOT Transportation Data Management System (TDMS) was utilized to review historical traffic volume data and Average Annual Daily Traffic (AADT) volume information along the study roadways of Grand River Avenue and Dobie Road / Central Park Drive. The results of the comparison are summarized in **Table 1**.

**Table 1: Traffic Volume (AADT) Comparison**

Year	Grand River (At Dobie Rd.)	Dobie Road / Central Park (At Grand River Ave.)	Grand River (E. of Hamilton Rd.)	Average
2018	0%	0%	0%	0%
2019	-4%	0%	-1%	-2%
2020	-20%	-15%	-20%	-18%
2021	+14%	+14%	+5%	11%
2022	+1%	0%	+1%	1%
<b>Difference (2018 - 2022)</b>	<b>-9%</b>	<b>-1%</b>	<b>-15%</b>	<b>-8%</b>

The results of the comparison indicates that the historical AADT (vpd) data has been decreasing on the adjacent roadways since 2018. Therefore, the 2018 TEA turning movement counts that were utilized in the original 2020 TIS are expected to provide a conservative analysis of the current 2023 conditions.

27725 Stansbury Boulevard, Suite 195  
Farmington Hills, MI 48334  
P: 248.536.0080  
F: 248.536.0079  
[www.fveng.com](http://www.fveng.com)

### 3 TRIP GENERATION ANALYSIS

The number of weekday peak hour (AM and PM) and daily vehicle trips that would be generated by the proposed development was forecast based on data published by ITE in the *Trip Generation, 11<sup>th</sup> Edition*. It should be noted that the trip generation analysis completed for this site in the F&V 2020 TIS utilized the ITE *Trip Generation, 10<sup>th</sup> Edition*. No changes to the previous trip generation calculations were made for this comparison. The site trip generation forecast is summarized in **Table 2**.

**Table 2: Site Trip Generation Comparison**

Scenario	Land Use	ITE Code	Size	Unit	Average Daily Traffic (vpd)	AM Peak Hour (vph)			PM Peak Hour (vph)		
						In	Out	Total	In	Out	Total
Previous Site Plan (1/21/2020 TIS)	Marijuana Dispensary*	882	5,430	SF	1,372	32	25	57	60	59	119
Current Site Plan (2023)	Marijuana Dispensary	882	4,000	SF	844	22	20	42	38	38	76
<b>Difference</b>					<b>-528</b>	<b>-10</b>	<b>-5</b>	<b>-15</b>	<b>-22</b>	<b>-21</b>	<b>-43</b>

\* ITE Trip Generation 10th Edition

### 4 CONCLUSIONS

- The results of the traffic volume comparison indicates that the historical AADT (vpd) data has been decreasing since 2018. Therefore, the turning movement counts that were utilized in the original 2020 TIS are expected to provide a conservative analysis of the current 2023 conditions.
- The trip generation comparison indicates that the currently proposed site plan will generate **less trips** than the trip generation projections utilized for the previous 2020 TIS, based on the reduced building size and the updated ITE rates and equations.
- The results of this comparison show that trip generation and the traffic volumes in 2023 are *less* than the analysis that was performed in 2020.
  - Therefore, the proposed development is expected to have less of an impact to the adjacent roadway network than evaluated in the 2020 TIS.

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



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

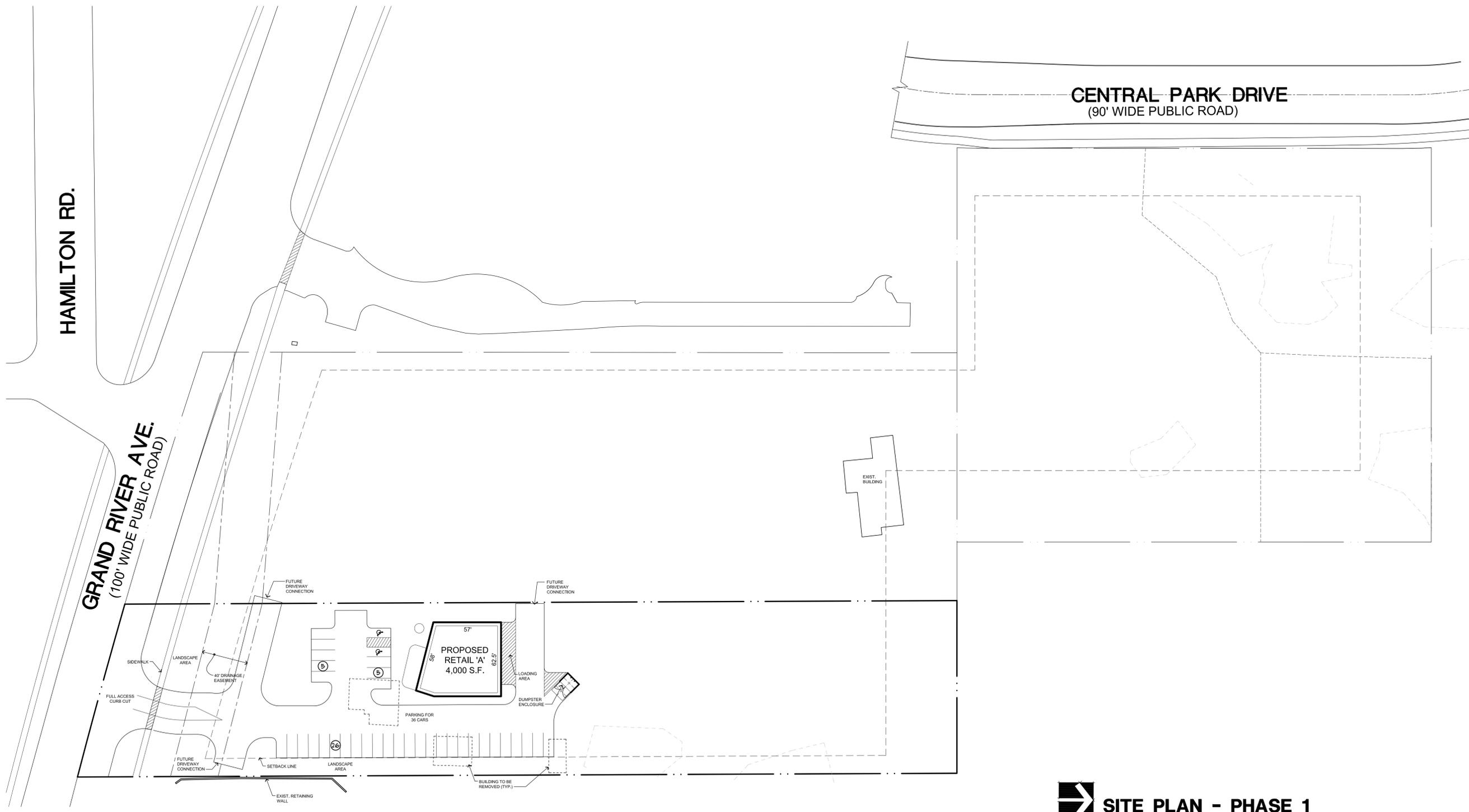
**Attached:** Proposed Site Plan  
 2020 Traffic Impact Study

JJS2:jmk

LAND/ BUILDING/ PARKING DATA :	
<b>PHASE 1</b>	
<b>LAND DATA :</b>	
OVERALL LAND AREA :	2.4 ACRES
<b>BUILDING DATA :</b>	
PROPOSED RETAIL 'A' :	4,000 S.F.
<b>PARKING REQUIRED :</b> 20 SPACES	
RETAIL :	
5 SPACES/ 1,000 GFA	
(4,000/ 1000 = 4 X 5 = 20 SPACES)	
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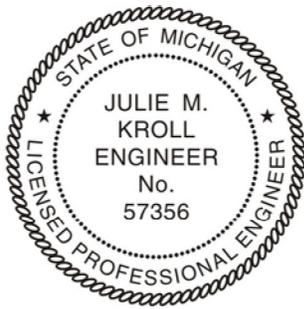
**SITE PLAN - PHASE 1**  
 SCALE: 1"=40'-0"

**SP-1A**

# PROPOSED PROVISION CENTER TRAFFIC IMPACT STUDY

MERIDIAN TOWNSHIP, MICHIGAN

JANUARY 21, 2020



*Julie M. Kroll*

Digitally signed by Julie M.  
Kroll  
Date: 2020.01.21 16:52:39  
-05'00'

**PREPARED FOR:**

W INVESTMENT HOLDINGS, LLC  
29580 NORTHWESTERN HWY, SUITE 1000  
SOUTHFIELD, MI 48034

**PREPARED BY:**



27725 STANSBURY BLVD., SUITE 195  
FARMINGTON HILLS, MI 48834

### Notice and Disclaimer

This document is provided by Fleis & VandenBrink Engineering, Inc. for informational purposes only. No changes or revisions may be made to the information presented in the document without the express consent of Fleis & VandenBrink Engineering, Inc. The information contained in this document is as accurate and complete as reasonably possible. Should you find any errors or inconsistencies, we would be grateful if you could bring them to our attention.

The opinions, findings, and conclusions expressed herein are those of Fleis & VandenBrink Engineering, Inc. and do not necessarily reflect the official views or policy of the Meridian Township, or the Michigan Department of Transportation (MDOT), which makes no warranty, either implied or expressed, for the information contained in this document; neither does it assume legal liability or responsibility for the accuracy, completeness or usefulness of this information. Any products, manufacturers or trademarks referenced in this document are used solely for reference purposes.

Agency Review	Date	Comments



## TABLE OF CONTENTS

<b>EXECUTIVE SUMMARY .....</b>	<b>1</b>
EXISTING OPERATIONS .....	1
<i>Grand River Ave. &amp; Central Park Drive.....</i>	<i>1</i>
<i>Grand River Ave. &amp; Hamilton Road .....</i>	<i>2</i>
FUTURE CONDITIONS.....	2
<i>Grand River Ave. &amp; Central Park Drive.....</i>	<i>2</i>
<i>Grand River Ave. &amp; Hamilton Road .....</i>	<i>2</i>
<i>Grand River Ave. &amp; Site Drive.....</i>	<i>2</i>
ACCESS MANAGEMENT .....	2
RECOMMENDATIONS.....	2
<b>1 INTRODUCTION.....</b>	<b>3</b>
<b>2 BACKGROUND DATA.....</b>	<b>6</b>
2.1 EXISTING ROAD NETWORK.....	6
2.2 EXISTING TRAFFIC VOLUMES.....	6
<b>3 ANALYSIS .....</b>	<b>6</b>
3.1 EXISTING CONDITIONS .....	6
<i>Grand River Ave. &amp; Central Park Drive.....</i>	<i>9</i>
3.2 EXISTING IMPROVEMENTS .....	9
3.3 BACKGROUND CONDITIONS.....	10
3.4 SITE TRIP GENERATION .....	10
3.5 SITE TRAFFIC ASSIGNMENT.....	10
3.6 FUTURE CONDITIONS.....	13
<i>Grand River Ave. &amp; Central Park Drive.....</i>	<i>14</i>
3.7 FUTURE IMPROVEMENTS.....	14
3.8 ACCESS MANAGEMENT .....	14
3.8.1 <i>Grand River Ave. (M-43) Corridor Access Management .....</i>	<i>14</i>
3.8.2 <i>MDOT Right-Turn Lane Analysis .....</i>	<i>15</i>
3.8.3 <i>Intersection Sight Distance Analysis.....</i>	<i>15</i>
<b>4 CONCLUSIONS.....</b>	<b>16</b>
<b>5 RECOMMENDATIONS.....</b>	<b>17</b>

## LIST OF TABLES

TABLE 1: EXISTING INTERSECTION OPERATIONS .....	9
TABLE 2: EXISTING INTERSECTION OPERATIONS-WITH IMPROVEMENTS .....	10
TABLE 3: SITE TRIP GENERATION .....	10
TABLE 4: SITE TRIP DISTRIBUTION.....	10
TABLE 5: FUTURE INTERSECTION OPERATIONS .....	13
TABLE 6: FUTURE INTERSECTION OPERATIONS WITH IMPROVEMENTS .....	14
TABLE 7: INTERSECTION/ DRIVEWAY SPACING SUMMARY .....	14
TABLE 8: INTERSECTION/ DRIVEWAY SPACING SUMMARY-ALTERNATIVE MINIMUMS .....	15

**LIST OF FIGURES**

FIGURE E1: SITE LOCATION ..... 1  
 FIGURE 1: SITE LOCATION ..... 4  
 FIGURE 2: LANE USE AND TRAFFIC CONTROL ..... 7  
 FIGURE 3: EXISTING TRAFFIC VOLUMES ..... 8  
 FIGURE 4: SITE-GENERATED TRAFFIC VOLUMES..... 11  
 FIGURE 5: FUTURE TRAFFIC VOLUMES ..... 12  
 FIGURE 6: ACCESS MANAGEMENT INTERSECTION SPACING..... 15  
 FIGURE 7: INTERSECTION SIGHT DISTANCE ..... 16

**LIST OF APPENDICES**

- A. BACKGROUND INFORMATION
- B. EXISTING TRAFFIC CONDITIONS
- C. FUTURE TRAFFIC CONDITIONS
- D. WARRANT SUMMARIES

**REFERENCES**

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO). (2018). *A POLICY ON GEOMETRIC DESIGN OF HIGHWAYS AND STREETS*. WASHINGTON DC.

FEDERAL HIGHWAY ADMINISTRATION, MICHIGAN DEPARTMENT OF TRANSPORTATION, MICHIGAN STATE POLICE. (2011). *MICHIGAN MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES*.

INSTITUTE OF TRANSPORTATION ENGINEERS. (2017). *TRIP GENERATION MANUAL, 10TH EDITION*. WASHINGTON DC.

NATIONAL RESEARCH COUNCIL (U.S.) TRANSPORTATION RESEARCH BOARD. (2016). *HIGHWAY CAPACITY MANUAL, 6TH EDITION (HCM6)*. WASHINGTON, D.C.: TRANSPORTATION RESEARCH BOARD.

PAPACOSTAS, & PREVEDOUROS. (2001). *TRANSPORTATION ENGINEERING AND PLANNING*.

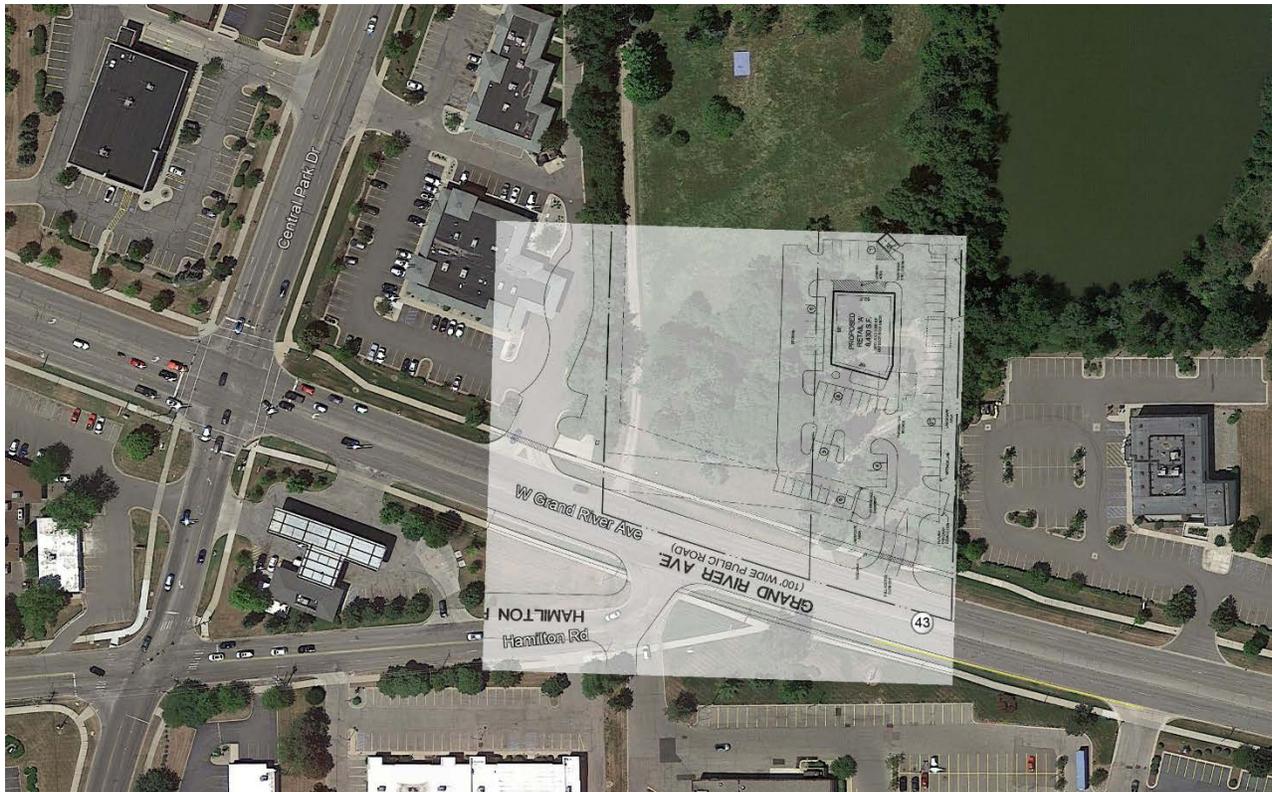
STOVER, V. G., & KOEPKE, F. J. (2006). *TRANSPORTATION AND LAND DEVELOPMENT (VOL. 2ND EDITION)*. WASHINGTON DC: INSTITUTE OF TRANSPORTATION ENGINEERS (ITE).



## EXECUTIVE SUMMARY

This report presents the results of a Traffic Impact Study (TIS) for the proposed provision center development in Meridian Township, Michigan. The project site is located generally in the northeast quadrant of W. Grand River Avenue and Central Park Avenue, adjacent to the north side of W. Grand River Avenue, opposite the intersection with Hamilton Road, as shown on **Figure E1**. The proposed development includes a 5,430 SF marijuana dispensary with site access to be provided via one site driveway to W. Grand River Ave. The Michigan Department of Transportation (MDOT) has jurisdiction over W. Grand River Ave. (M-43).

**FIGURE E1: SITE LOCATION**



This TIA has been completed at the request of Meridian Township to identify the impacts (if any) of the proposed development on the proposed site access point and the permitting of the site access. 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, methodologies published by the Institute of Transportation Engineers (ITE) and the requirements of Meridian Township. Additionally, F&V obtained input regarding the scope of work from Meridian Township Planning Department. In accordance with Township Ordinance, a Traffic Impact Study (TIS) is required for site plan approval.

## EXISTING OPERATIONS

The existing conditions analysis included the evaluation of the existing 2020 operations at the study intersections. The results of the existing conditions analysis are summarized below.

### Grand River Ave. & Central Park Drive

- During the AM peak hour, the intersection operates well, with an acceptable LOS and queue lengths for all approaches and movements.
- During the PM peak hour, the southbound left-turns on Central Park Drive operate at a LOS E, with excessive queue lengths that extend beyond the existing left-turn lane and impact the southbound through traffic on Central Park Drive.

- In order to improve the existing operations at this intersection mitigation measures were investigated, including signal timing changes and operations.
  - Signal timing optimization **is** recommended.
  - Left-turn phasing *is not* recommended.
- With the signal timing optimization at this intersection the operations improve to acceptable LOS and significantly reduce queue length.

#### **Grand River Ave. & Hamilton Road**

- During the both the AM and PM peak hours the intersection operates well, with an acceptable LOS and queue lengths for all approaches and movements.

### **FUTURE CONDITIONS**

The future conditions analysis included the evaluation of the future 2020 operations with the addition of the proposed development traffic at the study intersections. The results of the future conditions analysis are summarized below.

#### **Grand River Ave. & Central Park Drive**

- During the AM peak hour the intersection operates well, with acceptable LOS and queue lengths for all approaches and movements.
- During the PM peak hour the southbound left-turns on Central Park Drive operate at a LOS E, with excessive queue lengths that extend beyond the existing left-turn lane and impact the southbound through traffic on Central Park Drive.
  - With the signal timing optimization at this intersection the operations improve to an acceptable LOS and significantly reduce queue length.

#### **Grand River Ave. & Hamilton Road**

- During the both the AM and PM peak hours the intersection operates well, with an acceptable LOS and queue lengths for all approaches and movements.

#### **Grand River Ave. & Site Drive**

- During both the AM and PM peak hours the intersection operates well, at a LOS B/C during the peak periods with queue lengths of 1-2 vehicles.

### **ACCESS MANAGEMENT**

1. The proposed site driveway meets Grand River Ave. (M-43) Corridor Access Management criterion, provided the exceptions are granted by the Township and MDOT for the following driveways:
  - Tom's Driveway
  - Speedway Driveway
  - Sparrow Driveway
2. There is an existing center left-turn lane adjacent to the site; therefore, only the MDOT right-turn lane criteria was evaluated for the proposed site drive intersection. The results of the analysis show that a right-turn lane or taper is not required.
3. The results of the intersection sight distance analysis show that there will be adequate intersection sight distance at the proposed site driveway on Grand River Ave.

### **RECOMMENDATIONS**

*The recommendations of this TIS are as follows:*

- MDOT should investigate signal timing optimization at the Grand River & Central Park Drive intersection to improve existing and future PM peak hour operations.

## 1 INTRODUCTION

This report presents the results of a Traffic Impact Study (TIS) for the proposed provision center development in Meridian Township, Michigan. The project site is located generally in the northeast quadrant of W. Grand River Avenue and Central Park Avenue, adjacent to the north side of W. Grand River Avenue, opposite the intersection with Hamilton Road, as shown on **Figure 1**. The proposed development includes a 5,430 SF marijuana dispensary with site access to be provided via one site driveway to W. Grand River Ave. The Michigan Department of Transportation (MDOT) has jurisdiction over W. Grand River Ave. (M-43).

This TIA has been completed at the request of Meridian Township to identify the impacts (if any) of the proposed development on the proposed site access point and the permitting of the site access. 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, methodologies published by the Institute of Transportation Engineers (ITE) and the requirements of Meridian Township. Additionally, F&V obtained input regarding the scope of work from Meridian Township Planning Department. In accordance with Township Ordinance, a Traffic Impact Study (TIS) is required for site plan approval.

The purpose of this study is to identify the traffic related impacts, if any, of the proposed development project on the adjacent road network. Specific tasks undertaken for this study include the following:

### 1. Study Area

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

### 2. Proposed Land Use

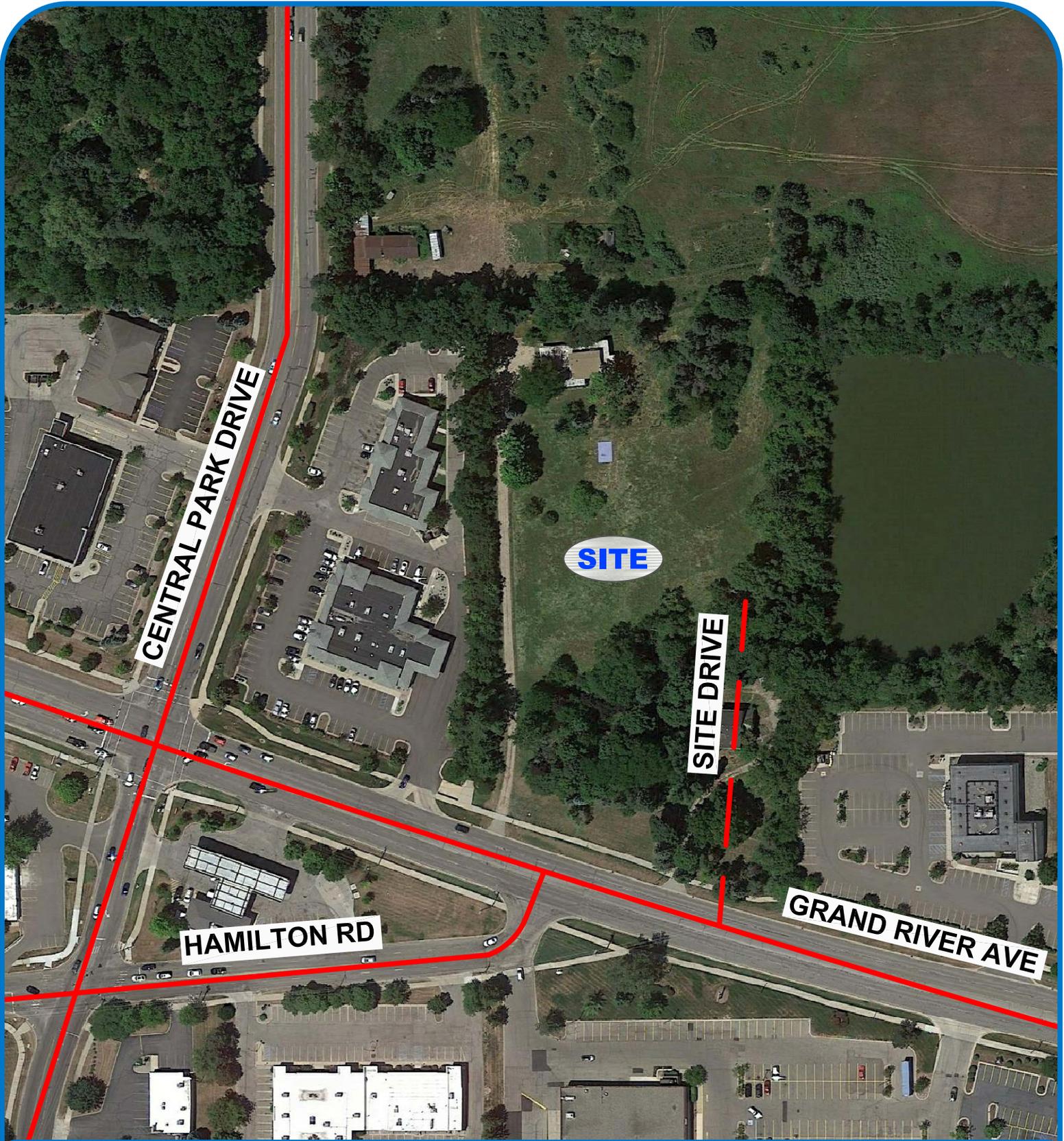
- a. Obtain and review the proposed site plan which includes the proposed land uses, densities, and desired site access locations. A description of the current and proposed land use will be accompanied with a complete project site plan (with buildings identified as to proposed use). A schedule for construction of the development will also be provided.

### 3. Existing Conditions

- a. Provide an analysis of the traffic-related impacts of the proposed development at the following study intersections:
  - Grand River Ave. & Central Park Drive/Dobie Road
  - Grand River Ave. & Hamilton Road
  - Grand River Ave. & Proposed Site Drive
- b. Obtain existing AM (7:00 AM to 9:00 AM) and PM (4:00 PM to 6:00 PM) peak period turning movement counts at the study intersections from Meridian Township for use in this study.
- c. Identify the Existing AM and PM peak hour traffic volumes at the study intersections based on turning movement count data provided.
- d. Calculate the **Existing** vehicle delays, LOS, and vehicle queues at the study intersections during the AM and PM. The analysis will be performed at each of the study intersections. Intersection analysis shall include LOS determination for all approaches and movements. The LOS will be based on the procedures outlined in the HCM 6th Edition, the latest edition of Transportation Research Board's Highway Capacity Manual.
- e. Identify improvements (if any) for the study road network that would be required to accommodate the existing traffic volumes.

### 4. Future Background Growth

- a. If the planned completion date for the project or the last phase of the project is beyond one year of the study, an estimate of background traffic growth for the adjacent street network will be made and included in the analysis.
- b. Calculate the future background traffic volumes based on an appropriate traffic growth determined from local or statewide data to the project build-out year and/or any applicable background developments in the vicinity of this project as identified by Meridian Township.



# FIGURE 1 SITE LOCATION MAP

PROPOSED PROVISIONING CENTER  
MERIDIAN TOWNSHIP, MI

## LEGEND

 SITE LOCATION



## 5. Background Conditions (No Build)

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

## 6. Trip Generation

- a. Forecast the number of AM and PM peak hour trips that would be generated by the proposed development based on data published by the Institute of Transportation Engineers (ITE) in *Trip Generation, 10<sup>th</sup> Edition*.
- b. A table will be provided in the report outlining the categories and quantities of land uses, with the corresponding trip generation rates or equations, and the resulting number of trips.

## 7. Trip Distribution and Traffic Assignment

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

## 8. Future Conditions

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

## 9. Access Management

- a. Evaluate the Meridian Township Access Management criteria for the proposed site driveway on Grand River Ave., including adjacent driveway locations, opposite driveway locations, the location and spacing of the proposed site access in relation to the existing adjacent driveway and intersections.
- b. Evaluate the proposed intersection sight distance at the proposed site driveway intersection on Grand River Ave.

The scope of this study was developed based on Fleis & VandenBrink's (F&V) knowledge of the study area, understanding of the development program, accepted traffic engineering practice and information published by the Institute of Transportation Engineers (ITE). In addition, Meridian Township provided input regarding the scope of work for this study. The study analyses were completed using Synchro/SimTraffic (Version 10). Sources of data for this study included Traffic Engineering Associates (TEA) and information provided by Meridian Township, MDOT and ITE. All background information is provided in **Appendix A**.

## 2 BACKGROUND DATA

### 2.1 EXISTING ROAD NETWORK

Vehicle transportation for the proposed development is provided via Grand River Avenue located adjacent to the south side of the project site location. The lane use and traffic control at the study intersections are shown on **Figure 2** and the study roadways are further described below. For the purpose of this study, all minor streets and driveways are assumed to have an operating speed of 25 miles per hour (mph).

**Grand River Avenue (M-43)** runs generally in the east and west directions with a posted speed limit of 45 mph. Grand River Ave. is under the jurisdiction of MDOT and is classified a *Minor Arterial* adjacent to the proposed project site. The study segment has an AADT of approximately 13,250 vehicles per day (MDOT 2019). Grand River has a typical five-lane cross section in the vicinity of the site location, with two lanes in each direction and a center left-turn lane. The intersection with Central Park Drive is signalized, the intersection with Hamilton Road is unsignalized.

### 2.2 EXISTING TRAFFIC VOLUMES

The existing weekday turning movement count data used in this study were obtained from Meridian Township. TEA performed a traffic impact study in the vicinity of this project in 2018 and turning movement count data was collected at the study intersections for that project. The turning movement count data collected in 2018 was compared to the weekday traffic volume data obtained from the MDOT Traffic Data Management System (TDMS). This data included 24-hour traffic volume data collected on March 11-12, 2019 and recorded in 15-minute intervals. This data was used as a baseline to determine if a background growth rate was necessary to calculate the existing 2020 traffic volume for use in this study. The results of this comparison showed that the 2018 traffic volumes were essentially equal to the 2019 traffic volumes; therefore, no background growth was applied to the 2018 traffic volumes to establish the existing 2020 traffic conditions without the proposed development. The 2018 data were used as a baseline to establish the current 2020 peak hour traffic volumes for the analysis of existing traffic conditions. During collection of the turning movement counts, pedestrian data and commercial truck percentages were recorded and used in the traffic analysis. Peak Hour Factors (PHFs) were also calculated for each study intersection approach.

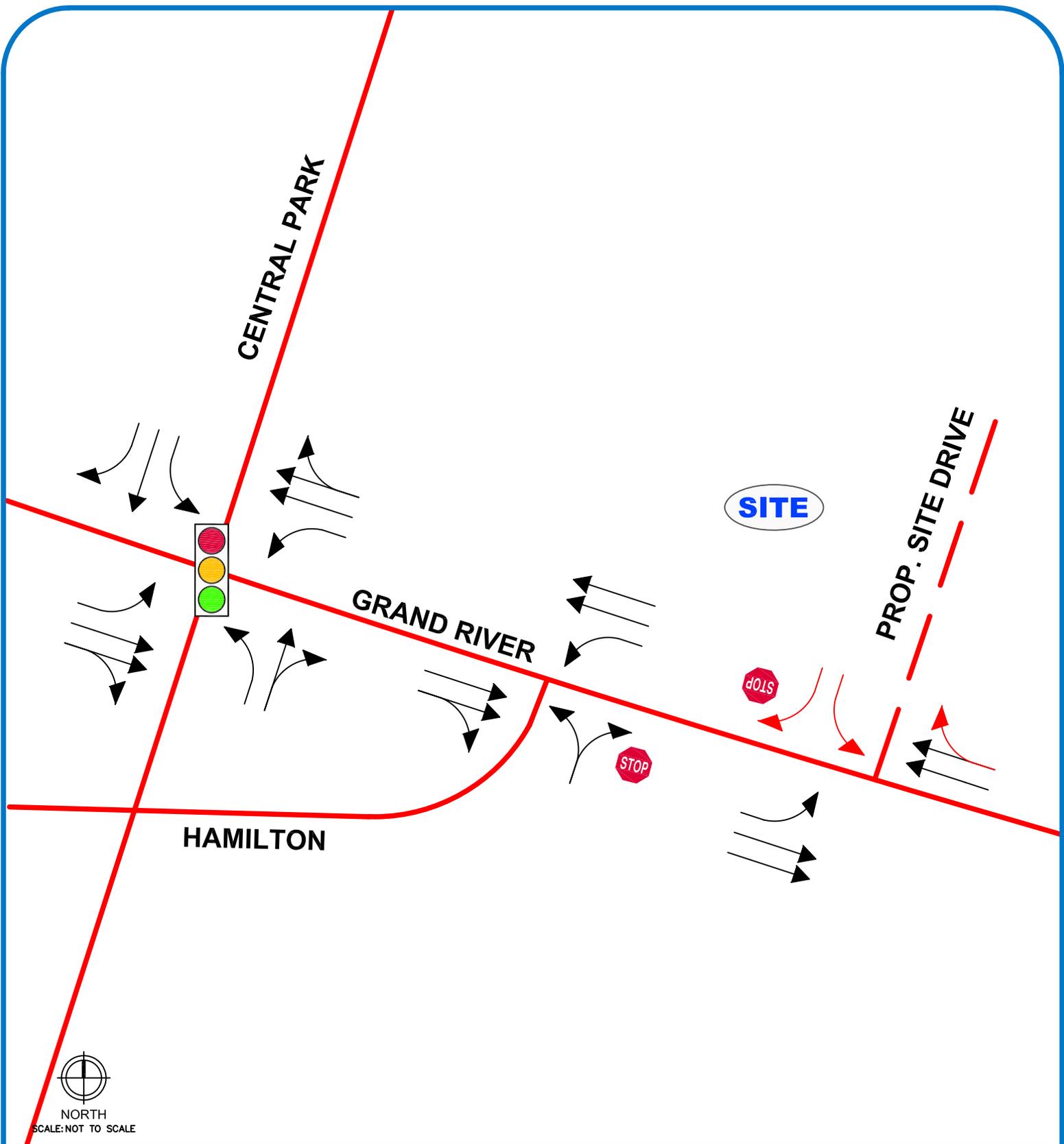
The peak hour volumes for each intersection were utilized for this study and the volumes were balanced upward through the study network, and through volumes were carried along the main study roadways. The peak hour traffic volumes were identified to occur between 7:45 AM to 8:45 AM and 5:00 PM to 6:00 PM. The traffic volume data are included in **Appendix A** and the existing peak hour traffic volumes used in the analysis are summarized on **Figure 3**.

## 3 ANALYSIS

### 3.1 EXISTING CONDITIONS

The existing AM and PM peak hour vehicle delays and Levels of Service (LOS) were calculated at the study intersection using Synchro traffic analysis software. The results of the analysis of existing conditions were based on the existing lane use and traffic control shown on **Figure 2**, the existing traffic volumes shown on **Figure 3**, and the methodologies presented in the Highway Capacity Manual 6<sup>th</sup> Edition (HCM6).

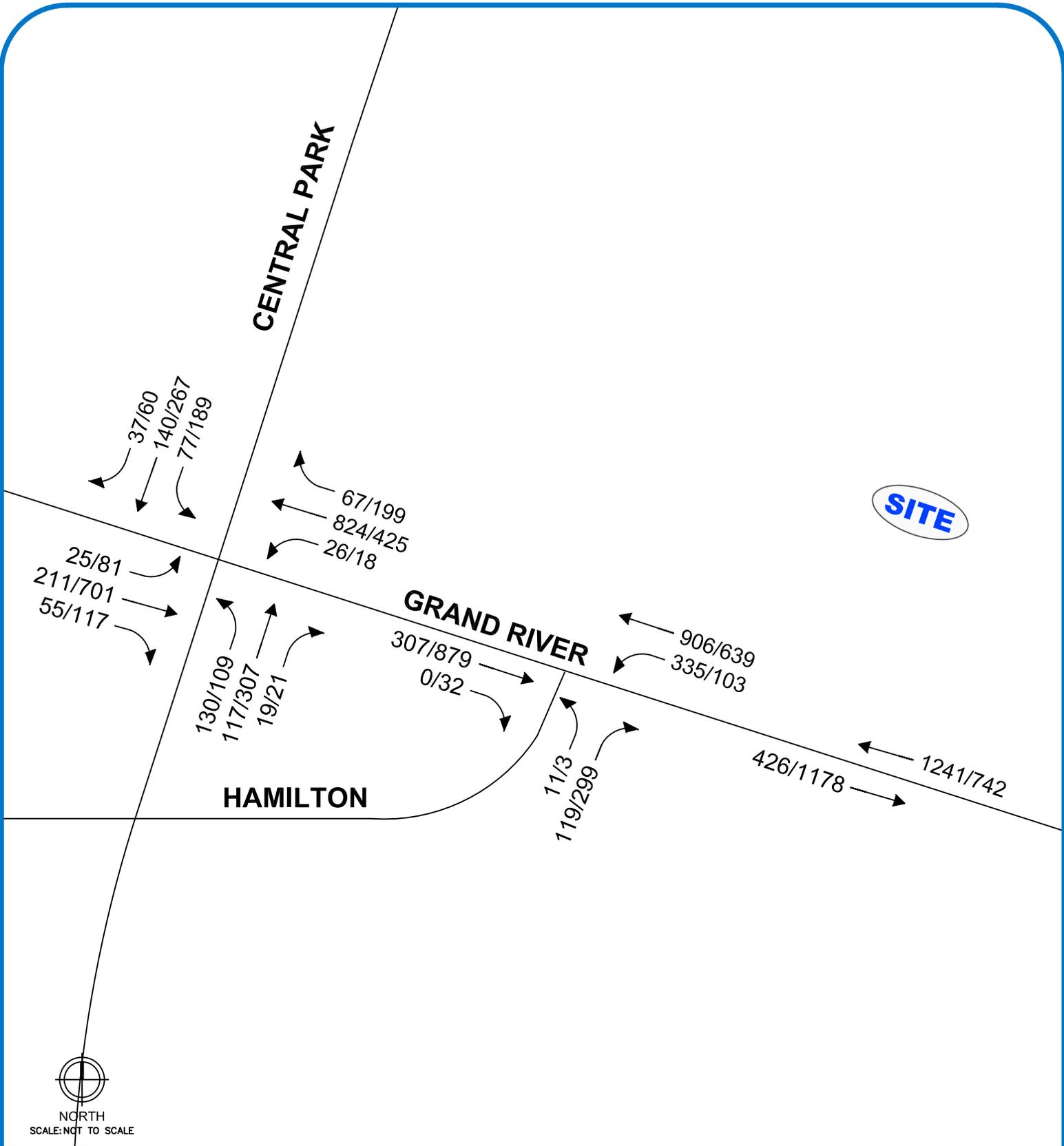
Descriptions of LOS "A" through "F" as defined in the HCM, are provided in **Appendix B** for signalized and unsignalized intersections. Typically, LOS D is considered acceptable, with LOS A representing minimal delay, and LOS F indicating failing conditions. The results of the analysis of existing conditions are presented in **Appendix B** and are summarized in **Table 1**. Microsimulations were also conducted at the study intersections using SimTraffic to further evaluate the network performance.



**FIGURE 2**  
**LANE USE AND TRAFFIC CONTROL**  
 PROPOSED PROVISIONING CENTER  
 MERIDIAN TOWNSHIP, MI

**LEGEND**

-  ROADS
-  LANE USE
-  PROPOSED LANE USE
-  UNSIGNALIZED INTERSECTION
-  SIGNALIZED INTERSECTION



**FIGURE 3**  
**EXISTING TRAFFIC**  
**VOLUMES**  
 PROPOSED PROVISIONING CENTER  
 MERIDIAN TOWNSHIP, MI



**LEGEND**

ROADS

TRAFFIC VOLUMES (AM/PM)

**Table 1: Existing Intersection Operations**

Intersection	Control	Approach	Existing Conditions								
			AM Peak				PM Peak				
			Delay (s/veh)	LOS	Avg. Queue (ft)	95th% Queue (ft)	Delay (s/veh)	LOS	Avg. Queue (ft)	95th% Queue (ft)	
1	Grand River Ave. & Central Park/Dobie	Signalized	NBL	43.6	D	94	170	36.1	D	70	137
			NBTR	32.6	C	65	126	28.8	C	140	240
			SBL	38.6	D	49	95	55.9	E	326	503
			SBT	32.9	C	67	123	27.0	C	441	991
			SBR	30.1	C	17	43	23.3	C	131	647
			EBL	15.8	B	17	48	20.4	C	45	92
			EBT	8.0	A	37	82	14.7	B	95	149
			EBR	7.8	A	8	28	12.6	B	21	53
			WBL	8.9	A	11	42	18.5	B	11	34
			WBTR	11.7	B	125	214	14.8	B	97	162
			<b>Overall</b>	<b>18.4</b>	<b>B</b>			<b>22.4</b>	<b>C</b>		
2	Grand River Ave. & Hamilton Road	STOP (Minor Street)	NB	9.0	A	43	72	26.2	D	67	98
			WBL	9.4	A	40	73	11.1	B	34	76

The results of the existing conditions analysis show that all approaches and movements at the study intersections are currently operating acceptably at a LOS D or better, with the exception of the following:

**Grand River Ave. & Central Park Drive**

- During the PM peak hour, the southbound left-turns on Central Park Drive operate at a LOS E, with excessive queue lengths that extend beyond the existing left-turn lane and impact the southbound through traffic on Central Park Drive.

**3.2 EXISTING IMPROVEMENTS**

In order to improve the existing operations at this intersection mitigation measures were investigated, including signal timing changes and operations. The signal timing changes evaluated include optimizing the existing splits, and the amount of green time allocated for N/S and E/W movements. The operations evaluation included a review of the MDOT left-turn phasing calculations to determine if permissive/protected left-turn phasing should be added to the signal operations.

**Signal Timing Changes**

The signal currently operates during the PM peak hour with the 100 sec cycle length and 60(E/W)/40(N/S) splits. The 40 seconds does not provide adequate time to accommodate the existing southbound left-turn volume on the Central Park Drive approach. Therefore, the splits were optimized to provide 46(E/W)/54(N/S). The results of this change in signal timing are summarized below in **Table 2** and show significant improvement in the existing operations and reductions in queue lengths on the southbound approach. Furthermore, these changes in signal timing did not impact the operations on Grand River Ave.

**Left-Turn Phasing**

The MDOT left-turn phasing analysis spreadsheet was used to evaluate the existing left-turn volumes at this intersection to determine if separate left-turn phasing should be provided. The results of the analysis are attached and show that permissive/protected left-turns are warranted only on the SB Central Park Drive approach during the PM peak hour. Therefore, left-turn phasing is not recommended at this intersection to mitigate existing left-turn delays.

**Table 2: Existing Intersection Operations-With Improvements**

Intersection	Control	Approach	PM Peak Period												
			Existing Conditions				Existing with Improvements				Difference				
			Delay (s/veh)	LOS	Avg. Queue (ft)	95th% Queue (ft)	Delay (s/veh)	LOS	Avg. Queue (ft)	95th% Queue (ft)	Delay (s/veh)	LOS	Avg. Queue (ft)	95th% Queue (ft)	
1	Grand River Ave. & Central Park/Dobie	Signalized	NBL	36.1	D	70	137	30.5	C	62	118	-5.6	D to C	-8	-19
			NBTR	28.8	C	140	240	24.2	C	127	223	-4.6	n/c	-13	-17
			SBL	55.9	E	326	503	39.3	D	119	200	-16.6	E to D	-207	-303
			SBT	27.0	C	441	991	23.0	C	106	186	-4.0	n/c	-335	-805
			SBR	23.3	C	131	647	20.0	B	20	42	-3.3	C to B	-111	-605
			EBL	20.4	C	45	92	25.0	C	47	101	4.6	n/c	2	9
			EBT	14.7	B	95	149	18.0	B	125	199	3.3	n/c	30	50
			EBR	12.6	B	21	53	15.4	B	19	46	2.8	n/c	-2	-7
			WBL	18.5	B	11	34	22.6	C	15	40	4.1	B to C	4	6
			WBTR	14.8	B	97	162	18.3	B	112	183	3.5	n/c	15	21
			Overall	22.4	C			21.8	C			-0.6	n/c		

**3.3 BACKGROUND CONDITIONS**

Since the proposed development is anticipated to be constructed and completed within the next year, existing conditions were assumed equal to background (no build) conditions with a project buildout year of 2020.

**3.4 SITE TRIP GENERATION**

The number of Weekday AM and PM peak hour and daily vehicle trips that would be generated by the proposed development was forecast based on data published by ITE in the *Trip Generation Manual, 10<sup>th</sup> Edition*. The site trip generation forecast is summarized in **Table 3**.

**Table 3: Site Trip Generation**

Land Use	ITE Code	Amount	Units	Average Daily Traffic (vpd)	AM Peak Hour (vph)			PM Peak Hour (vph)		
					In	Out	Total	In	Out	Total
Marijuana Dispensary	882	5,430	SF	1,372	32	25	57	60	59	119

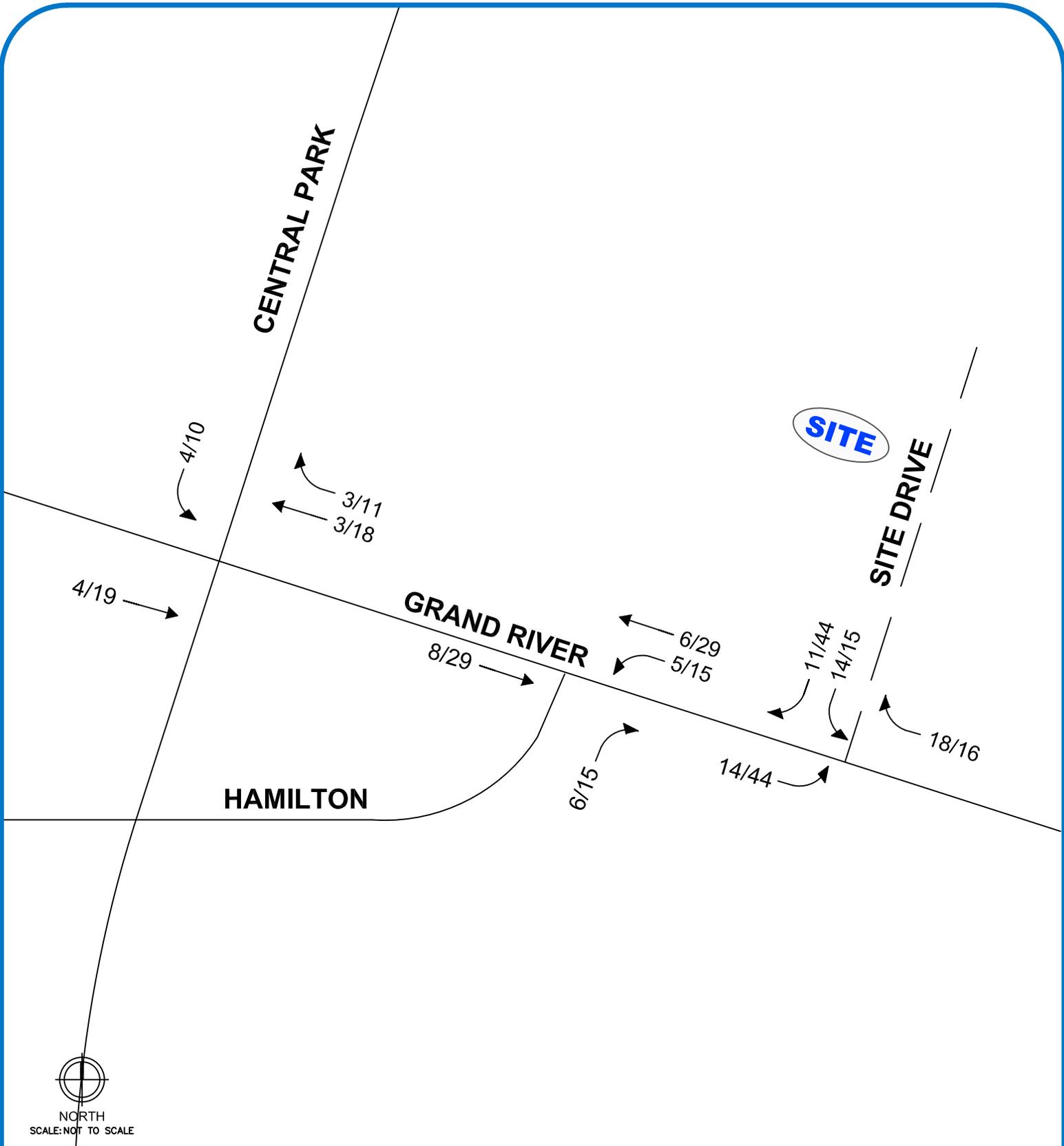
**3.5 SITE TRAFFIC ASSIGNMENT**

The vehicular trips that would be generated by the proposed development were assigned to the study roads based on existing peak hour traffic patterns in the adjacent roadway network, the proposed site access points, and the methodologies published by ITE. To determine trip distribution using the adjacent street traffic, it was assumed that the development land uses are trip generators; therefore, the global trip generation is based on trips entering the study network and traveling to the development. The ITE trip distribution methodology also assumes that new trips will return to their direction of origin. The resulting site trip distributions used in the analysis are summarized in **Table 4**.

**Table 4: Site Trip Distribution**

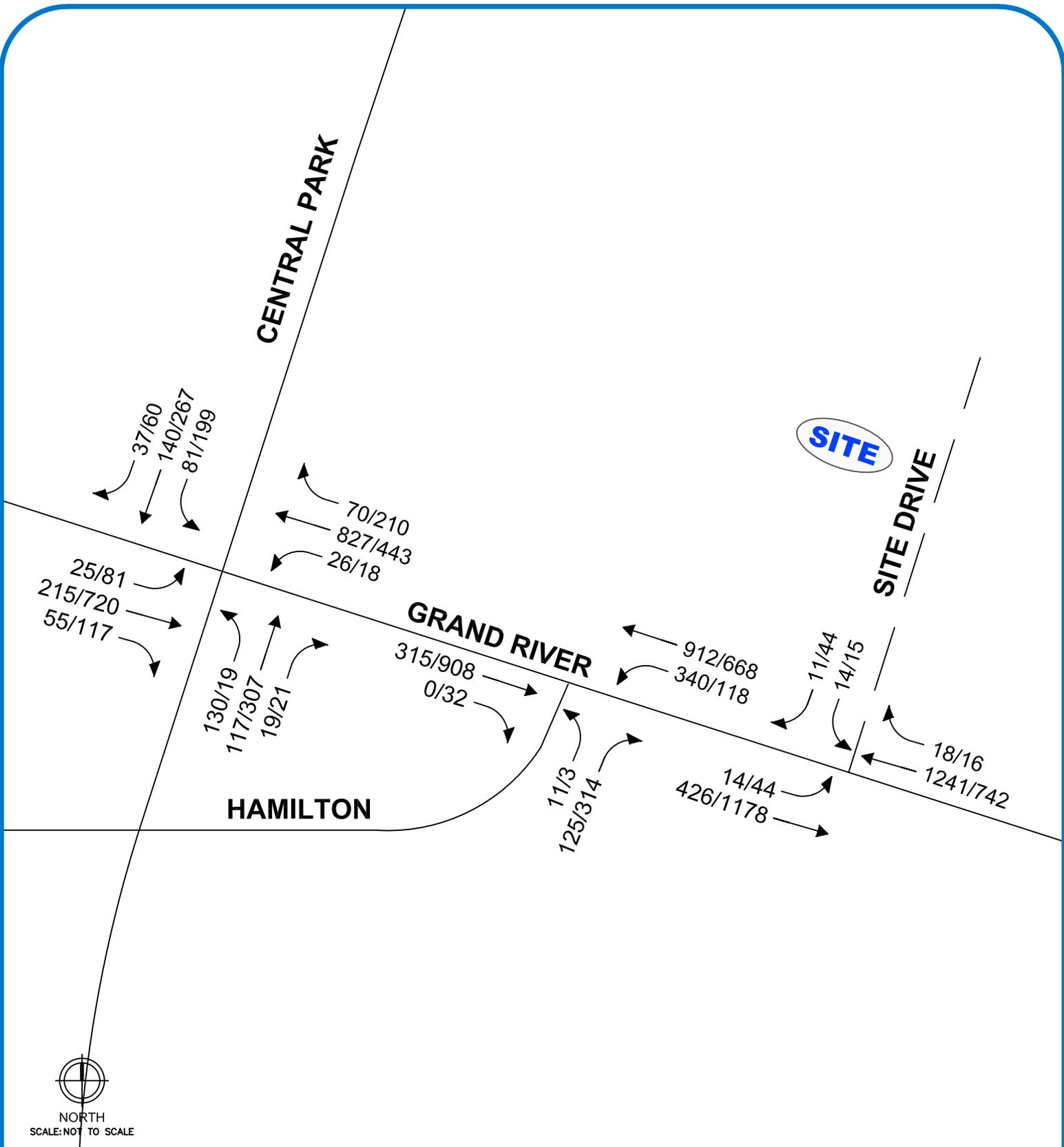
To / From	Via	AM	PM
West	Grand River Ave.	13%	31%
East	Grand River Ave.	57%	25%
South/West	Hamilton Rd./Dobie Rd.	18%	26%
North	Central Park Drive	12%	18%
Total		100%	100%

The vehicular traffic volumes shown in **Table 3** were distributed to the roadway network according to the distribution shown in **Table 4**. The site generated trips are shown on **Figure 4** and were added to the future existing traffic volumes shown on **Figure 2** to calculate the future peak hour traffic volumes with the proposed development, as shown on **Figure 5**.



**FIGURE 4**  
**SITE-GENERATED**  
**TRAFFIC VOLUMES**  
 PROPOSED PROVISIONING CENTER  
 MERIDIAN TOWNSHIP, MI

LEGEND	
	ROADS
	TRAFFIC VOLUMES (AM/PM)



**FIGURE 5**  
**FUTURE TRAFFIC**  
**VOLUMES**  
 PROPOSED PROVISIONING CENTER  
 MERIDIAN TOWNSHIP, MI

**LEGEND**

- ROADS
- TRAFFIC VOLUMES (AM/PM)

### 3.6 FUTURE CONDITIONS

The future peak hour vehicle delays and LOS **with the proposed development** were calculated based on the existing lane use and traffic control shown on **Figure 2**, the proposed site access plan, the future traffic volumes shown on **Figure 5**, and the methodologies presented in the HCM6. The results of the future conditions analysis are presented in **Appendix C** and are summarized in **Table 5**.

**Table 5: Future Intersection Operations**

Intersection	Control	Approach	AM Peak Period												
			Existing Conditions				Future Conditions				Difference				
			Delay (s/veh)	LOS	Avg. Queue (ft)	95th% Queue (ft)	Delay (s/veh)	LOS	Avg. Queue (ft)	95th% Queue (ft)	Delay (s/veh)	LOS	Avg. Queue (ft)	95th% Queue (ft)	
1	Grand River Ave. & Central Park Drive/Dobie Road	Signalized	NBL	43.6	D	94	170	43.6	D	82	139	0.0	n/c	-12	-31
			NBTR	32.6	C	65	126	32.6	C	67	129	0.0	n/c	2	3
			SBL	38.6	D	49	95	38.9	D	52	101	0.3	n/c	3	6
			SBT	32.9	C	67	123	32.9	C	67	120	0.0	n/c	0	-3
			SBR	30.1	C	17	43	30.1	C	17	44	0.0	n/c	0	1
			EBL	15.8	B	17	48	15.9	B	16	50	0.1	n/c	-1	2
			EBT	8.0	A	37	82	8.0	A	36	74	0.0	n/c	-1	-8
			EBR	7.8	A	8	28	7.8	A	15	24	0.0	n/c	7	-4
			WBL	8.9	A	11	42	8.9	A	12	36	0.0	n/c	1	-6
			WBTR	11.7	B	125	214	11.7	B	126	210	0.0	n/c	1	-4
		Overall	18.4	B			18.4	B			0.0	n/c			
2	Grand River Ave. & Hamilton Road	STOP (Minor Street)	NB	9.0	A	43	72	9.3	A	42	71	0.3	n/c	-1	-1
			WBL	9.4	A	40	73	9.5	A	41	71	0.1	n/c	1	-2
3	Grand River Ave. & Site Drive	STOP (Minor Street)	SBL					28.7	D	15	42	28.7	D	15	42
			SBR					14.5	B	10	33	14.5	B	10	33
			EBL					12.5	B	9	32	12.5	B	9	32
Intersection	Control	Approach	PM Peak Period												
			Existing Conditions				Future Conditions				Difference				
			Delay (s/veh)	LOS	Avg. Queue (ft)	95th% Queue (ft)	Delay (s/veh)	LOS	Avg. Queue (ft)	95th% Queue (ft)	Delay (s/veh)	LOS	Avg. Queue (ft)	95th% Queue (ft)	
1	Grand River Ave. & Central Park/Dobie	Signalized	NBL	36.1	D	70	137	36.1	D	62	124	0.0	n/c	-8	-13
			NBTR	28.8	C	140	240	28.8	C	153	258	0.0	n/c	13	18
			SBL	55.9	E	326	503	60.3	E	380	528	4.4	n/c	54	25
			SBT	27.0	C	441	991	27.0	C	695	1276	0.0	n/c	254	285
			SBR	23.3	C	131	647	23.3	C	360	1138	0.0	n/c	229	491
			EBL	20.4	C	45	92	21.0	C	39	84	0.6	n/c	-6	-8
			EBT	14.7	B	95	149	14.9	B	102	159	0.2	n/c	7	10
			EBR	12.6	B	21	53	12.6	B	17	47	0.0	n/c	-4	-6
			WBL	18.5	B	11	34	18.8	B	13	37	0.3	n/c	2	3
			WBTR	14.8	B	97	162	15.2	B	98	164	0.4	n/c	1	2
		Overall	22.4	C			22.8	C			0.4	n/c			
2	Grand River Ave. & Hamilton Road	STOP (Minor Street)	NB	26.2	D	67	98	30.1	D	70	100	3.9	n/c	3	2
			WBL	11.1	B	34	76	11.5	B	42	81	0.4	n/c	8	5
3	Grand River Ave. & Site Drive	STOP (Minor Street)	SBL					22.4	C	13	38	22.4	C	13	38
			SBR					11.6	B	25	53	11.6	B	25	53
			EBL					9.7	A	19	47	9.7	A	19	47

*Note: Slight variations (+/-) in the vehicle queuing from existing and future conditions are due to the multiple iterations included in the SimTraffic modeling of the network. Approaches/movements with significant increases in queue lengths were further evaluated for mitigation measures as summarized in Section 3.7.*

The results of the future conditions analysis show that all approaches and movements at the study intersections are expected to operate in a manner similar to existing conditions, operating acceptably at a LOS D or better, with the exception of the following:

**Grand River Ave. & Central Park Drive**

- During the PM peak hour, the southbound left-turns on Central Park Drive will continue to operate at a LOS E, with excessive queue lengths that extend beyond the existing left-turn lane and impact the southbound through traffic on Central Park Drive.

**3.7 FUTURE IMPROVEMENTS**

In order to improve traffic operations to a LOS D or better for all approaches and movements at the study intersections under future conditions **with the proposed development**, mitigation measures were investigated. The results of the analyses are summarized in **Table 6** and summarized below.

- Signal timing optimization was evaluated for Grand River Ave. & Central Park Drive and found to adequately mitigate the impact of the proposed development and improve the existing operations.

**Table 6: Future Intersection Operations with Improvements**

Intersection	Control	Approach	PM Peak Period											
			Future Conditions				Future with Improvements				Difference			
			Delay (s/veh)	LOS	Avg. Queue	95th% Queue	Delay (s/veh)	LOS	Avg. Queue	95th% Queue	Delay (s/veh)	LOS	Avg. Queue	95th% Queue
1 Grand River Ave. & Central Park/Dobie	Signalized	NBL	36.1	D	62	124	29.7	C	60	122	-6.4	D to C	-2	-2
		NBTR	28.8	C	153	258	23.6	C	119	206	-5.2	n/c	-34	-52
		SBL	60.3	E	380	528	39.1	D	125	207	-21.2	E to D	-255	-321
		SBT	27.0	C	695	1276	22.4	C	105	189	-4.6	n/c	-590	-1087
		SBR	23.3	C	360	1138	19.5	B	17	41	-3.8	C to B	-343	-1097
		EBL	21.0	C	39	84	26.5	C	48	100	5.5	n/c	9	16
		EBT	14.9	B	102	159	18.7	B	126	192	3.8	n/c	24	33
		EBR	12.6	B	17	47	15.8	B	20	45	3.2	n/c	3	-2
		WBL	18.8	B	13	37	23.6	C	14	43	4.8	B to C	1	6
		WBTR	15.2	B	98	164	19.0	B	119	191	3.8	n/c	21	27
		Overall	22.8	C			22.1	C			-0.7	n/c		

**3.8 ACCESS MANAGEMENT**

**3.8.1 Grand River Ave. (M-43) Corridor Access Management**

Meridian Township, in coordination with MDOT, has developed access management criteria for use in evaluating proposed site access driveways along this corridor. The access management criteria for the proposed site driveway location are summarized in **Table 7** and shown on **Figure 6**.

**Table 7: Intersection/ Driveway Spacing Summary**

Adjacent Driveways/ Intersections	Same Side/Opposite	Distance	Meridian Twp. Rec.	Meets Req.
Speedway	Opposite	550	630	NO
Bank of America	Same Side	400	350	YES
Hamilton Road	Opposite-Intersection	225	200	YES
Sparrow (1600 Grand River)	Same Side	317	350	NO
Tom's	Opposite	286	630	YES*

\* With exception granted by Meridian Township Planning (minimum 150 ft for non-conflicting left-turns)

In accordance with MDOT guidelines, in the event that a particular parcel lacks sufficient frontage to maintain adequate spacing, the Region/TSC Traffic and Safety and Utility and Permit Engineers have the following options:

1. Choose the next lowest spacing. For example, on 30 mph roadway requiring 185 ft spacing, the distance may be reduced to no less than 130 ft which is the spacing from 25 mph speed.

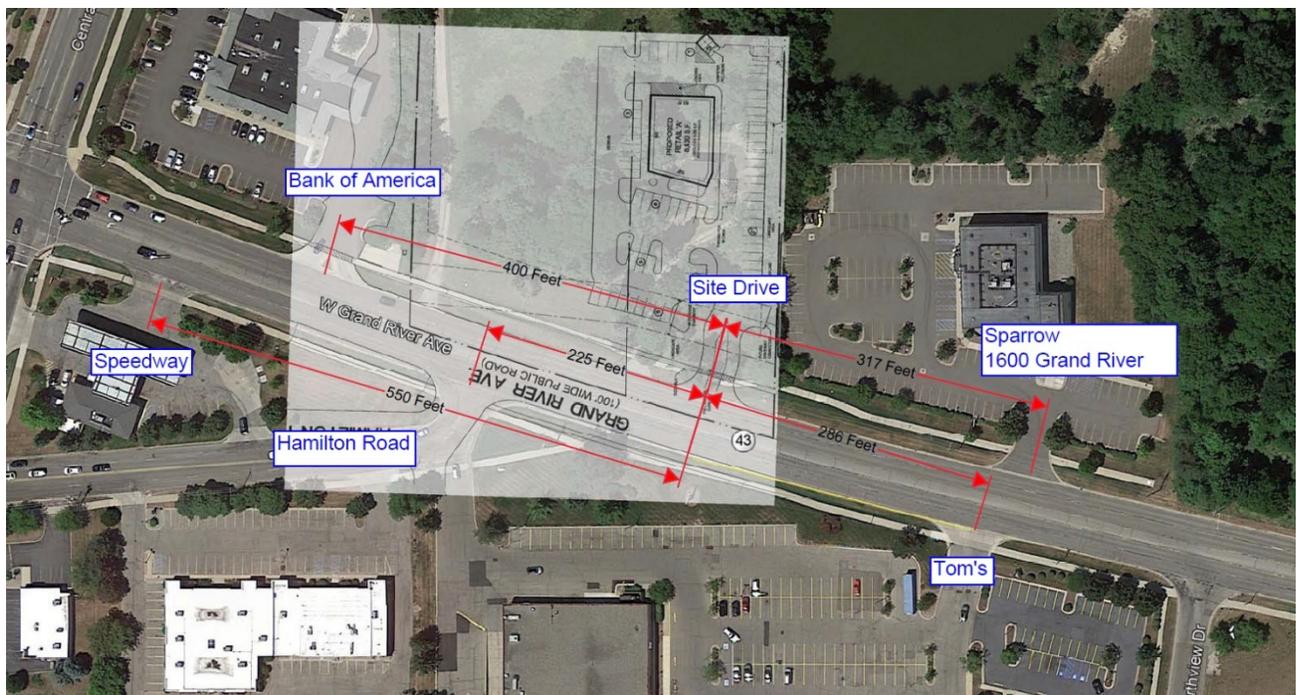
The next lowest speed was reviewed at the locations that do not meet the minimum spacing requirements. The results of this analysis are summarized in **Table 8** and show that the spacing requirements are still not met at these locations.

**Table 8: Intersection/ Driveway Spacing Summary-Alternative Minimums**

Adjacent Driveways/ Intersections	Adjacent/Opposite	Distance	Meridian Twp. Rec.	Meets Req.
Speedway	Opposite	550	525	YES
Sparrow (1600 Grand River)	Same Side	317	300	YES

By using the next lowest speed category, all of the driveways and intersections will meet access management spacing criteria. Therefore, none of the further criterion was necessary for consideration for this site driveway.

**FIGURE 6: ACCESS MANAGEMENT INTERSECTION SPACING**



**3.8.2 MDOT Right-Turn Lane Analysis**

The MDOT Geometric Design Guidance Sections 1.1.4 (formerly MDOT Traffic & Safety Notes 604A) was utilized in order to determine if a right-turn lane or taper is required at the proposed site driveway. The results of the analysis are provided in **Appendix D** and indicate the following:

- A right-turn radius only is recommended for the proposed Site Drive. No additional right-turn treatment is required.

**3.8.3 Intersection Sight Distance Analysis**

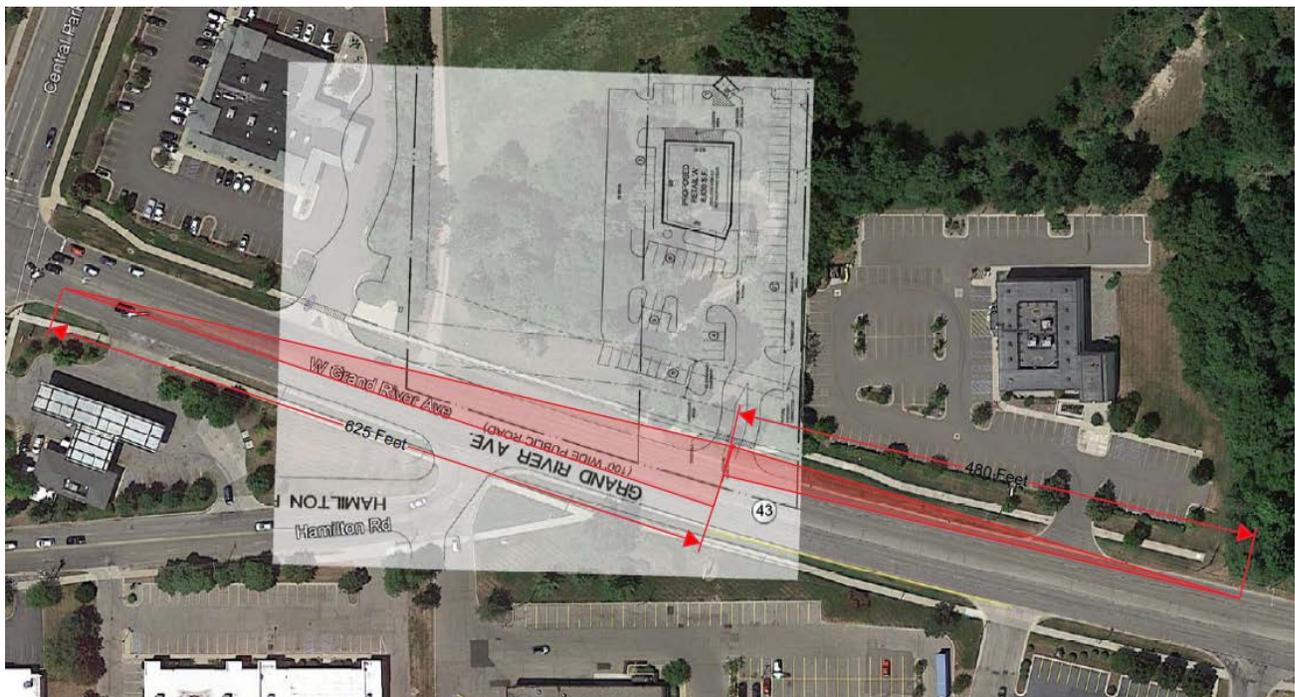
The intersection sight distance was reviewed at the proposed Grand River Ave. & Site Drive intersection. According to *Section 9.5 – Intersection Sight Distance* of the AASHTO design manual *A Policy on Geometric Design of Highways and Streets, 7<sup>th</sup> Edition (2018)*, an intersection sight distance of 625 feet is required for a left turn from a complete stop and a sight distance of 480 feet is required for a right turn from a stopped position at the study intersection based on the existing 45 mph speed limit (50 mph design speed).

The AASHTO manual states that the “vertex (decision point) of the departure sight triangle on the minor road should be 14.5 ft from the edge of the major-road traveled way”. This gives an accurate depiction of driver

behavior when making a turn from a minor roadway. The results of the sight distance analysis show that there is adequate sight distance at the proposed intersection location. In addition, this section of Grand River Ave. has very little grade change and vertical distance is not a concern at this location. The intersection sight distance measurements are shown on **Figure 7**.

The results of the intersection sight distance analysis show that there will be adequate intersection sight distance at the proposed site driveway on Grand River Ave. There is the potential for vehicles queued on EB Grand River Ave. at the signalized intersection at Central Park Drive to block the view for egress left-turns; however, based on the vehicle queuing analysis (both with and without recommended signal timing improvements) the peak vehicle queues on this approach will not extend into the sight distance area as shown on **Figure 7**.

**FIGURE 7: INTERSECTION SIGHT DISTANCE**



## 4 CONCLUSIONS

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

1. The results of the existing conditions analysis show that all approaches and movements at the study intersections are currently operating acceptably at a LOS D or better, with the exception of the Grand River Ave. & Central Park Drive. During the PM peak hour, the southbound left-turns on Central Park Drive operate at a LOS E, with excessive queue lengths that extend beyond the existing left-turn lane and impact the southbound through traffic on Central Park Drive.
2. In order to improve the existing operations at this intersection, mitigation measures were investigated, including signal timing changes and operations.
  - a. Signal timing optimization **is** recommended.
  - b. Left-turn phasing *is not* recommended.
3. With the addition of site generated traffic volumes, the Grand River Ave. & Central Park Drive intersection is expected to operate similar to existing conditions, with both increased delays and vehicle queue lengths on the southbound approach.
4. In order to improve the future operations at the Grand River Ave. & Central Park Drive intersection, signal timing optimization is recommended.

5. The proposed site driveway is expected to operate well, at LOS B/C during the peak periods with queue lengths of 1-2 vehicles.
6. The proposed site driveway meets Grand River Ave. (M-43) Corridor Access Management criterion, provided the following exceptions are granted by the Township and MDOT.
  - a. The Tom's driveway is located opposite the proposed site driveway, approximately 286 feet to the east. The requirement is 630 feet; however, "The Director of Community Planning and Development may reduce this to no less than 150 feet where the offsets are aligned to not create left-turn conflict<sup>1</sup>", as they are in this location.
  - b. The Speedway driveway is located opposite the proposed site driveway, approximately 550 feet to the west. The requirement is 630 feet; however, in accordance with MDOT guidelines, in the event that a particular parcel lacks sufficient frontage to maintain adequate spacing, the Region/TSC Traffic and Safety and Utility and Permit Engineers may reduce this and choose the next lowest spacing. The next lowest spacing would be for a design speed of 45 mph, with a spacing criteria of 525 feet. Therefore, the driveway spacing would meet the spacing requirement.
  - c. The Sparrow driveway is located on the same side as the proposed site driveway, approximately 317 feet to the east. The requirement is 350 feet; again due to limited frontage, the next lowest spacing is 300 feet. Therefore, the driveway spacing would meet the spacing requirement.
7. There is an existing center left-turn lane adjacent to the site; therefore, only the MDOT right-turn lane criteria was evaluated for the proposed site drive intersection. The results of the analysis show that a right-turn lane or taper is not required.
8. The results of the intersection sight distance analysis show that there will be adequate intersection sight distance at the proposed site driveway on Grand River Ave.

## 5 RECOMMENDATIONS

*The recommendations of this TIS are as follows:*

- MDOT should investigate signal timing optimization at the Grand River & Central Park Drive intersection to improve PM peak hour operations.

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<sup>1</sup> Ord. No. 2004-06, 9-5-2004, (e) (8)

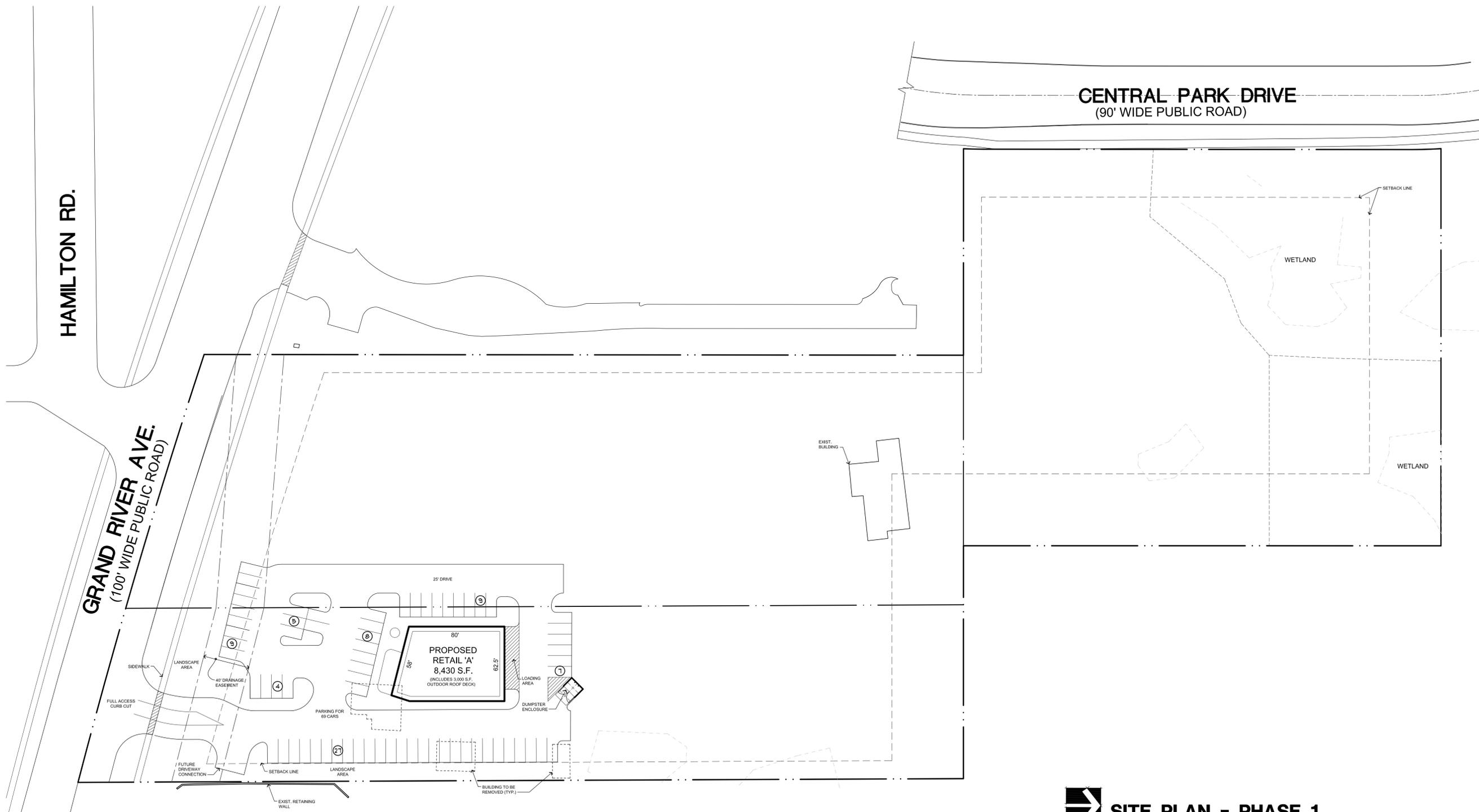
## **Appendix A**

# **BACKGROUND INFORMATION**

LAND/ BUILDING/ PARKING DATA :	
<b>PHASE 1</b>	
<b>LAND DATA :</b>	
OVERALL LAND AREA :	8.67 ACRES
<b>BUILDING DATA :</b>	
PROPOSED RETAIL 'A' :	5,430 S.F.
OUTDOOR ROOF DECK :	3,000 S.F.
TOTAL BUILDING AREA :	8,430 S.F.
<b>PARKING REQUIRED :</b> 42 SPACES	
<b>RETAIL :</b> 42 SPACES	
5 SPACES/ 1,000 GFA	
(8,430/ 1000 = 8.43 X 5 = 42 SPACES)	
<b>PARKING PROVIDED :</b> 69 SPACES	

issued for:  
 OWNER REVIEW: 17 OCTOBER 2019  
 OWNER REVIEW: 21 OCTOBER 2019  
 OWNER REVIEW: 23 OCTOBER 2019  
 OWNER REVIEW: 28 OCTOBER 2019  
 OWNER REVIEW: 31 OCTOBER 2019  
 OWNER REVIEW: 15 JAN. 2020

project:



Proposed for  
**Commercial Development**  
 Grand River Ave.  
 Meridian Twp., MI

**ROGVOY**  
 ARCHITECTS  
 32500 TELEGRAPH ROAD  
 SUITE 250  
 BINGHAM FARMS, MICHIGAN  
 48025-2404  
 PH 248.540.7700 FX 248.540.2710  
 www.rogvoy.com

drawing:  
**Conceptual Site Plan Phase 1**  
 DO NOT SCALE DRAWING  
 issue date: 02 AUG. 2019  
 drawn: KS/KL  
 checked: MD  
 approved: MD

file number: 19030  
 sheet:

**SITE PLAN - PHASE 1**  
 SCALE: 1"=40'-0"

**SP-1A**

# Traffic Engineering Associates, Inc.

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

Location: Grand River & Central Park Dr  
County/City: Meridian Twp  
Weather: Sunny  
Counted By: DES & JJ

File Name : Grand River & Central Park - AM  
Site Code : 09201801  
Start Date : 9/20/2018  
Page No : 1

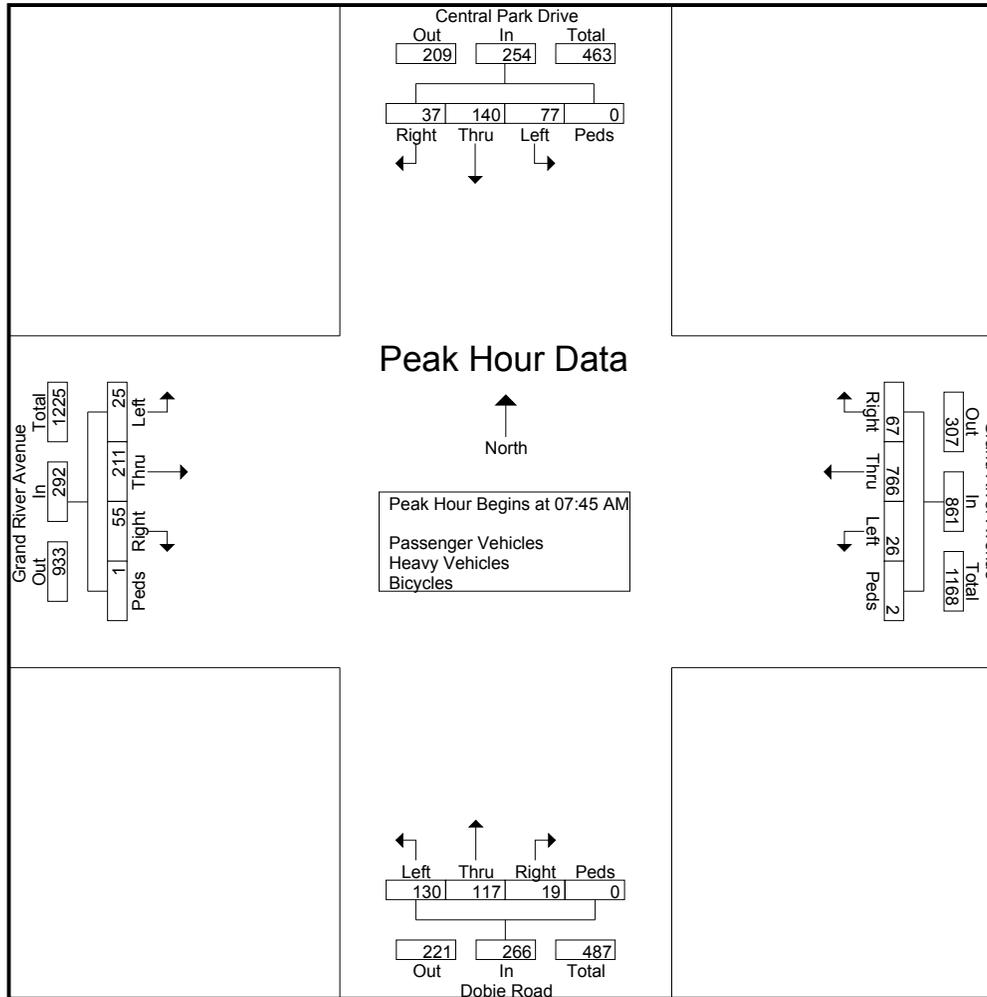
### Groups Printed- Passenger Vehicles - Heavy Vehicles - Bicycles

Start Time	Central Park Drive From North					Grand River Avenue From East					Dobie Road From South					Grand River Avenue From West					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
07:00 AM	9	11	3	0	23	6	102	5	0	113	15	24	4	0	43	3	31	7	0	41	220
07:15 AM	10	20	4	0	34	8	166	13	0	187	20	11	0	0	31	4	35	7	0	46	298
07:30 AM	5	31	5	0	41	8	199	17	1	225	33	13	8	0	54	2	51	9	0	62	382
07:45 AM	17	31	7	0	55	3	233	13	0	249	32	33	8	0	73	11	57	9	0	77	454
<b>Total</b>	<b>41</b>	<b>93</b>	<b>19</b>	<b>0</b>	<b>153</b>	<b>25</b>	<b>700</b>	<b>48</b>	<b>1</b>	<b>774</b>	<b>100</b>	<b>81</b>	<b>20</b>	<b>0</b>	<b>201</b>	<b>20</b>	<b>174</b>	<b>32</b>	<b>0</b>	<b>226</b>	<b>1354</b>
08:00 AM	18	32	6	0	56	7	178	21	1	207	31	32	2	0	65	6	49	15	1	71	399
08:15 AM	19	37	10	0	66	12	166	13	1	192	33	31	5	0	69	5	58	22	0	85	412
08:30 AM	23	40	14	0	77	4	189	20	0	213	34	21	4	0	59	3	47	9	0	59	408
08:45 AM	14	28	8	0	50	7	143	30	0	180	37	52	3	0	92	13	56	13	0	82	404
<b>Total</b>	<b>74</b>	<b>137</b>	<b>38</b>	<b>0</b>	<b>249</b>	<b>30</b>	<b>676</b>	<b>84</b>	<b>2</b>	<b>792</b>	<b>135</b>	<b>136</b>	<b>14</b>	<b>0</b>	<b>285</b>	<b>27</b>	<b>210</b>	<b>59</b>	<b>1</b>	<b>297</b>	<b>1623</b>
<b>Grand Total</b>	<b>115</b>	<b>230</b>	<b>57</b>	<b>0</b>	<b>402</b>	<b>55</b>	<b>1376</b>	<b>132</b>	<b>3</b>	<b>1566</b>	<b>235</b>	<b>217</b>	<b>34</b>	<b>0</b>	<b>486</b>	<b>47</b>	<b>384</b>	<b>91</b>	<b>1</b>	<b>523</b>	<b>2977</b>
Apprch %	28.6	57.2	14.2	0		3.5	87.9	8.4	0.2		48.4	44.7	7	0		9	73.4	17.4	0.2		
Total %	3.9	7.7	1.9	0	13.5	1.8	46.2	4.4	0.1	52.6	7.9	7.3	1.1	0	16.3	1.6	12.9	3.1	0	17.6	
Passenger Vehicles	111	229	57	0	397	55	1367	130	3	1555	230	212	32	0	474	46	355	83	1	485	2911
% Passenger Vehicles	96.5	99.6	100	0	98.8	100	99.3	98.5	100	99.3	97.9	97.7	94.1	0	97.5	97.9	92.4	91.2	100	92.7	97.8
Heavy Vehicles	4	1	0	0	5	0	9	2	0	11	5	5	2	0	12	1	29	8	0	38	66
% Heavy Vehicles	3.5	0.4	0	0	1.2	0	0.7	1.5	0	0.7	2.1	2.3	5.9	0	2.5	2.1	7.6	8.8	0	7.3	2.2
Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Start Time	Central Park Drive From North					Grand River Avenue From East					Dobie Road From South					Grand River Avenue From West					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:45 AM																					
07:45 AM	17	31	7	0	55	3	233	13	0	249	32	33	8	0	73	11	57	9	0	77	454
08:00 AM	18	32	6	0	56	7	178	21	1	207	31	32	2	0	65	6	49	15	1	71	399
08:15 AM	19	37	10	0	66	12	166	13	1	192	33	31	5	0	69	5	58	22	0	85	412
08:30 AM	23	40	14	0	77	4	189	20	0	213	34	21	4	0	59	3	47	9	0	59	408
<b>Total Volume</b>	<b>77</b>	<b>140</b>	<b>37</b>	<b>0</b>	<b>254</b>	<b>26</b>	<b>766</b>	<b>67</b>	<b>2</b>	<b>861</b>	<b>130</b>	<b>117</b>	<b>19</b>	<b>0</b>	<b>266</b>	<b>25</b>	<b>211</b>	<b>55</b>	<b>1</b>	<b>292</b>	<b>1673</b>
% App. Total	30.3	55.1	14.6	0		3	89	7.8	0.2		48.9	44	7.1	0		8.6	72.3	18.8	0.3		
PHF	.837	.875	.661	.000	.825	.542	.822	.798	.500	.864	.956	.886	.594	.000	.911	.568	.909	.625	.250	.859	.921

Location: Grand River & Central Park Dr  
 County/City: Meridian Twp  
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File Name : Grand River & Central Park - AM  
 Site Code : 09201801  
 Start Date : 9/20/2018  
 Page No : 2



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Saranac, MI 48881  
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File Name : Grand River & Central Park - PM  
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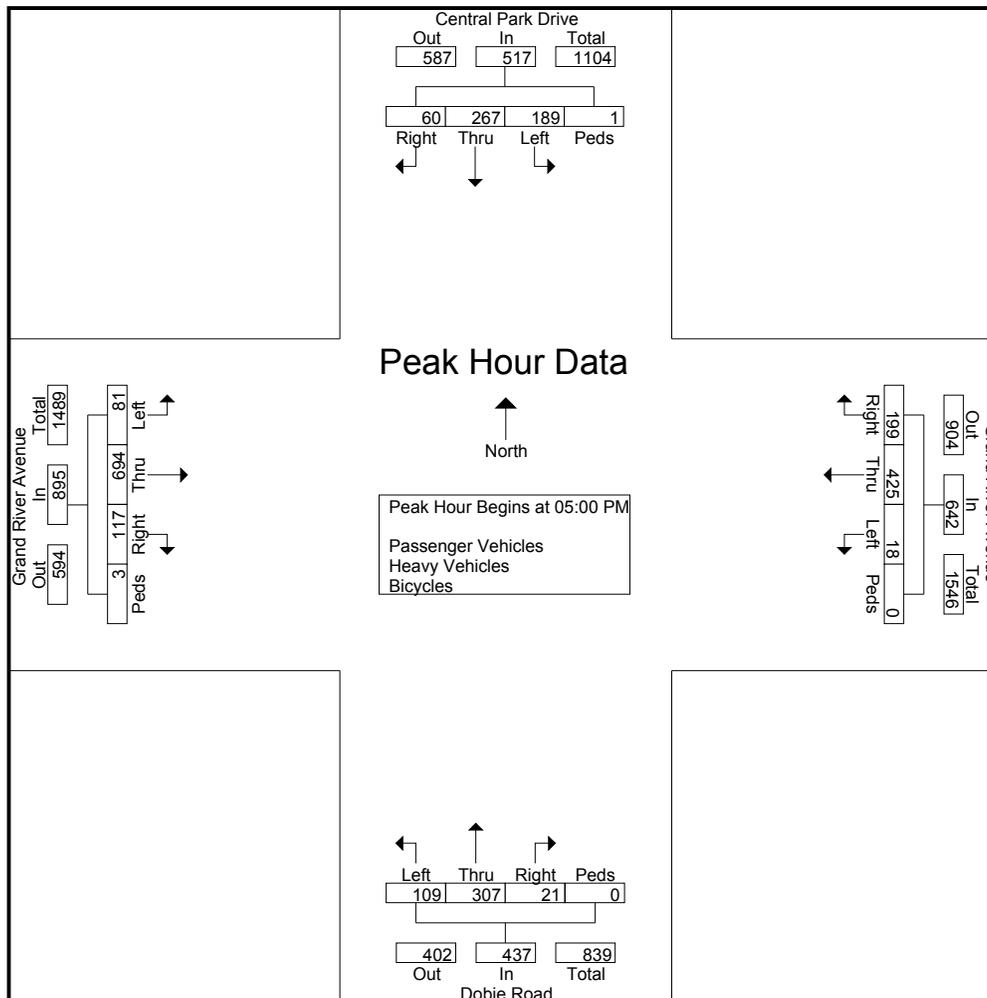
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Start Time	Central Park Drive From North					Grand River Avenue From East					Dobie Road From South					Grand River Avenue From West					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
04:00 PM	53	32	18	0	103	4	96	38	0	138	16	56	7	0	79	19	123	16	0	158	478
04:15 PM	44	55	16	0	115	6	91	29	0	126	22	72	2	0	96	13	126	20	0	159	496
04:30 PM	42	61	17	0	120	3	97	29	0	129	21	78	5	0	104	12	143	20	1	176	529
04:45 PM	46	60	16	0	122	12	100	42	1	155	20	68	4	0	92	23	161	21	0	205	574
<b>Total</b>	<b>185</b>	<b>208</b>	<b>67</b>	<b>0</b>	<b>460</b>	<b>25</b>	<b>384</b>	<b>138</b>	<b>1</b>	<b>548</b>	<b>79</b>	<b>274</b>	<b>18</b>	<b>0</b>	<b>371</b>	<b>67</b>	<b>553</b>	<b>77</b>	<b>1</b>	<b>698</b>	<b>2077</b>
05:00 PM	53	73	10	0	136	6	90	63	0	159	29	68	5	0	102	15	163	23	1	202	599
05:15 PM	51	75	15	0	141	5	107	47	0	159	18	81	5	0	104	20	185	31	1	237	641
05:30 PM	38	66	15	0	119	1	117	35	0	153	30	74	9	0	113	20	176	35	0	231	616
05:45 PM	47	53	20	1	121	6	111	54	0	171	32	84	2	0	118	26	170	28	1	225	635
<b>Total</b>	<b>189</b>	<b>267</b>	<b>60</b>	<b>1</b>	<b>517</b>	<b>18</b>	<b>425</b>	<b>199</b>	<b>0</b>	<b>642</b>	<b>109</b>	<b>307</b>	<b>21</b>	<b>0</b>	<b>437</b>	<b>81</b>	<b>694</b>	<b>117</b>	<b>3</b>	<b>895</b>	<b>2491</b>
<b>Grand Total</b>	<b>374</b>	<b>475</b>	<b>127</b>	<b>1</b>	<b>977</b>	<b>43</b>	<b>809</b>	<b>337</b>	<b>1</b>	<b>1190</b>	<b>188</b>	<b>581</b>	<b>39</b>	<b>0</b>	<b>808</b>	<b>148</b>	<b>1247</b>	<b>194</b>	<b>4</b>	<b>1593</b>	<b>4568</b>
<b>Apprch %</b>	<b>38.3</b>	<b>48.6</b>	<b>13</b>	<b>0.1</b>		<b>3.6</b>	<b>68</b>	<b>28.3</b>	<b>0.1</b>		<b>23.3</b>	<b>71.9</b>	<b>4.8</b>	<b>0</b>		<b>9.3</b>	<b>78.3</b>	<b>12.2</b>	<b>0.3</b>		
<b>Total %</b>	<b>8.2</b>	<b>10.4</b>	<b>2.8</b>	<b>0</b>	<b>21.4</b>	<b>0.9</b>	<b>17.7</b>	<b>7.4</b>	<b>0</b>	<b>26.1</b>	<b>4.1</b>	<b>12.7</b>	<b>0.9</b>	<b>0</b>	<b>17.7</b>	<b>3.2</b>	<b>27.3</b>	<b>4.2</b>	<b>0.1</b>	<b>34.9</b>	
Passenger Vehicles	372	474	127	1	974	43	805	335	1	1184	183	578	39	0	800	147	1231	191	4	1573	4531
% Passenger Vehicles	99.5	99.8	100	100	99.7	100	99.5	99.4	100	99.5	97.3	99.5	100	0	99	99.3	98.7	98.5	100	98.7	99.2
Heavy Vehicles	2	1	0	0	3	0	4	2	0	6	5	3	0	0	8	1	16	3	0	20	37
% Heavy Vehicles	0.5	0.2	0	0	0.3	0	0.5	0.6	0	0.5	2.7	0.5	0	0	1	0.7	1.3	1.5	0	1.3	0.8
Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Start Time	Central Park Drive From North					Grand River Avenue From East					Dobie Road From South					Grand River Avenue From West					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
05:00 PM	53	73	10	0	136	6	90	63	0	159	29	68	5	0	102	15	163	23	1	202	599
05:15 PM	51	75	15	0	141	5	107	47	0	159	18	81	5	0	104	20	185	31	1	237	641
05:30 PM	38	66	15	0	119	1	117	35	0	153	30	74	9	0	113	20	176	35	0	231	616
05:45 PM	47	53	20	1	121	6	111	54	0	171	32	84	2	0	118	26	170	28	1	225	635
<b>Total Volume</b>	<b>189</b>	<b>267</b>	<b>60</b>	<b>1</b>	<b>517</b>	<b>18</b>	<b>425</b>	<b>199</b>	<b>0</b>	<b>642</b>	<b>109</b>	<b>307</b>	<b>21</b>	<b>0</b>	<b>437</b>	<b>81</b>	<b>694</b>	<b>117</b>	<b>3</b>	<b>895</b>	<b>2491</b>
% App. Total	36.6	51.6	11.6	0.2		2.8	66.2	31	0		24.9	70.3	4.8	0		9.1	77.5	13.1	0.3		
PHF	.892	.890	.750	.250	.917	.750	.908	.790	.000	.939	.852	.914	.583	.000	.926	.779	.938	.836	.750	.944	.972

Location: Grand River & Central Park Dr  
 County/City: Meridian Twp.  
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File Name : Grand River & Central Park - PM  
 Site Code : 09201801  
 Start Date : 9/20/2018  
 Page No : 2



# Traffic Engineering Associates, Inc.

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

Location: Grand River & Hamilton Rd.  
County/City: Meridian Twp.  
Weather: Sunny  
Counted By: JJ

File Name : Grand River & Hamilton - AM  
Site Code : 09181802  
Start Date : 9/18/2018  
Page No : 1

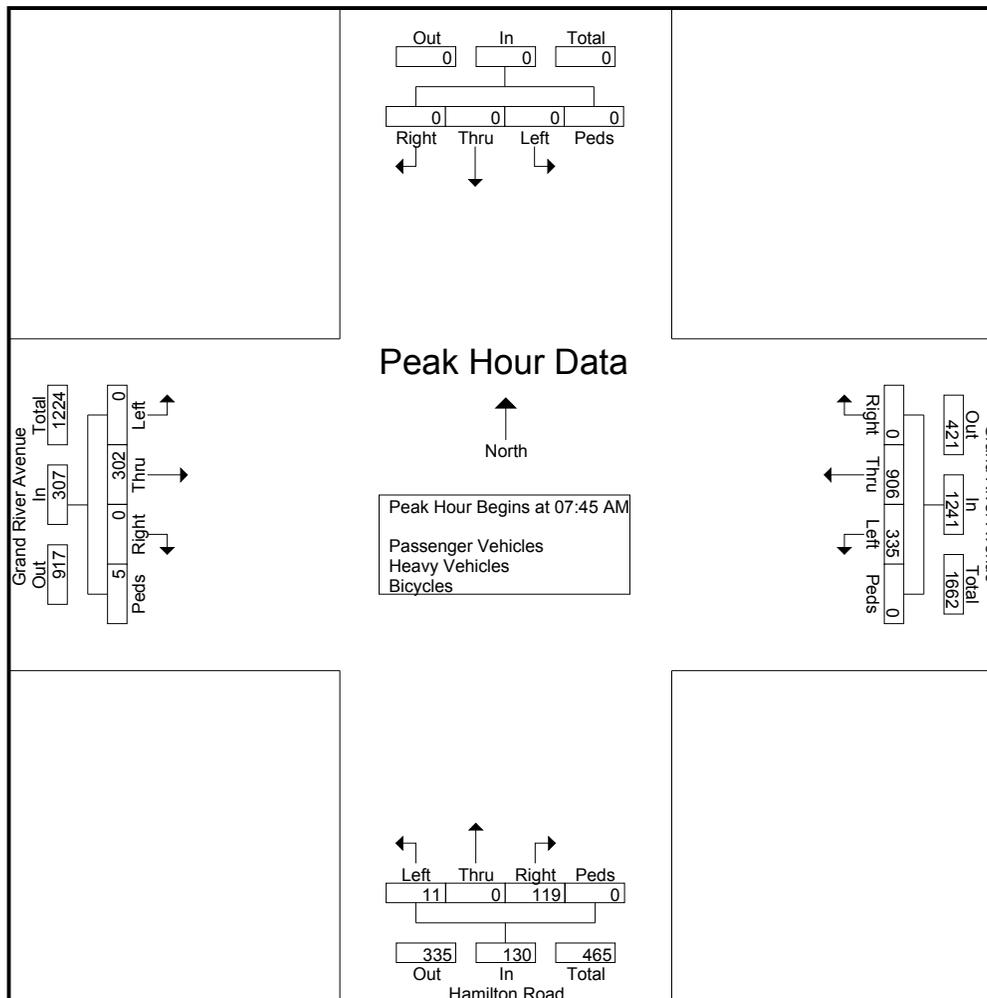
### Groups Printed- Passenger Vehicles - Heavy Vehicles - Bicycles

Start Time	From North					Grand River Avenue From East					Hamilton Road From South					Grand River Avenue From West					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
07:00 AM	0	0	0	0	0	41	121	0	0	162	3	0	10	0	13	0	42	3	0	45	220
07:15 AM	0	0	0	0	0	78	197	0	0	275	4	0	14	0	18	0	40	0	0	40	333
07:30 AM	0	0	0	0	0	89	270	0	0	359	4	0	28	0	32	0	74	0	2	76	467
07:45 AM	0	0	0	0	0	103	255	0	0	358	5	0	50	0	55	0	84	0	0	84	497
<b>Total</b>	0	0	0	0	0	311	843	0	0	1154	16	0	102	0	118	0	240	3	2	245	1517
08:00 AM	0	0	0	0	0	78	223	0	0	301	2	0	18	0	20	0	57	0	0	57	378
08:15 AM	0	0	0	0	0	71	227	0	0	298	1	0	20	0	21	0	80	0	1	81	400
08:30 AM	0	0	0	0	0	83	201	0	0	284	3	0	31	0	34	0	81	0	4	85	403
08:45 AM	0	0	0	0	0	69	219	0	0	288	3	0	28	0	31	0	75	1	2	78	397
<b>Total</b>	0	0	0	0	0	301	870	0	0	1171	9	0	97	0	106	0	293	1	7	301	1578
<b>Grand Total</b>	0	0	0	0	0	612	1713	0	0	2325	25	0	199	0	224	0	533	4	9	546	3095
<b>Apprch %</b>	0	0	0	0	0	26.3	73.7	0	0		11.2	0	88.8	0		0	97.6	0.7	1.6		
<b>Total %</b>	0	0	0	0	0	19.8	55.3	0	0	75.1	0.8	0	6.4	0	7.2	0	17.2	0.1	0.3	17.6	
Passenger Vehicles	0	0	0	0	0	601	1669	0	0	2270	23	0	191	0	214	0	506	4	9	519	3003
% Passenger Vehicles	0	0	0	0	0	98.2	97.4	0	0	97.6	92	0	96	0	95.5	0	94.9	100	100	95.1	97
Heavy Vehicles	0	0	0	0	0	11	44	0	0	55	2	0	8	0	10	0	27	0	0	27	92
% Heavy Vehicles	0	0	0	0	0	1.8	2.6	0	0	2.4	8	0	4	0	4.5	0	5.1	0	0	4.9	3
Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Start Time	From North					Grand River Avenue From East					Hamilton Road From South					Grand River Avenue From West					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
Peak Hour Analysis From 07:45 AM to 08:30 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:45 AM																					
07:45 AM	0	0	0	0	0	103	255	0	0	358	5	0	50	0	55	0	84	0	0	84	497
08:00 AM	0	0	0	0	0	78	223	0	0	301	2	0	18	0	20	0	57	0	0	57	378
08:15 AM	0	0	0	0	0	71	227	0	0	298	1	0	20	0	21	0	80	0	1	81	400
08:30 AM	0	0	0	0	0	83	201	0	0	284	3	0	31	0	34	0	81	0	4	85	403
<b>Total Volume</b>	0	0	0	0	0	335	906	0	0	1241	11	0	119	0	130	0	302	0	5	307	1678
<b>% App. Total</b>	0	0	0	0	0	27	73	0	0		8.5	0	91.5	0		0	98.4	0	1.6		
<b>PHF</b>	.000	.000	.000	.000	.000	.813	.888	.000	.000	.867	.550	.000	.595	.000	.591	.000	.899	.000	.313	.903	.844

Location: Grand River & Hamilton Rd.  
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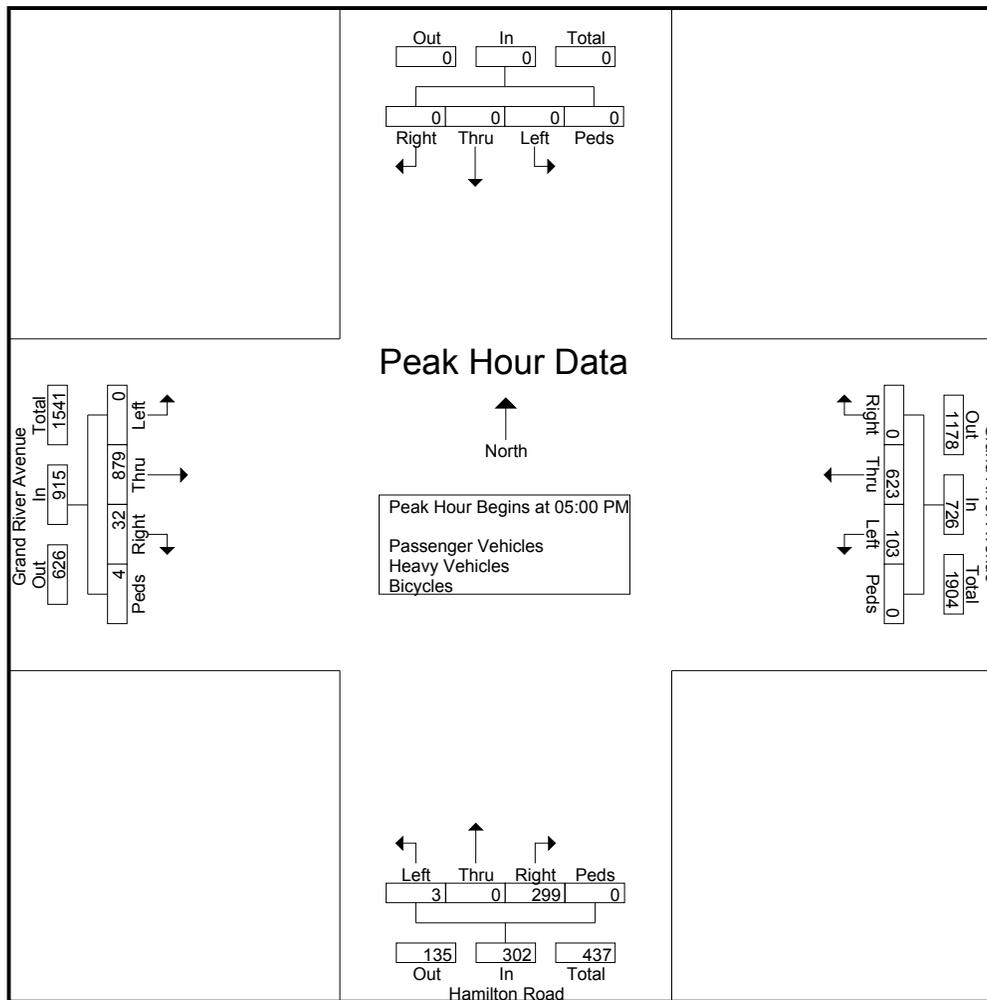
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04:00 PM	0	0	0	0	0	37	153	0	0	190	0	0	56	0	56	0	166	3	2	171	417
04:15 PM	0	0	0	0	0	32	129	0	0	161	0	0	67	0	67	0	178	6	0	184	412
04:30 PM	0	0	0	0	0	28	144	0	0	172	11	0	67	0	78	0	188	10	2	200	450
04:45 PM	0	0	0	0	0	46	173	0	0	219	0	0	48	0	48	0	196	6	0	202	469
<b>Total</b>	0	0	0	0	0	143	599	0	0	742	11	0	238	0	249	0	728	25	4	757	1748
05:00 PM	0	0	0	0	0	16	153	0	0	169	0	0	89	0	89	0	203	16	3	222	480
05:15 PM	0	0	0	0	0	29	142	0	0	171	0	0	61	0	61	0	233	9	1	243	475
05:30 PM	0	0	0	0	0	26	164	0	0	190	2	0	80	0	82	0	228	4	0	232	504
05:45 PM	0	0	0	0	0	32	164	0	0	196	1	0	69	0	70	0	215	3	0	218	484
<b>Total</b>	0	0	0	0	0	103	623	0	0	726	3	0	299	0	302	0	879	32	4	915	1943
<b>Grand Total</b>	0	0	0	0	0	246	1222	0	0	1468	14	0	537	0	551	0	1607	57	8	1672	3691
<b>Apprch %</b>	0	0	0	0	0	16.8	83.2	0	0		2.5	0	97.5	0		0	96.1	3.4	0.5		
<b>Total %</b>	0	0	0	0	0	6.7	33.1	0	0	39.8	0.4	0	14.5	0	14.9	0	43.5	1.5	0.2	45.3	
Passenger Vehicles	0	0	0	0	0	238	1197	0	0	1435	14	0	528	0	542	0	1583	57	8	1648	3625
% Passenger Vehicles	0	0	0	0	0	96.7	98	0	0	97.8	100	0	98.3	0	98.4	0	98.5	100	100	98.6	98.2
Heavy Vehicles	0	0	0	0	0	8	25	0	0	33	0	0	9	0	9	0	24	0	0	24	66
% Heavy Vehicles	0	0	0	0	0	3.3	2	0	0	2.2	0	0	1.7	0	1.6	0	1.5	0	0	1.4	1.8
Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Start Time	From North					Grand River Avenue From East					Hamilton Road From South					Grand River Avenue From West					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
05:00 PM	0	0	0	0	0	16	153	0	0	169	0	0	<b>89</b>	0	<b>89</b>	0	203	<b>16</b>	<b>3</b>	222	480
05:15 PM	0	0	0	0	0	29	142	0	0	171	0	0	61	0	61	0	<b>233</b>	9	1	<b>243</b>	475
05:30 PM	0	0	0	0	0	26	<b>164</b>	0	0	190	<b>2</b>	0	80	0	82	0	228	4	0	232	<b>504</b>
05:45 PM	0	0	0	0	0	<b>32</b>	164	0	0	<b>196</b>	1	0	69	0	70	0	215	3	0	218	484
<b>Total Volume</b>	0	0	0	0	0	103	623	0	0	726	3	0	299	0	302	0	879	32	4	915	1943
<b>% App. Total</b>	0	0	0	0	0	14.2	85.8	0	0		1	0	99	0		0	96.1	3.5	0.4		
<b>PHF</b>	.000	.000	.000	.000	.000	.805	.950	.000	.000	.926	.375	.000	.840	.000	.848	.000	.943	.500	.333	.941	.964

Location: Grand River & Hamilton Rd.  
County/City: Meridian Twp.  
Weather: Sunny  
Counted By: JJ

File Name : Grand River & Hamilton - PM  
Site Code : 09181802  
Start Date : 9/18/2018  
Page No : 2





## ADVANCED TIMING PARAMETERS FORM

SYSTEM INFORMATION	LEFT-TURN PHASING						RING AND BARRIER STRUCTURE													
<b>Controller Type:</b> <input type="checkbox"/> EPAC <input type="checkbox"/> Other:	Phase # / Description	<i>Permissive-Protected</i>			<i>Protected-Only</i>			B1			B2			B3			B4			
		Lead	Lag	Split	Lead	Lag	R1													
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	R2												
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	R3												
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	R4												
<b>System Type:</b> <input type="checkbox"/> Closed Loop <input type="checkbox"/> Stand By <input type="checkbox"/> Group 1 <input type="checkbox"/> Group 2 Address: <input type="checkbox"/> TBC <input type="checkbox"/> TBC/GPS <input type="checkbox"/> None <input type="checkbox"/> Other:	<b>VEHICULAR AND PEDESTRIAN DETECTION</b>												<b>DISAPPEARING LEGEND CASE SIGNS</b>							
	Approach	<i>Vehicular Detection</i>						<i>Pedestrian Detection</i>												
		Movements and Call Delay (s)			Type			Push-Button Crossing Locations												
	Left	Thru	Right	Loop	Video	Other														
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>														
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>														
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>														
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>														
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>														
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>														
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>															
<b>ADDITIONAL DIAL SPLIT DATA</b>												<b>COORDINATION DATA</b>								
PHASE			1	2	3	4	5	6	7	8	O1	O2	O3	Operation Mode						
DIAL	SPLIT	CYCLE												Coordination Mode						
DIAL	SPLIT	CYCLE												Maximum Mode						
DIAL	SPLIT	CYCLE												Correction Mode						
DIAL	SPLIT	CYCLE												Offset Mode						
DIAL	SPLIT	CYCLE												Force Mode						
DIAL	SPLIT	CYCLE												Max Dwell						
DIAL	SPLIT	CYCLE												Yield Period						
						<b>ADDITIONAL OVERLAP DATA</b>														
												<i>Load Bays</i>	<i>Phases Overlapped</i>		T.G. (s)	Y (s)	R (s)	-G/Y	+GRN	
												=								
												=								
												=								
If Phone Drop, Phone #						PREPARED BY: _____ DATE: _____						LOCATION:								
												Master Location: _____						CONTROL SECTION-SPOT # _____		
Master Spot # : _____																				

## PREEMPTION INFORMATION FORM

Preemption Description:																Preempt System Data													
Preempt # =	Time (s)	Phases	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16											
SEL Ped Cl		Vehicle	Track																<input type="checkbox"/> Locking  <input type="checkbox"/> Non-Locking	Delay (s)		Ring	1	2	3	4			
SEL Yellow			Dwell																	Extend (s)		MIN							
SEL Red Cl			Cycle																	Duration (s)		GRN/WLK (s)							
TRACK Green		Ped	Exit																Max Call (s)		Priority	PE/FL	PE1/2	PE2/3	PE3/4	PE4/5	PE5/6		
TRACK Ped Cl			Track																Lockout (s)		Status								
TRACK Yellow			Dwell																Link PE #		REMARKS :								
TRACK Red CL		Cycle																Max Call (s)											
DWELL Green		Overlap Vehicle	Overlap	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Lockout (s)									
RET Ped Cl			Track																	Link PE #									
RET Yellow			Dwell																	Link PE #									
RET Red Cl		Cycle																	Link PE #										
Preemption Description:																													
Preempt # =	Time (s)	Phases	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16											
SEL Ped Cl		Vehicle	Track																<input type="checkbox"/> Locking  <input type="checkbox"/> Non-Locking	Delay (s)		REMARKS :							
SEL Yellow			Dwell																	Extend (s)									
SEL Red Cl			Cycle																	Duration (s)									
TRACK Green		Ped	Exit																Max Call (s)										
TRACK Ped Cl			Track																Lockout (s)										
TRACK Yellow			Dwell																Link PE #										
TRACK Red CL		Cycle																	Link PE #										
DWELL Green		Overlap Vehicle	Overlap	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Max Call (s)									
RET Ped Cl			Track																	Lockout (s)									
RET Yellow			Dwell																	Link PE #									
RET Red Cl		Cycle																	Link PE #										
Preemption Description:																													
Preempt # =	Time (s)	Phases	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16											
SEL Ped Cl		Vehicle	Track																<input type="checkbox"/> Locking  <input type="checkbox"/> Non-Locking	Delay (s)		REMARKS :							
SEL Yellow			Dwell																	Extend (s)									
SEL Red Cl			Cycle																	Duration (s)									
TRACK Green		Ped	Exit																Max Call (s)										
TRACK Ped Cl			Track																Lockout (s)										
TRACK Yellow			Dwell																Link PE #										
TRACK Red CL		Cycle																	Link PE #										
DWELL Green		Overlap Vehicle	Overlap	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Max Call (s)									
RET Ped Cl			Track																	Lockout (s)									
RET Yellow			Dwell																	Link PE #									
RET Red Cl		Cycle																	Link PE #										
Preemption Description:																													
Preempt # =	Time (s)	Phases	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16											
SEL Ped Cl		Vehicle	Track																<input type="checkbox"/> Locking  <input type="checkbox"/> Non-Locking	Delay (s)		REMARKS :							
SEL Yellow			Dwell																	Extend (s)									
SEL Red Cl			Cycle																	Duration (s)									
TRACK Green		Ped	Exit																Max Call (s)										
TRACK Ped Cl			Track																Lockout (s)										
TRACK Yellow			Dwell																Link PE #										
TRACK Red CL		Cycle																	Link PE #										
DWELL Green		Overlap Vehicle	Overlap	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Max Call (s)									
RET Ped Cl			Track																	Lockout (s)									
RET Yellow			Dwell																	Link PE #									
RET Red Cl		Cycle																	Link PE #										
Preemption Description:																													
Preempt # =	Time (s)	Phases	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16											
SEL Ped Cl		Vehicle	Track																<input type="checkbox"/> Locking  <input type="checkbox"/> Non-Locking	Delay (s)		REMARKS :							
SEL Yellow			Dwell																	Extend (s)									
SEL Red Cl			Cycle																	Duration (s)									
TRACK Green		Ped	Exit																Max Call (s)										
TRACK Ped Cl			Track																Lockout (s)										
TRACK Yellow			Dwell																Link PE #										
TRACK Red CL		Cycle																	Link PE #										
DWELL Green		Overlap Vehicle	Overlap	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Max Call (s)									
RET Ped Cl			Track																	Lockout (s)									
RET Yellow			Dwell																	Link PE #									
RET Red Cl		Cycle																	Link PE #										

PREPARED BY: \_\_\_\_\_ DATE: \_\_\_\_\_

LOCATION: \_\_\_\_\_

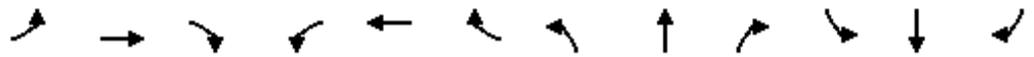
CONTROL SECTION-SPOT # \_\_\_\_\_

## **Appendix B**

# **EXISTING TRAFFIC CONDITIONS**

HCM 6th Signalized Intersection Summary  
 1: Dobie Road/Central Park Drive & Grand River Ave

Existing Conditions  
 AM Peak Hour



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	25	211	55	26	824	67	130	117	19	77	140	37
Future Volume (veh/h)	25	211	55	26	824	67	130	117	19	77	140	37
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1796	1796	1796	1885	1885	1885	1856	1856	1856	1885	1885	1885
Adj Flow Rate, veh/h	29	245	64	30	958	78	143	129	21	93	169	45
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.91	0.91	0.91	0.83	0.83	0.83
Percent Heavy Veh, %	7	7	7	1	1	1	3	3	3	1	1	1
Cap, veh/h	314	2105	938	705	2069	168	262	372	61	284	451	382
Arrive On Green	0.62	0.62	0.62	0.62	0.62	0.62	0.24	0.24	0.24	0.24	0.24	0.24
Sat Flow, veh/h	523	3413	1520	1078	3354	273	1158	1557	253	1247	1885	1598
Grp Volume(v), veh/h	29	245	64	30	512	524	143	0	150	93	169	45
Grp Sat Flow(s),veh/h/ln	523	1706	1520	1078	1791	1836	1158	0	1810	1247	1885	1598
Q Serve(g_s), s	3.1	3.0	1.7	1.2	15.3	15.3	11.8	0.0	6.9	6.7	7.5	2.2
Cycle Q Clear(g_c), s	18.5	3.0	1.7	4.1	15.3	15.3	19.3	0.0	6.9	13.6	7.5	2.2
Prop In Lane	1.00		1.00	1.00		0.15	1.00		0.14	1.00		1.00
Lane Grp Cap(c), veh/h	314	2105	938	705	1105	1132	262	0	433	284	451	382
V/C Ratio(X)	0.09	0.12	0.07	0.04	0.46	0.46	0.55	0.00	0.35	0.33	0.37	0.12
Avail Cap(c_a), veh/h	314	2105	938	705	1105	1132	487	0	784	526	816	692
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	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	15.2	7.9	7.7	8.8	10.3	10.3	39.9	0.0	31.6	37.2	31.8	29.8
Incr Delay (d2), s/veh	0.6	0.1	0.1	0.1	1.4	1.4	3.7	0.0	1.0	1.4	1.1	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	0.4	1.0	0.5	0.3	5.5	5.6	3.5	0.0	3.1	2.1	3.5	0.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	15.8	8.0	7.8	8.9	11.7	11.6	43.6	0.0	32.6	38.6	32.9	30.1
LnGrp LOS	B	A	A	A	B	B	D	A	C	D	C	C
Approach Vol, veh/h		338			1066			293			307	
Approach Delay, s/veh		8.6			11.6			38.0			34.2	
Approach LOS		A			B			D			C	
Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		69.4		30.6		69.4		30.6				
Change Period (Y+Rc), s		7.7		* 6.7		7.7		* 6.7				
Max Green Setting (Gmax), s		42.3		* 43		42.3		* 43				
Max Q Clear Time (g_c+I1), s		0.0		15.6		0.0		21.3				
Green Ext Time (p_c), s		0.0		2.9		0.0		2.6				

Intersection Summary

HCM 6th Ctrl Delay	18.4
HCM 6th LOS	B

Notes

\* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

HCM 6th TWSC  
2: Hamilton Road & Grand River Ave

Existing Conditions  
AM Peak Hour

Intersection						
Int Delay, s/veh	2.8					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↖	↑↑	↗	
Traffic Vol, veh/h	307	0	335	906	11	119
Future Vol, veh/h	307	0	335	906	11	119
Conflicting Peds, #/hr	0	5	5	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	500	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	87	87	60	60
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	341	0	385	1041	18	198

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	0	346	0	1637
Stage 1	-	-	-	-	346
Stage 2	-	-	-	-	1291
Critical Hdwy	-	-	4.14	-	6.84
Critical Hdwy Stg 1	-	-	-	-	5.84
Critical Hdwy Stg 2	-	-	-	-	5.84
Follow-up Hdwy	-	-	2.22	-	3.52
Pot Cap-1 Maneuver	-	-	1210	-	91
Stage 1	-	-	-	-	688
Stage 2	-	-	-	-	222
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1204	-	62
Mov Cap-2 Maneuver	-	-	-	-	-407
Stage 1	-	-	-	-	466
Stage 2	-	-	-	-	222

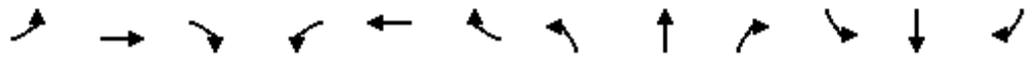
Approach	EB	WB	NB
HCM Control Delay, s	0	2.5	9
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	1122	-	-	1204	-
HCM Lane V/C Ratio	0.193	-	-	0.32	-
HCM Control Delay (s)	9	-	-	9.4	-
HCM Lane LOS	A	-	-	A	-
HCM 95th %tile Q(veh)	0.7	-	-	1.4	-

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

HCM 6th Signalized Intersection Summary  
 1: Dobie Road/Central Park Drive & Grand River Ave

Existing Conditions  
 PM Peak Hour



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	81	701	117	18	425	199	109	307	21	189	267	60
Future Volume (veh/h)	81	701	117	18	425	199	109	307	21	189	267	60
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1984	1984	1984	1984	1984	1984	1984	1984	1984	2000	2000	2000
Adj Flow Rate, veh/h	86	746	124	19	452	212	117	330	23	205	290	65
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.93	0.93	0.93	0.92	0.92	0.92
Percent Heavy Veh, %	1	1	1	1	1	1	1	1	1	0	0	0
Cap, veh/h	396	1972	877	332	1306	607	299	611	43	267	666	564
Arrive On Green	0.52	0.52	0.52	0.52	0.52	0.52	0.33	0.33	0.33	0.33	0.33	0.33
Sat Flow, veh/h	777	3770	1677	641	2497	1161	1034	1833	128	1044	2000	1693
Grp Volume(v), veh/h	86	746	124	19	340	324	117	0	353	205	290	65
Grp Sat Flow(s),veh/h/ln	777	1885	1677	641	1885	1773	1034	0	1961	1044	2000	1693
Q Serve(g_s), s	7.3	11.8	3.8	1.8	10.5	10.7	10.0	0.0	14.6	18.7	11.3	2.7
Cycle Q Clear(g_c), s	17.9	11.8	3.8	13.6	10.5	10.7	21.3	0.0	14.6	33.3	11.3	2.7
Prop In Lane	1.00		1.00	1.00		0.66	1.00		0.07	1.00		1.00
Lane Grp Cap(c), veh/h	396	1972	877	332	986	927	299	0	653	267	666	564
V/C Ratio(X)	0.22	0.38	0.14	0.06	0.35	0.35	0.39	0.00	0.54	0.77	0.44	0.12
Avail Cap(c_a), veh/h	396	1972	877	332	986	927	299	0	653	267	666	564
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	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	19.1	14.2	12.3	18.2	13.9	13.9	34.3	0.0	27.1	41.1	26.0	23.1
Incr Delay (d2), s/veh	1.3	0.6	0.3	0.3	1.0	1.0	1.8	0.0	1.6	14.7	1.0	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	1.4	4.6	1.4	0.3	4.3	4.1	2.6	0.0	6.9	6.1	5.4	1.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	20.4	14.7	12.6	18.5	14.8	15.0	36.1	0.0	28.8	55.9	27.0	23.3
LnGrp LOS	C	B	B	B	B	B	D	A	C	E	C	C
Approach Vol, veh/h		956			683			470			560	
Approach Delay, s/veh		15.0			15.0			30.6			37.1	
Approach LOS		B			B			C			D	
Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		60.0		40.0		60.0		40.0				
Change Period (Y+Rc), s		7.7		* 6.7		7.7		* 6.7				
Max Green Setting (Gmax), s		52.3		* 33		52.3		* 33				
Max Q Clear Time (g_c+I1), s		0.0		35.3		0.0		23.3				
Green Ext Time (p_c), s		0.0		0.0		0.0		3.2				

Intersection Summary

HCM 6th Ctrl Delay	22.4
HCM 6th LOS	C

Notes

\* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

HCM 6th TWSC  
2: Hamilton Road & Grand River Ave

Existing Conditions  
PM Peak Hour

Intersection						
Int Delay, s/veh	5					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↖	↑↑	↘	
Traffic Vol, veh/h	879	32	103	639	3	299
Future Vol, veh/h	879	32	103	639	3	299
Conflicting Peds, #/hr	0	4	4	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	500	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	94	94	93	93	85	85
Heavy Vehicles, %	1	1	2	2	2	2
Mvmt Flow	935	34	111	687	4	352

Major/Minor	Major1	Major2	Minor1	Minor2	Minor3
Conflicting Flow All	0	0	973	0	1522
Stage 1	-	-	-	-	956
Stage 2	-	-	-	-	566
Critical Hdwy	-	-	4.14	-	6.84
Critical Hdwy Stg 1	-	-	-	-	5.84
Critical Hdwy Stg 2	-	-	-	-	5.84
Follow-up Hdwy	-	-	2.22	-	3.52
Pot Cap-1 Maneuver	-	-	704	-	109
Stage 1	-	-	-	-	334
Stage 2	-	-	-	-	532
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	701	-	91
Mov Cap-2 Maneuver	-	-	-	-	193
Stage 1	-	-	-	-	280
Stage 2	-	-	-	-	532

Approach	EB	WB	NB
HCM Control Delay, s	0	1.5	26.2
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	514	-	-	701	-
HCM Lane V/C Ratio	0.691	-	-	0.158	-
HCM Control Delay (s)	26.2	-	-	11.1	-
HCM Lane LOS	D	-	-	B	-
HCM 95th %tile Q(veh)	5.3	-	-	0.6	-

**Intersection: 1: Dobie Road/Central Park Drive & Grand River Ave**

Movement	EB	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	T	T	R	L	T	TR	L	TR	L	T	R
Maximum Queue (ft)	62	102	90	50	61	240	237	204	152	130	153	54
Average Queue (ft)	17	37	18	8	11	114	125	94	65	49	67	17
95th Queue (ft)	48	82	54	28	42	206	214	170	126	95	123	43
Link Distance (ft)		2046	2046			398	398	522	522		1029	1029
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	500			250	500					400		
Storage Blk Time (%)												
Queuing Penalty (veh)												

**Intersection: 2: Hamilton Road & Grand River Ave**

Movement	WB	NB	B7
Directions Served	L	LR	T
Maximum Queue (ft)	96	82	50
Average Queue (ft)	40	43	3
95th Queue (ft)	73	72	25
Link Distance (ft)		15	400
Upstream Blk Time (%)		17	
Queuing Penalty (veh)		0	
Storage Bay Dist (ft)	500		
Storage Blk Time (%)			
Queuing Penalty (veh)			

**Network Summary**

Network wide Queuing Penalty: 0
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**Intersection: 1: Dobie Road/Central Park Drive & Grand River Ave**

Movement	EB	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	T	T	R	L	T	TR	L	TR	L	T	R
Maximum Queue (ft)	113	169	167	74	39	153	201	154	272	424	866	644
Average Queue (ft)	45	95	86	21	11	79	97	70	140	326	441	131
95th Queue (ft)	92	149	147	53	34	130	162	137	240	503	991	647
Link Distance (ft)		2046	2046			398	398	522	522		1029	1029
Upstream Blk Time (%)											8	3
Queuing Penalty (veh)											0	0
Storage Bay Dist (ft)	500			250	500					400		
Storage Blk Time (%)										31	7	
Queuing Penalty (veh)										83	14	

**Intersection: 2: Hamilton Road & Grand River Ave**

Movement	EB	WB	NB	B7
Directions Served	TR	L	LR	T
Maximum Queue (ft)	9	99	97	144
Average Queue (ft)	0	34	67	17
95th Queue (ft)	4	76	98	71
Link Distance (ft)	398		15	400
Upstream Blk Time (%)			37	
Queuing Penalty (veh)			0	
Storage Bay Dist (ft)		500		
Storage Blk Time (%)				
Queuing Penalty (veh)				

**Intersection: 7: Bend**

Movement	SB
Directions Served	T
Maximum Queue (ft)	22
Average Queue (ft)	1
95th Queue (ft)	11
Link Distance (ft)	15
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

**Network Summary**

Network wide Queuing Penalty: 96

HCM 6th Signalized Intersection Summary  
 1: Dobie Road/Central Park Drive & Grand River Ave

Existing Conditions with Improvements

PM Peak Hour



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	81	701	117	18	425	199	109	307	21	189	267	60
Future Volume (veh/h)	81	701	117	18	425	199	109	307	21	189	267	60
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1984	1984	1984	1984	1984	1984	1984	1984	1984	2000	2000	2000
Adj Flow Rate, veh/h	86	746	124	19	452	212	117	330	23	205	290	65
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.93	0.93	0.93	0.92	0.92	0.92
Percent Heavy Veh, %	1	1	1	1	1	1	1	1	1	0	0	0
Cap, veh/h	349	1785	794	292	1182	550	359	701	49	330	765	648
Arrive On Green	0.47	0.47	0.47	0.47	0.47	0.47	0.38	0.38	0.38	0.38	0.38	0.38
Sat Flow, veh/h	777	3770	1676	641	2496	1161	1034	1833	128	1044	2000	1694
Grp Volume(v), veh/h	86	746	124	19	340	324	117	0	353	205	290	65
Grp Sat Flow(s),veh/h/ln	777	1885	1676	641	1885	1773	1034	0	1961	1044	2000	1694
Q Serve(g_s), s	8.0	13.0	4.2	2.0	11.6	11.8	9.2	0.0	13.6	18.4	10.5	2.5
Cycle Q Clear(g_c), s	19.8	13.0	4.2	15.0	11.6	11.8	19.7	0.0	13.6	32.0	10.5	2.5
Prop In Lane	1.00		1.00	1.00		0.66	1.00		0.07	1.00		1.00
Lane Grp Cap(c), veh/h	349	1785	794	292	893	839	359	0	750	330	765	648
V/C Ratio(X)	0.25	0.42	0.16	0.06	0.38	0.39	0.33	0.00	0.47	0.62	0.38	0.10
Avail Cap(c_a), veh/h	349	1785	794	292	893	839	453	0	928	424	946	801
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	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	23.3	17.3	15.0	22.2	16.9	17.0	29.4	0.0	23.2	35.3	22.3	19.8
Incr Delay (d2), s/veh	1.7	0.7	0.4	0.4	1.2	1.3	1.1	0.0	1.0	4.0	0.7	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.5	5.3	1.6	0.3	4.9	4.7	2.3	0.0	6.3	4.9	4.9	1.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	25.0	18.0	15.4	22.6	18.2	18.3	30.5	0.0	24.2	39.3	23.0	20.0
LnGrp LOS	C	B	B	C	B	B	C	A	C	D	C	B
Approach Vol, veh/h		956			683			470			560	
Approach Delay, s/veh		18.3			18.3			25.8			28.6	
Approach LOS		B			B			C			C	
Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		55.0		45.0		55.0		45.0				
Change Period (Y+Rc), s		7.7		* 6.7		7.7		* 6.7				
Max Green Setting (Gmax), s		38.3		* 47		38.3		* 47				
Max Q Clear Time (g_c+I1), s		0.0		34.0		0.0		21.7				
Green Ext Time (p_c), s		0.0		4.3		0.0		5.3				

Intersection Summary

HCM 6th Ctrl Delay	21.8
HCM 6th LOS	C

Notes

\* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

**Intersection: 1: Dobie Road/Central Park Drive & Grand River Ave**

Movement	EB	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	T	T	R	L	T	TR	L	TR	L	T	R
Maximum Queue (ft)	133	217	223	73	48	166	200	137	265	215	224	51
Average Queue (ft)	47	125	119	19	15	92	112	62	127	119	106	20
95th Queue (ft)	101	195	199	46	40	148	183	118	223	200	186	42
Link Distance (ft)		2046	2046			398	398	522	522		1029	1029
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	500			250	500					400		
Storage Blk Time (%)	0											
Queuing Penalty (veh)	0											

**Intersection: 2: Hamilton Road & Grand River Ave**

Movement	EB	WB	NB	B7
Directions Served	TR	L	LR	T
Maximum Queue (ft)	9	77	101	121
Average Queue (ft)	0	30	67	16
95th Queue (ft)	5	62	98	72
Link Distance (ft)	398		15	400
Upstream Blk Time (%)	37			
Queuing Penalty (veh)	0			
Storage Bay Dist (ft)		500		
Storage Blk Time (%)				
Queuing Penalty (veh)				

**Intersection: 7: Bend**

Movement	SB
Directions Served	T
Maximum Queue (ft)	11
Average Queue (ft)	0
95th Queue (ft)	8
Link Distance (ft)	15
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

**Network Summary**

Network wide Queuing Penalty: 0

## **Appendix C**

# **FUTURE TRAFFIC CONDITIONS**

HCM 6th Signalized Intersection Summary  
 1: Dobie Road/Central Park Drive & Grand River Ave

Future Conditions  
 AM Peak Hour



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	25	215	55	26	827	70	130	117	19	81	140	37
Future Volume (veh/h)	25	215	55	26	827	70	130	117	19	81	140	37
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1796	1796	1796	1885	1885	1885	1856	1856	1856	1885	1885	1885
Adj Flow Rate, veh/h	29	250	64	30	962	81	143	129	21	98	169	45
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.91	0.91	0.91	0.83	0.83	0.83
Percent Heavy Veh, %	7	7	7	1	1	1	3	3	3	1	1	1
Cap, veh/h	312	2105	938	701	2063	174	262	372	61	284	451	382
Arrive On Green	0.62	0.62	0.62	0.62	0.62	0.62	0.24	0.24	0.24	0.24	0.24	0.24
Sat Flow, veh/h	519	3413	1520	1073	3344	282	1158	1557	253	1247	1885	1598
Grp Volume(v), veh/h	29	250	64	30	515	528	143	0	150	98	169	45
Grp Sat Flow(s),veh/h/ln	519	1706	1520	1073	1791	1834	1158	0	1810	1247	1885	1598
Q Serve(g_s), s	3.2	3.0	1.7	1.2	15.5	15.5	11.8	0.0	6.9	7.1	7.5	2.2
Cycle Q Clear(g_c), s	18.7	3.0	1.7	4.2	15.5	15.5	19.3	0.0	6.9	14.0	7.5	2.2
Prop In Lane	1.00		1.00	1.00		0.15	1.00		0.14	1.00		1.00
Lane Grp Cap(c), veh/h	312	2105	938	701	1105	1132	262	0	433	284	451	382
V/C Ratio(X)	0.09	0.12	0.07	0.04	0.47	0.47	0.55	0.00	0.35	0.34	0.37	0.12
Avail Cap(c_a), veh/h	312	2105	938	701	1105	1132	487	0	784	526	816	692
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	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	15.3	7.9	7.7	8.8	10.3	10.3	39.9	0.0	31.6	37.4	31.8	29.8
Incr Delay (d2), s/veh	0.6	0.1	0.1	0.1	1.4	1.4	3.7	0.0	1.0	1.5	1.1	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	0.4	1.0	0.5	0.3	5.6	5.7	3.5	0.0	3.1	2.2	3.5	0.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	15.9	8.0	7.8	8.9	11.7	11.7	43.6	0.0	32.6	38.9	32.9	30.1
LnGrp LOS	B	A	A	A	B	B	D	A	C	D	C	C
Approach Vol, veh/h		343			1073			293			312	
Approach Delay, s/veh		8.7			11.6			38.0			34.4	
Approach LOS		A			B			D			C	
Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		69.4		30.6		69.4		30.6				
Change Period (Y+Rc), s		7.7		* 6.7		7.7		* 6.7				
Max Green Setting (Gmax), s		42.3		* 43		42.3		* 43				
Max Q Clear Time (g_c+I1), s		0.0		16.0		0.0		21.3				
Green Ext Time (p_c), s		0.0		2.9		0.0		2.6				

Intersection Summary

HCM 6th Ctrl Delay	18.4
HCM 6th LOS	B

Notes

\* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

HCM 6th TWSC  
2: Hamilton Road & Grand River Ave

Future Conditions  
AM Peak Hour

Intersection						
Int Delay, s/veh	3.6					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↘	↑↑	↘	
Traffic Vol, veh/h	315	0	340	912	11	125
Future Vol, veh/h	315	0	340	912	11	125
Conflicting Peds, #/hr	0	5	5	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	50	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	87	87	60	60
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	350	0	391	1048	18	208

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	0	355	0	1661 180
Stage 1	-	-	-	-	355 -
Stage 2	-	-	-	-	1306 -
Critical Hdwy	-	-	4.14	-	6.84 6.94
Critical Hdwy Stg 1	-	-	-	-	5.84 -
Critical Hdwy Stg 2	-	-	-	-	5.84 -
Follow-up Hdwy	-	-	2.22	-	3.52 3.32
Pot Cap-1 Maneuver	-	-	1200	-	88 832
Stage 1	-	-	-	-	681 -
Stage 2	-	-	-	-	218 -
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1194	-	59 828
Mov Cap-2 Maneuver	-	-	-	-	124 -
Stage 1	-	-	-	-	678 -
Stage 2	-	-	-	-	147 -

Approach	EB	WB	NB
HCM Control Delay, s	0	2.6	15.5
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	567	-	-	1194	-
HCM Lane V/C Ratio	0.4	-	-	0.327	-
HCM Control Delay (s)	15.5	-	-	9.5	-
HCM Lane LOS	C	-	-	A	-
HCM 95th %tile Q(veh)	1.9	-	-	1.4	-

HCM 6th TWSC  
3: Grand River Ave & Site Drive

Future Conditions  
AM Peak Hour

Intersection						
Int Delay, s/veh	0.4					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	14	426	1241	18	14	11
Future Vol, veh/h	14	426	1241	18	14	11
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	50	-	-	-	50	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	15	463	1349	20	15	12

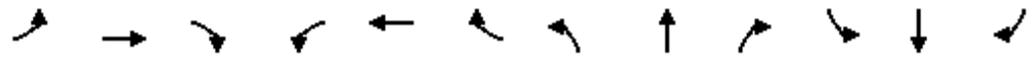
Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	1369	0	-	0	1621 685
Stage 1	-	-	-	-	1359 -
Stage 2	-	-	-	-	262 -
Critical Hdwy	4.14	-	-	-	6.84 6.94
Critical Hdwy Stg 1	-	-	-	-	5.84 -
Critical Hdwy Stg 2	-	-	-	-	5.84 -
Follow-up Hdwy	2.22	-	-	-	3.52 3.32
Pot Cap-1 Maneuver	497	-	-	-	94 391
Stage 1	-	-	-	-	204 -
Stage 2	-	-	-	-	758 -
Platoon blocked, %		-	-	-	
Mov Cap-1 Maneuver	497	-	-	-	91 391
Mov Cap-2 Maneuver	-	-	-	-	167 -
Stage 1	-	-	-	-	198 -
Stage 2	-	-	-	-	758 -

Approach	EB	WB	SB
HCM Control Delay, s	0.4	0	22.5
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	497	-	-	-	167	391
HCM Lane V/C Ratio	0.031	-	-	-	0.091	0.031
HCM Control Delay (s)	12.5	-	-	-	28.7	14.5
HCM Lane LOS	B	-	-	-	D	B
HCM 95th %tile Q(veh)	0.1	-	-	-	0.3	0.1

HCM 6th Signalized Intersection Summary  
 1: Dobie Road/Central Park Drive & Grand River Ave

Future Conditions  
 PM Peak Hour



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	81	720	117	18	443	210	109	307	21	199	267	60
Future Volume (veh/h)	81	720	117	18	443	210	109	307	21	199	267	60
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1984	1984	1984	1984	1984	1984	1984	1984	1984	2000	2000	2000
Adj Flow Rate, veh/h	86	766	124	19	471	223	117	330	23	216	290	65
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.93	0.93	0.93	0.92	0.92	0.92
Percent Heavy Veh, %	1	1	1	1	1	1	1	1	1	0	0	0
Cap, veh/h	382	1972	877	325	1301	612	299	611	43	267	666	564
Arrive On Green	0.52	0.52	0.52	0.52	0.52	0.52	0.33	0.33	0.33	0.33	0.33	0.33
Sat Flow, veh/h	756	3770	1677	629	2487	1170	1034	1833	128	1044	2000	1693
Grp Volume(v), veh/h	86	766	124	19	356	338	117	0	353	216	290	65
Grp Sat Flow(s),veh/h/ln	756	1885	1677	629	1885	1771	1034	0	1961	1044	2000	1693
Q Serve(g_s), s	7.6	12.2	3.8	1.9	11.1	11.2	10.0	0.0	14.6	18.7	11.3	2.7
Cycle Q Clear(g_c), s	18.8	12.2	3.8	14.0	11.1	11.2	21.3	0.0	14.6	33.3	11.3	2.7
Prop In Lane	1.00		1.00	1.00		0.66	1.00		0.07	1.00		1.00
Lane Grp Cap(c), veh/h	382	1972	877	325	986	926	299	0	653	267	666	564
V/C Ratio(X)	0.22	0.39	0.14	0.06	0.36	0.36	0.39	0.00	0.54	0.81	0.44	0.12
Avail Cap(c_a), veh/h	382	1972	877	325	986	926	299	0	653	267	666	564
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	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	19.6	14.3	12.3	18.5	14.0	14.1	34.3	0.0	27.1	41.6	26.0	23.1
Incr Delay (d2), s/veh	1.4	0.6	0.3	0.3	1.0	1.1	1.8	0.0	1.6	18.7	1.0	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	1.4	4.8	1.4	0.3	4.5	4.3	2.6	0.0	6.9	6.7	5.4	1.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	21.0	14.9	12.6	18.8	15.1	15.2	36.1	0.0	28.8	60.3	27.0	23.3
LnGrp LOS	C	B	B	B	B	B	D	A	C	E	C	C
Approach Vol, veh/h		976			713			470			571	
Approach Delay, s/veh		15.1			15.2			30.6			39.2	
Approach LOS		B			B			C			D	
Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		60.0		40.0		60.0		40.0				
Change Period (Y+Rc), s		7.7		* 6.7		7.7		* 6.7				
Max Green Setting (Gmax), s		52.3		* 33		52.3		* 33				
Max Q Clear Time (g_c+I1), s		0.0		35.3		0.0		23.3				
Green Ext Time (p_c), s		0.0		0.0		0.0		3.2				

Intersection Summary

HCM 6th Ctrl Delay	22.8
HCM 6th LOS	C

Notes

\* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

HCM 6th TWSC  
2: Hamilton Road & Grand River Ave

Future Conditions  
PM Peak Hour

Intersection						
Int Delay, s/veh	5.7					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↖	↑↑	↘	
Traffic Vol, veh/h	908	32	118	668	3	314
Future Vol, veh/h	908	32	118	668	3	314
Conflicting Peds, #/hr	0	4	4	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	500	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	94	94	93	93	85	85
Heavy Vehicles, %	1	1	2	2	2	2
Mvmt Flow	966	34	127	718	4	369

Major/Minor	Major1	Major2	Minor1	Minor2	Minor3
Conflicting Flow All	0	0	1004	0	1600
Stage 1	-	-	-	-	987
Stage 2	-	-	-	-	613
Critical Hdwy	-	-	4.14	-	6.84
Critical Hdwy Stg 1	-	-	-	-	5.84
Critical Hdwy Stg 2	-	-	-	-	5.84
Follow-up Hdwy	-	-	2.22	-	3.52
Pot Cap-1 Maneuver	-	-	686	-	97
Stage 1	-	-	-	-	322
Stage 2	-	-	-	-	503
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	683	-	79
Mov Cap-2 Maneuver	-	-	-	-	175
Stage 1	-	-	-	-	261
Stage 2	-	-	-	-	503

Approach	EB	WB	NB
HCM Control Delay, s	0	1.7	30.1
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	502	-	-	683	-
HCM Lane V/C Ratio	0.743	-	-	0.186	-
HCM Control Delay (s)	30.1	-	-	11.5	-
HCM Lane LOS	D	-	-	B	-
HCM 95th %tile Q(veh)	6.2	-	-	0.7	-

HCM 6th TWSC  
3: Grand River Ave & Site Drive

Future Conditions  
PM Peak Hour

Intersection						
Int Delay, s/veh	0.7					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↖	↗	↖		↖	↖
Traffic Vol, veh/h	44	1178	742	16	15	44
Future Vol, veh/h	44	1178	742	16	15	44
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	50	-	-	-	50	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	94	94	93	93	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	47	1253	798	17	16	48

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	815	0	-	0	1528
Stage 1	-	-	-	-	807
Stage 2	-	-	-	-	721
Critical Hdwy	4.14	-	-	-	6.84
Critical Hdwy Stg 1	-	-	-	-	5.84
Critical Hdwy Stg 2	-	-	-	-	5.84
Follow-up Hdwy	2.22	-	-	-	3.52
Pot Cap-1 Maneuver	808	-	-	-	108
Stage 1	-	-	-	-	399
Stage 2	-	-	-	-	443
Platoon blocked, %		-	-	-	
Mov Cap-1 Maneuver	808	-	-	-	102
Mov Cap-2 Maneuver	-	-	-	-	223
Stage 1	-	-	-	-	376
Stage 2	-	-	-	-	443

Approach	EB	WB	SB
HCM Control Delay, s	0.4	0	14.3
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	808	-	-	-	223	593
HCM Lane V/C Ratio	0.058	-	-	-	0.073	0.081
HCM Control Delay (s)	9.7	-	-	-	22.4	11.6
HCM Lane LOS	A	-	-	-	C	B
HCM 95th %tile Q(veh)	0.2	-	-	-	0.2	0.3

**Intersection: 1: Dobie Road/Central Park Drive & Grand River Ave**

Movement	EB	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	T	T	R	L	T	TR	L	TR	L	T	R
Maximum Queue (ft)	67	101	54	33	47	231	228	162	159	131	133	54
Average Queue (ft)	16	36	15	8	12	111	126	82	67	52	67	17
95th Queue (ft)	50	74	44	24	36	194	210	139	129	101	120	44
Link Distance (ft)		2046	2046			398	398	522	522		1029	1029
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	500			250	500					400		
Storage Blk Time (%)												
Queuing Penalty (veh)												

**Intersection: 2: Hamilton Road & Grand River Ave**

Movement	WB	WB	NB	B7
Directions Served	L	T	LR	T
Maximum Queue (ft)	72	48	82	51
Average Queue (ft)	41	2	42	3
95th Queue (ft)	71	24	71	28
Link Distance (ft)		182	15	400
Upstream Blk Time (%)	14			
Queuing Penalty (veh)	0			
Storage Bay Dist (ft)	50			
Storage Blk Time (%)	3	0		
Queuing Penalty (veh)	12	0		

**Intersection: 3: Grand River Ave & Site Drive**

Movement	EB	SB	SB
Directions Served	L	L	R
Maximum Queue (ft)	41	44	35
Average Queue (ft)	9	15	10
95th Queue (ft)	32	42	33
Link Distance (ft)			271
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	50	50	
Storage Blk Time (%)	1	3	0
Queuing Penalty (veh)	2	0	0

**Network Summary**

Network wide Queuing Penalty: 14

**Intersection: 1: Dobie Road/Central Park Drive & Grand River Ave**

Movement	EB	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	T	T	R	L	T	TR	L	TR	L	T	R
Maximum Queue (ft)	110	183	164	67	44	144	191	163	287	425	969	845
Average Queue (ft)	39	102	92	17	13	82	98	62	153	380	695	360
95th Queue (ft)	84	159	156	47	37	133	164	124	258	528	1276	1138
Link Distance (ft)		2046	2046			398	398	522	522		1029	1029
Upstream Blk Time (%)											27	11
Queuing Penalty (veh)											0	0
Storage Bay Dist (ft)	500			250	500					400		
Storage Blk Time (%)										60	16	
Queuing Penalty (veh)										161	31	

**Intersection: 2: Hamilton Road & Grand River Ave**

Movement	EB	EB	WB	NB	B7
Directions Served	T	TR	L	LR	T
Maximum Queue (ft)	10	22	100	99	117
Average Queue (ft)	0	1	42	70	18
95th Queue (ft)	7	7	81	100	69
Link Distance (ft)	398	398		15	400
Upstream Blk Time (%)				41	
Queuing Penalty (veh)				0	
Storage Bay Dist (ft)			500		
Storage Blk Time (%)					
Queuing Penalty (veh)					

**Intersection: 3: Grand River Ave & Site Drive**

Movement	EB	EB	WB	SB	SB
Directions Served	L	T	TR	L	R
Maximum Queue (ft)	50	17	4	45	62
Average Queue (ft)	19	1	0	13	25
95th Queue (ft)	47	10	3	38	53
Link Distance (ft)		174	1722		270
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	50			50	
Storage Blk Time (%)	1			1	1
Queuing Penalty (veh)	3			0	0

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**Intersection: 7: Bend**

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Movement	SB
Directions Served	T
Maximum Queue (ft)	33
Average Queue (ft)	1
95th Queue (ft)	14
Link Distance (ft)	15
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

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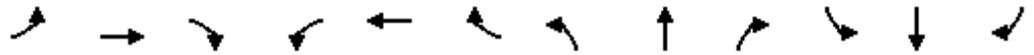
**Network Summary**

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Network wide Queuing Penalty: 196

HCM 6th Signalized Intersection Summary  
 1: Dobie Road/Central Park Drive & Grand River Ave

Future Conditions With Improvements  
 PM Peak Hour



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	81	720	117	18	443	210	109	307	21	199	267	60
Future Volume (veh/h)	81	720	117	18	443	210	109	307	21	199	267	60
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1984	1984	1984	1984	1984	1984	1984	1984	1984	2000	2000	2000
Adj Flow Rate, veh/h	86	766	124	19	471	223	117	330	23	216	290	65
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.93	0.93	0.93	0.92	0.92	0.92
Percent Heavy Veh, %	1	1	1	1	1	1	1	1	1	0	0	0
Cap, veh/h	329	1757	781	280	1159	545	368	715	50	339	780	661
Arrive On Green	0.47	0.47	0.47	0.47	0.47	0.47	0.39	0.39	0.39	0.39	0.39	0.39
Sat Flow, veh/h	756	3770	1676	629	2487	1170	1034	1833	128	1044	2000	1694
Grp Volume(v), veh/h	86	766	124	19	356	338	117	0	353	216	290	65
Grp Sat Flow(s),veh/h/ln	756	1885	1676	629	1885	1771	1034	0	1961	1044	2000	1694
Q Serve(g_s), s	8.5	13.6	4.3	2.1	12.4	12.6	9.1	0.0	13.4	19.4	10.3	2.4
Cycle Q Clear(g_c), s	21.1	13.6	4.3	15.7	12.4	12.6	19.4	0.0	13.4	32.8	10.3	2.4
Prop In Lane	1.00		1.00	1.00		0.66	1.00		0.07	1.00		1.00
Lane Grp Cap(c), veh/h	329	1757	781	280	878	825	368	0	765	339	780	661
V/C Ratio(X)	0.26	0.44	0.16	0.07	0.41	0.41	0.32	0.00	0.46	0.64	0.37	0.10
Avail Cap(c_a), veh/h	329	1757	781	280	878	825	454	0	928	426	946	801
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	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	24.6	17.9	15.4	23.2	17.6	17.6	28.7	0.0	22.7	34.9	21.8	19.3
Incr Delay (d2), s/veh	1.9	0.8	0.4	0.5	1.4	1.5	1.0	0.0	0.9	4.2	0.6	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.6	5.6	1.6	0.3	5.3	5.1	2.3	0.0	6.1	5.2	4.8	1.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	26.5	18.7	15.8	23.6	19.0	19.1	29.7	0.0	23.6	39.1	22.4	19.5
LnGrp LOS	C	B	B	C	B	B	C	A	C	D	C	B
Approach Vol, veh/h		976			713			470			571	
Approach Delay, s/veh		19.0			19.2			25.1			28.4	
Approach LOS		B			B			C			C	
Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		54.3		45.7		54.3		45.7				
Change Period (Y+Rc), s		7.7		* 6.7		7.7		* 6.7				
Max Green Setting (Gmax), s		38.3		* 47		38.3		* 47				
Max Q Clear Time (g_c+I1), s		0.0		34.8		0.0		21.4				
Green Ext Time (p_c), s		0.0		4.2		0.0		5.3				

Intersection Summary

HCM 6th Ctrl Delay	22.1
HCM 6th LOS	C

Notes

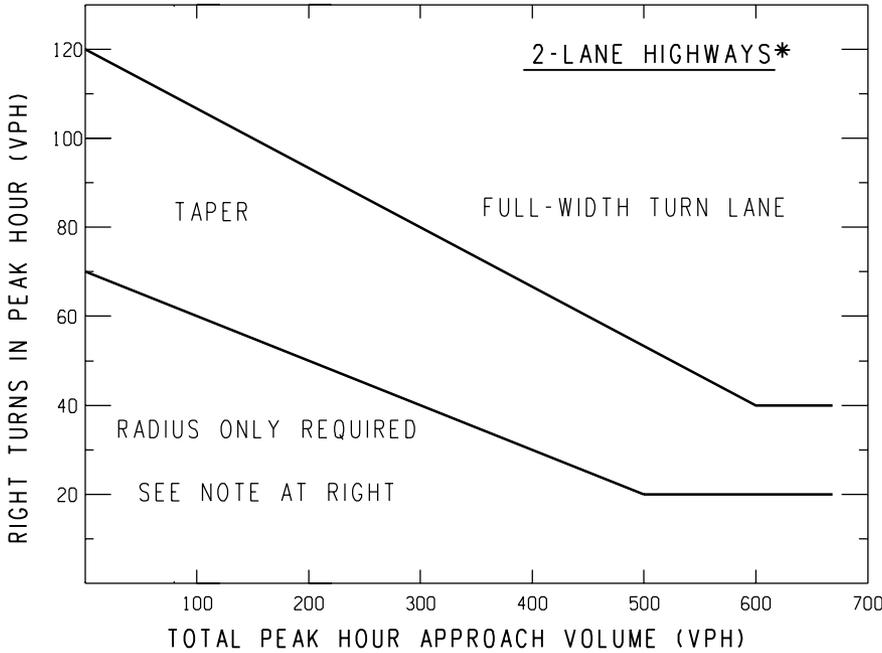
\* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Intersection: 1: Dobie Road/Central Park Drive & Grand River Ave

Movement	EB	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	T	T	R	L	T	TR	L	TR	L	T	R
Maximum Queue (ft)	131	209	202	59	65	195	229	150	250	242	238	50
Average Queue (ft)	48	126	117	20	14	98	119	60	119	125	105	17
95th Queue (ft)	100	192	188	45	43	163	191	122	206	207	189	41
Link Distance (ft)		2046	2046			398	398	522	522		1029	1029
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	500			250	500					400		
Storage Blk Time (%)												
Queuing Penalty (veh)												

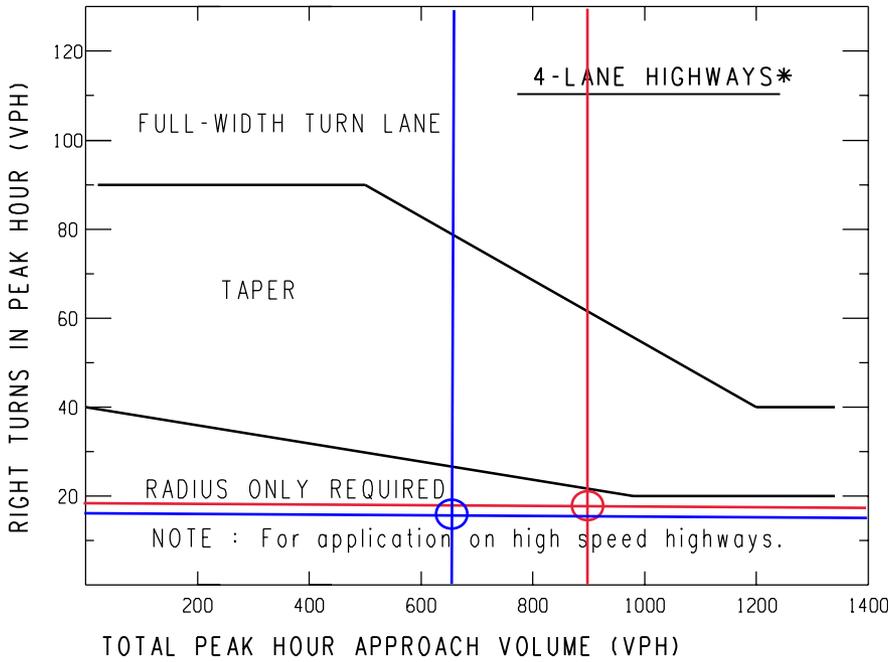
## **Appendix D**

# **WARRANT SUMMARIES**



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.

AM  
 18 Right-turns  
 906 Approach

PM  
 16 Right-turns  
 639 Approach

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.

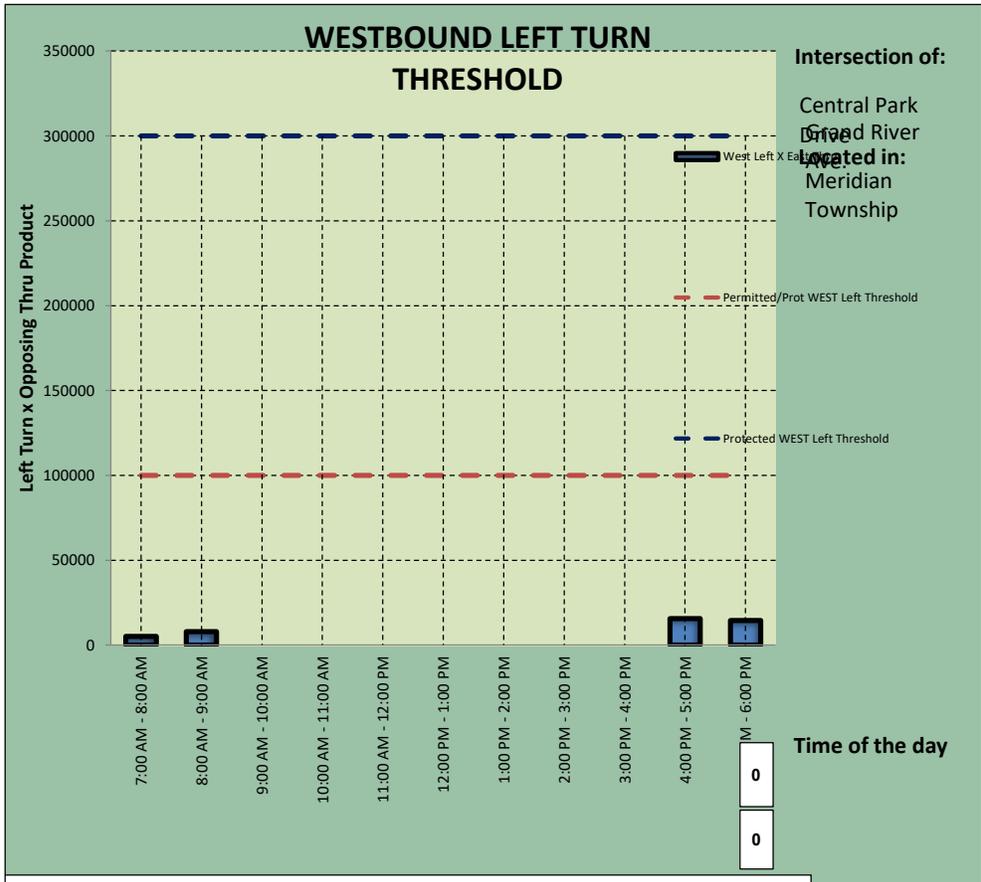
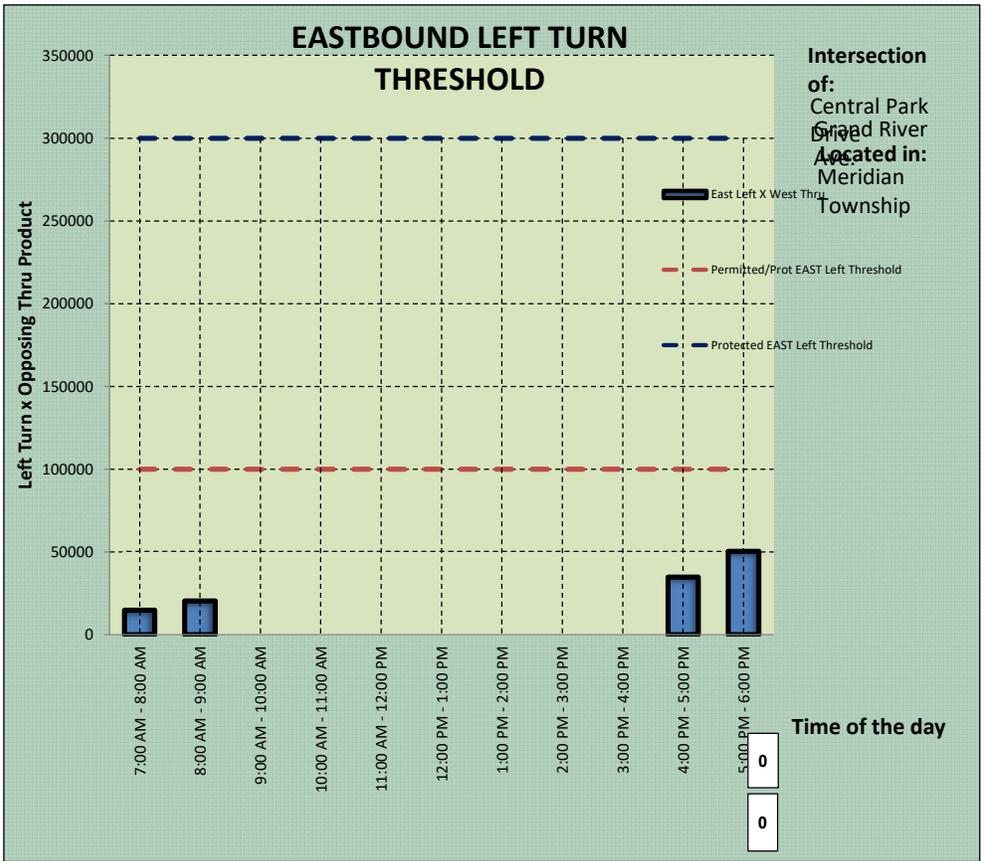
		<b>TRAFFIC VOLUME GUIDELINES          FOR RIGHT-TURN LANES AND TAPERS</b>	
<b>TRAFFIC AND SAFETY          NOTE</b>			
DRAWN BY: MTS	08/05/2004	<b>604A</b>	SHEET 2 OF 2
CHECKED BY: JAT	PLAN DATE:		
FILE: K:\DGN\ts notes\Note604A tsn.dgn		REV. 08/05/2004	

## EASTBOUND AND WESTBOUND LEFT TURN PHASE THRESHOLDS

Please enter Data in Yellow Boxes ONLY

CONDITIONS		Items to Consider for Protected Only	Items to Consider for Permissive/Protected
<b>EASTBOUND LEFT TURN GEOMETRY</b>			
No. of Opposing WESTbound Thru Lanes (include combination thru lanes)	2	NO	YES
No. of Opposing WESTbound Right Turn Only Lanes	0		N / A
What is the Opposing WESTbound speed limit or 85%ile? (mph)	45	NO	N / A
No. of EASTbound Left Turning Lanes	1	NO	N / A
What is the EASTbound sight distance in the field? (ft)	500	NO	YES
Minimum Required Sight Distance (ft)	397		
<b>WESTBOUND LEFT TURN GEOMETRY</b>			
No. of Opposing EASTbound Thru Lanes (include combination thru lanes)	2	NO	YES
No. of Opposing EASTbound Right Turn Only Lanes	0		N / A
What is the Opposing EASTbound speed limit or 85%ile? (mph)	45	NO	N / A
No. of WESTbound Left Turning Lanes	1	NO	N / A
What is the WESTbound sight distance in the field? (ft)	500	NO	YES
Minimum Required Sight Distance (ft)	397		
<b>TRAFFIC CHARACTERISTICS</b>			
EASTbound Left Turn Vol (vph)	81	NO	
WESTbound Left Turn Vol (vph)	30	NO	
Cross Product of LEFT TURN EAST (See Chart Below)	50544	NO	NO
Cross Product of LEFT TURN WEST (See Chart Below)	15750	NO	NO
<b>CRASH HISTORY</b>			
Is there an existing permissive/protected or permissive/protected LT phase?	NO		
Which Approach does the "One Left Turn Movement" crashes correspond to?	EASTBOUND		
<b>ONE LEFT TURN MOVEMENT</b>	Crash History for 12 Month Period		
	Enter Number of Correctable crashes? (Left-Turn Head-On)	0	NO
	Crash History for 24 Month Period		
	Enter Number of Correctable crashes? (Left-Turn Head-On)	0	NO
<b>TWO LEFT TURN MOVEMENTS</b>	Crash History for 12 Month Period		
	Enter Number of Correctable crashes? (Left-Turn Head-On)	0	NO
	Crash History for 24 Month Period		
	Enter Number of Correctable crashes? (Left-Turn Head-On)	0	NO
EASTbound Left Turn DELAY per vehicle? Sec. / Veh.	20.4	NO	
EASTbound TOTAL Left Turn DELAY? Veh-Hr	0.46	NO	
WESTbound Left Turn DELAY per vehicle? Sec. / Veh.	55.9	NO	
WESTbound TOTAL Left Turn DELAY? Veh-Hr	0.47	NO	

*Left-turn phasing should only be approved and installed after a comprehensive engineering study indicates such an operation is necessary for the safe and efficient operation of an intersection. The type of left-turn phasing will be determined based on data from the engineering study which includes the amount of delay experienced by left-turning traffic, crash patterns that may be occurring and available capacity of the intersection.*



# NORTHBOUND AND SOUTHBOUND LEFT TURN PHASE THRESHOLDS

Please enter Data in Yellow Boxes ONLY

CONDITIONS		Items to Consider for Protected Only	Items to Consider for Permissive/Protected
<b>NORTHBOUND LEFT TURN GEOMETRY</b>			
No. of Opposing SOUTHbound Thru Lanes (include combination thru lanes)	1	NO	YES
No. of Opposing SOUTHbound Right Turn Only Lanes	1		N / A
What is the Opposing SOUTHbound speed limit or 85%ile? (mph)	35	NO	N / A
No. of NORTHbound Left Turning Lanes	1	NO	N / A
What is the NORTHbound sight distance in the field? (ft)	500	NO	YES
Minimum Required Sight Distance (ft)	309		
<b>SOUTHBOUND LEFT TURN GEOMETRY</b>			
No. of Opposing NORTHbound Thru Lanes (include combination thru lanes)	1	NO	YES
No. of Opposing NORTHbound Right Turn Only Lanes	0		N / A
What is the Opposing NORTHbound speed limit or 85%ile? (mph)	35	NO	N / A
No. of SOUTHbound Left Turning Lanes	1	NO	N / A
What is the SOUTHbound sight distance in the field? (ft)	500	NO	YES
Minimum Required Sight Distance (ft)	283		
<b>TRAFFIC CHARACTERISTICS</b>			
NORTHbound Left Turn Vol (vph)	135		YES
SOUTHbound Left Turn Vol (vph)	189		YES
Cross Product of LEFT TURN NORTH (See Chart Below)	33463	NO	NO
Cross Product of LEFT TURN SOUTH (See Chart Below)	61992	NO	YES
<b>CRASH HISTORY</b>			
Is there an existing permissive/protected or permissive/protected LT phase?		YES	
Which Approach does the "One Left Turn Movement" crashes correspond to?		SOUTHBOUND	
ONE LEFT TURN MOVEMENT	Crash History for 12 Month Period		
	Enter Number of Correctable crashes? (Left-Turn Head-On)	0	NO
	Crash History for 24 Month Period		
	Enter Number of Correctable crashes? (Left-Turn Head-On)	0	NO
TWO LEFT TURN MOVEMENTS	Crash History for 12 Month Period		
	Enter Number of Correctable crashes? (Left-Turn Head-On)	0	NO
	Crash History for 24 Month Period		
	Enter Number of Correctable crashes? (Left-Turn Head-On)	0	NO
NORTHbound Left Turn DELAY per vehicle? Sec. / Veh.	36.1	NO	
NORTHbound TOTAL Left Turn DELAY? Veh-Hr	1.35	NO	
SOUTHbound Left Turn DELAY per vehicle? Sec. / Veh.	55.9	YES	
SOUTHbound TOTAL Left Turn DELAY? Veh-Hr	2.93	YES	

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