GRAND HAVEN CHARTER TOWNSHIP

Community Development Memo

DATE: March 1, 2018

TO: Township Board

FROM: Stacey Fedewa, Community Development Director

RE: Commercial PUD – Robbins Centre Pointe

BACKGROUND

In October 2015, Robbins Road Real Estate LLC purchased the 7-acres of land in the Township at 17200 Robbins Road (*i.e., the "VandenBerg property"*) along with the small barbershop parcel, which is attached to one of the buildings at 17200. In early-January 2018, the developers signed a purchase agreement to buy the Pizza Hut property. Altogether, this has resulted in approximately 8-acres of land dedicated to the proposed development.

The following meetings have occurred thus far:

- February 5th Presentation & Discussion with Township Planning Commission
- February 13th Joint Planning Commission Meeting with City and Township
- February 19th Public Hearing with Township Planning Commission

The February 13th meeting with the City Planning Commission was pursuant to the Joint Robbins Road Corridor Plan, which provided both communities with the ability to discuss the project with the developers. On February 19th, the Planning Commission adopted a motion that **recommends conditional approval** for the project.

LOCATION MAP

The timeline for this development is important because part of the purchase agreement is to relocate Pizza Hut into the new multi-tenant retail building by December 31st. Failure to do so will result in stiff financial penalties of $100,000 from the franchise. In order to meet that goal, the development team needs to break ground April 1st.

PROPOSED PROJECT DESCRIPTION

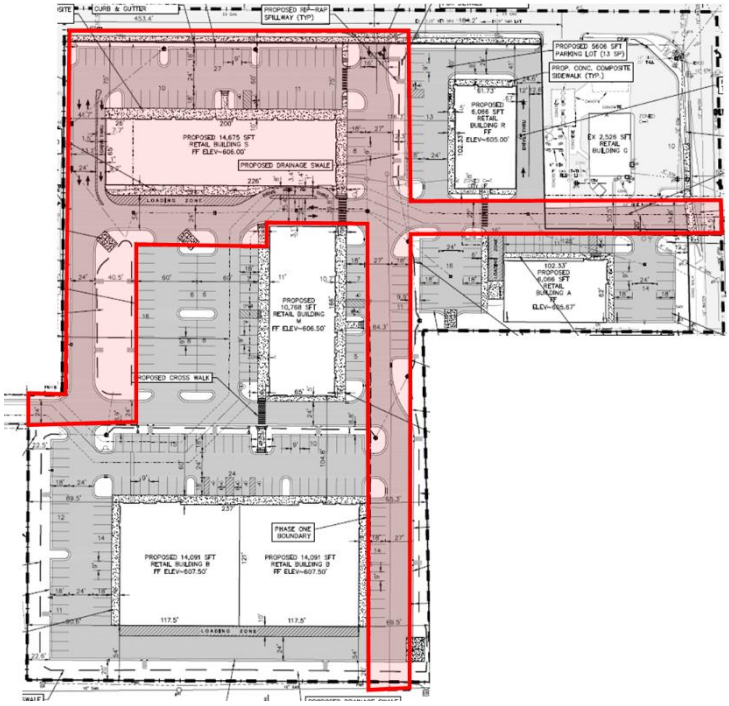
Phase 1

Phase 1 for this development was the gas station at the corner of Robbins Road and 172nd Avenue. This was approved as a Special Land Use in April 2017. Although it was approved under a separate application the developer is requesting it be included in the PUD for rezoning purposes and continuity (*the special land use provisions are incorporated by reference and are not superseded by the PUD application*).

Phase 2

Phase 2 will consist of:

- The major portions of the underground work with utilities.
- Building the large swale for stormwater management via infiltration.
- Reconstructing the two main entrances.
- Closing the continuous curb-cut on Robbins Road.
- Constructing a nearly 15,000 sqft multi-tenant retail building, which would include Pizza Hut as an end-anchor.



Future Phases

Development of future phases will depend on market demand to determine the order and sequencing of the remaining buildings. All of which would be retail, commercial, or office uses, and are likely to be the following, but may be subject to change depending on prospective tenants (*i.e., automotive retailer could become a small office building*):

- Big Box Retailer 20,000 – 30,000 sf Building B
- Automotive – Related Retailer 7,000 sf Building A
- Multi-Tenant Retail Building 11,000 sf Building M
- Restaurant – Full Service 7,000 sf Building R

INVESTMENT IN COMMUNITY

The developer estimates the **total investment and value of this project will <u>exceed $10 million</u>**, and **add more than 100 jobs** when the project is built-out.

In addition, the construction itself will bring seasonal jobs to the area and estimate that up to 50 people will be employed to construct each phase. Considering there will likely be 5-phases to construct the full site that could **provide up to 250 seasonal jobs**.

PROPOSED PROCESS FOR FUTURE PHASES

Staff is proposing a unique way to address future phases for this development. Within the Motion and Report of Findings, the Township would indicate the overall project, design, and concept are approved; and future phases are only subject to Site Plan Review with the Planning Commission. This would be applicable, so long as they occur within 1-year of each other.

For example, to be eligible for the Site Plan Review route, the next phase would need to be presented prior to April 1, 2019. If the following phase was presented on 9/1/2019, the phase after that would have to be presented prior to 9/1/2020.

Following this procedure will provide a **51%-time savings** for the developer.

Option's A vs. Option's B

Another new concept being proposed by staff are site plan Option's A-1 & A-2, and Option's B-1 & B-2. The reason for this is predominately due to the uncertainty of which big box retailer will locate on the site, and if/when the access point to Whittaker Way can be revised.

There are two layouts for the building, and two layouts for the access connection. They are being proposed in each configuration (*please note these sketches are using the 1/18/18 plan, and not 2/16/18 the main difference being the deceleration lane for the Robbins Road entrance*):

- The desired version is Option A-1, which would include an amendment to the Health Pointe PUD to shift the point of access. The developer has met with Health Pointe and Meijer

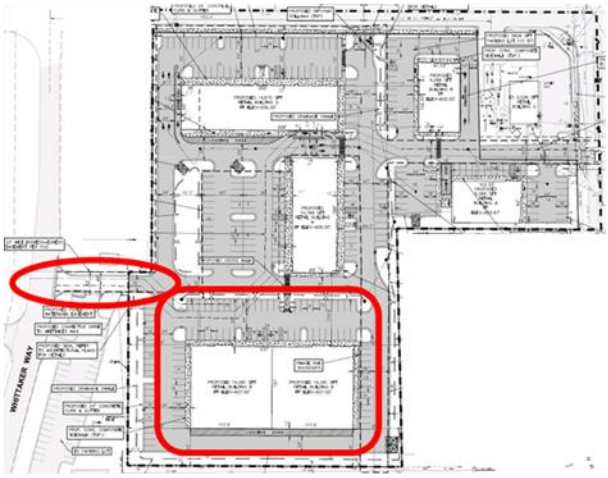
regarding this potential shift and learned that both are willing to discuss the possibility at a later date.

- Option A-2 would keep the desired building layout, but keep the available access to Whittaker Way without having to pursue the amendment.
- Option B-1 is the alternative layout for the big box retailer, and maintaining the available access to Whittaker Way.
- Option B-2 is the alternative building layout that includes the amended access to Whittaker Way.

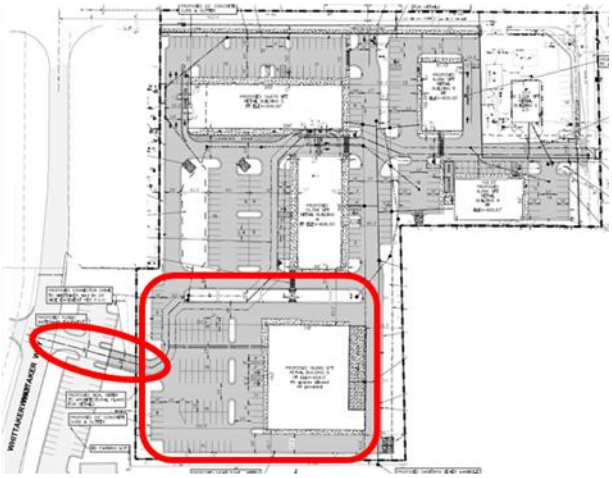
Staff has reviewed all options and confirmed they comply with the zoning ordinance (*with the exceptions of the departures requested by the developer*).

Similar to the proposal for future phases, staff is recommending the Motion and Report of Findings would include an avenue for **staff to administratively approve a conversion to Option's A-2, B-1, or B-2** if that becomes necessary; and follow that up with an email to the Board and Planning Commission providing notification of the conversion.

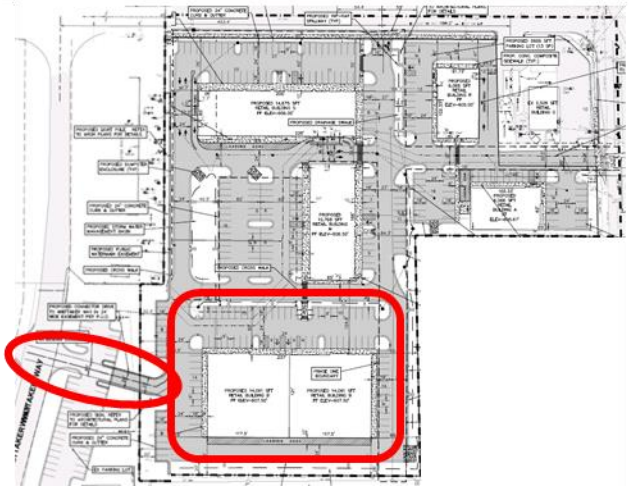
Option A-1



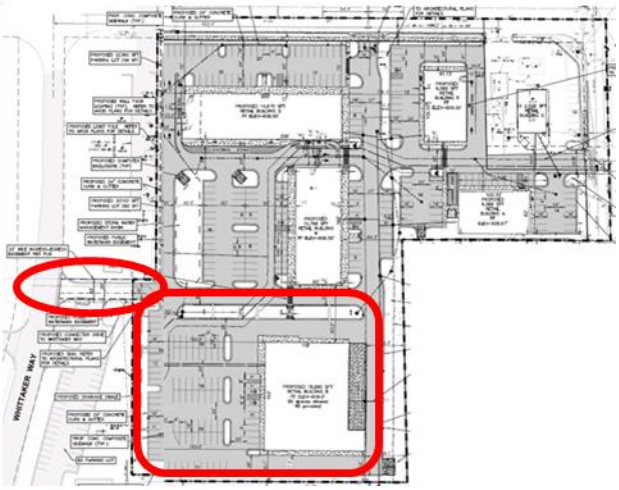
Option B-1



Option A-2



Option B-2



TRAFFIC STUDY

The traffic study includes the following findings:

- Existing study area intersections currently operate at acceptable levels of service (LOS).
  - However, the southbound through movement at **US-31 & Robbins Road is over capacity**.
  - The "no build" scenario (*i.e., proposed project not built, and average growth and traffic continues to increase*), the LOS at this intersection would operate at E or F, which is not acceptable. To improve that LOS the following is recommended:
    - Increase cycle length, and adjust timing on traffic signals.

- If the project is built to its full capacity the following improvements are warranted:
  - Robbins Road & Main Site Driveway:
    - Construct eastbound right-turn lane along Robbins Road (*i.e., deceleration lane for a right-turn into the site*)
    - Construct separate left- and right-turn exit lanes
  - US-31 & Robbins Road (*MDOT has indicated they are unwilling to consider any improvements to this intersection until the site is built-out and actual traffic counts justify the improvements*).
    - Restriping of westbound approach to a shared through/right-turn lane, and a right-turn only lane.
      - MDOT and the City have indicated they will not allow a shared lane configuration, which would result in 3 lanes—one through lane, and two right-turn lanes. This has many implications related to lack of right-of-way and relocation of utilities.
    - Increase cycle length, and adjust timing on traffic signals.

Traffic Study Recommendation:
- Right-only
- Thru + Right
- Thru-only

City & MDOT Standard:
- 2 Right-only
- Thru-only

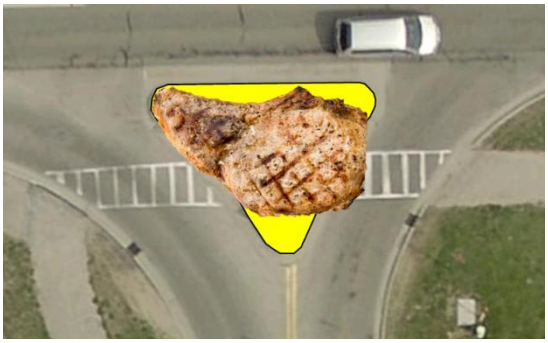
MAIN SITE DRIVEWAY ON ROBBINS ROAD & ALIGNMENT WITH WALGREENS

One of the primary topics of conversation about this development has been the alignment of the main entrance with the Walgreens driveway. There is concern about left-turn lock-ups occurring if

vehicle 1 is attempting to exit-left from the project site, while vehicle 2 is attempting to exit-left from Walgreens. The limited spacing between the driveways could result in vehicle conflicts.

Out of the many improvements that were discussed, there are two prevailing options. The Board will need to make a determination on which option is desired:

1. Require the developer to add a "pork chop" to the main entrance to prohibit vehicles from turning left into the site (*similar to the Meijer entrance at Whittaker Way*).
    - This was recommended by the Planning Commission, and the City's engineering firm.



2. Allow the developer to construct a normal entrance, but give the Township a "second bite at the apple" each time another building is constructed. Specifically, the language would read:
    - If the Township determines, through traffic crash data or other means, there are incidences involving left-turn conflicts between the PUD and the Walgreens driveway, a "pork chop" curb shall be installed to prevent inbound left-turns. This shall be installed within 6-months after written notification from the Township. The Township shall have the opportunity to require this improvement within 2 calendar years after each final certificate of occupancy is granted for the PUD.

DEPARTURE REQUESTS

The following departures are being requested by the developer:

Section	Requirement	Comments
15A.06.1 15A.06.2 **PC Recommends Approval, but believes "pork chop" should be installed now, not later.**	Only 1 driveway is permitted, but a second can be allowed if conditions A & B are met. • A – 660' of frontage; • B – additional driveways will not prevent compliance for other sites.	4 driveways requested: 1 on Whittaker Way, 2 on Robbins Rd, and 1 on 172nd Ave. Condition A – just shy of 660'; B – is met, other adjacent properties are in City. • Robbins Rd Sub-Area Plan calls for the closure of numerous curb-cuts. Current site has a continuous driveway the length of Robbins Rd. • 17.05.4.A allows the PC to approve additional driveways if it allows other uses within the PUD, or adjoining principal uses or existing lot.
15A.06.7 **PC Recommends Approval**	Access point spacing standards based on a signalized non-trunkline street measured pavement edge to pavement edge. Requirement is 200'.	• Requesting to allow the gas station to maintain its existing driveway on Robbins Rd. • Requesting to allow the existing driveway to remain in current location on 172nd Ave. This will act as a main

	• Easternmost driveway on Robbins Rd = 100’ • Main entrance on 172nd = 160’	entrance, and shifting further south will cause misalignment with adjacent driveways and potentially make Building A impossible to construct.
15A.10.5 **PC Recommends Approval**	Minimum width for an interior landscape island = 18’	Requesting to allow a smaller landscape island in an effort to maximize the parking on site while still providing for visual and paving breaks.
15A.10.3 **PC Recommends Approval**	Onsite landscaping must abut the walls to reduce the visual impact of the building mass.	Developer’s narrative says it best, “requesting departure from landscaping abutting walls of retail buildings in order to meet the functional needs of a retail use and allow for future flexibility in placement of door openings within a storefront, reduces the likelihood of trip hazards along the main walking path, allows pedestrians to circulate farther away from vehicular traffic and make snow removal easier. Landscaping around the perimeter of the building has been pulled back and consolidated in designated planting beds dispersed along the edge of the parking area at the front (north) elevation of Retail S but is still in close proximity and related to the architecture. The planting areas will feature ornamental trees and shrubs to soften the visual appearance of the building from Robbins Rd. The back (south) side of Retail S has landscaped pockets identified immediately adjacent to the building wall, coordinated with rear service doors as required. Plantings around future retail buildings on site will follow suit with a similar concept and meet the plant size and type requirements of the ordinance.”
24.04.2 **PC Recommends Approval**	Maneuvering lanes shall be 24’ in width.	Requesting an allowance of 27’ for the main entrance off Robbins Rd to provide additional space for an anticipated high traffic corridor, allowing more space for passing vehicles and/or delivery trucks.
20.13.5.H **PC Recommends Approval**	Minimum caliper size for an ornamental tree = 3”	• Developer is proposing to use native Michigan species. Per the landscape architect certain species are best to be planted as “clumps.” The final result would be several trees grown together in a “clump” that would total 3+-inch caliper. • Similarly, several native species can only be found in a 2½” size.

		○ Staff is still waiting on a narrative from the landscape architect to provide justification for this departure request.

425 AGREEMENT

The developer has proposed a 425 Agreement over this property. The basic summary of what the Agreement would entail are:

- The Township would be "annexing" land from the City.
    - Nearly all the 8-acres (*excluding the gas station*), would be combined into one new parcel number to prevent the need of providing fire rated walls and suppression systems within any building that abutted, or crossed-over a boundary line.
- The City millage rate would be assessed on all 8-acres of land, except the gas station because the existing lease was based upon the Township millage and not the City's.
- The Township would receive our millage rate out of the City's rate, and the City would receive the balance.
    - For example, if the City's rate is 12-mills, and the Township rate is 5-mills, the Township would receive the standard 5-mills and the City would receive the balance of 7-mills.
- The Township would provide all services except police, and the City would continue to have jurisdictional control over Robbins Road.
- It is for a period of 50-years.
    - It is assumed the City would want to renew the agreement upon its expiration because they would be receiving much more revenue under the 425 Agreement than they are currently.

The current draft of the 425 Agreement has been included in your packets for review. There are still legal descriptions and sketches that have to be included. That said, it is anticipated the final draft will be substantially similar.

SAMPLE MOTIONS

If the Township Board finds the PUD meets the applicable standards, the following motion can be offered:

> **Motion** to postpone further action until March 26th on the proposed Robbins Centre Pointe PUD application and rezoning of 17200, 17222, and 1000 Robbins Road from Commercial to Planned Unit Development. **This is the first reading.**

If the Township Board finds the PUD does not meet the applicable standards, the following motion can be offered:

> **Motion** to direct staff to draft a formal motion and report, which will **deny** the Robbins Centre Pointe PUD application, with those discussion points which will be reflected in the meeting minutes. This will be reviewed and considered for adoption at the next meeting.

If the Township Board finds the applicant must make revisions to the PUD, the following motion can be offered:

> **Motion** to **table** the Robbins Centre Pointe PUD, and direct the applicant to make the following revisions:
>
> 1. *List revisions.*

Please contact me if this raises questions.

RECEIVED 11/9/17

Clear Form

Print

GRAND HAVEN CHARTER TOWNSHIP

PLANNED UNIT DEVELOPMENT (PUD) APPLICATION

Application Type	Fee	Escrow*
Overlay Zone	$310	$2,500
Non-Overlay Zone	$300	$1,500

Sewer Escrow**	
Main Extension	$5,000
Lift Station	$2,000

Applicant Information

Name: Robbins Center Pointe

Phone: (616) 732-5018 Fax: (616) 732-5098

Address: P.O. Box 1029 Saugatuck, MI 49453

Email Address: kpw@msblaw.com

Owner Information *(If different from applicant)*

Name:

Phone: Fax:

Address:

Property Information

Address/Location: Robbins Rd. & 172nd Ave.

Parcel Number: 70 - - - - * Size *(acres)*:

Current Zoning: ZONED C-1 Zoning Requested: PUD

Adjacent Zoning: *North:* COMMERCIAL *South:* PUD *East:* COMMERCIAL *West:* COMMERCIAL

Master-Planned Zoning: C-1 Consistent with Master Plan? YES

*70-03-33-100-010, 70-03-33-100-047 & 70-03-33-10-049

Other Information

Does Property Abut Township Border? YES

Present Use of the Subject Property? MIXED COMMERCIAL

Number & Type of Existing Structures? 9 COMMERCIAL

Subject Property Located on a Paved Road? YES

Municipal Water within 2,700 Feet of Subject Property? YES

Municipal Sewer within 2,700 Feet of Subject Property? YES

NOTE: The architect, engineer, planner, or designer shall be responsible for utilizing the Township Ordinance Books and following the procedures and requirements as specified in Chapters 17 and 23 (*and Chapter 15A if located in the Overlay Zone*), and any other applicable ordinances. Initially, submit five copies of the required information for staff review. Once staff has granted tentative approval, additional copies will be required as requested by staff.

I hereby attest the information on this application is, to the best of my knowledge, true and accurate.

Signature of applicant *Date* 11/8/17

Last Revised 2/8/2016

** To cover cost of legal and consulting fees, may be increased as necessary*

*** If approval of this application requires/includes the extension of a municipal sanitary sewer main, an additional $5,000.00 escrow fee shall be required, and an additional $2,000.00 escrow fee shall be required for the installation of a lift station.*

NOTICE

IF I PLAN TO SPLIT THE PARCEL(S) AFTER THE ZONING APPROVALS ARE GRANTED, I REALIZE THAT I MUST APPLY FOR A LAND DIVISION WITH THE ASSESSING DEPARTMENT. ALL LAND DIVISION REQUIREMENTS MUST BE CONFORMED TO BEFORE PROCEEDING WITH FURTHER DEVELOPMENT.

_____ _____

Signature of applicant *Date* 11/8/17

For Office Use Only

Date Received _____ Fee Paid? _____

Materials Received: Site Plans _____ Location Map _____

Survey _____ Legal Description _____

Dated copy of approved minutes sent to applicant? _____ Date Sent _____

PLANNING COMMISSION USE ONLY

Approval _____

Tabled _____

Denied _____

Conditional Approval _____

The following conditions shall be met for approval:

_____

_____

_____

_____

_____

_____

_____ _____

Signature of Planning Commission Chair *Date*

1/24/2018

ConceptDesign
ARCHITECTURE INTERIOR DESIGN

ROBBINS CENTRE POINTE: PROJECT NARRATIVE

About a year ago our team purchased the almost 8 acres that runs from 172nd West on Robbins road toward 31. We have recently added the Pizza Hut site to our project. Therefore, the project will run west from 172nd for approximately 700 feet to almost Whitaker Way. The site has a North to South depth of 315 feet to 660 feet.

We upgraded, remodeled and environmentally addressed the service station on the corner of 172nd and Robbins road and now have a long term Lease with Spartan Nash to operate the station. We will tear down the existing Pizza Hut and add them as an end anchor to our 15,000 sf center that will front on Robbins Road.

We have an easement to travel over all of the Spectrum property for ingress and egress to our site and are showing only two other curb cuts (one on Robbins Road and one on 172 and in turn giving up our continuous curb cut on Robbin's road and one of the two curb cuts we now have on 172nd. The existing curb cut serving the oil change building on 172nd is also proposed to be removed and connected to the internal site circulation.

We are upgrading the site utilities and in fact looping the water at our cost. We expect to build a 20,000 to 30,000 big box in the back toward our South Property line and a small 7000 sf building that could serve a Tire Store or Auto Parts store or something in that vein. We also expect to build a second center between the strip on Robbins and the big box store proposed at the South end of the site. Finally we expect a full service restaurant to come to the site between the main entrance off of Robbins and the Service Station.

We expect to start demolition in April, as soon as we receive site plan approvals, and hope to demo the entire site at that time. But, we are cognizant of several tenants that may need some occupancy past April and we are working with them to see if there is any way we can accommodate them for a longer period. The next phase of the project will consist of the main retail building (Retail S) and looping the public water main through the site to make it ready for further development. Market demand will determine the order and sequencing for the remaining buildings.

The development team is comprised of 3 experienced individuals, with expertise in legal, development, construction, and brokerage encompassing 1000's of developments and transaction totaling several billion dollars. We expect to start construction on phase 2 (phase one was the service station) in April and finish in December of 2018. The balance of the site should be finished in another year after that. We have not attempted any leasing activities up to this point until we have site plan approval.

89 MONROE CENTER NW . GRAND RAPIDS . MI 49503 . 616.771.0909 . WWW.CONCEPTGR.COM

ConceptDesign
ARCHITECTURE INTERIOR DESIGN

3/7/2018

ROBBINS CENTRE POINTE: REQUESTED DEPARTURES

15A.06.1 & 15A.06.2:

- Request to allow the 4 driveways (One on Whittaker Way, two on Robbins Roads and one on 172nd Ave). The site currently has a continuous curb cut on Robbins Road and two curb cuts on 172nd. A maximum of one driveway or street opening per existing public street frontage shall be permitted for the PUD. Additional driveways may be permitted provided that such drive is constructed ad permitted to share access with other uses within the PUD, or an adjoining principal us or existing lot. The four driveways provided share access with other uses, as well as an adjoining principle use and existing lot.

15A.06.7:

- Request departure to allow easternmost drive on Robbins Road, in front of the gas station, to remain as existing, at 100' from intersection of 17nd. Departing from required 200' to allow existing drives to remain as-is.
- Request departure to allow main drive on 172nd Ave to remain as existing, at 160' from intersection. Departing from required 200' to allow existing drives to remain as-is. Adjacent drive to the south, serving the oil change building, is proposed to be removed.

15A.10.5:

- Request departure from the minimum 18' wide parking island in an effort to maximize the amount of parking on the site while still providing for visual and paving breaks.

15A.10.3

- Request departure from landscaping abutting walls of retail buildings in order to meet the functional needs of a retail use and allow for future flexibility in placement of door openings within a storefront, reduces the likelihood of trip hazards along the main walking path, allows pedestrians to circulate farther away from vehicular traffic and make snow removal easier. Landscaping around the perimeter of the building has been pulled back and consolidated in designated planting beds dispersed along the edge of the parking area at the front (north) elevation of Retail S but it still in close proximity and related to the architecture. The planting areas will feature ornamental trees and shrubs to soften the visual appearance of the building from Robbins Road. The back (south) side of Retail S has landscaped pockets identified immediately adjacent to the building wall, coordinated with rear service doors as required. Plantings around future retails buildings on site will follow suit with a similar concept and meet the plant size and type requirements of the ordinance.

20.13.5.H:

- Request departure from minimum tree diameter due to availability and clustered planting design. A check of availability of stock sizes did not produce an adequate supply of 3" diameter trees in the requested native species, so the largest size available will be specified. To help in achieving the intent of the ordinance, plantings will be in clusters of three trunks with an average caliper of each trunk to be 1-1/2" to 2". Clump trees are too big to plant with 3" caliper trunks.

24.04.2:

- Request departure to increase the main maneuvering lane from 24' to 27' in order to provide additional space for an anticipated high traffic corridor, allowing more space for passing vehicles and/or delivery trucks.

FACE BRICK
MODULAR SIZE

FACE BRICK
LARGE FORMAT

DECORATIVE CONCRETE MASONRY
UNITS - SPLIT/GROUND FACE

ROBBINS CENTRE POINTE

Robbins Road at 172nd
Grand Haven (Township), Michigan 49417

ConceptDesign
www.conceptgr.com

1604-11
01/24/18

© 2017 CONCEPT DESIGN

EXISTING UNDERGROUND UTILITY DATA

STORM CB#1
RIM 601.16
12" CONC INV E 598.31
2' SQUARE RIM
2' DIA BLOCK STRUCTURE

STORM CB#2
RIM 602.24
4" PVC INV WNW 599.69
12" PVC INV N=S 599.39
2' DIA RIM
2' DIA BLOCK STRUCTURE

STORM CB#3
RIM 603.74
12" CONC INV NE
2' SQUARE RIM
UNABLE TO SEE INTO STRUCTURE
SILT BAG FILLED WITH SAND

STORM CB#4
RIM 602.72
12" PVC INV N 599.57
12" PVC INV W 599.57
2' SQUARE RIM
4' DIA BLOCK STRUCTURE

SANITARY MH#5
RIM 603.96
6" PVC INV WNW 599.96
6" PVC INV ESE 599.86
2' DIA RIM
4' DIA PRECAST STRUCTURE

SANITARY MH#6
RIM 603.66
8" PVC INV NW 597.66
8" PVC INV SE 597.66
2' DIA RIM
4' DIA PRECAST STRUCTURE

STORM MH#7
RIM 604.07
12" CONC INV E 598.97
12" CONC INV SW 598.97
15" CONC INV S 598.87
15" CONC INV N 598.77
2' DIA RIM
4' DIA PRECAST STRUCTURE

STORM CB#8
RIM 603.49
12" CONC INV W 599.84
2' SQUARE RIM
2' DIA PRECAST STRUCTURE

SANITARY MH#9
RIM 603.51
8" PVC INV NW 594.16
8" PVC INV S 594.01
2' DIA RIM
4' DIA PRECAST STRUCTURE

STORM MH#10
RIM 601.84
12" CONC INV W 596.99
15" CONC INV S 597.29
18" CONC INV E 596.99
2' DIA RIM
4' DIA PRECAST STRUCTURE

STORM CB#11
RIM 601.23
18" CONC INV W 596.93
18" CONC INV N 596.93
2' SQUARE RIM
4' DIA PRECAST STRUCTURE

SANITARY MH#12
RIM 601.62
10" PVC INV N 594.12
10" PVC INV SE 594.12
2' DIA RIM
4' DIA PRECAST STRUCTURE

STORM MH#13
RIM 601.49
18" CONC INV S 596.14
30" CONC INV N 596.14
30" CONC INV E 595.84
2' DIA RIM
5' DIA BLOCK STRUCTURE

STORM MH#14
RIM 601.52
10" CONC INV N 599.12
12" PVC INV S 599.12
2' DIA RIM
2' DIA CONC STRUCTURE

STORM CB#15
RIM 601.61
8" PVC INV NW 598.76
10" CONC INV S 597.86
2' SQUARE RIM
2' DIA BLOCK STRUCTURE

STORM CB#16
RIM 601.75
12" CONC INV S 597.25
2' DIA RIM
4' DIA PRECAST STRUCTURE

MH#17
RIM 602.91

MH#18
RIM 602.99

STORM CB#19
RIM 603.25
6" PVC INV E 600.75
2' DIA RIM
2' DIA BLOCK STRUCTURE

STORM CB#20
RIM 604.32
10" PVC INV NNW 602.12
10" PVC INV SSE 602.02
2' DIA RIM
2' DIA BLOCK STRUCTURE

STORM CB#21
RIM 603.82
6" CLAY INV E 602.57
2' DIA RIM
4' DIA BLOCK STRUCTURE

STORM CB#22
RIM 604.04
3" PVC INV NE 601.04
3" PVC INV NW 601.04
10" PVC INV S 601.04
10" PVC INV E 601.04
2' DIA RIM
3' DIA BLOCK STRUCTURE
TOP OF 4" SAN PIPE NW-SE 601.99

SANITARY MH#23
RIM 603.96
6" PVC INV NW 601.56
6" PVC INV S 601.56
8" PVC INV E 601.51
2' DIA RIM
3' DIA BLOCK STRUCTURESTORM CB#24
RIM 603.53
6" CLAY INV SSW 602.53
2' DIA RIM
3' DIA BLOCK STRUCTURE

MH#25
RIM 604.14

STORM CB#26
RIM 603.34

STORM CB#27
RIM 603.28
10" CONC INV S 599.38
10" CONC INV N 598.88
2' SQUARE RIM
2' DIA BLOCK STRUCTURE

STORM CB#28
RIM 602.57
10" CONC INV N 600.97
2' SQUARE RIM
2' DIA CONC STRUCTURE

MH#29
RIM 603.39

MH#30
RIM 603.86

STORM MH#31
RIM 603.47
12" CONC INV N 599.47
12" CONC INV W 599.37
2' DIA RIM
4' DIA BRICK STRUCTURE

STORM CB#32
RIM 604.32
2' DIA RIM
4' DIA PRECAST STRUCTURE
LEACHING BASIN

STORM CB#33
RIM 604.52
2' DIA RIM
4' DIA PRECAST STRUCTURE
LEACHING BASIN

STORM CB#34
RIM 604.30
3" PVC INV NW 601.50
3" PVC INV NE 601.50
3" PVC INV S 601.35
10" PVC INV W 600.35
12" PVC INV E 600.30
2' DIA RIM
4' DIA BLOCK STRUCTURE

SANITARY MH#35
RIM 604.42
4" PVC INV NW 601.72
4" PVC INV S 601.22
8" PVC INV E 600.42
8" PVC INV W 600.42
2' DIA RIM
3' DIA BLOCK STRUCTURE

STORM CB#36
RIM 604.25
3" PVC INV N 601.35
3" PVC INV SSE 601.30
12" PVC INV E 600.05
12" PVC INV W 600.05
2' DIA RIM
3' DIA BLOCK STRUCTURE

SANITARY MH#37
RIM 603.75
4" PVC INV NE 599.25
4" PVC INV NW 599.25
8" PVC INV W 599.05
8" PVC INV SE 597.85
2' DIA RIM
3' DIA BLOCK STRUCTURE

MH#38
4" PVC INV E
2' DIA RIM
PRECAST VAULT
POSSIBLE GREASE/OIL TRAP
SHARED WITH MH#39

MH#39
4" PVC INV W
2' DIA RIM
PRECAST VAULT
POSSIBLE GREASE/OIL TRAP
SHARED WITH MH#38

SANITARY MH#40
RIM 607.08
6" PVC INV N 598.28
6" PVC INV S 598.28
2' DIA RIM
4' DIA PRECAST STRUCTURE

SANITARY MH#41
RIM 606.88
10" PVC INV W 593.88
10" PVC INV E 593.88
2' DIA RIM
4' DIA PRECAST STRUCTURE

SANITARY MH#42
RIM 607.00
10" PVC INV N 594.80
10" PVC INV E 594.70
2' DIA RIM

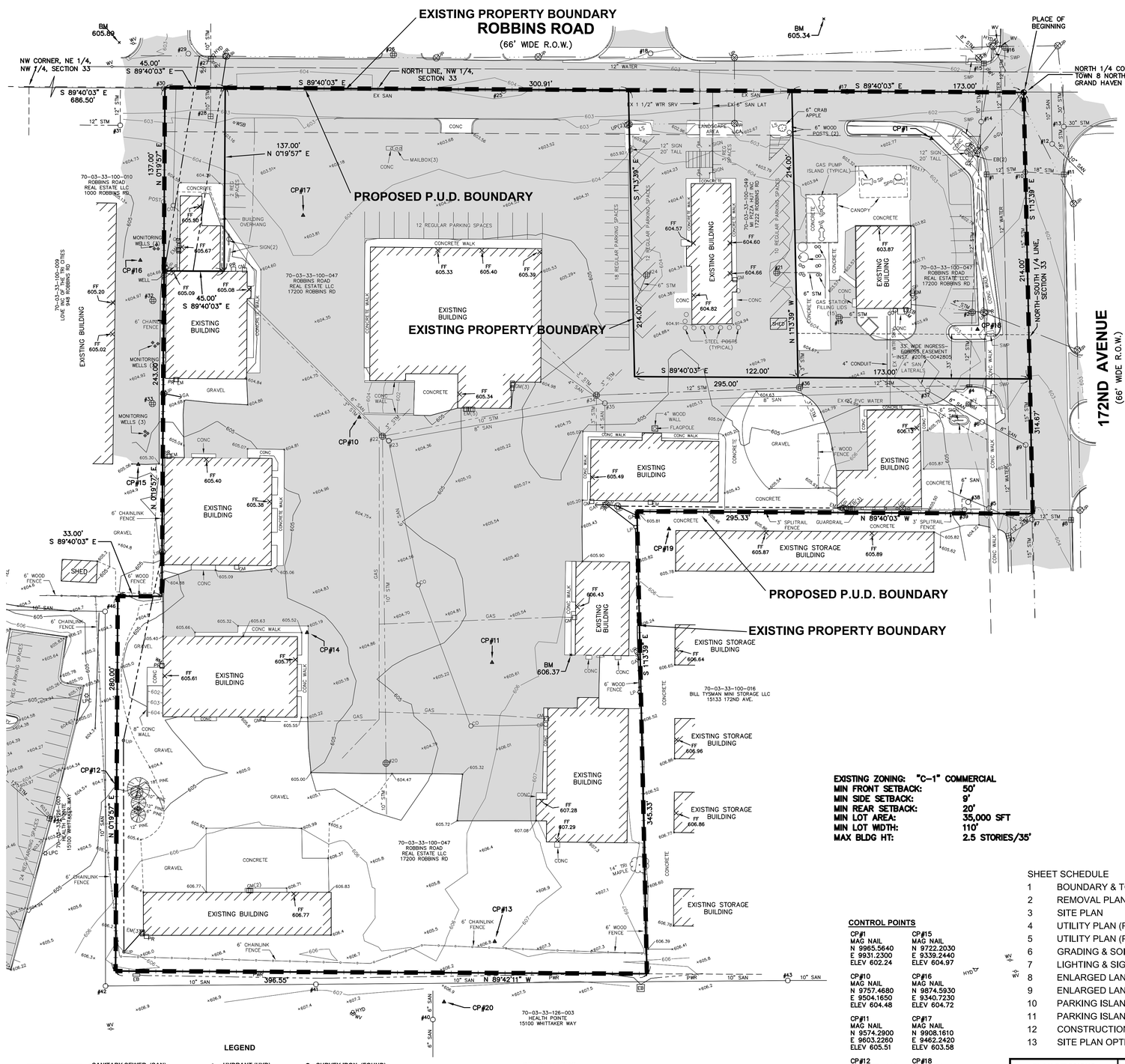
SANITARY MH#43
RIM 607.18
10" PVC INV W 592.31
10" PVC INV E 592.31
2' DIA RIM
4' DIA PRECAST STRUCTURE

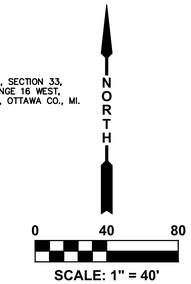
STORM CB#44
RIM 602.94
12" CPP INV NW 600.13
BOTTOM STRUCTURE 598.34
2' RECTANGLE CURB RIM,
4' DIA PRECAST STRUCTURE

STORM MH#45
RIM 604.97
12" CPP INV W 599.67
12" CPP INV SE 599.67
12" CPP INV N 599.62
12" CPP INV S 599.57
2' DIA RIM,
4' DIA PRECAST STRUCTURE

SANITARY MH#46
RIM 604.10
10" PVC INV S 595.70
10" PVC INV W 595.80
2' DIA RIM,
4' DIA PRECAST STRUCTURE

SANITARY MH#47
RIM 605.33
10" PVC INV E 597.28
2' DIA RIM,
4' DIA PRECAST STRUCTURE





LOCATION MAP
NO SCALE:

EXISTING PROPERTY DESCRIPTION

Part of the Northeast one-quarter of the Northwest one-quarter, Section 33, Town 8 North, Range 16 West, Grand Haven Township, Ottawa County, Michigan, described as: **COMMENCING** at the North one-quarter corner; thence South 01°13'39" East 314.67 feet along the North-South one-quarter line; thence North 89°40'03" West 295.33 feet; thence South 01°13'39" East 345.33 feet parallel with the North-South one-quarter line; thence North 89°42'11" West 396.55 feet; thence North 00°19'57" East 280 feet; thence South 89°40'03" East 33.00 feet parallel with the North line of said Northwest one-quarter; thence North 00°19'57" East 243 feet; thence South 89°40'03" East 45 feet; thence North 00°19'57" East 137 feet to the North line of the Northwest one-quarter, said point being South 89°40'03" East 686.50 feet from the Northwest corner of the Northeast one-quarter of the Northwest one-quarter; thence South 89°40'03" East 300.91 feet; thence South 01°13'39" East 214 feet parallel with the North-South one-quarter line; thence South 89°40'03" East 122 feet parallel with the North line of the Northwest one-quarter; thence North 01°13'39" West 214 feet parallel with the North-South one-quarter line to the North line of the Northwest one-quarter; thence South 89°40'03" East 173 feet to the place of beginning.

PROPOSED P.U.D. PROPERTY DESCRIPTION

Part of the Northeast one-quarter of the Northwest one-quarter, Section 33, Town 8 North, Range 16 West, Grand Haven Township, Ottawa County, Michigan, described as: **COMMENCING** at the North one-quarter corner of said Section 33; thence South 01°13'39" East 33.01 feet along the North-South one-quarter line of said section; thence North 89°40'03" West 33.01 feet parallel with the North line of said section to the PLACE OF BEGINNING; thence South 01°13'39" East 281.66 feet parallel with and 33.00 feet West of the North-South one-quarter line of said section; thence North 89°40'03" West 262.32 feet parallel with the North line of said section; thence South 01°13'39" East 345.33 feet parallel with the North-South one-quarter line of said section; thence North 89°42'11" West 396.55 feet; thence North 00°19'57" East 280.00 feet; thence South 89°40'03" East 33.00 feet parallel with the North line of said section; thence North 00°19'57" East 347.00 feet; thence South 89°40'03" East 608.80 feet parallel with and 33.00 South of the North line of said section to the place of beginning.

EXISTING ZONING: "C-1" COMMERCIAL

MIN FRONT SETBACK:	50'
MIN SIDE SETBACK:	9'
MIN REAR SETBACK:	20'
MIN LOT AREA:	35,000 SFT
MIN LOT WIDTH:	110'
MAX BLDG HT:	2.5 STORIES/35'

CONTROL POINTS

CP#1 MAG NAIL N 9965.5640 E 9931.2300 ELEV 602.24	CP#15 MAG NAIL N 9722.2030 E 9339.2440 ELEV 604.97
CP#10 MAG NAIL N 9757.4680 E 9504.1650 ELEV 604.48	CP#16 MAG NAIL N 9874.5930 E 9340.7230 ELEV 604.72
CP#11 MAG NAIL N 9574.2900 E 9603.2260 ELEV 605.51	CP#17 MAG NAIL N 9908.1610 E 9462.2420 ELEV 603.58
CP#12 M&G RED CAP N 9482.9780 E 9322.8830 ELEV 604.09	CP#18 MAG NAIL N 9823.0430 E 9965.5370 ELEV 602.70
CP#13 M&G RED CAP N 9365.9130 E 9605.2210 ELEV 606.83	CP#19 MAG NAIL N 9674.0020 E 9735.3070 ELEV 605.67
CP#14 NAIL N 9596.6370 E 9465.1490 ELEV 605.5	CP#20 NAIL N 9320.8330 E 9567.4270 ELEV 607.32

SHEET SCHEDULE

1 BOUNDARY & TOPOGRAPHIC SURVEY
2 REMOVAL PLAN
3 SITE PLAN
4 UTILITY PLAN (PRIVATE)
5 UTILITY PLAN (PUBLIC)
6 GRADING & SOIL EROSION CONTROL PLAN
7 LIGHTING & SIGNAGE PLAN
8 ENLARGED LANDSCAPE PLAN (NORTH)
9 ENLARGED LANDSCAPE PLAN (SOUTH)
10 PARKING ISLAND DETAILS "A" -"O"
11 PARKING ISLAND DETAILS "P" - "T"
12 CONSTRUCTION DETAILS
13 SITE PLAN OPTION "B"

PREPARED FOR:
VISSER BROTHERS, INC
1946 TURNER AVENUE, NW
GRAND RAPIDS, MI 49504
PH (616) 363-3825
FX (616) 363-6477

WWW.VISSERBROTHERS.COM

ATTN: MR BILL MAST

LEGEND

- SANITARY SEWER (SAN)
- STORM SEWER (STM)
- WATERMAIN (WAT)
- GAS MAIN (GAS)
- UG ELECTRIC CABLE (PWR)
- UG PHONE CABLE (TEL)
- AERIAL UTILITY LINE (AERIAL)
- FENCE
- PROPERTY BOUNDARY LINE
- PROPOSED P.U.D. BOUNDARY LINE
- BITUMINOUS SURFACE
- HYDRANT (HYD)
- WATER VALVE (WV)
- MANHOLE (MH)
- CATCH BASIN (CB)
- UTILITY POLE (UP)
- GUY ANCHOR (GA)
- WATER METER (WM)
- WATER STOP BOX (WSB)
- SAN CLEANOUT (CO)
- PHONE RISER (PR)
- GAS METER (GM)
- GAS VALVE (GV)
- ELECTRIC METER (EM)
- ELECTRIC BOX (EB)
- STEEL POST (SP)
- PEDESTRIAN CROSSWALK POLE (CW)
- LIGHT POLE (LP)
- SURVEY IRON (FOUND)
- SURVEY IRON (SET)
- M - MEASURED DIMENSION
- D - DEEDED DIMENSION
- P - PLATTED DIMENSION
- R - RECORDED DIMENSION
- SWP - SIDEWALK WARNING PAD
- FF - FINISHED FLOOR

BENCHMARKS

ELEVATION 605.34
CHISELED SQUARE ON THE TOP SOUTH SIDE OF A CONC BASE TO LIGHT POLE, LOCATED ON THE NORTH SIDE OF ROBBINS ROAD. POLE IS THE SECOND POLE EAST OF DRIVE TO WALGREENS PHARMACY.

ELEVATION 605.89
TOP OF SOUTH BOLT OF A 1.5'x1.5' CONC LIGHT POLE BASE, LOCATED AT THE NORTHWEST CORNER OF ROBBINS ROAD AND DE SPELDER STREET, 2.5' ABOVE WALK

ELEVATION 606.37
SOUTHEAST CORNER OF A 5' WIDE NORTH-SOUTH CONC WALK, 3.0' WEST OF THE SOUTHWEST CORNER OF BUILDING #17232 ROBBINS ROAD

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

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PLAN REVISIONS
ISSUED 11/09/17 SCHEMATIC DESIGN REVIEW
REV 12/28/17 REV PER REVIEW COMMENTS
REV 01/18/18 REV PER REVIEW COMMENTS
REV 03/07/18 REV PER TWP COMMENTS

BOUNDARY & TOPOGRAPHIC SURVEY

FOR

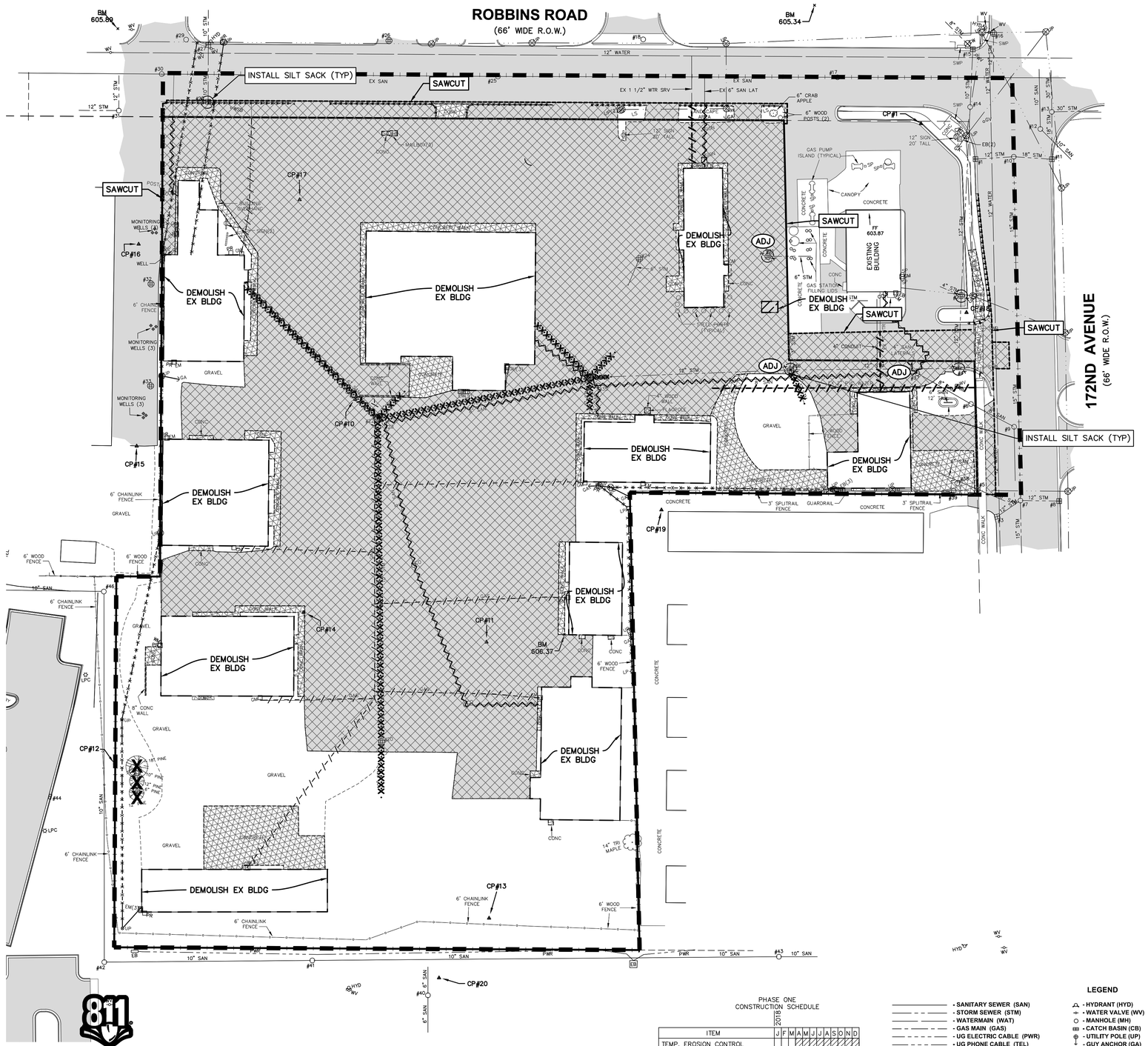
ROBBINS CENTER POINT P.U.D.

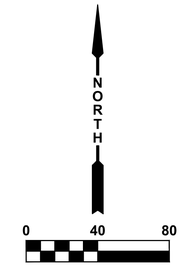
GRAND HAVEN TOWNSHIP, OTTAWA COUNTY, MICHIGAN

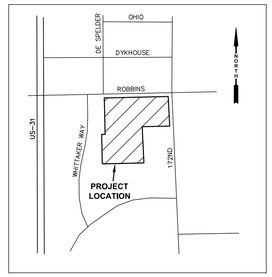
MOORE & BRUGGINK, INC.
Consulting Engineers
2020 Monroe Avenue N.W.
Grand Rapids, Michigan 49505-6298
Phone: (616) 363-9801 Web: www.mbce.com

FIELD SURVEY / DATE:	M&B-10-05-16
DESIGNED BY:	JFL
DESIGN DRAWN BY:	FEF
CHECKED BY:	JFL
PLAN DATE:	11/6/17
PROJECT NO.:	160190.01
SHEET NUMBER	1 OF 12

P:\160190.1 Visser - Robbins Road\CAD\DWG\160190 PUD PLAN SHEETS (2017).dwg, 3/6/2018 3:55:33 PM, LISA FRIZZELL







LOCATION MAP
NO SCALE:

GENERAL DEMOLITION NOTES:

1. THE CONTRACTOR SHALL OBTAIN ALL PERMITS AND SURETY AS PART OF THIS WORK.
2. THE CONTRACTOR SHALL CALL MISS DIG 3 WORKING DAYS PRIOR TO THE START OF CONSTRUCTION.
3. THE CONTRACTOR SHALL REMOVE ALL CONCRETE, BIT PAVEMENT, STORM SEWER STRUCTURES, STORM SEWER PIPE, LIGHT POLES, FENCING, UNDERGROUND ELECTRIC, VEGETATION AND SO ON TO PREPARE THE SITE FOR IMPROVEMENTS. CASTINGS, VALVE BOXES AND/OR OTHER UTILITY STRUCTURES TO REMAIN SHALL BE ADJUSTED AND PROTECTED FROM DAMAGE.
4. COORDINATE PRIVATE UTILITY REMOVALS WITH THE CORRESPONDING UTILITY COMPANY.
5. GROUND WATER WELLS SHALL BE ABANDONED IN ACCORDANCE WITH APPLICABLE RULES AND REGULATIONS.
6. WORK ITEMS WITHIN THE RIGHT OF WAY SHALL BE PERFORMED IN ACCORDANCE WITH THE OTTAWA COUNTY ROAD COMMISSION STANDARDS AND PERMITS.
7. ALL SOIL EROSION CONTROL MEASURES SHALL COMPLY ACT 451 OF PUBLIC ACTS OF 1997, SOIL EROSION AND SEDIMENTATION CONTROL, NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION ACT.
8. ALL SOIL EROSION CONTROL MEASURE SHALL BE IN PLACE PRIOR TO COMMENCEMENT OF EARTHWORK ACTIVITIES.
9. THE CONTRACTOR SHALL CLEAN PUBLIC STREETS DAILY OF ANY DIRT AND/OR DEBRIS FROM CONSTRUCTION SITE.
10. ABANDON ALL EXISTING UTILITY SERVICES TO EXISTING BUILINGS TO BE REMOVED UPON DEMOLITION.

REMOVAL LEGEND

- COLD MILL HMA
- REMOVE BITUMINOUS
- REMOVE CONCRETE
- REMOVE CURB & GUTTER
- REMOVE SANITARY SEWER
- REMOVE WATERMAIN
- REMOVE STORM SEWER
- X — TREE REMOVAL
- R/O — RELOCATE BY OTHERS
- R&S — REMOVE & SALVAGE
- REM — REMOVE ITEM
- ADJ — DRAINAGE STRUCTURE ADJUST

SHEET SCHEDULE

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13 SITE PLAN OPTION "B"

PREPARED FOR:
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1946 TURNER AVENUE, NW
GRAND RAPIDS, MI 49504
PH (616) 363-3825
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WWW.VISSERBROTHERS.COM

ATTN: MR BILL MAST

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PHASE ONE CONSTRUCTION SCHEDULE

ITEM	2018 J	F	M	A	M	J	J	A	S	O	N	D
TEMP. EROSION CONTROL												
TOPSOIL STRIPPING												
SITE GRADING												
SITE UTILITIES												
DETENTION POND												
BUILDING CONSTRUCTION												
PERM. EROSION CONTROL												
LANDSCAPING												
PAVING												
REMOVE TEMP. EROSION CONTROL												

LEGEND

- SANITARY SEWER (SAN)
- STORM SEWER (STM)
- WATERMAIN (WAT)
- GAS MAIN (GAS)
- UG ELECTRIC CABLE (PWR)
- UG PHONE CABLE (TEL)
- AERIAL UTILITY LINE (AERIAL)
- FENCE
- PROPERTY BOUNDARY LINE
- PROPOSED P.U.D. BOUNDARY LINE
- PROPOSED DRAINAGE SWALE
- PROPOSED CURB & GUTTER
- EX BITUMINOUS SURFACE
- PROPOSED BITUMINOUS SURFACE
- PROPOSED CONCRETE SURFACE
- HYDRANT (HYD)
- WATER VALVE (WV)
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- CATCH BASIN (CB)
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- GUY ANCHOR (GA)
- WATER METER (WM)
- WATER STOP BOX (WSB)
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PLAN REVISIONS
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REV 12/28/17 REV PER REVIEW COMMENTS
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REV 03/07/18 REV PER TWP COMMENTS
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REMOVAL PLAN
FOR
ROBBINS CENTER POINT P.U.D.
GRAND HAVEN TOWNSHIP, OTTAWA COUNTY, MICHIGAN

MOORE & BRUGGINK, INC.
Consulting Engineers
2020 Monroe Avenue N.W.
Grand Rapids, Michigan 49505-6298
Phone: (616) 363-9801 Web: www.mbce.com

FIELD SURVEY / DATE: M&B-10-05-16
DESIGNED BY: JFL
DESIGN DRAWN BY: FEF
CHECKED BY: JFL
PLAN DATE: 11/6/17
PROJECT NO.: 160190.01

SHEET NUMBER
2 OF 12

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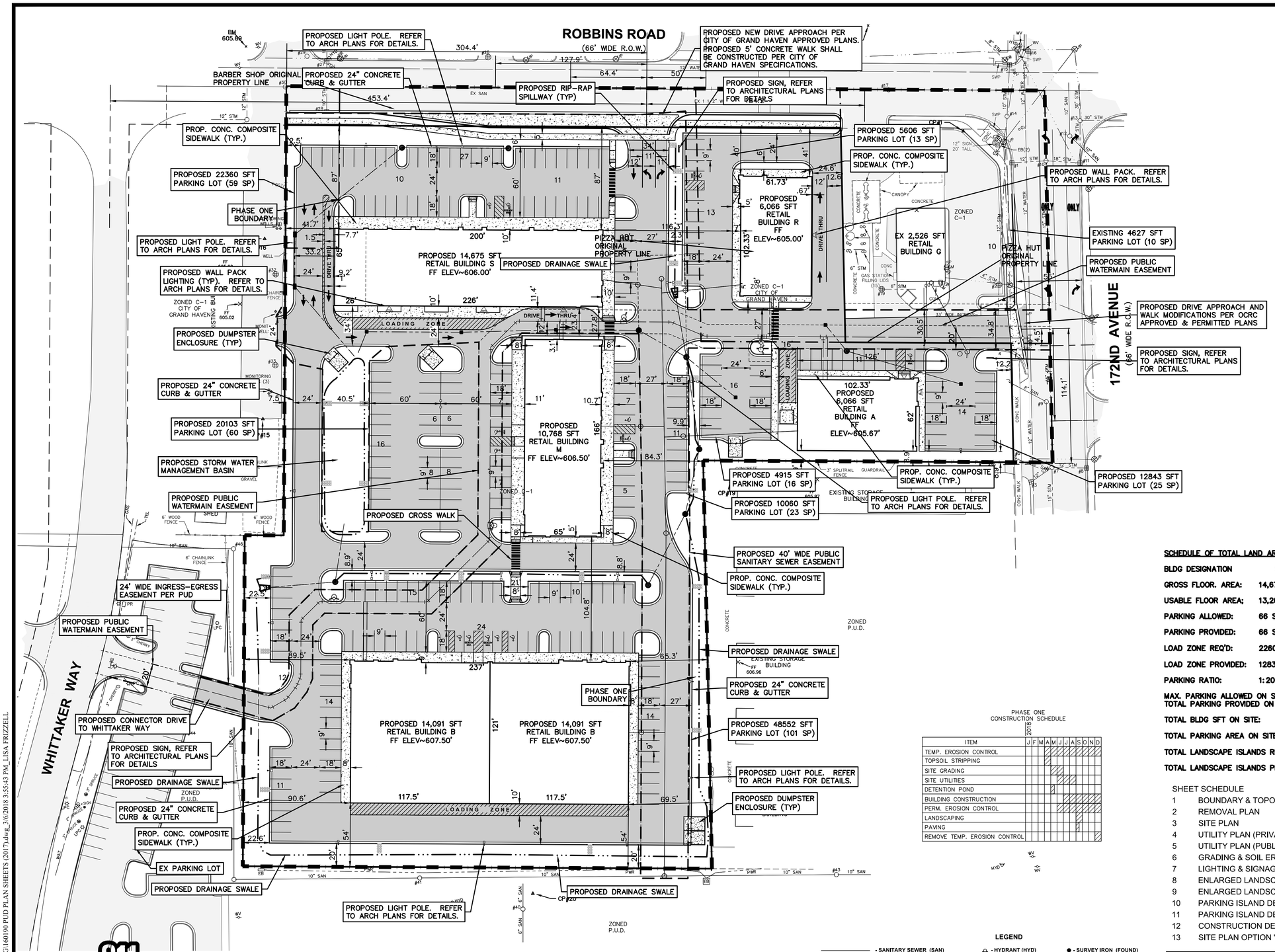

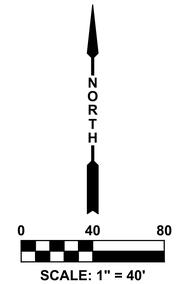

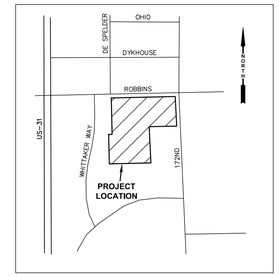

LOCATION MAP
NO SCALE:

SITE PLAN GENERAL NOTES:

1. THE CONTRACTOR SHALL OBTAIN ALL PERMITS AND SURETY AS PART OF THIS WORK.
2. THE CONTRACTOR SHALL CALL MISS DIG 3 WORKING DAYS PRIOR TO THE START OF CONSTRUCTION.
3. THE CONTRACTOR SHALL FURNISH AND PLACE THE DRIVE APPROACH, NEW CURBING, WALK, AND DRIVE CLOSURES WITHIN THE PUBLIC RIGHT OF WAY IN ACCORDANCE WITH OTTAWA COUNTY ROAD COMMISSION PERMITS & STANDARD CONSTRUCTION SPECIFICATIONS.
4. ALL STORM SEWER PIPE SHALL BE ADS N-12 PLASTIC PIPE UNLESS OTHERWISE SPECIFIED.
5. ALL CATCH BASINS AND MANHOLES SHALL BE MINIMUM 4' DIAMETER PRECAST CONCRETE, UNLESS NOTED OTHERWISE.
6. PAVED AREAS SHALL BE CONSTRUCTED WITH:
   12" MDOT CL-2 SAND SUBBASE (C.I.P)
   6" 22-A GRAVEL BASE (C.I.P)
   1 1/2" 3C HMA LEVELING COURSE
   1 1/2" 4C HMA WEARING COURSE
7. THE CONTRACTOR SHALL BED AND BACKFILL ALL UNDERGROUND PIPING WITH MDOT CL-2 SAND TO A MINIMUM OF 95% MAXIMUM DRY DENSITY PER ASTM- 1557.
8. THIS SITE PLAN SHALL NOT BE USED TO STAKE THE LOCATION OF PROPOSED BUILDING COLUMN LINES. THE SURVEYORS ARE TO USE THE BUILDING FOUNDATION PLANS.
9. THE CONTRACTOR SHALL PLACE AND COMPACT FILL UNDER THE PROPOSED BUILDING AREA TO A MINIMUM OF 95% MAXIMUM DRY DENSITY PER ASTM-1557. ALL OTHER AREAS SHALL BE COMPACTED TO A MINIMUM OF 90% MAXIMUM DRY DENSITY.
10. THE CONTRACTOR SHALL REQUEST CONSTRUCTION STAKING BY FAX USING THE MOORE & BRUGGINK, INC. CONTRACTORS CONSTRUCTION STAKING REQUEST FORM. ONLY COMPLETED REQUESTS WILL BE SCHEDULED. NOTE THE PROJECT OWNER WILL PAY THE SURVEYOR TO PLACE STAKES ONLY ONCE. ALL LOST AND DAMAGED STAKES ARE THE CONTRACTORS RESPONSIBILITY
11. REGULATORY AGENCIES AS FOLLOWS:
    GRAND HAVEN CHARTER TOWNSHIP
    CITY OF GRAND HAVEN
    OTTAWA COUNTY ROAD COMMISSION
    OTTAWA COUNTY WATER RESOURCES COMMISSIONER
    OTTAWA COUNTY ENVIRONMENTAL HEALTH DEPARTMENT
    MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY.

SCHEDULE OF TOTAL LAND AREAS:

BLDG DESIGNATION	S	M	B	R	A	G
GROSS FLOOR. AREA:	14,675 SFT	10,768 SFT	28,182 SFT	6,066 SFT	6,066 SFT	2,526 SFT
USABLE FLOOR AREA;	13,208 SFT	9,681 SFT	25,364 SFT	5,459 SFT	5,459 SFT	2,273 SFT
PARKING ALLOWED:	66 SPACES	48 SPACES	127 SPACES	27 SPACES	27 SPACES	11 SPACES
PARKING PROVIDED:	66 SPACES	48 SPACES	123 SPACES	27 SPACES	27 SPACES	10 SPACES
LOAD ZONE REQ'D:	2260 SFT	1660 SFT	2370 SFT	620 SFT	620 SFT	608 SFT
LOAD ZONE PROVIDED:	1283 SFT	0	2370 SFT	624 SFT	630 SFT	624 SFT
PARKING RATIO:	1:200 SFT USABLE FLOOR AREA					

MAX. PARKING ALLOWED ON SITE: 306 SPACES
TOTAL PARKING PROVIDED ON SITE: 301 SPACES

TOTAL BLDG SFT ON SITE: 68,283 SFT

TOTAL PARKING AREA ON SITE: 141,277 SFT (/15 = 9418)

TOTAL LANDSCAPE ISLANDS REQUIRED: 9418 SFT

TOTAL LANDSCAPE ISLANDS PROVIDED: 9455 SFT

PHASE ONE CONSTRUCTION SCHEDULE

ITEM	2018 J	F	M	A	M	J	J	A	S	O	N	D
TEMP. EROSION CONTROL												
TOPSOIL STRIPPING												
SITE GRADING												
SITE UTILITIES												
DETENTION POND												
BUILDING CONSTRUCTION												
PERM. EROSION CONTROL												
LANDSCAPING												
PAVING												
REMOVE TEMP. EROSION CONTROL												

SHEET SCHEDULE

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EXISTING ZONING: "C-1" COMMERCIAL
MIN FRONT SETBACK: 50'
MIN SIDE SETBACK: 9'
MIN REAR SETBACK: 20'
MIN LOT AREA: 35,000 SFT
MIN LOT WIDTH: 110'
MAX BLDG HT: 2.5 STORIES/35'

PROPOSED ZONING: P.U.D. PLANNED UNIT DEVELOPMENT

LEGEND

- SANITARY SEWER (SAN)
- STORM SEWER (STM)
- WATERMAIN (WAT)
- GAS MAIN (GAS)
- UG ELECTRIC CABLE (PWR)
- UG PHONE CABLE (TEL)
- AERIAL UTILITY LINE (AERIAL)
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- PROPOSED CONCRETE SURFACE
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PLAN REVISIONS
ISSUED 11/09/17 SCHEMATIC DESIGN REVIEW
REV 12/28/17 REV PER REVIEW COMMENTS
REV 01/18/18 REV PER REVIEW COMMENTS
REV 02-16-18
REV 03/07/18 REV PER TWP COMMENTS

SITE PLAN
FOR
ROBBINS CENTER POINT P.U.D.
GRAND HAVEN TOWNSHIP, OTTAWA COUNTY, MICHIGAN

MOORE & BRUGGINK, INC.
Consulting Engineers
2020 Monroe Avenue N.W.
Grand Rapids, Michigan 49505-6298
Phone: (616) 363-9801 Web: www.mbce.com

FIELD SURVEY / DATE: M&B-10-05-16
DESIGNED BY: JFL
DESIGN DRAWN BY: FEF
CHECKED BY: JFL
PLAN DATE: 11/6/17
PROJECT NO.: 160190.01
SHEET NUMBER 3 OF 12

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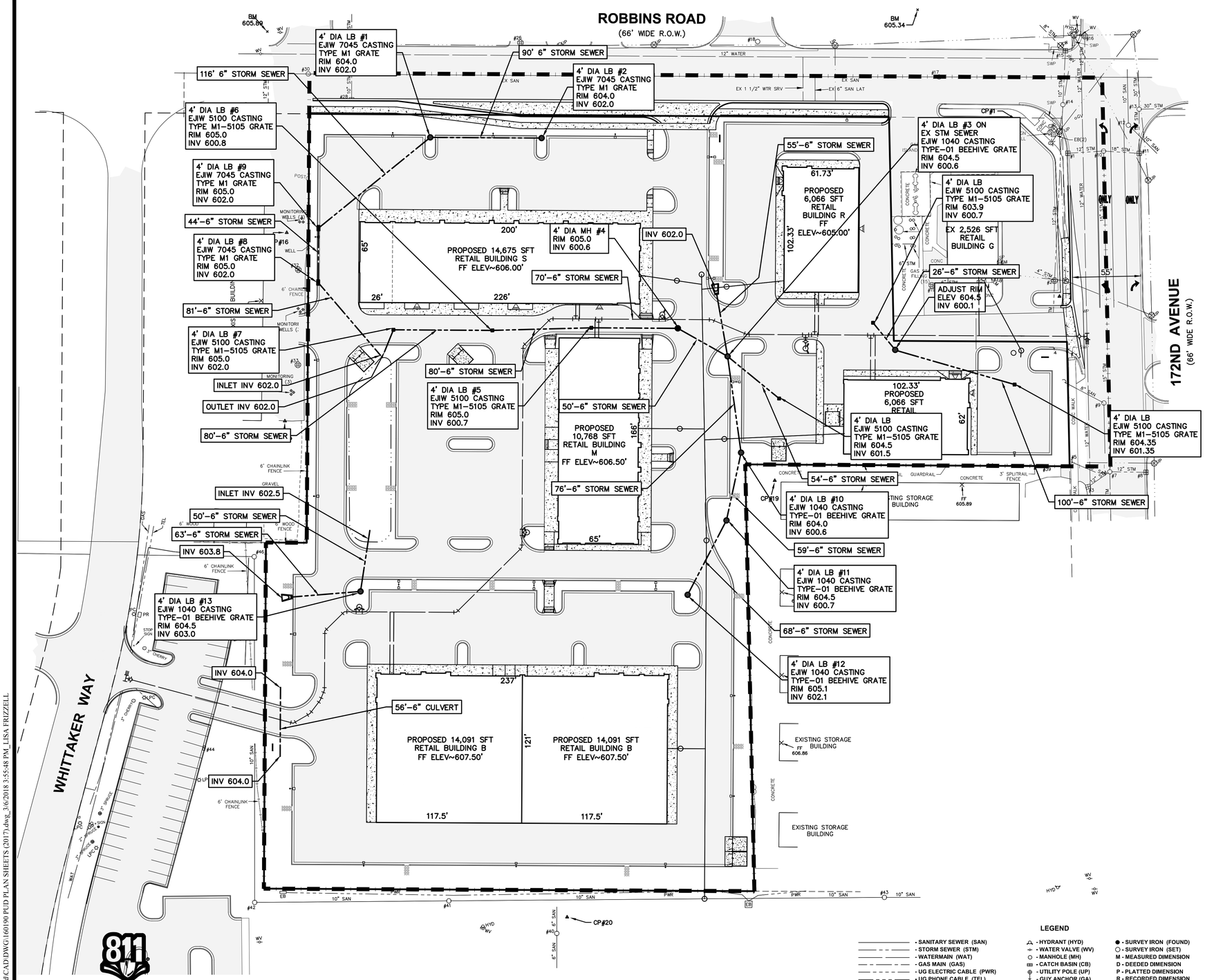

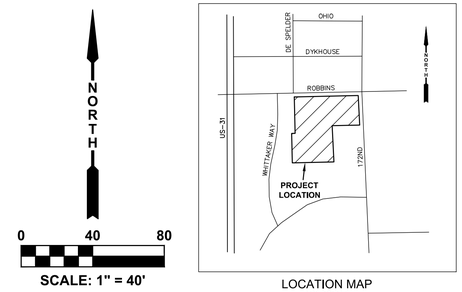

LOCATION MAP
NO SCALE:

UTILITY PLAN GENERAL NOTES:

1. THE CONTRACTOR SHALL OBTAIN ALL PERMITS AND SURETY AS PART OF THIS WORK.
2. THE CONTRACTOR SHALL CALL MISS DIG 3 WORKING DAYS PRIOR TO THE START OF CONSTRUCTION.
3. ALL STORM SEWER PIPE SHALL BE ADS N-12 PLASTIC PIPE UNLESS OTHERWISE SPECIFIED.
4. ALL LEACH BASINS AND MANHOLES SHALL BE MINIMUM 4' DIAMETER PRECAST CONCRETE, UNLESS NOTED OTHERWISE.
5. THE CONTRACTOR SHALL BED AND BACKFILL ALL UNDERGROUND PIPING WITH MDOT CL-2 SAND TO A MINIMUM OF 95% MAXIMUM DRY DENSITY PER ASTM- 1557.
6. THE PROPOSED PUBLIC WATERMAIN AND PUBLIC SANITARY SEWER SHALL BE CONSTRUCTED PER SEPARATE APPROVED AND PERMITTED UTILITY PLANS.
7. THE CONTRACTOR SHALL REQUEST CONSTRUCTION STAKING BY FAX USING THE MOORE & BRUGGINK, INC. CONTRACTORS CONSTRUCTION STAKING REQUEST FORM. ONLY COMPLETED REQUESTS WILL BE SCHEDULED. NOTE: THE PROJECT OWNER WILL PAY THE SURVEYOR TO PLACE STAKES ONLY ONCE. ALL LOST AND DAMAGED STAKES ARE THE CONTRACTORS RESPONSIBILITY.
8. ALL UTILITIES WILL BE LOCATED UNDERGROUND.

PHASE ONE CONSTRUCTION SCHEDULE

ITEM	2018 J	F	M	A	M	J	J	A	S	O	N	D
TEMP. EROSION CONTROL												
TOPSOIL STRIPPING												
SITE GRADING												
SITE UTILITIES												
DETENTION POND												
BUILDING CONSTRUCTION												
PERM. EROSION CONTROL												
LANDSCAPING												
PAVING												
REMOVE TEMP. EROSION CONTROL												

SHEET SCHEDULE

1 BOUNDARY & TOPOGRAPHIC SURVEY
2 REMOVAL PLAN
3 SITE PLAN
4 UTILITY PLAN (PRIVATE)
5 UTILITY PLAN (PUBLIC)
6 GRADING & SOIL EROSION CONTROL PLAN
7 LIGHTING & SIGNAGE PLAN
8 ENLARGED LANDSCAPE PLAN (NORTH)
9 ENLARGED LANDSCAPE PLAN (SOUTH)
10 PARKING ISLAND DETAILS "A" -"O"
11 PARKING ISLAND DETAILS "P" - "T"
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13 SITE PLAN OPTION "B"

PREPARED FOR:
VISSER BROTHERS, INC
1946 TURNER AVENUE, NW
GRAND RAPIDS, MI 49504
PH (616) 363-3825
FX (616) 363-6477

WWW.VISSERBROTHERS.COM

ATTN: MR BILL MAST

Know what's below. Call before you dig.

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LEGEND

- SANITARY SEWER (SAN)
- STORM SEWER (STM)
- WATERMAIN (WAT)
- GAS MAIN (GAS)
- UG ELECTRIC CABLE (PWR)
- UG PHONE CABLE (TEL)
- AERIAL UTILITY LINE (AERIAL)
- FENCE
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REV 12/28/17 REV PER REVIEW COMMENTS
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UTILITY PLAN (PRIVATE)

FOR

ROBBINS CENTER POINT P.U.D.

GRAND HAVEN TOWNSHIP, OTTAWA COUNTY, MICHIGAN

MOORE & BRUGGINK, INC.
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2020 Monroe Avenue N.W.
Grand Rapids, Michigan 49505-6298
Phone: (616) 363-9801 Web: www.mbce.com

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DESIGNED BY: JFL
DESIGN DRAWN BY: FEF
CHECKED BY: JFL
PLAN DATE: 11/6/17
PROJECT NO.: 160190.01

SHEET NUMBER 4 OF 12

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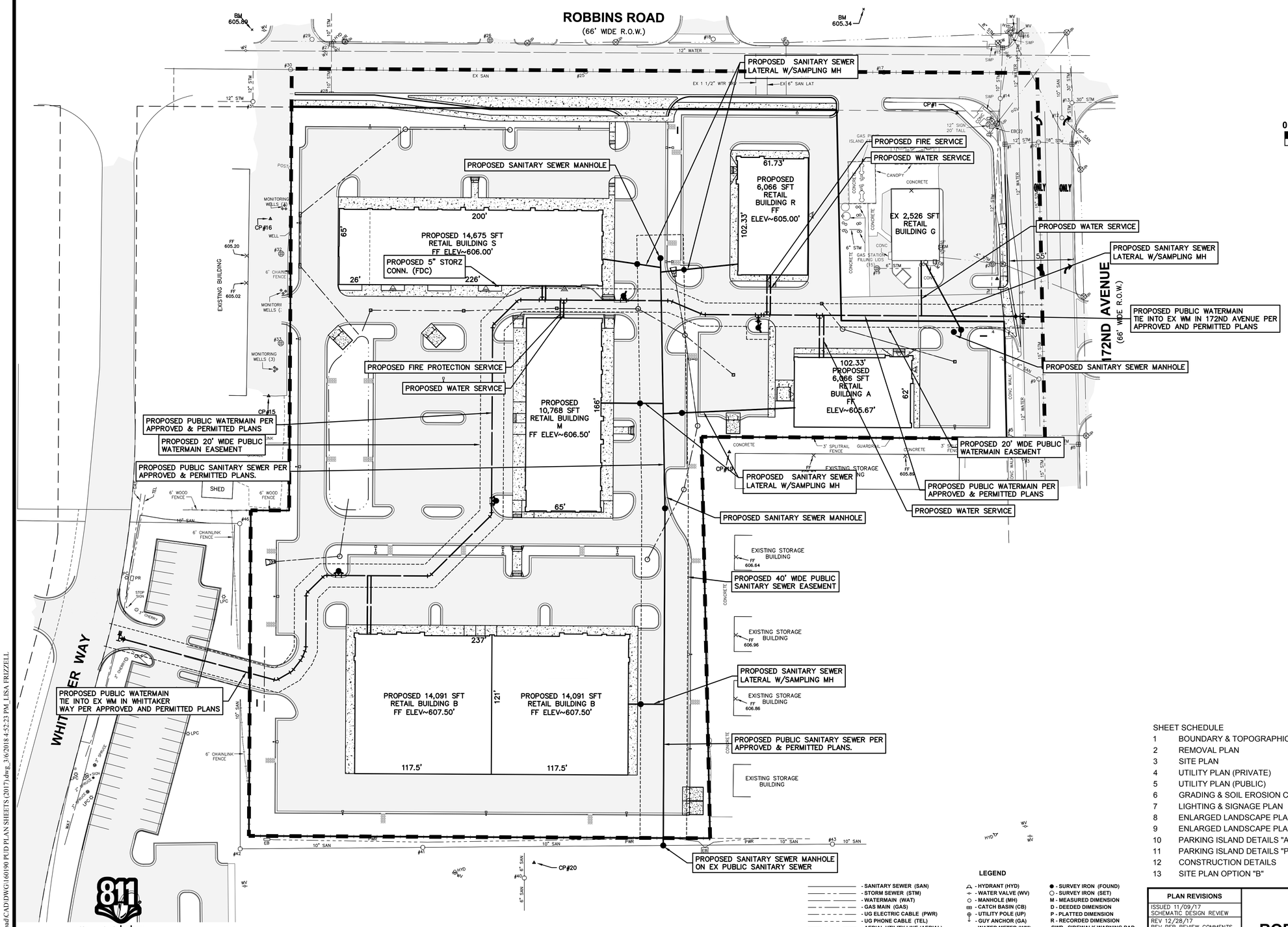

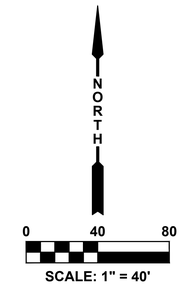

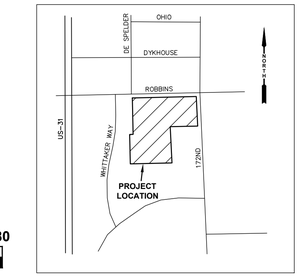

LOCATION MAP
NO SCALE:

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PREPARED FOR:
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UTILITY PLAN (PUBLIC)

FOR

ROBBINS CENTER POINT P.U.D.

GRAND HAVEN TOWNSHIP, OTTAWA COUNTY, MICHIGAN

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Consulting Engineers
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FIELD SURVEY / DATE: M&B-10-05-16
DESIGNED BY: JFL
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PLAN DATE: 11/6/17
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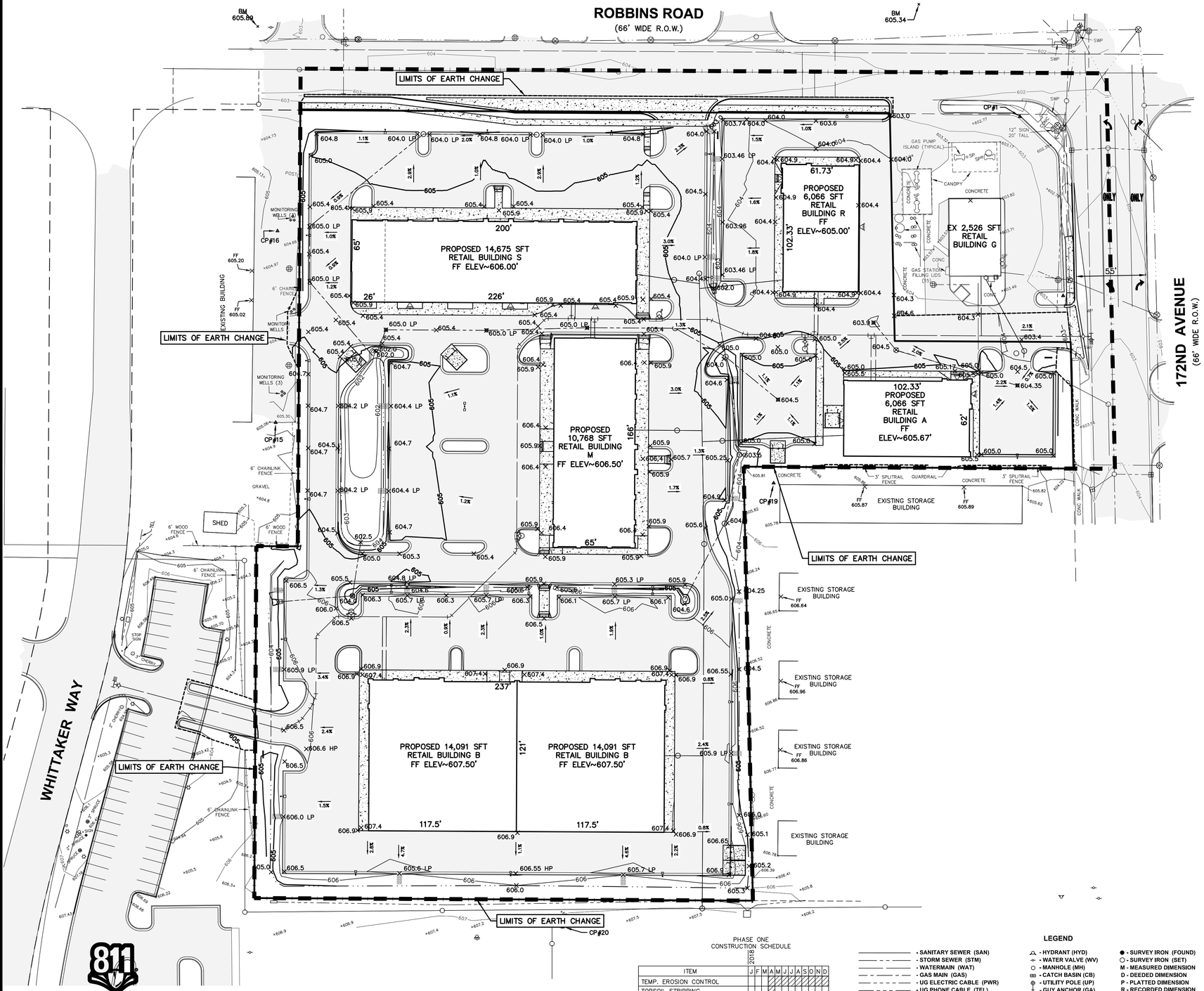
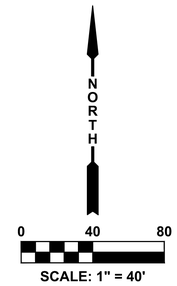
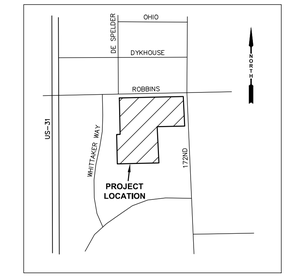




SCALE: 1" = 40'



LOCATION MAP
NO SCALE:

SOIL EROSION CONTROL NOTES:

1. THE CONTRACTOR SHALL OBTAIN ALL PERMITS AND SURETY AS PART OF THIS WORK.
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4. THE CONTRACTOR SHALL REMOVE ALL CONCRETE, BIT PAVEMENT, STORM SEWER STRUCTURES, STORM SEWER PIPE, LIGHT POLES, FENCING, UNDERGROUND ELECTRIC, VEGETATION AND SO ON TO PREPARE THE SITE FOR IMPROVEMENTS. CASTINGS, VALVE BOXES AND/OR OTHER UTILITY STRUCTURES TO REMAIN SHALL BE ADJUSTED AND PROTECTED FROM DAMAGE.
5. NORTH AMERICAN GREEN DS-150 EROSION CONTROL BLANKET SHALL BE PLACED ON ALL SLOPES 1:3 OR GREATER. SECURE BLANKET TO SLOPE PER MANUFACTURERS SPECIFICATIONS.
6. ALL SILT FENCING SHALL BE TRENCHED IN PRIOR TO COMMENCEMENT OF EARTHWORK ACTIVITIES.
7. SILT FENCING IS REQUIRED ALONG ALL DOWNSTREAM EDGES OF THE GRADING LIMITS AND MUST REMAIN IN PLACE UNTIL VEGETATION IS UNIFORMLY RE-ESTABLISHED.
8. ALL SOIL EROSION CONTROL MEASURES SHALL COMPLY WITH THE CITY OF GRAND RAPIDS LUDS PERMIT, ACT 451 OF PUBLIC ACTS OF 1997, SOIL EROSION AND SEDIMENTATION CONTROL, NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION ACT.
9. NEW & EXISTING STORM SEWER INLET POINTS SHALL BE PROTECTED FROM SEDIMENT INFILTRATION WITH INLET FABRIC DROP (SILT SACK) PER CITY OF GRAND RAPIDS APPROVED MANUFACTURERS (H-FLOW AND/OR ACF BRANDS). CONTRACTOR SHALL PROVIDE PRODUCT INFORMATION TO THE CITY PRIOR TO INSTALLATION.
10. ALL SOIL EROSION AND SEDIMENTATION CONTROL MEASURES SHALL BE INSPECTED AND MAINTAINED ON A DAILY BASIS, AND IMMEDIATELY FOLLOWING EVERY SIGNIFICANT RAINFALL EVENT.
11. ALL EXCESS SPOILS ARE TO BE REMOVED FROM THE SITE. OTHERWISE STOCKPILES MUST BE PROVIDED WITH TEMPORARY AND PERMANENT STABILIZATION MEASURES.
12. IF EXCESS DIRT IS TO BE PLACED ON SITE, THE LOCATION SHALL BE APPROVED BY THE PROPERTY OWNER & ENGINEER.
13. ALL TEMPORARY EROSION CONTROLS MUST REMAIN IN PLACE UNTIL VEGETATION IS UNIFORMLY RE-ESTABLISHED.
14. DUST CONTROL SHALL BE PROVIDED BY MEANS OF WATER DISTRIBUTION ON A REGULAR BASIS OVER AREAS THAT COULD POTENTIALLY PRODUCE DUST CONDITIONS.
15. A TRACKING PAD MUST BE PROVIDED AT CONSTRUCTION ACCESS POINTS TO PREVENT SOILS FROM BEING TRACKED OFF-SITE, PER DETAIL THIS SHEET.
16. CONTRACTOR SHALL SWEEP PAVED AREAS EACH DAY (OR MORE AS NEEDED) BY MECHANICAL MEANS FOR ALL PAVED AREAS IN AND AROUND THE PERIMETER OF THE PROJECT AFFECTED BY TRUCKING OPERATIONS.
17. CONSTRUCTION ENTRANCE SHALL BE PROVIDED FROM 172ND AVENUE.
18. APPROXIMATELY 8180 CYDS OF MATERIAL TO BE REMOVED FROM THE SITE.
19. SEE LANDSCAPE PLAN FOR RESTORATION SPECIFICATIONS IN YARD AREAS.

SHEET SCHEDULE

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PHASE ONE CONSTRUCTION SCHEDULE

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GRADING & SOIL EROSION CONTROL PLAN

FOR

ROBBINS CENTER POINT P.U.D.

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SHEET NUMBER 6 OF 12

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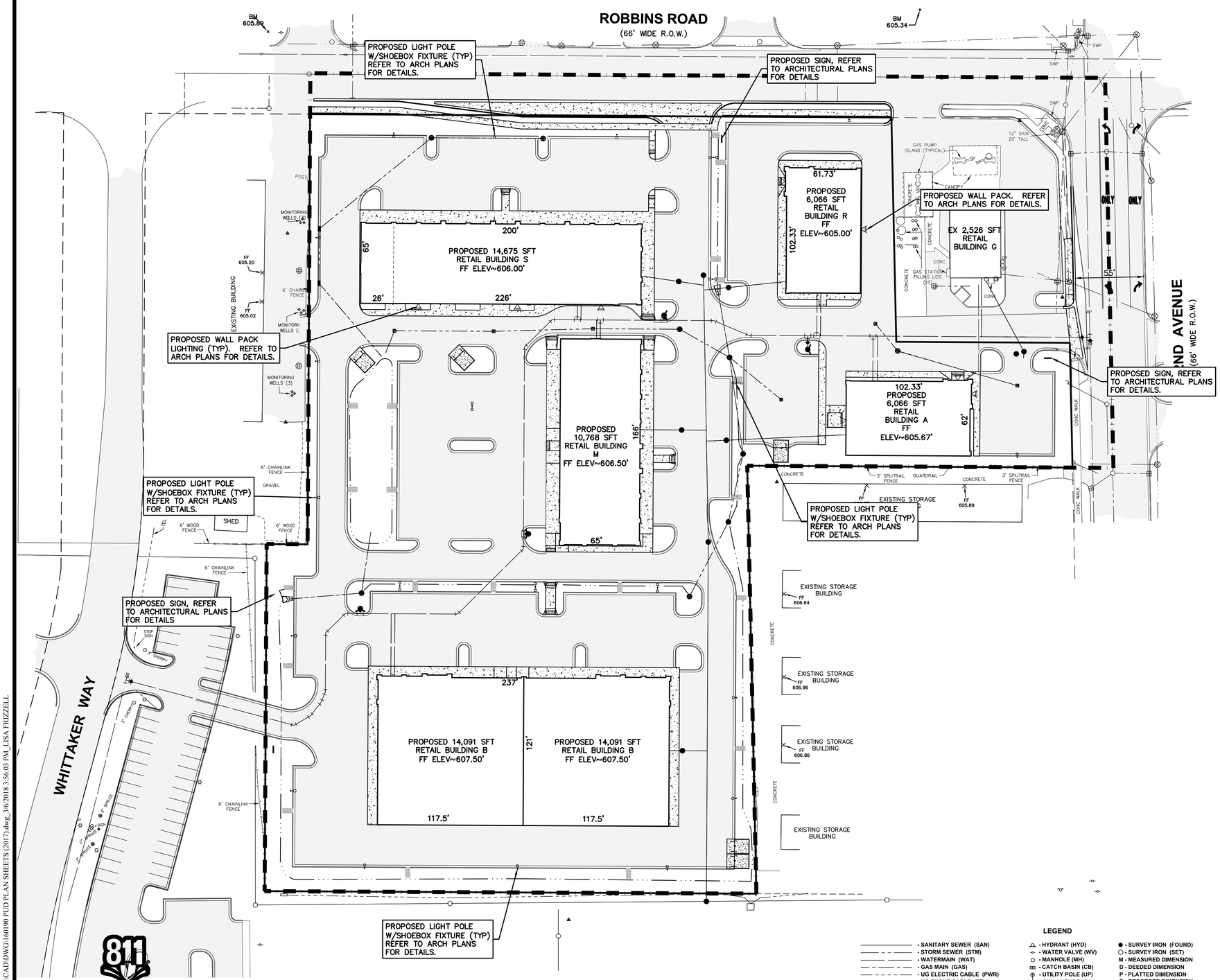

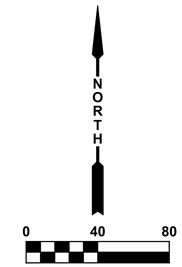

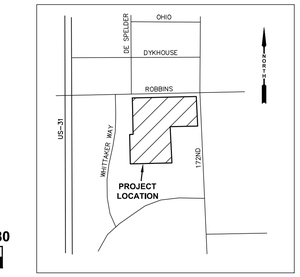

LOCATION MAP
NO SCALE:

LANDSCAPING GENERAL NOTES:

1. ALL TREES TO HAVE CLAY OR CLAY LOAM BALLS, TREES WITH SAND BALLS WILL BE REJECTED.
2. ALL SINGLE STEM SHADE TREES TO HAVE STRAIGHT TRUNKS AND SYMMETRICAL CROWNS.
3. ALL SINGLE TRUNK SHADE TREES TO HAVE A CENTRAL LEADER; TREES WITH FORKED OR IRREGULAR TRUNKS WILL NOT BE ACCEPTED.
4. ALL MULTI-STEM TREES SHALL BE HEAVILY BRANCHED AND HAVE SYMMETRICAL CROWNS; ONE SIDED TREES OR THOSE WITH THIN OR OPEN CROWNS SHALL NOT BE ACCEPTED.
5. ALL EVERGREEN TREES SHALL BE HEAVILY BRANCHED AND FULL TO THE GROUND, SYMMETRICAL IN SHAPE AND NOT SHEARED FOR THE LAST FIVE GROWING SEASONS.
6. SHRUBS AND PERENNIALS SHALL BE FULL AND WELL ROOTED. INSTALLATION SHALL BE MARCH 1 – NOVEMBER 30, ANNUALLY.
7. ALL PLANT MATERIALS SHALL BE NORTHERN NURSERY GROWN, NO. 1 GRADE AND INSTALLED ACCORDING TO ACCEPTED PLANTING PROCEDURES. ALL PLANT MATERIALS SHALL MEET CURRENT AMERICAN ASSOCIATION OF NURSERYMAN STANDARDS.
8. ALL PROPOSED MULCH TO BE NATURAL COLOR, DOUBLE PROCESSED, SHREDDED HARDWOOD BARK, 4" THICK BARK MULCH FOR TREES IN A 4-FOOT DIAMETER CIRCLE WITH 3" PULLED AWAY FROM THE TRUCK, 3" THICK BARK FOR SHRUBS AND 2" THICK BARK FOR PERENNIALS, TYP.
9. THE CONTRACTOR SHALL GUARANTEE ALL PLANTINGS FOR A TIME PERIOD OF ONE YEAR AFTER FINAL ACCEPTANCE OF ALL WORK ITEMS. DURING THIS GUARANTEE PERIOD, THE CONTRACTOR SHALL IMMEDIATELY REPLACE ALL PLANT MATERIALS THAT DIE OR ARE DISEASED.
10. YARD AREAS ARE TO BE RESTORED WITH 4" OF TOPSOIL, CLASS A SEED AT 200#/ACRE, FERTILIZER & MULCH (MULCH BLANKET ON SLOPES 1:3 OR STEEPER).

PHASE ONE CONSTRUCTION SCHEDULE

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LANDSCAPING												
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REMOVE TEMP. EROSION CONTROL												

SHEET SCHEDULE

1 BOUNDARY & TOPOGRAPHIC SURVEY
2 REMOVAL PLAN
3 SITE PLAN
4 UTILITY PLAN (PRIVATE)
5 UTILITY PLAN (PUBLIC)
6 GRADING & SOIL EROSION CONTROL PLAN
7 LIGHTING & SIGNAGE PLAN
8 ENLARGED LANDSCAPE PLAN (NORTH)
9 ENLARGED LANDSCAPE PLAN (SOUTH)
10 PARKING ISLAND DETAILS "A" -"O"
11 PARKING ISLAND DETAILS "P" - "T"
12 CONSTRUCTION DETAILS
13 SITE PLAN OPTION "B"

PREPARED FOR:
VISSER BROTHERS, INC
1946 TURNER AVENUE, NW
GRAND RAPIDS, MI 49504
PH (616) 363-3825
FX (616) 363-6477

WWW.VISSERBROTHERS.COM

ATTN: MR BILL MAST

LEGEND

- SANITARY SEWER (SAN)
- STORM SEWER (STM)
- WATERMAIN (WAT)
- GAS MAIN (GAS)
- UG ELECTRIC CABLE (PWR)
- UG PHONE CABLE (TEL)
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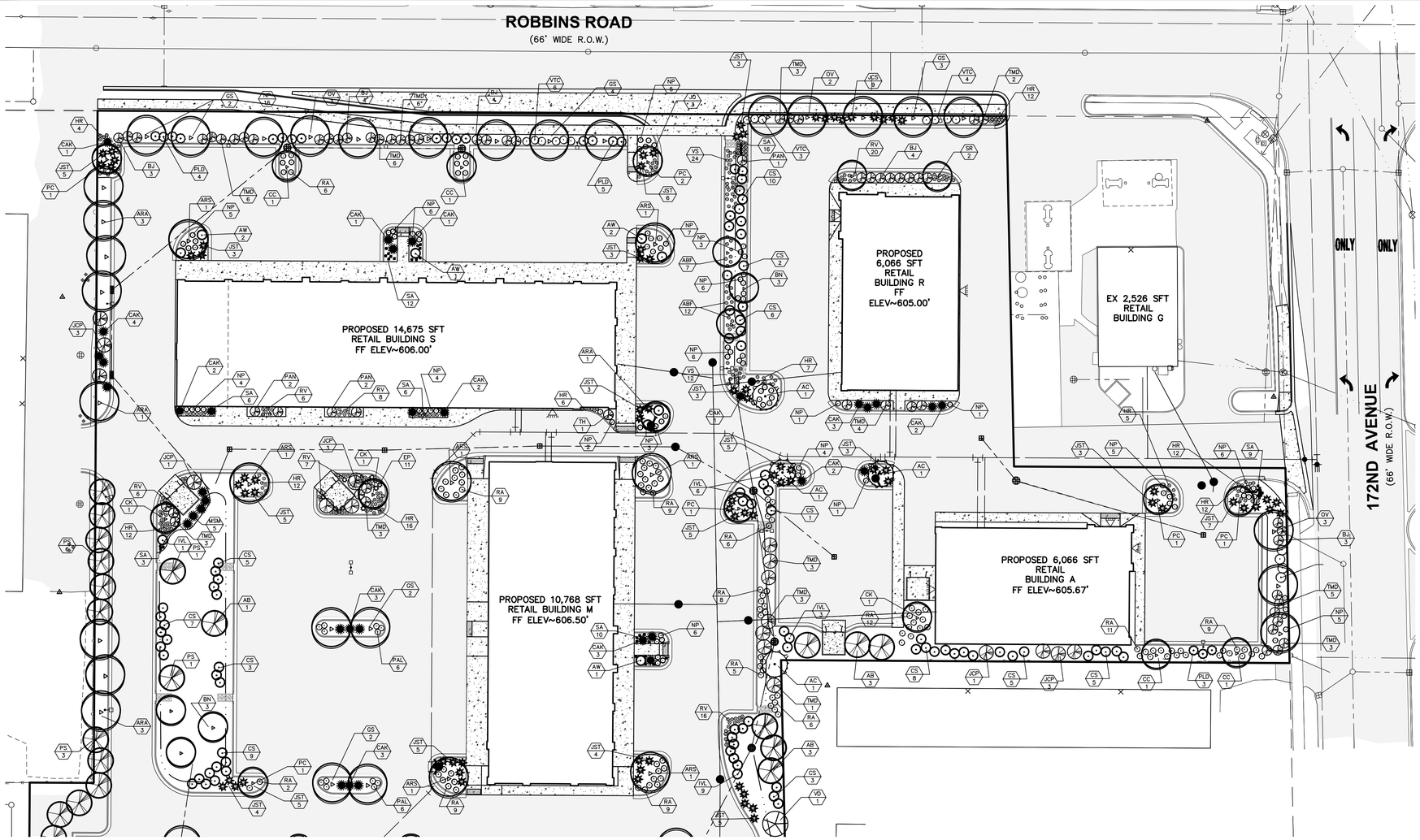
PLAN REVISIONS
ISSUED 11/09/17 SCHEMATIC DESIGN REVIEW
REV 12/28/17 REV PER REVIEW COMMENTS
REV 01/18/18 REV PER REVIEW COMMENTS
REV 03/07/18 REV PER TWP COMMENTS

LIGHTING & SIGNAGE PLAN
FOR
ROBBINS CENTER POINT P.U.D.
GRAND HAVEN TOWNSHIP, OTTAWA COUNTY, MICHIGAN

MOORE & BRUGGINK, INC.
Consulting Engineers
2020 Monroe Avenue N.W.
Grand Rapids, Michigan 49505-6298
Phone: (616) 363-9801 Web: www.mbce.com

FIELD SURVEY / DATE:	M&B-10-05-16
DESIGNED BY:	JFL
DESIGN DRAWN BY:	FEF
CHECKED BY:	JFL
PLAN DATE:	11/6/17
PROJECT NO.:	160190.01
SHEET NUMBER	7 OF 12

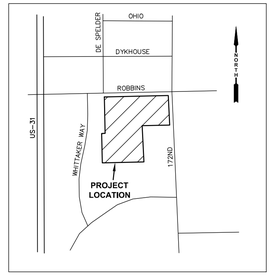
P:\160190.1 Visser - Robbins Road\CAD\DWG\160190 PUD PLAN SHEETS (2017).dwg_3/6/2018 3:56:03 PM_LISA FRIZZELL



NORTH

0 30 60

SCALE: 1" = 30'



LOCATION MAP
NO SCALE:

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1. ALL TREES TO HAVE CLAY OR CLAY LOAM BALLS, TREES WITH SAND BALLS WILL BE REJECTED.
2. ALL SINGLE STEM SHADE TREES TO HAVE STRAIGHT TRUNKS AND SYMMETRICAL CROWNS.
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10. YARD AREAS ARE TO BE RESTORED WITH 4" OF TOPSOIL, CLASS A SEED AT 200#/ACRE, FERTILIZER & MULCH (MULCH BLANKET ON SLOPES 1:3 OR STEEPER).
11. YARD AREAS THAT ARE CONSIDERED STORM AREAS AND SWALES TO BE SEEDED WITH A STORMWATER SEED MIX AND MULCH BLANKET
12. ALL UTILITY BOXES WILL BE SCREENED WITH PLANTINGS ONCE THE LOCATION IS DETERMINED.

PHASE ONE CONSTRUCTION SCHEDULE

ITEM	J	F	M	A	M	J	J	A	S	O	N	D
TEMP. EROSION CONTROL												
TOPSOIL STRIPPING												
SITE GRADING												
SITE UTILITIES												
DETENTION POND												
BUILDING CONSTRUCTION												
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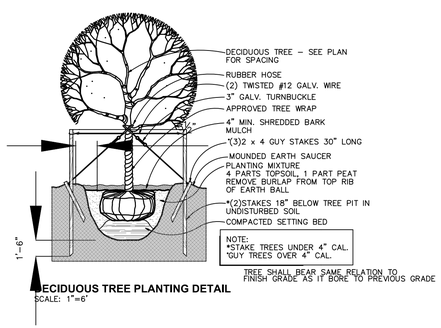
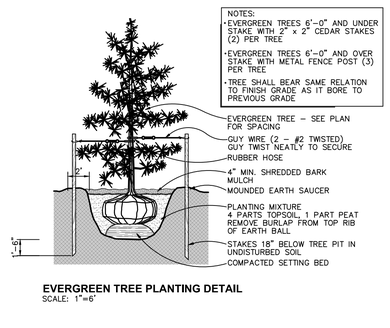


DECIDUOUS TREE PLANTING DETAIL
SCALE: 1"=6'



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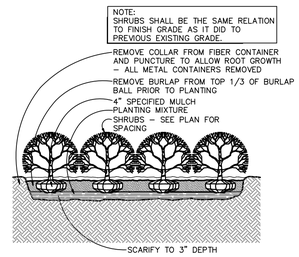

SHRUB PLANTING DETAIL
SCALE: 1"=2'

STORMWATER MIX

Grasses, Sedges & Rushes		PLS oz/acre
Carex bebbii	Bebb's oval sedge	1.75
Carex vulpinoidea	Fox Sedge	2.00
Elleocharis palustris	Great Spike Rush	1.00
Elymus virginicus	Virginia Wild Rye	16.00
Juncus effusus	Soft Rush	0.50
Juncus tenuis	Path Rush	0.50
Juncus torrey	Torrey's Rush	0.25
Panicum virgatum	Switchgrass	8.00
Scirpus pungens	Three square Rush	1.00
Scirpus validus	Soft-stem Bulrush	1.00
Sorghastrum nutans	Indian Grass	8.00
		40.00
Forbs		**PLS oz/acre**
Alisma subcordatum	Common Water Plantain	1.00
Asclepias incarnata	Swamp Milkweed	1.50
Aster novae-angliae	New England Aster	0.50
Aster umbellatus	Flat-topped Aster	0.50
Bidens cernua	Nodding Bur Marigold	1.00
Echinacea purpurea	Purple Coneflower	2.50
Helenium autumnale	Sneezeweed	1.00
Liatris spicata	Marsh Blazingstar	1.00
Lycopus americanus	Water Horehound	0.50
Mimulus ringens	Monkey Flower	0.25
Monarda fistulosa	Wild Bergamot	0.60
Oenothera biennis	Common Evening Primrose	2.20
Penthorum sedoides	Ditch Stonecrop	0.40
Physostegia virginiana	Obedient Plant	0.50
Polygonum pennsylvanicum	Pennsylvania Smartweed	1.25
Rudbeckia hirta	Black-eyed Susan	2.50
Verbena hastata	Blue Vervain	2.80
Zizia aurea	Golden Alexander	4.00
		24.00

Total Seeding Rate: 40 lbs per acre 2.5 lbs grasses + 1.5 lbs forbs + 36 lbs cover crop 101 native seeds per sq ft

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PLAN REVISIONS
ISSUED 01/18/18
REV 03/07/18 REV PER TWP COMMENTS

LANDSCAPE PLAN (NORTH)

FOR

ROBBINS CENTER POINT P.U.D.

GRAND HAVEN TOWNSHIP, OTTAWA COUNTY, MICHIGAN

MOORE & BRUGGINK, INC.
Consulting Engineers
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DESIGNED BY: JFL
DESIGN DRAWN BY: FEF
CHECKED BY: JFL
PLAN DATE: 11/6/17
PROJECT NO.: 160190.01

SHEET NUMBER 8 OF 12

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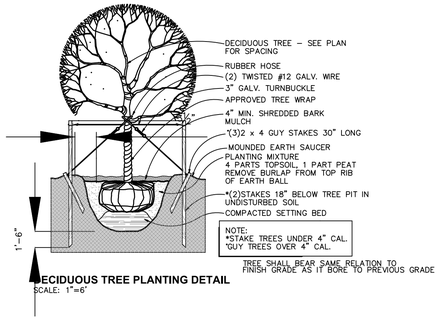

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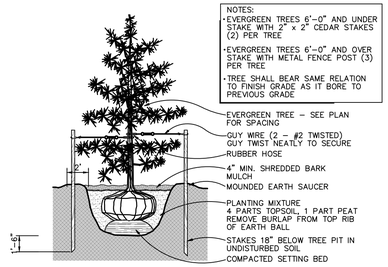
SCALE: 1"=6'



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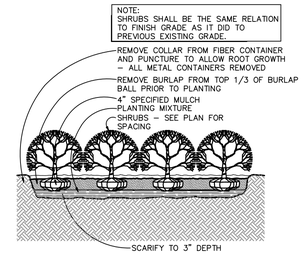

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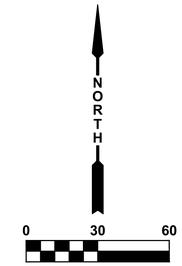
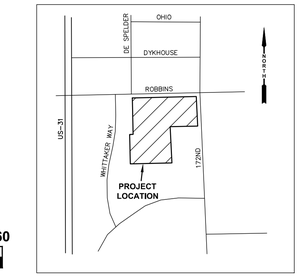
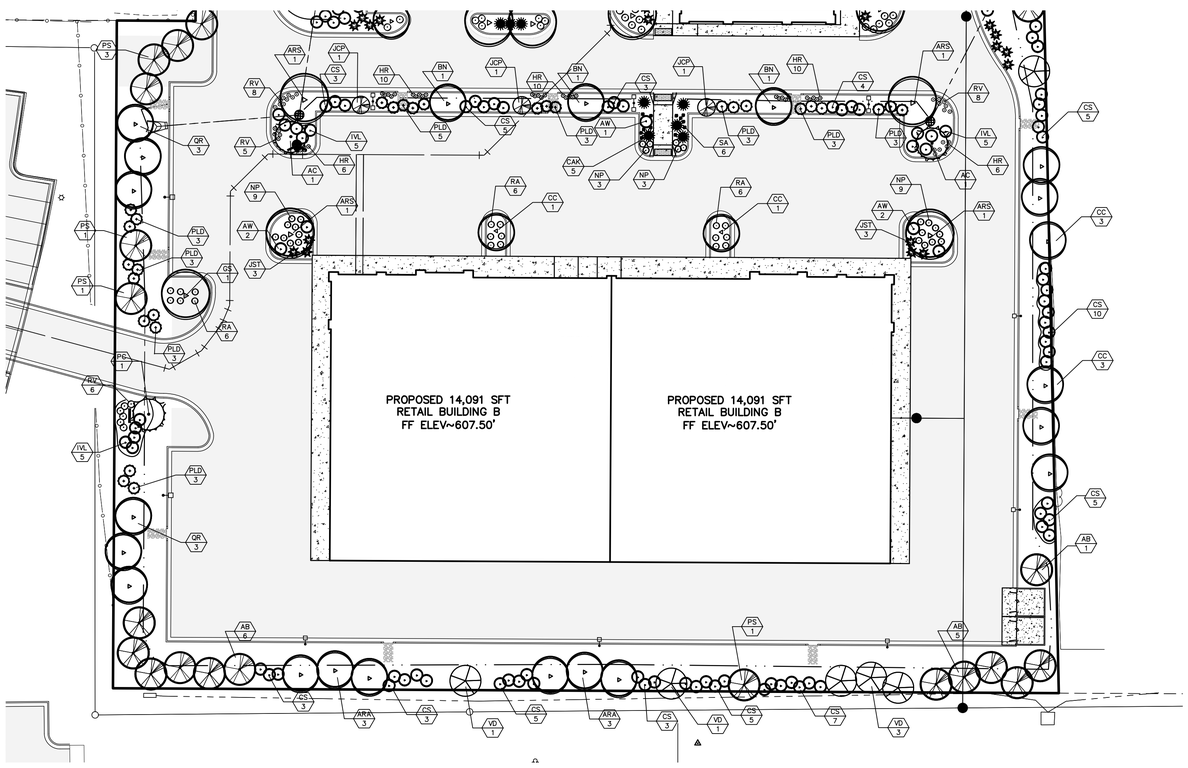


SCALE: 1" = 30'



LOCATION MAP
NO SCALE:



PLANT LIST					
CODE	QNTY.	BOTANICAL NAME	COMMON NAME	SIZE	DESCR.
DECIDUOUS CANOPY TREES					
ARS	12	Acer freemani 'Red Sunset'	Clump Red Sunset Maple	14–16'	B&B
ARA	13	Acer freemanni 'Autumn Blaze'	Autumn Blaze Red Maple	3½"	B&B
GS	14	Gleditsia tricanthos 'Suncole'	Sunburst Honey Locust	3 ½"	B&B
OV	8	Ostrya virginiana	Hophornbeam	3 ½"	B&B
QA	6	Quercus Bicolor	Swamp White Oak	3 ½"	B&B
EVERGREEN TREES					
AB	19	Abies balsamea	Balsam Fir	6'	B&B
PS	15	Pinus Strobus	White Pine	6"	B&B
ORNAMENTAL TREES					
AC	6	Amelanchier candensis 'Autumn Brilliance'	Autumn Brilliance Juneberry	10'Clump	B&B
CK	3	Cornus Kousa	Clump Chinese Dogwood	10' Clump	B&B
CC	12	Crataegus inermis 'Cruzam'	Thornless Crusader Hawthorn	2 1/2"	B&B
BN	6	Betula Nigra	River Birch	10' Clump	B&B
PC	8	Pyrus calleryana 'Redspire'	Redspire Flowering Pear	2 1/2"	B&B
SR	2	Syringa reticulata 'Ivory Silk'	Ivory Silk Tree Lilac	2 ½"	B&B
EVERGREEN SHRUBS					
BJ	21	Buxus microphylla japonica 'Winter Gem'	Winter Gem Boxwood	36"	B&B
JO	3	Juniperus chinensis 'Old Gold'	Old Gold Juniper	36"	B&B
JCP	14	Juniperus chinensis 'Keteleeri'	Upright Green Juniper	5–6'	B&B
JCS	12	Juniperus chinensis 'Sea Green'	Sea Green Juniper	36"	B&B
JST	59	Juniperus sabina tamariscifolia'	Tamarix Juniper	24"	B&B
PAN	5	Picea ables nidiformis	Bird's Nest Spruce	24"	B&B
TMD	51	Taxus x. media densiformis	Dense Yew	36"	B&B
TO	1	Thuja occidentalis Techny	Techny Arborvitea	6'	B&B
DECIDUOUS SHRUBS					
CS	125	Cornus servicea 'Farrow'	Arctic Fire Red Twig Dogwood	36"	B&B
AW	11	Spirea 'Anthony Waterer'	Anthony Waterer Spirea	24"	B&B
IVL	31	Itea virginica 'Little Henry'	Little Henry Viginia Sweetspire	36"	B&B
PLD	38	Physocarpus 'Little Devil'	Little Devil Ninebark	36"	B&B
RA	111	Rhus aromatica 'Gro–low'	Gro–low Sumac	36"	B&B
VD	5	Viburnum dentatum	Arrowwood Viburnum	4–5'	B&B
VTC	17	Viburnum trilobum 'Compactum'	Compact American Cranberry	36"	B&B
ORNAMENTAL GRASSES					
CAK	33	Calamagrotis 'Karl Foerster'	Karl Foerster Reed Grass	#5	Pot
MSM	5	Miscanthis Sinensis 'Morning Light'	Morning Light Japanese Silver Grass	#5	Pot
PERENNIALS					
VS	12	Acorus calamus 'Variegatus'	Variigated Sweet Flag	#1 Pot	18" o.c.
ABF	30	Agastache x 'Blue Fortune'	Blue Fortune Anise Hyssop	#1	18" o.c.
EP	11	Echinacea Purpurea 'Magnus'	Magnus Purple Coneflower	#1	14"o.c.
HR	134	Hemerocallis 'Happy Returns'	Happy Returns Daylily	#1	Pot
NP	95	Nepeta x Faassenii 'Walkers Low'	Walkers Low Catmint	#3	Pot
PAL	12	Perovskia atriplicfolia 'Little Spire'	'Little Spire' Russian Sage	#1	Pot
RV	83	Rudbeckia 'Viette's Little Suzy'	Little Suzy Dwarf Orange Coneflower	#1	Pot
SA	68	Sedum 'Autumn Joy'	Autumn Joy Sedum	#1	Pot

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PHASE ONE
CONSTRUCTION SCHEDULE

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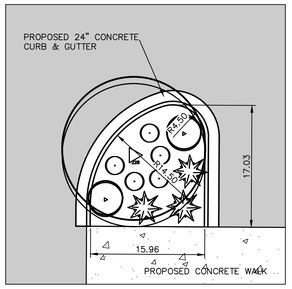
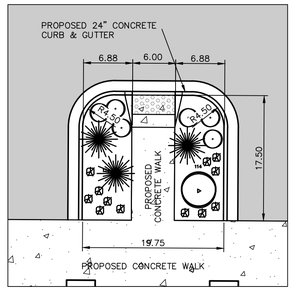
DESIGN DRAWN BY:	FEF
CHECKED BY:	JFL
PLAN DATE:	11/6/17
PROJECT NO.:	160190.01

SHEET NUMBER
9 OF 12

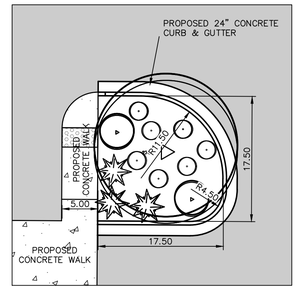
P:\160190.1 Visser - Robbins Road\CAD\DWG\160190 PUD PLAN SHEETS (2017).dwg, 3/6/2018 3:56:16 PM, LISA FRIZZELL



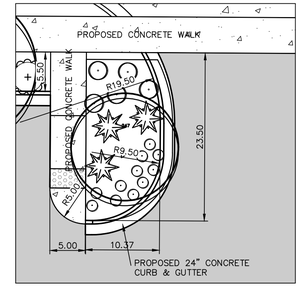
ISLAND "A"
228 SFT
SCALE: 1" = 10'



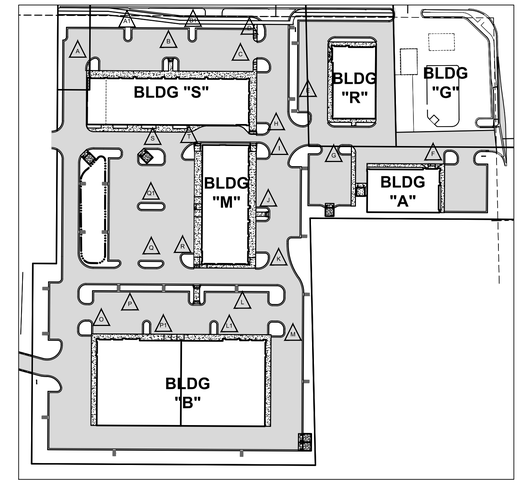
ISLAND "B"
228 SFT
SCALE: 1" = 10'



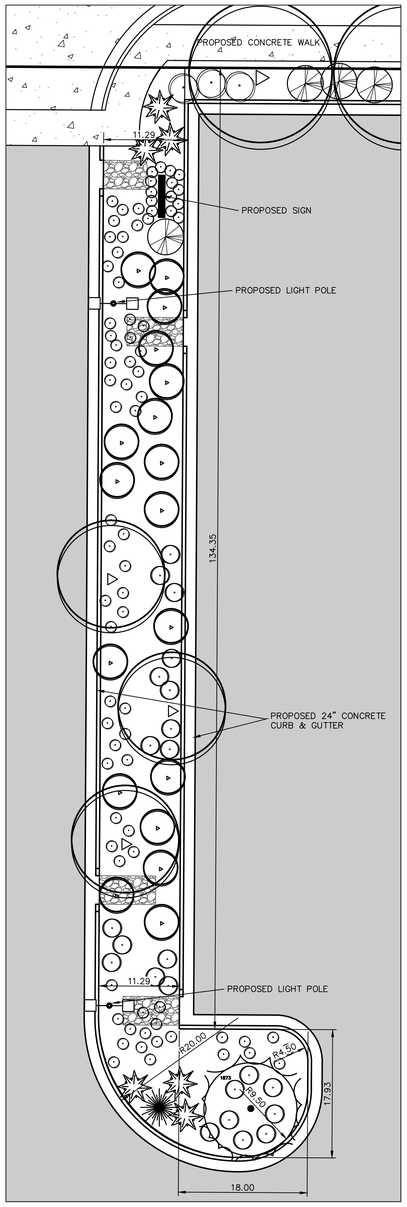
ISLAND "C"
274 SFT
SCALE: 1" = 10'



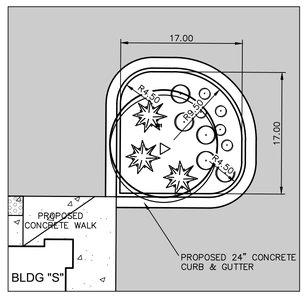
ISLAND "D"
247 SFT
SCALE: 1" = 10'



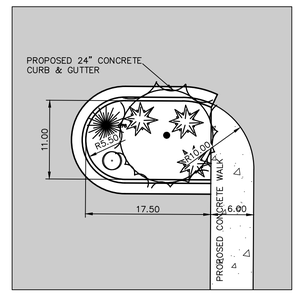
ISLAND MAP
SCALE: 1" = 100'



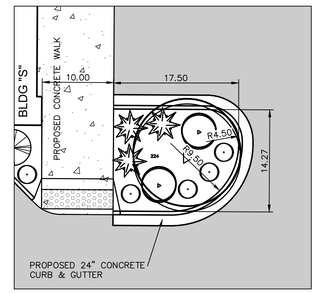
ISLAND "E"
1873 SFT
SCALE: 1" = 10'



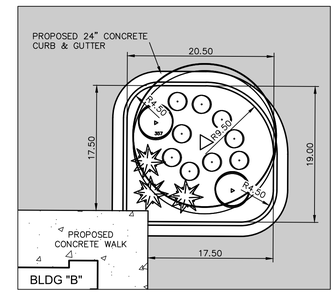
ISLAND "F"
261 SFT
SCALE: 1" = 10'



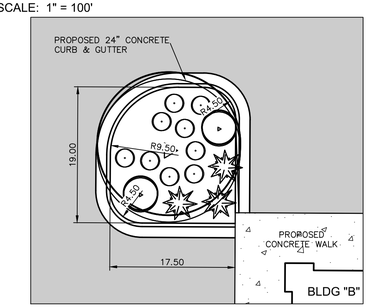
ISLAND "G"
178 SFT
SCALE: 1" = 10'



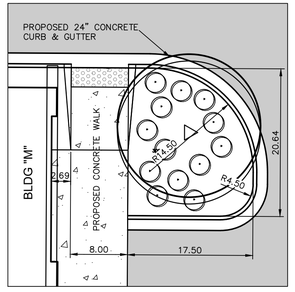
ISLAND "H"
224 SFT
SCALE: 1" = 10'



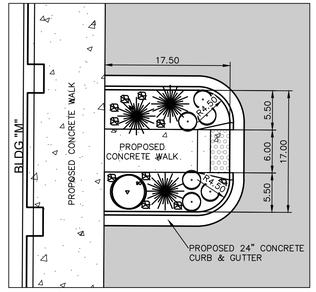
ISLAND "M"
357 SFT
SCALE: 1" = 10'



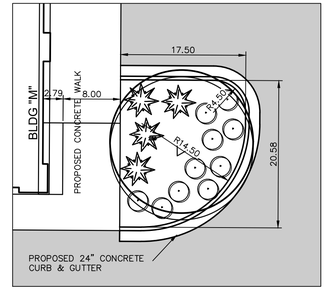
ISLAND "0"
308 SFT
SCALE: 1" = 10'



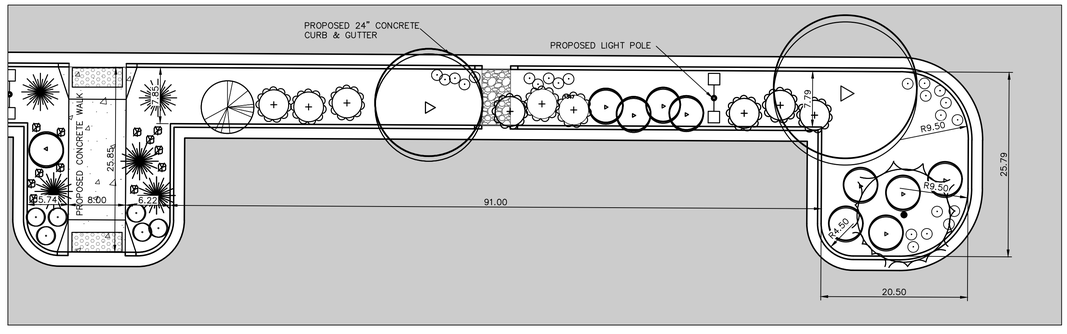
ISLAND "I"
306 SFT
SCALE: 1" = 10'



ISLAND "J"
180 SFT
SCALE: 1" = 10'



ISLAND "K"
280 SFT
SCALE: 1" = 10'



ISLAND "L"
1347 SFT
SCALE: 1" = 10'

ISLAND	AREA
A	228
B	228
C	274
D	247
E	1873
F	261
G	178
H	224
I	306
J	180
K	280
L	1347
M	357
N	0
O	308
P	1347
Q	234
R	276
S	472
T	257
A1	137
B1	137
L1	133
P1	133
Q1	266
TOTAL	9455

SHEET SCHEDULE

1 BOUNDARY & TOPOGRAPHIC SURVEY
2 REMOVAL PLAN
3 SITE PLAN
4 UTILITY PLAN (PRIVATE)
5 UTILITY PLAN (PUBLIC)
6 GRADING & SOIL EROSION CONTROL PLAN
7 LIGHTING & SIGNAGE PLAN
8 ENLARGED LANDSCAPE PLAN (NORTH)
9 ENLARGED LANDSCAPE PLAN (SOUTH)
10 PARKING ISLAND DETAILS "A" -"O"
11 PARKING ISLAND DETAILS "P" - "T"
12 CONSTRUCTION DETAILS
13 SITE PLAN OPTION "B"

PREPARED FOR:
VBSSER BROTHERS, INC
1946 TURNER AVENUE, NW
GRAND RAPIDS, MI 49504
PH (616) 363-3825
FX (616) 363-6477

WWW.VISSERBROTHERS.COM

ATTN: MR BILL MAST

PLAN REVISIONS
ISSUED 11/09/17 SCHEMATIC DESIGN REVIEW
REV 12/28/17 REV PER REVIEW COMMENTS
REV 01/18/18 REV PER REVIEW COMMENTS
REV 03/07/18 REV PER TWP COMMENTS

PARKING ISLAND DETAILS A-O

FOR

ROBBINS CENTER POINT P.U.D.

GRAND HAVEN TOWNSHIP, OTTAWA COUNTY, MICHIGAN

MOORE & BRUGGINK, INC.
Consulting Engineers
2020 Monroe Avenue N.W.
Grand Rapids, Michigan 49505-6298
Phone: (616) 363-9801 Web: www.mbce.com

FIELD SURVEY / DATE:	M&B-10-05-16
DESIGNED BY:	JFL
DESIGN DRAWN BY:	FEF
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PLAN DATE:	11/6/17
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SHEET NUMBER
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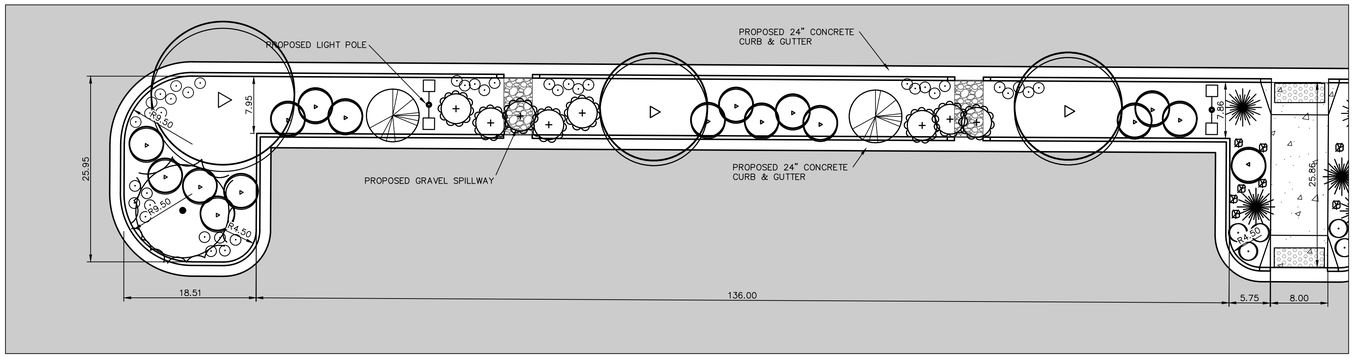
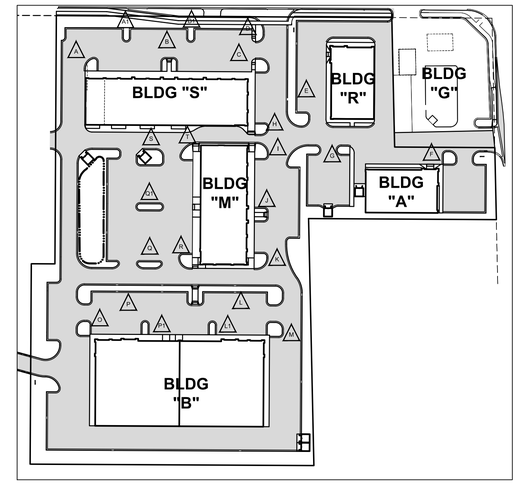


ISLAND "P"
1347 SFT
SCALE: 1" = 10'



ISLAND MAP
SCALE: 1" = 100'

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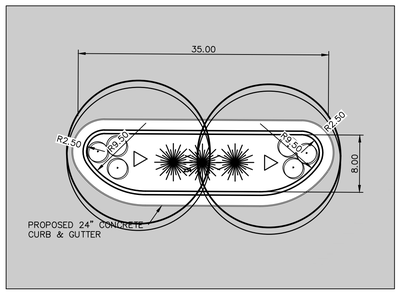
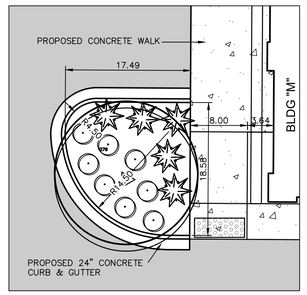
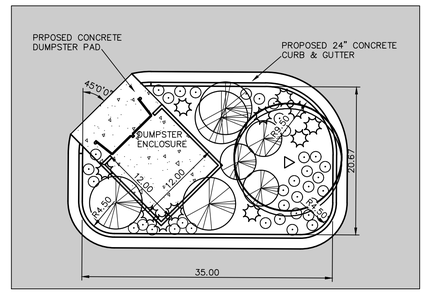


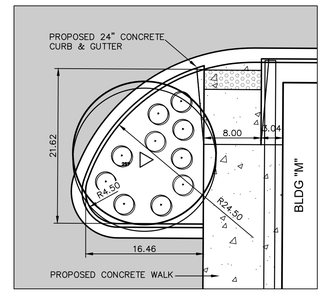
ISLAND "Q"
234 SFT
SCALE: 1" = 10'



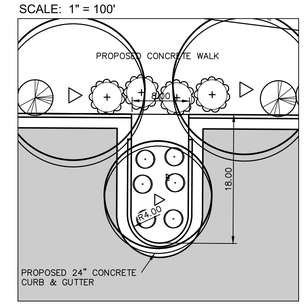
ISLAND "R"
276 SFT
SCALE: 1" = 10'



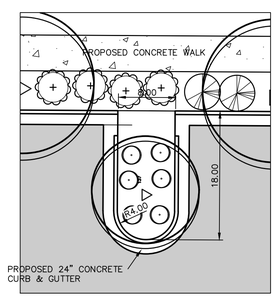
ISLAND "S"
472 SFT
SCALE: 1" = 10'



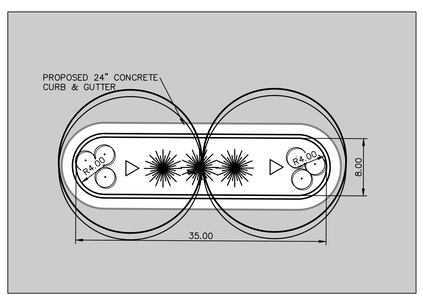
ISLAND "T"
257 SFT
SCALE: 1" = 10'



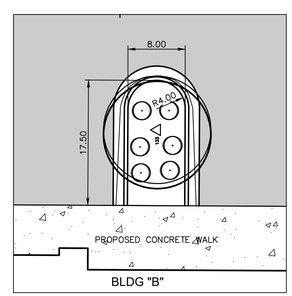
ISLAND "A1"
137 SFT
SCALE: 1" = 10'



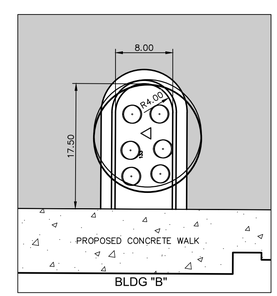
ISLAND "B1"
137 SFT
SCALE: 1" = 10'



ISLAND "Q1"
266 SFT
SCALE: 1" = 10'



ISLAND "P1"
133 SFT
SCALE: 1" = 10'



ISLAND "L1"
133 SFT
SCALE: 1" = 10'

SHEET SCHEDULE

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10 PARKING ISLAND DETAILS "A" -"O"
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13 SITE PLAN OPTION "B"

PREPARED FOR:
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1946 TURNER AVENUE, NW
GRAND RAPIDS, MI 49504
PH (616) 363-3825
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ATTN: MR BILL MAST

PLAN REVISIONS
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PARKING ISLAND DETAILS P-T
FOR
ROBBINS CENTER POINT P.U.D.
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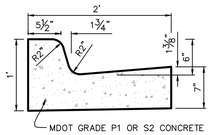
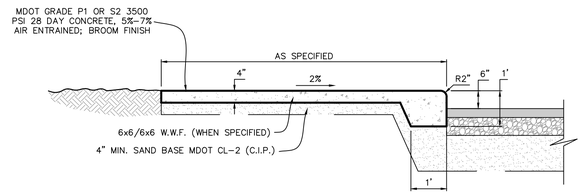
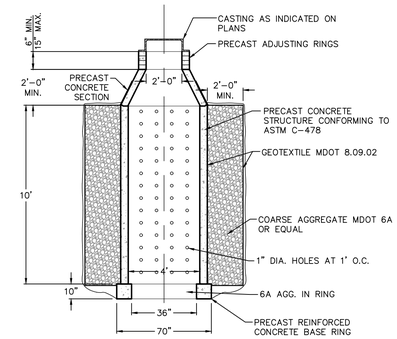
P:\160190.1 Visser - Robbins Road\CAD\DWG\160190 PUD PLAN SHEETS (2017).dwg, 3/6/2018 3:57:20 PM, LISA FRIZZELL



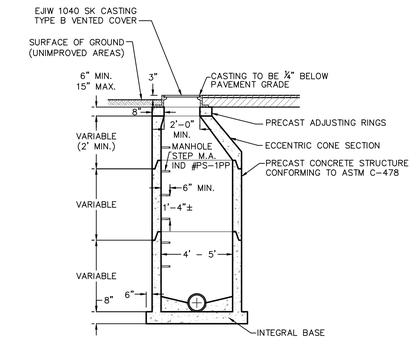
24" CURB & GUTTER DETAIL
(STANDARD RESIDENTIAL/COMMERCIAL)
SCALE: 1"=1'



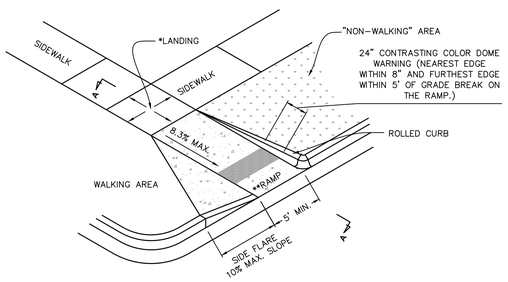
COMPOSITE CONCRETE WALK & CURB DETAIL
SCALE: 1"=2'



LEACHING BASIN DETAIL
SCALE: 1"=4'



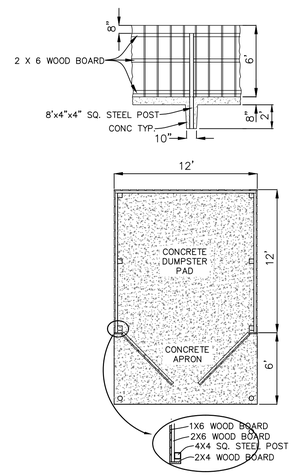
STORM SEWER MANHOLE DETAIL
SCALE: 1"=4'



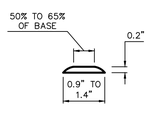
* MAXIMUM LANDING SLOPE IN ANY DIRECTION IS 2%. MINIMUM LANDING DIMENSIONS 5'x5'.

** MAXIMUM CROSS SLOPE ON RAMP IS THE SAME AS THAT FOR SIDEWALK (2%).

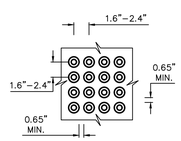
SIDEWALK RAMP TYPE F DETAIL
SCALE: 1"=8'



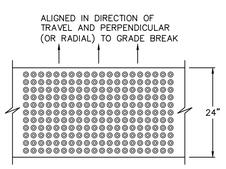
WOOD DUMPSTER ENCLOSURE DETAIL
SCALE: 1" = 6'



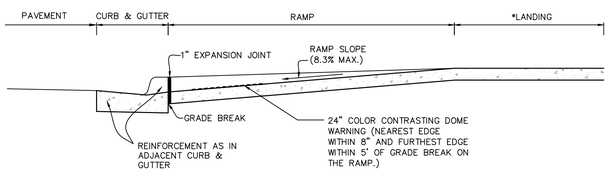
DOME SECTION
SCALE: 1"=10'



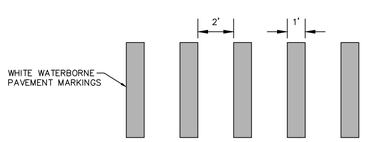
DOME SPACING
SCALE: 1"=10'



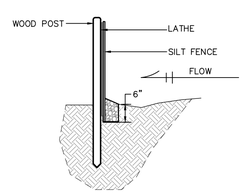
DOME ALIGNMENT
SCALE: 1"=2'



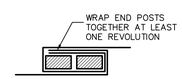
SECTION A-A
SCALE: 1"=4'



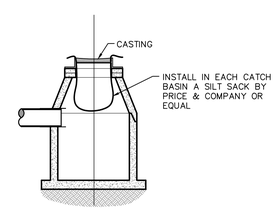
CROSS HATCHING PAVEMENT MARKING DETAIL
SCALE: 1"=4'



SILT FENCE DETAIL
SCALE: 1"=2'



SPLICE DETAIL



INLET PROTECTION DETAIL
SCALE: 1"=4'

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ATTN: MR BILL MAST

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

Utility locations are approximate only. Please contact "Miss Dig" three working days prior to the start of construction for exact locations. (1-800-482-7171)

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FIELD SURVEY / DATE:	M&B-10-05-16
DESIGNED BY:	JFL
DESIGN DRAWN BY:	FEF
CHECKED BY:	JFL
PLAN DATE:	11/6/17
PROJECT NO.:	160190.01
SHEET NUMBER	12 OF 12

P:\160190.1 Visser - Robbins Road\CAD\DWG\160190 PUD PLAN SHEETS (2017).dwg, 3/6/2018 3:57:25 PM, LISA FRIZZELL

ROBBINS CENTRE POINTE

BUILDING A&S

Robbins Road at 172nd
Grand Haven (Township), Michigan 49417

ISSUED:

01/24/2018 SCHEMATIC DESIGN REVIEW

SHEET INDEX:

CIVIL 1 OF 11	BOUNDRY & TOPOGRAPHIC SURVEY
CIVIL 2 OF 11	REMOVAL PLAN
CIVIL 3 OF 11	SITE PLAN
CIVIL 4 OF 11	UTILITY PLAN (PRIVATE)
CIVIL 5 OF 11	UITLITY PLAN (PUBLIC)
CIVIL 6 OF 11	GRADING & SOIL EROSION CONTROL PLAN
CIVIL 7 OF 11	LANDSCAPE, LIGHTING AND SIGNAGE PLAN
CIVIL 8 OF 11	PARKING ISLAND DETAILS A-O
CIVIL 9 OF 11	PARKING ISLAND DETAILS P-T
CIVIL 10 OF 11	CONSTRUCTION DETAILS
CIVIL 11 OF 11	SITE PLAN OPTION B
CIVIL DRIVE 1 OF 1	DRIVE EXHIBIT MAP
ES101	SITE LIGHTING
A111	RETAIL S FLOOR PLAN
A121	RETAIL A FLOOR PLAN & ELEVATIONS
A511	RETAIL S EXTERIOR ELEVATIONS
A513	SITE SIGNAGE
AP101	RETAIL S PERSPECTIVE

APPLICABLE CODES AND STANDARDS

THE PRIMARY CODE USED FOR THIS SUMMARY IS NFPA 101 LIFE SAFETY 2015. THE IBC 2015 IS ONLY USED WHEN NFPA 101 IS SILENT ON THE SUBJECT MATTER, OR THE IBC IS SPECIFICALLY REFERENCED.

NEW CONSTRUCTION

JURISDICTION:
GRAND HAVEN CHARTER TOWNSHIP, MICHIGAN

APPLICABLE CODES:
- BUILDING: 2015 MICHIGAN BUILDING CODE (MBC)\\
- MECHANICAL:2015 MICHIGAN MECHANICAL CODE (MMC)
- PLUMBING: 2015 MICHIGAN PLUMBING CODE (MPC)
- ELECTRICAL: 2014 NATIONAL ELECTRIC CODE
- ICC/ANSI A117.1 2009 (ACCESSIBILITY CODE)

CHAPTER 3 OCCUPANCY CLASSIFICATION:
- GROUP M, MERCANTILE / A2, ASSEMBLY

CHAPTER 5 ALLOWABLE HEIGHT AND BUILDING AREA:

CONSTRUCTION CLASS:		**2B** SPRINKLED
ALLOWABLE HEIGHT:		1 STORY
ALLOWABLE AREA:	A-2	38,000 SQ. FT.
ACTUAL:		14,808 SQ. FT.

CHAPTER 6 CONSTRUCTION TYPE:
BUILDING CONSTRUCTION: **2B** SECTION 5.3 OF M.B.C. 2015
- EXTERIOR WALLS: ANY MATERIAL PERMITED BY CODE
- INTERIOR WALLS: ANY MATERIAL PERMITED BY CODE

Fire Resistance Requirements for Building Elements - Table 601 / 713

Building Element	Required	Provide
Structural Framing	0 hr.	0 hr.
Bearing Walls - <5'	0 hr.	0 hr.
Bearing Walls - >30'	0 hr.	0 hr.
Nonbearing - Exterior <5'	0 hr.	0 hr.
Nonbearing - Exterior >30'	0 hr.	0 hr.
Nonbearing - Interior	0 hr.	0 hr.
Supporting beams and joist	0 hr.	0 hr.
Roof Structure	0 hr.	0 hr.

CHAPTER 7 FIRE RATING:
Section 508.4 (Building is Sprinkled)

CHAPTER 8 INTERIOR WALL AND CEILING FINISHES:
Class B finishes shall be provided for exit enclosures and exit passageways.
- Flame spread 26-75, smoke development 0-450

Class C finishes shall be provided for corridors.
- Flame spread 76-200, smoke development 0-450

Class C finishes shall be allowed in all other areas
- Flame spread 76-200, smoke development 0-450

CHAPTER 9 FIRE SUPRESSION SYSTEM:

FIRE SUPRESSION IS REQUIRED PER **903.2.8**
- Fire supression drawings shall be submitted by others for review and approval prior to installation

PORTABLE FIRE EXTINGUISHERS IS REQUIRED PER **906**
Provide in the following locations:
1. Near exits and pull stations and as directed by Fire Marshall
2. Within 30' of commercial cooking equipment.
3. Special-hazard areas including but not limited to labotories, computer rooms, and generator rooms; where required by the fire code official.
4. Maximum travel distance to extinguisher is 75 feet.

FIRE ALARM SYSTEM IS REQUIRED PER **907.2.9**
- Fire alarm drawings shall be sumbitted by others for review and approval and approval prior to installation.

CHAPTER 10 EGRESS REQUIREMENTS:
OCCUPANCY: SECTION 1004

*Refer to future tenant Interior final plans by others.

NUMBER OF EXITS PROVIDED:

Tenant 1:	2 Exits
Tenant 2:	2 Exits
Tenant 3:	2 Exits
Tenant 4:	2 Exits
Tenant 5:	2 Exits
Tenant 6:	2 Exits
Tenant 7:	2 Exits
Tenant 8:	2 Exits
Tenant 9:	2 Exits
Tenant 10:	2 Exits

CHAPTER 17 SPECIAL INSPECTIONS:
SPECIAL INSPECTIONS SHALL BE PERFORMED BY A QUALIFIED PERSON PER MBC 2015 SECTION 1704.1 AND SUCH REPORTS WILL BE PROVIDED TO THE BUILDING DEPARTMENT FOR THEIR RECORD.

SPECIAL INSPECTIONS ARE REQUIRED FOR: SOILS (1705.6), MASONRY (1705.4), CONCRETE (1705.3), WOOD TRUSSES (1705.5), STEEL (1705.2)

A DETAILED SOILS INVESTIGATION REPORT PER SECTION 1705.6 AND SPECIAL INSPECTIONS FOR SITE SOILS CONDITIONS PER 1705.6 AND TABLE 1705.6 MUST BE SUBMITTED TO THE TOWNSHIP AND DESIGN PROFESSIONAL FOR THEIR RECORDS.

PRE-ENGINEERED TRUSSES SHALL HAVE SPECIAL INSPECTIONS AT THE MANUFACTURUER THOSE TEST SHALL BE SUBMITTED FOR RECORD TO THE DESIGNER AND THE BUILDING OFFICAL.

MOORE & BRUGGINK, INC.
Consulting Engineers
MOORE & BRUGGINK
2020 MONROE AVE NW
GRAND RAPIDS, MI 49505
(616) 363-8601

Classic Engineering, LLC
Engineering Consultants
CLASSIC ENGINEERING
100 GRANDVILLE AVE SW
STE 400
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ROBBINS CENTRE POINTE
1604-11

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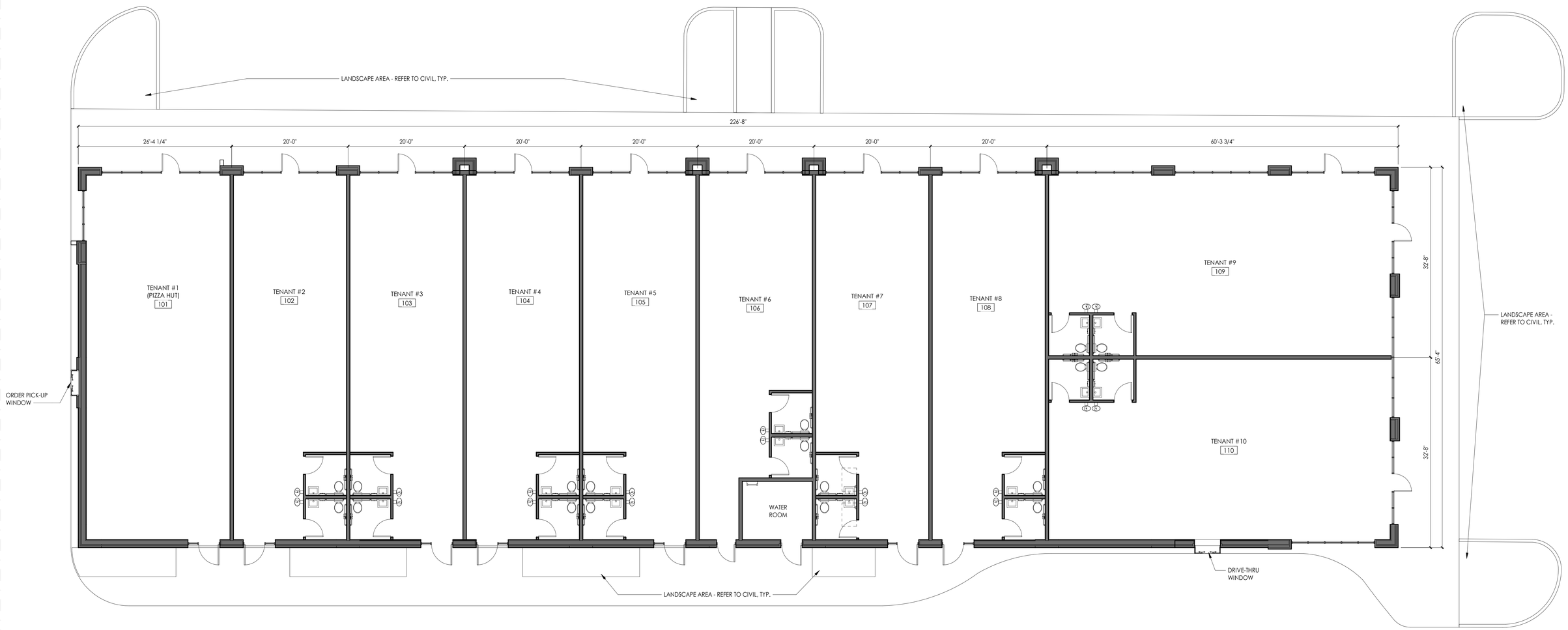
PROGRAM AREA

Name	Number	Area
FIRST FLOOR		
TENANT #1 (PIZZA HUT)	101	1636 SF
TENANT #2	102	1277 SF
TENANT #3	103	1276 SF
TENANT #4	104	1276 SF
TENANT #5	105	1276 SF
TENANT #6	106	1136 SF
TENANT #7	107	1274 SF
TENANT #8	108	1276 SF
TENANT #9	109	1894 SF
TENANT #10	110	1900 SF
UTILITY	111	139 SF
		14358 SF
Grand total		14358 SF



1 FIRST FLOOR PLAN
1/8" = 1'-0"

ROBBINS CENTRE POINTE

RETAIL S FLOOR PLAN

Robbins Road, Grand Haven Township

A111

1604-11
01/24/2018

STATE OF MICHIGAN
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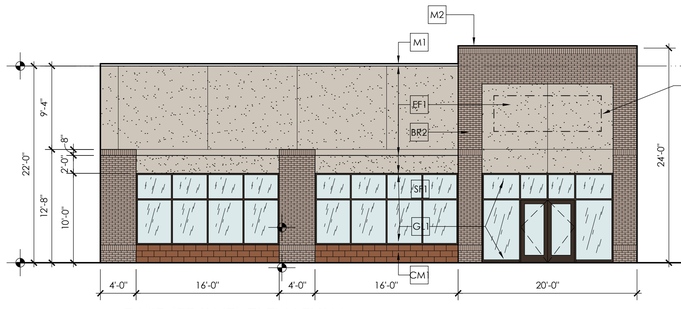
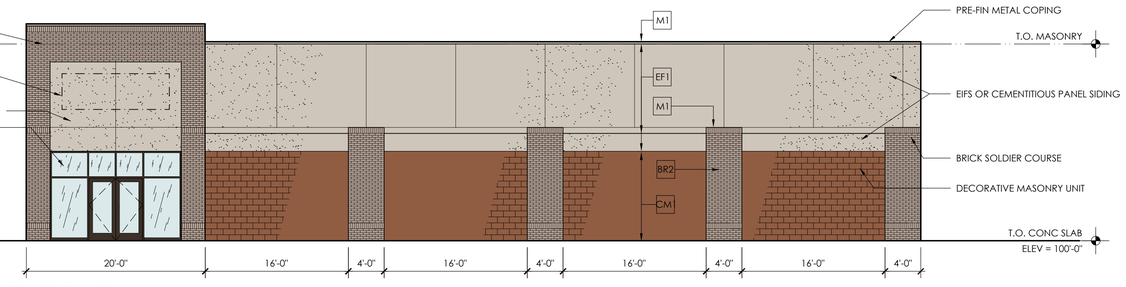
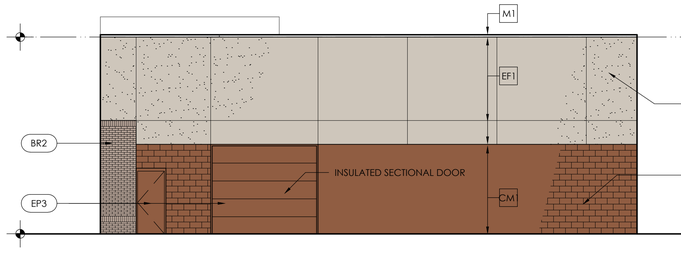


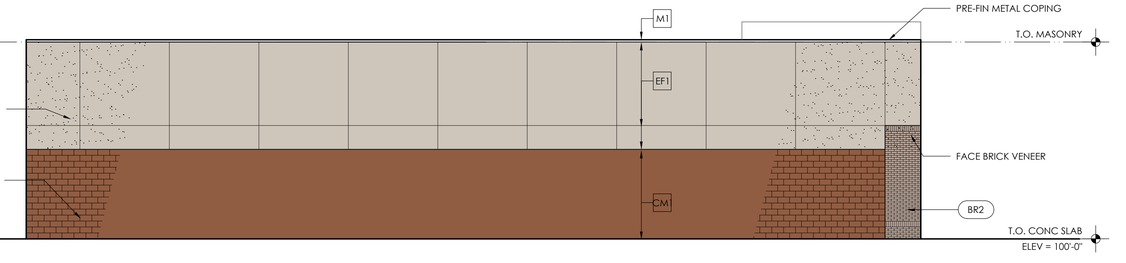
5 EAST (FRONT) ELEVATION
1/8" = 1'-0"



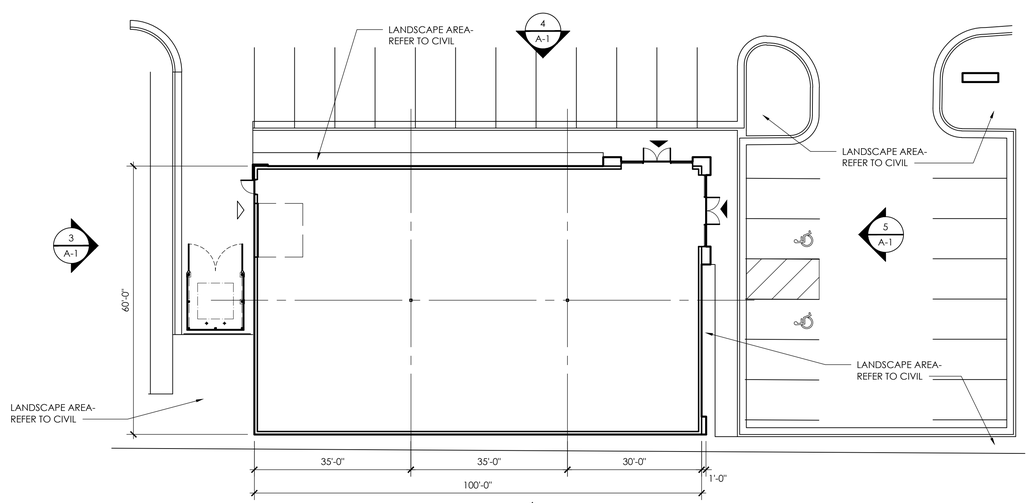
4 NORTH ELEVATION
1/8" = 1'-0"



3 WEST ELEVATION
1/8" = 1'-0"



2 SOUTH ELEVATION
1/8" = 1'-0"



1 PARTIAL SITE PLAN
1/16" = 1'-0"

EXTERIOR MATERIALS

MARK	MATERIAL	LOCATION	MANUFACTURER	COLOR, STYLE	REMARKS
BR1	BRICK (DARK)	-	BELDEN	BISMARK BLEND	-
BR2	BRICK (LIGHT)	-	BELDEN	LANDMARK GRAY	-
CM1	DECORATIVE CMU	FIELD	CONSUMERS	RED HILL, SPLIT FACE	COLORED MORTAR
CM1B	DECORATIVE CMU	FIELD	CONSUMERS	RED HILL, SMOOTH FACE	COLORED MORTAR
CM2	DECORATIVE CMU	FIELD	CONSUMERS	NATURAL, SPLIT FACE	COLORED MORTAR
CM2B	DECORATIVE CMU	FIELD	CONSUMERS	NATURAL , SMOOTH FACE	COLORED MORTAR
EF1	EIFS	FIELD	STO/DRYVIT	MATCH EP1	ALT SMOOTH CEMENTITIOUS PANEL
M1	METAL (LIGHT)	COPING	-	CLASSIC BRONZE	-
M2	METAL (DARK)	COPING, ENTRY	-	-	-
SF1	ALUM FRAME	-	-	CLASSIC BRONZE	THERMAL BREAK
GL1	GLASS	STOREFRONT	-	CLEAR	1" INSULATED, LOW-E, >75% VLT
EP1	PAINT (LIGHT)	SEE ELEV.	SHERWIN WILLIAMS	SW7043 WORLDLY GRAY	-
EP2	PAINT (DARK)	SEE ELEV.	SHERWIN WILLIAMS	SW6991 BLACK MAGIC	-
EP3	PAINT (DARK)	SEE ELEV.	SHERWIN WILLIAMS	SW6047 HOT COCOA	-

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ROBBINS CENTRE POINTE

RETAIL A FLOOR PLAN & ELEVATIONS

Robbins Road, Grand Haven Township

A121

FILE: 1604-11
DATE: 01/24/2018

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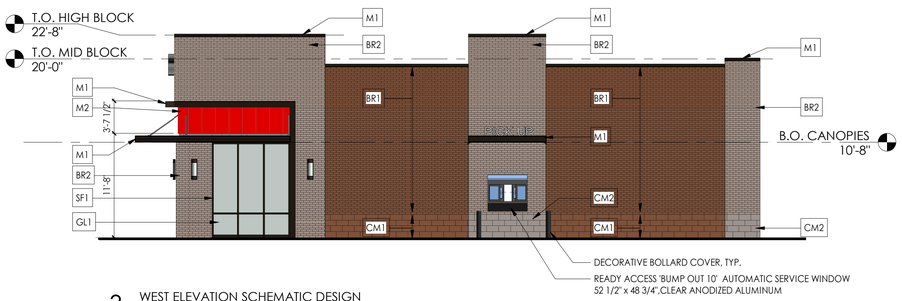
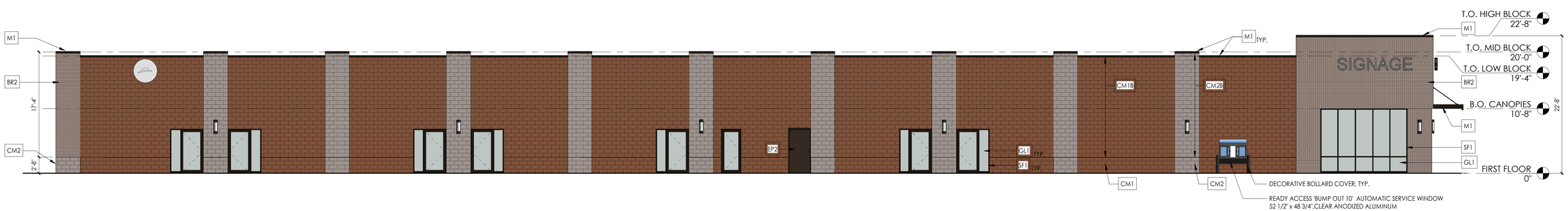
4 NORTH ELEVATION SCHEMATIC DESIGN
1/8" = 1'-0"



3 WEST ELEVATION SCHEMATIC DESIGN
1/8" = 1'-0"

2 EAST ELEVATION SCHEMATIC DESIGN
1/8" = 1'-0"



1 SOUTH ELEVATION SCHEMATIC DESIGN
1/8" = 1'-0"

EXTERIOR WALL AREA MATERIAL UTILIZATION:

WALL SURFACE AREAS:	
A. **NORTH ELEVATION** TOTAL AREA =	4,970 S.F.
• STOREFONT AREA =	1,906 S.F.
• OPAQUE AREA =	3,064 S.F.
• BRICK AREA =	2,940 S.F.
• BRICK % =	**95.9%**
B. **WEST ELEVATION** TOTAL AREA =	1,358 S.F.
• STOREFONT AREA =	92 S.F.
• OPAQUE AREA =	1,266 S.F.
• BLOCK AREA =	130 S.F.
• BRICK AREA =	1,068 S.F.
• BRICK AREA % =	**84.3%**
C. **SOUTH ELEVATION** TOTAL AREA =	4,486 S.F.
• STOREFONT AREA =	584 S.F.
• OPAQUE AREA =	3,902 S.F.
• BLOCK AREA=	3,476 S.F.
• BRICK AREA =	426 S.F.
• BRICK AREA % =	**11%**
D. **EAST ELEVATION** TOTAL AREA:	1,424 S.F.
• STOREFONT AREA =	584 S.F.
• OPAQUE AREA =	897 S.F.
• BRICK AREA =	897 S.F.
• BRICK AREA % =	**100%**

EXTERIOR ELEVATION GENERAL NOTES

1. ALL PRE-FINISHED METAL COLORS ARE TO BE SELECTED BY ARCHITECT FROM MANUFACTURER'S (STANDARD - CUSTOM - COLORS) SELECTIONS U.N.O.
2. AL WALL CAPS, VENTS, LOUVERS, SURFACE MOUNTED PIPES, ETC. ARE TO BE PAINTED OR PRE-FINISHED TO MATCH ADJACENT SURFACES U.N.O.
3. ALL SOFFITS AND FASCIAS TO ALIGN & MATCH.
4. SLOPE ALL GUTTERS 1/8" PER FOOT (MIN.)
5. LOCATE EXTERIOR WALL CONTROL JOINTS AT DOOR / WINDOW / STOREFRONT OPENING AS SHOWN. INTERIOR & EXTERIOR CONTROL JOINTS ON THE SAME WALL ARE TOO ALIGN.
6. CONNECT ALL DOWNSPOUTS TO CIVIL DRAIN LEADS. COORDINATE WITH CIVIL.
7. DOOR & FRAME TYPES, REFER TO SHEET A201

C.J= CONTROL JOINT. SEE DETAIL 4 / A202

T = TEMPERED GLASS

SF1 DENOTES STOREFRONT TYPE. SEE SHEET A201 FOR STOREFRONT TYPES & INFORMATION

C1 DENOTES WALL TYPE. SEE SHEET A202 FOR WALL TYPES & INFORMATION

EXTERIOR MATERIALS

###					
MARK	MATERIAL	LOCATION	MANUFACTURER	COLOR, STYLE	REMARKS
BR1	BRICK (DARK)	-	BELDEN	BISMARK BLEND	-
BR2	BRICK (LIGHT)	-	BELDEN	LANDMARK GRAY, SMOOTH	OVERSIZED -DOUBLE MONARCH
CM1	DECORATIVE CMU	FIELD	CONSUMERS	RED HILL, SPLIT FACE	COLORED MORTAR
CM1B	DECORATIVE CMU	FIELD	CONSUMERS	RED HILL, SMOOTH FACE	COLORED MORTAR
CM2	DECORATIVE CMU	FIELD	CONSUMERS	NATURAL, SPLIT FACE	COLORED MORTAR
CM2B	DECORATIVE CMU	FIELD	CONSUMERS	NATURAL , SMOOTH FACE	COLORED MORTAR
EF1	EIFS	FIELD	STO/DRYVIT	MATCH EP1	ALT SMOOTH CEMENTITIOUS PANEL
M1	METAL (LIGHT)	COPING, CANOPIES, STOREFRONT	-	CLASSIC BRONZE	-
M2	METAL (SPECIALTY)	ACCENT	MBCI OR EQ.	TENANT SPECIFIED RED	VERTICAL METAL PANEL
SF1	ALUM FRAME	-	-	CLASSIC BRONZE	THERMAL BREAK
GL1	GLASS	STOREFRONT	-	CLEAR	1" INSULATED, LOW-E, >75% VLT
EP1	PAINT (LIGHT)	SEE ELEV.	SHERWIN WILLIAMS	SW7043 WORLDLY GRAY	-
EP2	PAINT (DARK)	SEE ELEV.	SHERWIN WILLIAMS	SW6991 BLACK MAGIC	-

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ROBBINS CENTRE POINTE

RETAIL S EXTERIOR ELEVATIONS

Robbins Road, Grand Haven Township

A511

1604-11
01/24/2018

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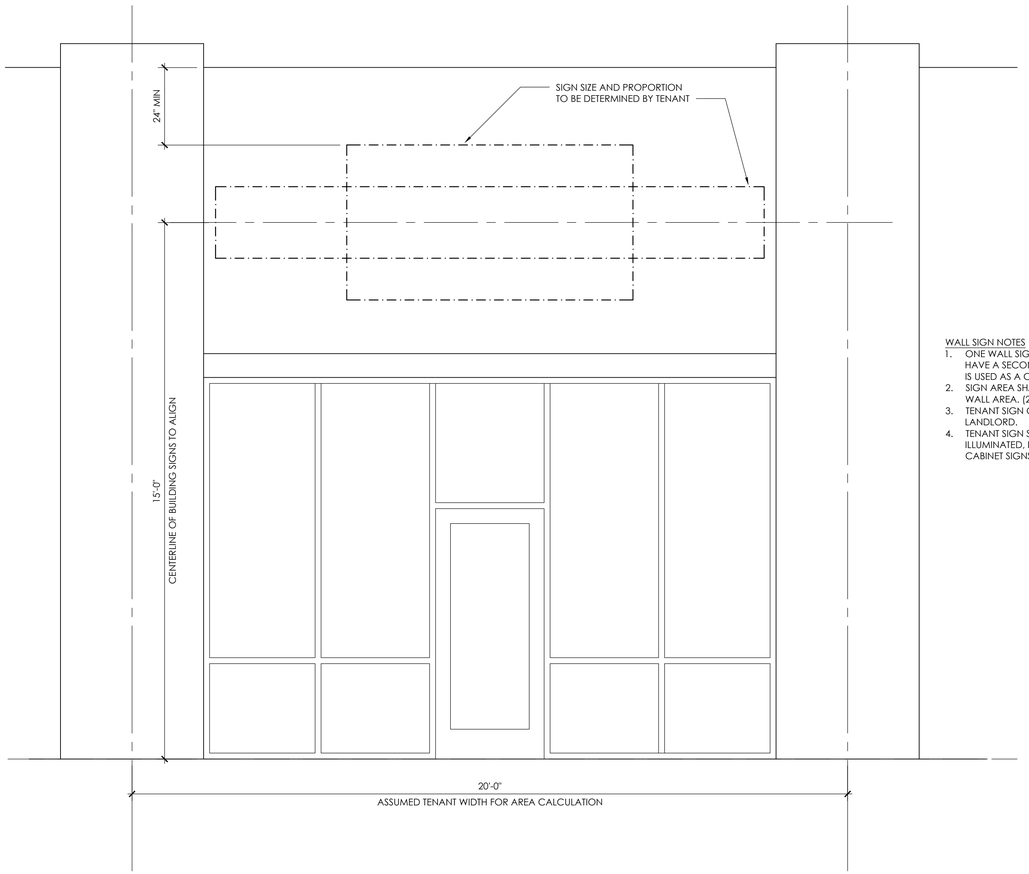
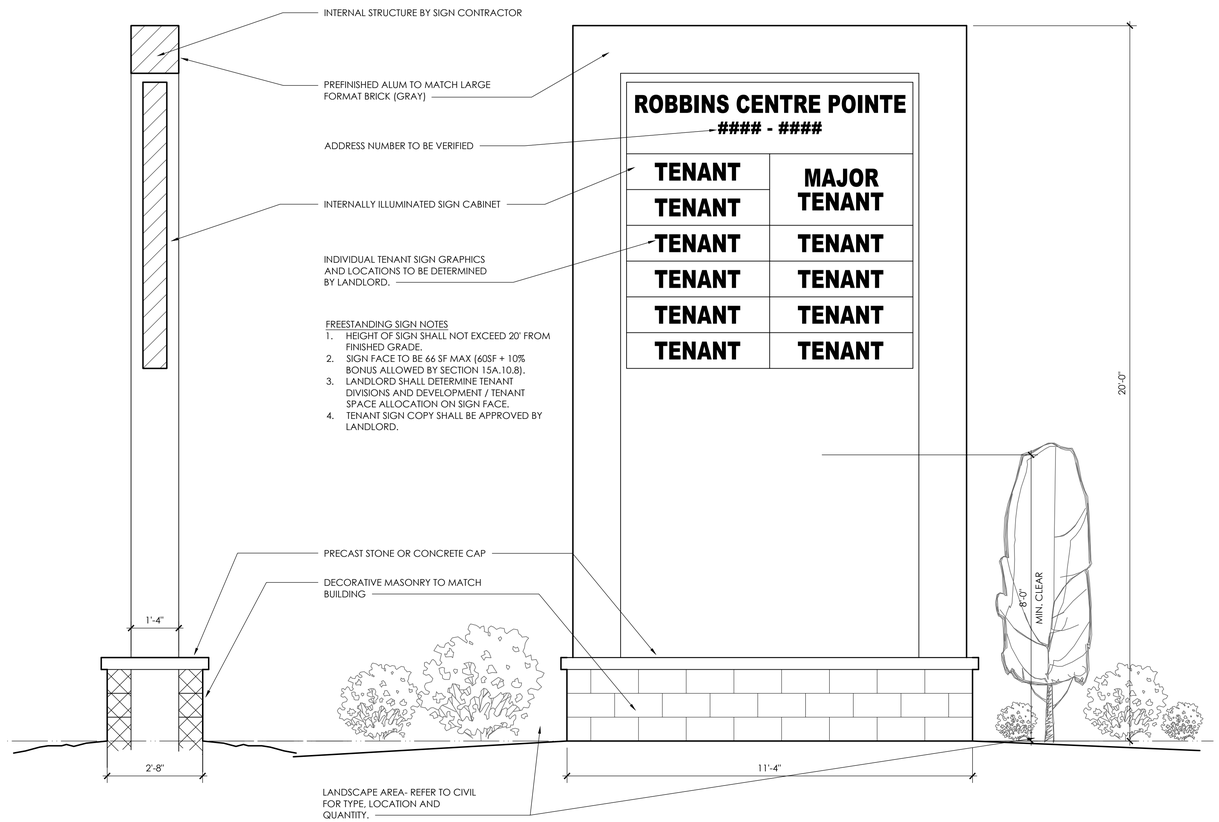


WALL SIGN NOTES
1. ONE WALL SIGN PER TENANT. TENANT MAY HAVE A SECOND SIGN OVER REAR DOOR IF IT IS USED AS A CUSTOMER ENTRANCE.
2. SIGN AREA SHALL NOT EXCEED 10% OF THE WALL AREA. (20'W x 19' H = 380/10 = 38SF).
3. TENANT SIGN COPY SHALL BE APPROVED BY LANDLORD.
4. TENANT SIGN SHALL BE INTERNALLY ILLUMINATED, INDIVIDUAL CHANNEL LETTERS. CABINET SIGNS ARE NOT PERMITTED.

3 TYPICAL RETAIL BUILDING SIGNAGE
1/2" = 1'-0"



FREESTANDING SIGN NOTES
1. HEIGHT OF SIGN SHALL NOT EXCEED 20' FROM FINISHED GRADE.
2. SIGN FACE TO BE 66 SF MAX (60SF + 10% BONUS ALLOWED BY SECTION 15A.10.8).
3. LANDLORD SHALL DETERMINE TENANT DIVISIONS AND DEVELOPMENT / TENANT SPACE ALLOCATION ON SIGN FACE.
4. TENANT SIGN COPY SHALL BE APPROVED BY LANDLORD.

2 FREESTANDING SIGN SECTION
1/2" = 1'-0"

1 FREESTANDING SIGN ELEVATION
1/2" = 1'-0"

ROBBINS CENTRE POINTE

SITE SIGNAGE

Robbins Road, Grand Haven Township

A513

FILE: 1604-11
DATE: 01/24/2018

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CSX1 LED
LED Area Luminaire

CONTOUR

Specifications

EPA: 0.7 ft² (0.07 m²)
Length: 23-1/2" (59.7cm)
Width: 18-1/2" (46.9cm)
Height: 5-7/8" (14.9cm)
Weight (max): 37 lbs (16.8kg)

Mounting Number
Notes
Type

Ordering Information

EXAMPLE: CSX1 LED 60C 1000 40K T3M MVOLT SPA DDBXD

CSX1 LED 60C

Series	LEDs	Drive current	Color temperature	Distribution	Voltage	Mounting	Optics	Shipped included / Shipped separately	Finish (required)
CSX1 LED	60C 60 LEDs	1000 1000mA 5000 5000mA (1.4)	40K 4000K 50K 5000K	T2M Type 2 T3M Type 3 T4M Type 4 T5M Type 5 T5VS Type 5 Very Short	MVOLT 120 277 208 240 347 480	SPA Square pole mounting RPA Round pole mounting WBA Wall bracket SPUMBA Square pole universal mounting adapter (specify finish) RPUMBA Round pole universal mounting adapter (specify finish) KMA8 DDBXD Mast arm mounting bracket (square or round poles)	HS House-side shield (not to be used with T5VS optic) SCWG Internally wired and controllable via I²C (ROAM² ready) DMG 0-10V dimming driver (no controls) WG Wireless ready (ROAM²) SF Single fuse (120, 277, 347V) DF Double fuse (208, 240, 480V) BL30 Bi-level switched dimming, nominal 30% BL50 Bi-level switched dimming, nominal 50% PE Photoelectric cell, factory installed DS Dual switching VG Vandal guard BS Bird deterrent spikes	DDBXD Dark bronze DBLXD Black DNAXD Natural aluminum DWHXD White DDBTXD Textured dark bronze DBLBXD Textured black DNATXD Textured natural aluminum DWHGXD Textured white

LITHONIA LIGHTING. One Lithonia Way • Conyers, Georgia 30012 • Phone: 800.279.8001 • www.lithonia.com
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CSX1 LED
Rev. 05/02/17

✓SA+ Capable Luminaire

This item is an A+ capable luminaire, which has been designed and tested to provide consistent color appearance and system-level interoperability.

- All configurations of this luminaire meet the Acuity Brands' specification for chromatic consistency
- This luminaire is A+ Certified when ordered with DTL® controls marked by a shaded background. DTL DLL equipped luminaires meet the A+ specification for luminaire to photocontrol interoperability!
- This luminaire is part of an A+ Certified solution for ROAM2® or XPoint™ Wireless control networks, providing out-of-the-box control compatibility with simple commissioning, when ordered with drivers and control options marked by a shaded background.

To learn more about A+, visit www.acuitybrands.com/aplus.

1. See ordering tree for details.
2. A+ Certified Solutions for ROAM require the order of one ROAM node per luminaire. Sold Separately: Link to Roam; Link to DTL DLL

A+ Capable options indicated by this color background.

SENTINEL™
WEB PIN™ 740

VB Vertical Bar

GENERAL SPECIFICATION

Housing: Die-cast and extruded (low copper) aluminum. Front housing hinges open for access and secures via a bolt hidden behind a spring loaded flap.
Finish: Exterior grade, metallic powder coated paint.
Gaskets: One piece silicone.
Reflector: Aluminum, white powder coated.
Diffuser: UV stabilized polycarbonate.
Drivers: HPF, electronic for 120-277V. LED modules are wired for a separate circuit.
Minimum Starting Temperature: -20°C.
Remote emergency: Emergency option provides a 1.5 hour emergency lighting facility. The remote system includes the inverter module, NiCad batteries and a remote wall/ceiling LED charge indicator and test switch (maximum distance between wall/ceiling plate and luminaire is 4.5m/15). Test switch fits a single gang box (not supplied).
Mechanical: Mounts directly over a standard electrical junction box (by others). Mounting hardware (by others).
Approval: ETL. Wet location, IP65

Note: *Decorative perforated accents on Sentinel LED luminaires have very minimal illumination, they function as a shield for the LED optical housing within the luminaire.*

SPECIFY DIRECT ILLUMINATION

Catalog Number	Finish	CCT	Illumination	*LPW:	Type (A):	Type (B):	Weight:	Photometry:
32 2755	14W LED	3000K	829	52	665mm/27"		5.5kg/12lb	File # 322755
32 2755	14W LED	4000K	829	57	665mm/27"		5.5kg/12lb	File # 322756
32 2755	28W LED	3000K	1672	60		1300mm/51.2"	11kg/24lb	File # 325155
32 2755	28W LED	4000K	1856	66		1300mm/51.2"	11kg/24lb	File # 325156

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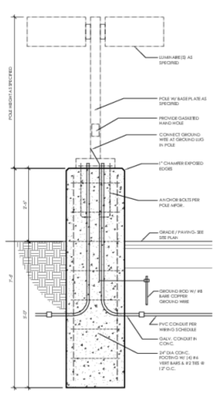
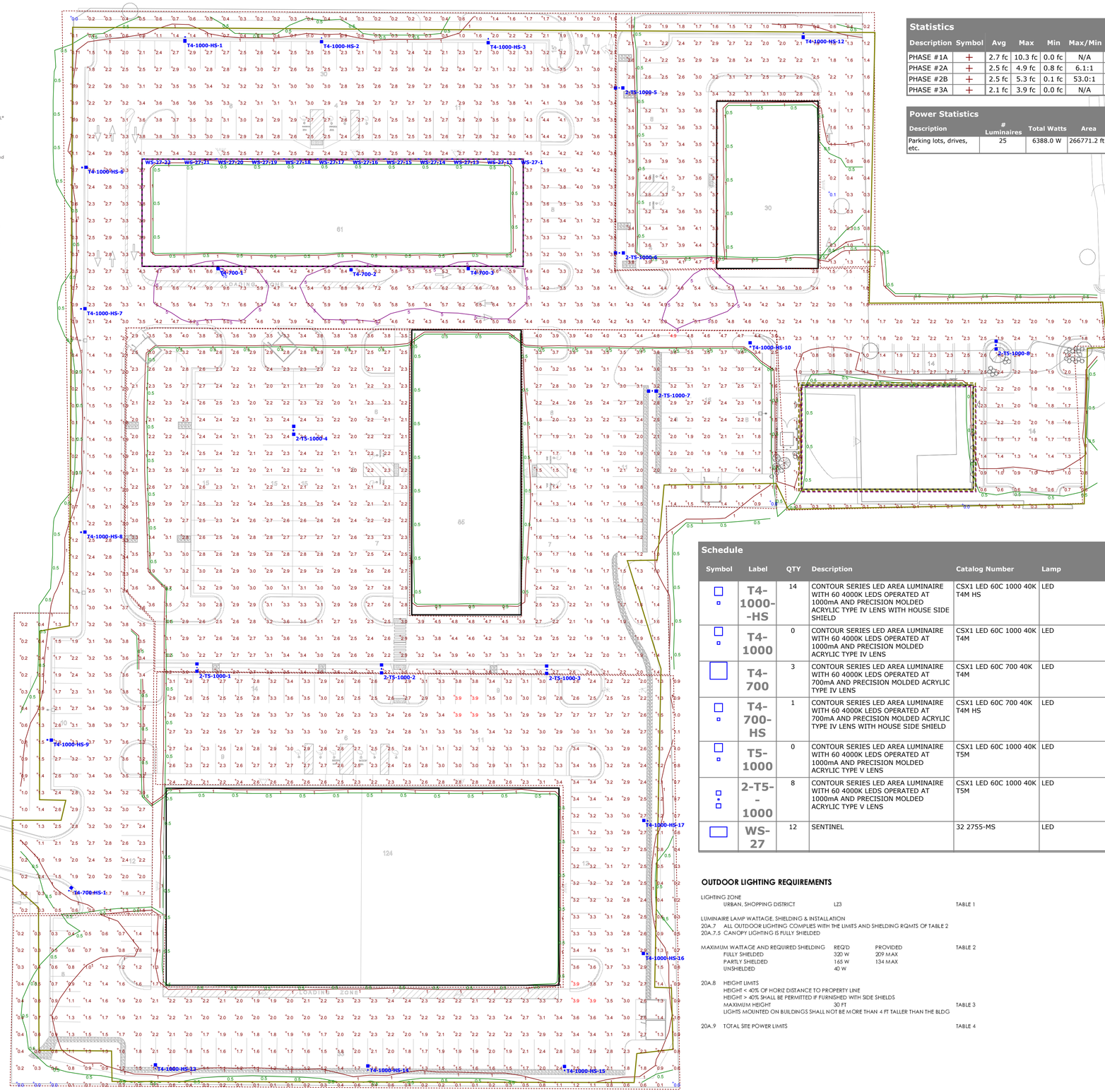


SITE LIGHTING
POLE BASE DETAIL
3/4" = 1'-0"



Statistics

Description	Symbol	Avg	Max	Min	Max/Min	Avg/Min
PHASE #1A	+	2.7 fc	10.3 fc	0.0 fc	N/A	N/A
PHASE #2A	+	2.5 fc	4.9 fc	0.8 fc	6.1:1	3.1:1
PHASE #2B	+	2.5 fc	5.3 fc	0.1 fc	53.0:1	25.0:1
PHASE #3A	+	2.1 fc	3.9 fc	0.0 fc	N/A	N/A

Power Statistics

Description	# Luminaires	Total Watts	Area	Density
Parking lots, drives, etc.	25	6388.0 W	266771.2 ft²	0.0 W/ft²

X

No.	Label	MH
1	2-T5-1000	30.00
2	2-T5-1000	30.00
3	2-T5-1000	30.00
4	2-T5-1000	30.00
5	2-T5-1000	30.00
6	2-T5-1000	30.00
7	2-T5-1000	30.00
8	2-T5-1000	30.00
1	T4-700-HS	30.00
1	T4-1000-HS	30.00
2	T4-1000-HS	30.00
3	T4-1000-HS	30.00
6	T4-1000-HS	30.00
7	T4-1000-HS	30.00
8	T4-1000-HS	30.00
9	T4-1000-HS	30.00
10	T4-1000-HS	30.00
12	T4-1000-HS	30.00
13	T4-1000-HS	30.00
14	T4-1000-HS	30.00
15	T4-1000-HS	30.00
16	T4-1000-HS	30.00
17	T4-1000-HS	30.00
1	T4-700	16.00
2	T4-700	16.00
3	T4-700	16.00
1	WS-27	8.00
12	WS-27	8.00
13	WS-27	8.00
14	WS-27	8.00
15	WS-27	8.00
16	WS-27	8.00
17	WS-27	8.00
18	WS-27	8.00
19	WS-27	8.00
20	WS-27	8.00
21	WS-27	8.00
22	WS-27	8.00

Schedule

Symbol	Label	QTY	Description	Catalog Number	Lamp	Number Lamps	Lumens per Lamp	LLF	Wattage
	T4-1000--HS	14	CONTOUR SERIES LED AREA LUMINAIRE WITH 60 4000K LEDS OPERATED AT 1000mA AND PRECISION MOLDED ACRYLIC TYPE IV LENS WITH HOUSE SIDE SHIELD	CSX1 LED 60C 1000 40K T4M HS	LED	1	16711.46	1	209
	T4-1000	0	CONTOUR SERIES LED AREA LUMINAIRE WITH 60 4000K LEDS OPERATED AT 1000mA AND PRECISION MOLDED ACRYLIC TYPE IV LENS	CSX1 LED 60C 1000 40K T4M	LED	1	22247.2	1	209
	T4-700	3	CONTOUR SERIES LED AREA LUMINAIRE WITH 60 4000K LEDS OPERATED AT 700mA AND PRECISION MOLDED ACRYLIC TYPE IV LENS	CSX1 LED 60C 700 40K T4M	LED	1	16478.29	1	134
	T4-700-HS	1	CONTOUR SERIES LED AREA LUMINAIRE WITH 60 4000K LEDS OPERATED AT 700mA AND PRECISION MOLDED ACRYLIC TYPE IV LENS WITH HOUSE SIDE SHIELD	CSX1 LED 60C 700 40K T4M HS	LED	1	12377.95	1	134
	T5-1000	0	CONTOUR SERIES LED AREA LUMINAIRE WITH 60 4000K LEDS OPERATED AT 1000mA AND PRECISION MOLDED ACRYLIC TYPE V LENS	CSX1 LED 60C 1000 40K T5M	LED	1	22329.02	1	209
	2-T5--1000	8	CONTOUR SERIES LED AREA LUMINAIRE WITH 60 4000K LEDS OPERATED AT 1000mA AND PRECISION MOLDED ACRYLIC TYPE V LENS	CSX1 LED 60C 1000 40K T5M	LED	1	22329.02	1	418
	WS-27	12	SENTINEL	32 2755-MS	LED	72	11.51157	1	16

OUTDOOR LIGHTING REQUIREMENTS

LIGHTING ZONE
URBAN, SHOPPING DISTRICT — LZ3 — TABLE 1

LUMINAIRE LAMP WATTAGE, SHIELDING & INSTALLATION
20A.7 ALL OUTDOOR LIGHTING COMPLIES WITH THE LIMITS AND SHIELDING RQMTS OF TABLE 2
20A.7.5 CANOPY LIGHTING IS FULLY SHIELDED

MAXIMUM WATTAGE AND REQUIRED SHIELDING	REQ'D	PROVIDED	TABLE 2
FULLY SHIELDED	320 W	209 MAX	
PARTLY SHIELDED	165 W	134 MAX	
UNSHIELDED	40 W		

20A.8 HEIGHT LIMITS
HEIGHT < 40% OF HORIZ DISTANCE TO PROPERTY LINE
HEIGHT > 40% SHALL BE PERMITTED IF FURNISHED WITH SIDE SHIELDS
MAXIMUM HEIGHT — 30 FT — TABLE 3
LIGHTS MOUNTED ON BUILDINGS SHALL NOT BE MORE THAN 4 FT TALLER THAN THE BLDG

20A.9 TOTAL SITE POWER LIMITS — TABLE 4

ConceptDesign
ARCHITECTURE INTERIOR DESIGN
89 MONROE CENTER NW
GRAND RAPIDS, MI 49503
PHONE: (616) 771-0909
WWW.CONCEPTGR.COM

Proposed Development:
ROBBINS CENTRE POINTE
Robbins Road at 172nd
Grand Haven (Township), Michigan

ISSUED	
11/08/2017	SCHEMATIC DESIGN REVIEW
01/02/2018	REVISED

STATE OF MICHIGAN
JAMES W RAMEY
ARCHITECT
LICENSED ARCHITECT

TITLE: SITE LIGHTING
SHEET: ES101
FILE: 1604-11

Robbins Center Point P.U.D.
Traffic Impact Study

Grand Haven Charter Township, Ottawa County, MI

Final Report

Prepared For
Moore & Bruggink, Inc.
2020 Monroe Avenue NW
Grand Rapids, MI 49505

February 8, 2018

WADE TRIM

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Robbins Center Pointe P.U.D. Traffic Impact Study

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DISCLAIMER

The contents of this report reflect the views of Wade Trim, Inc. who is responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of Robbins Road Real Estate, LLC, Moore & Bruggink, Inc., the Michigan Department of Transportation, Ottawa County Road Commission, Grand Haven Charter Township, or the City of Grand Haven.

EXECUTIVE SUMMARY

Robbins Road Real Estate, LLC is proposing to construct a new commercial development south of Robbins Road between Whittaker Way and 172nd Avenue in Grand Haven Charter Township. The proposed commercial development is expected to have 65,757 square feet of retail development and is anticipated to be complete within a five-year timeframe.

The report analyzes and presents the traffic impacts that the proposed commercial development will have on the following intersections in the project study area:

- US-31(Beacon Blvd) & Robbins Road
- US-31 (Beacon Blvd) & NB to SB Crossover North of Robbins Road
- US-31 (Beacon Blvd) & SB to NB Crossover South of Robbins Road
- Robbins Road & Whittaker Way
- Robbins Road & DeSpelder Street
- Robbins Road & 172nd Avenue

The above-mentioned intersections were analyzed for the morning peak (7:00-9:00AM) and afternoon peak (4:00-6:00PM) hours for the following conditions:

- Existing 2018 Conditions
- Future 2023 No-Build Conditions
- Projected 2023 Build Conditions

The elements to be covered in the traffic study were discussed with Grand Haven Charter Township prior to the study commencing.

Existing 2018 Conditions

Based on the intersection counts, the morning peak hour was found to occur between the hour of 7:15 a.m. and 8:15 a.m. while the afternoon peak hour was found to occur between the hour of 4:30 p.m. and 5:30 p.m. These hours were selected for analysis of existing and future year conditions.

Based on the recreational nature of this area, the existing traffic volumes collected during the winter months were adjusted to normalize the traffic volumes between peak summer months and low volume winter months. Per MDOT's PTR Pattern Assignments and discussions with Grand Haven Township, a seasonal adjustment factor of 1.25 was used to adjust the through volumes along US-31 while a seasonal adjustment factor of 1.18 was used to adjust the remaining traffic volumes in the study area. These adjusted traffic volumes formed the basis of the existing conditions analysis.

The capacity analyses for existing conditions revealed that all study area intersections and movements operate at an acceptable level of service during both the weekday morning and afternoon peak hours. It

should be noted that although the southbound US-31 through movement operates at a level of service C during both the morning and afternoon peak hours, the volume to capacity (v/c) ratio exceeds 1.0 during both peak hours, indicating that the amount of southbound through traffic exceeds the capacity of the facility.

Future 2023 No-Build Conditions

An evaluation of traffic impacts associated with the proposed commercial development relies on an understanding of the future traffic conditions in the study area without the proposed development. Future traffic for the 2023 analysis year is expected to come from background traffic growth expected to occur on the street network between 2018 and 2023 and adding any expected traffic from approved developments in the area. Per our discussions with Grand Haven Charter Township, a 1.5% per year growth rate was utilized over the five-year study period.

One committed development was identified as needing to be coordinated along with the Robbins Center Point project; Spectrum Health. The Spectrum Health medical office building has been constructed but was not occupied at the time traffic counts were collected. The Spectrum Health property lies immediately south of the proposed development and has access to Whittaker Way, 172nd Avenue, and the Meijer North Drive. Spectrum Health consists of a 120,000-square foot medical office building. A traffic study was prepared for Spectrum Health by URS in August of 2015. Trip generation and distribution for this facility was taken directly from their report.

The future no build capacity analyses revealed that all of the study area intersections will continue to operate with acceptable levels of service with the exception of the US-31 and Robbins Road intersection. During the morning peak hour, the southbound through movement will operate at a LOS F. During the afternoon peak hour, the southbound through movement and westbound right turn movement will operate at a LOS E. During the morning peak hour, adjustments to the existing signal timing splits by providing three more seconds to the north/south approaches from the east/west approaches will result in all movements operating acceptably. In order to mitigate the afternoon peak hour, the cycle length will need to be increased to a 90 second cycle length from the existing 70 second cycle length. Increasing the cycle length of the traffic signal and optimizing the splits will result in all movements operating at acceptable levels of service. It should be noted that even with the traffic signal timing adjustments, the southbound through traffic still has v/c ratios exceeding 1.0. During the afternoon peak hour, the v/c ratio for the northbound through movement is 0.99.

Projected 2023 Build Conditions

The projected traffic impacts for the commercial development were determined based on the analysis of future year 2023 traffic volumes upon full development of the proposed site.

Access to the development is proposed to be served via three full movement accesses. One access is proposed to Robbins Road at the existing middle curb cut of the five existing curb cuts located along Robbins Road. A second access is proposed to Whittaker Way immediately north of the Spectrum Health parking lot. The third access is to 172nd Avenue through the existing access for the D&W Quick Stop. The 172nd Avenue and Robbins Road accesses currently exist for the property. The proposed Robbins Road access will be reconstructed to consolidate five existing driveways to one main driveway. The 172nd Avenue access would remain as-is since it was just reconstructed for the D&W Quick Stop. The Whittaker Way access would consist of a new curb cut.

New trips to be generated by the proposed commercial development were estimated based on information and procedures contained in the Institute of Transportation Engineer's (ITE) report *Trip Generation, Tenth Edition, September 2017.* The proposed development is projected to generate a total of 185 weekday morning peak hour trips and 398 weekday afternoon peak hour trips. The estimated number of weekday morning and afternoon peak hour trips was distributed to the surrounding roadway network using existing traffic volumes. Traffic from the existing uses on the proposed site were also not subtracted from the overall study area numbers.

In order to determine the configurations of the proposed site driveways to Robbins Road, 172nd Avenue, and Whittaker Way, warrants for left and right-turn lanes were evaluated, and a capacity analysis was conducted. Michigan Department of Transportation (MDOT) traffic volume guidelines for right-turn lanes and tapers were reviewed for the necessity of constructing a right turn lane at the proposed site driveways. It was found that the proposed driveway to Whittaker Way does not meet the guidelines for a lane or taper. The existing driveway to 172nd Avenue was found to meet warrants for a right turn deceleration taper only and the proposed driveway to Robbins Road meets guidelines for a full right turn lane. The full right turn lane should be designed in accordance with the City of Grand Haven requirements. Whittaker Way was examined to determine the need for an exclusive left-turn lane along Whittaker Way at the proposed driveway location. The proposed driveway location is located within the existing taper area prior to the two-way center left-turn lane which begins south of the proposed driveway. It was found that the left-turn volume utilizing this driveway in conjunction with the through volumes do not meet warrants for an exclusive left turn lane.

The capacity analysis for the projected 2023 build conditions revealed that all of the study area intersections remained operating at acceptable levels of service with the exception of the US-31 and Robbins Road intersection. During the morning peak hour, the southbound through movement and the westbound right turn movement will both operate at a LOS E. During the afternoon peak hour, the southbound through movement is expected to operate at a LOS E while the westbound right turn movement degrades to a LOS F.

The capacity analysis for the site driveways revealed that all movements at all three site accesses will operate acceptably with the exception of the northbound exiting movement to Robbins Road during the

afternoon peak hour. As proposed, the exit lane from the proposed development onto Robbins Road has one lane for all movements. This approach is expected to operate at a level of service E during the afternoon peak hour.

In order to mitigate the effects of adding project traffic to the road system, improvements are needed at the US-31 and Robbins Road intersection as well as at the proposed main site driveway to Robbins Road.

Several investigations were conducted to determine mitigation for this intersection. The summary that was issued on January 30, 2018 discussed the need for construction of an additional westbound right turn lane. However, since that summary was issued, other options were considered and discussed with the Township. The recommended mitigation strategies include increasing the cycle length to 90-seconds during the morning peak hour and 120-seconds during the afternoon peak hour in addition to optimizing the splits and offsets. In addition, the westbound Robbins Road approach to US-31 should be restriped to provide a shared through/right turn lane and a right turn lane. At the proposed main site driveway to Robbins Road, separate left and right turn exit lanes should be constructed.

Highway capacity analyses were again conducted for projected year 2023 traffic volumes with the identified improvement strategies summarized above. Since the signalized crossover south of Robbins Road is in coordination with the Robbins Road signalized intersection, the cycle length at that study area intersection will also need to be increased for both peak hours.

All movements will operate acceptably during the morning peak hour with the improvements noted above. During the afternoon peak hour, all movements will operate acceptably with the exception of the shared westbound through/right turn movement which will operate at a level of service E with a delay of 56.7 seconds. The threshold for a level of service D is 55 seconds. This analysis has provided a worse case scenario including adding a seasonal adjustment factor to existing conditions, a 1.5% growth factor to project future volumes, a higher than average pass-by percentage, and lastly no subtraction of existing traffic volumes utilizing this site. It is our recommendation that no further mitigation is required to improve upon the level of service E. When comparing the overall intersection operations between the no build and build conditions, the overall delays and v/c ratios are improved from the no build condition.
The improvements to the site driveway result in a level of service D for the northbound left turn and level of service B for the northbound right turn lane.

Summary

The existing analyses revealed that all of the study area intersections currently operate at acceptable levels of service. However, the southbound through movement at the US-31 and Robbins Road intersection currently has v/c ratios exceeding 1.0 indicating that this movement is over capacity.

The future no build analyses revealed that movements at the intersection of US-31 and Robbins Road operate at a level of service E or F. Improvements are needed at this study area intersection in order to mitigate the future no build conditions. The improvement strategies for the future no build conditions are summarized below.

- Increase cycle length from 70 to 90 seconds during the afternoon peak hour
- Adjust traffic signal timing splits during both the morning and afternoon peak hours.

The analysis results for the future no build scenario revealed that these signal timing adjustments will result in acceptable levels of service.

The analysis results for the projected build scenario for the proposed commercial development reveal that additional improvements will be needed upon full build out in order to mitigate the traffic impacts caused by adding the project traffic. The improvements that will be required for full build out of the development include the following:

US-31 & Robbins Road

- Restriping of westbound approach to a shared through/right turn lane and a right turn lane.
- Increase the cycle length to 90 seconds for the morning peak hour and optimize the splits/offsets (adjust cycle length at adjacent signalized crossover as well).
- Increase the cycle length to 120 seconds for the afternoon peak hour and optimize the splits/offsets (adjust cycle length at adjacent signalized crossover as well).

Robbins Road & Main Site Driveway

- Construct eastbound right-turn lane along Robbins Road
- Construct separate left and right turn exit lanes.

1.0 INTRODUCTION

Robbins Road Real Estate, LLC is proposing to redevelop the area south of Robbins Road between Whittaker Way and 172nd Avenue in Grand Haven Charter Township. The proposed commercial development, known as Robbins Center Point, is expected to have 65,757 square feet of retail development and is anticipated to be complete within a five-year timeframe. Figures 1 and 2 illustrate the project location and the overall site area. The proposed site plan is provided in Appendix A.

Access to the development is proposed to be served via three full movement accesses. One access is proposed to Robbins Road at the existing middle curb cut of the five existing curb cuts located along Robbins Road. A second access is proposed to Whittaker Way immediately north of the Spectrum Health parking lot. The third access is to 172nd Avenue through the existing access for the D&W Quick Stop. The 172nd Avenue and Robbins Road accesses currently exist for the property. The proposed Robbins Road access will be reconstructed to consolidate five existing driveways to one main driveway. The 172nd Avenue access would remain as-is since it was just reconstructed for the D&W Quick Stop. The Whittaker Way access would consist of a new curb cut.

1.1 PURPOSE AND SCOPE

The purpose of this report is to document the assessment of the traffic impacts that the proposed commercial development is expected to have on the adjacent roadways and study area intersections. The traffic impacts and mitigation measures described in this report are based on existing and future no build traffic volumes and anticipated future traffic generated at full build out of the site in the year 2023.

The assessment included a review of existing roadway and intersection geometry, traffic control devices, and traffic volumes. The study also included trip generation, distribution, and traffic assignment. The analysis examined the following conditions:

- Existing Conditions: 2018 traffic volumes and operations.
- Future 2023 No Build Conditions: future no build traffic conditions that are anticipated in 2023 without the proposed development.
- Projected 2023 Build Conditions: future build traffic conditions that are anticipated in 2023 upon full development of the property.

A comparison of future no build conditions to projected build conditions was used to determine the traffic impacts of the proposed commercial development upon the adjacent street system.

Exhibit 1-1 Location Map

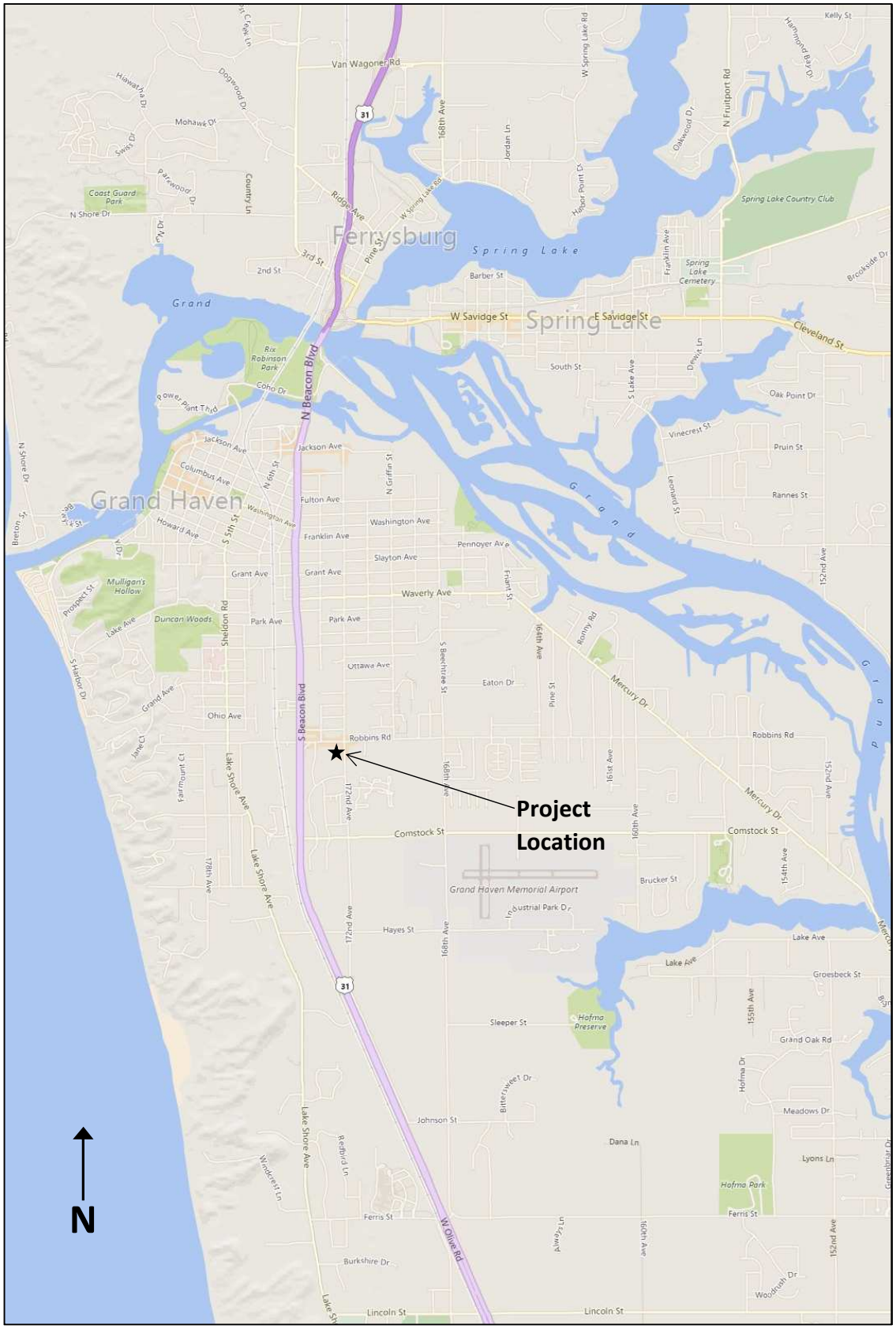
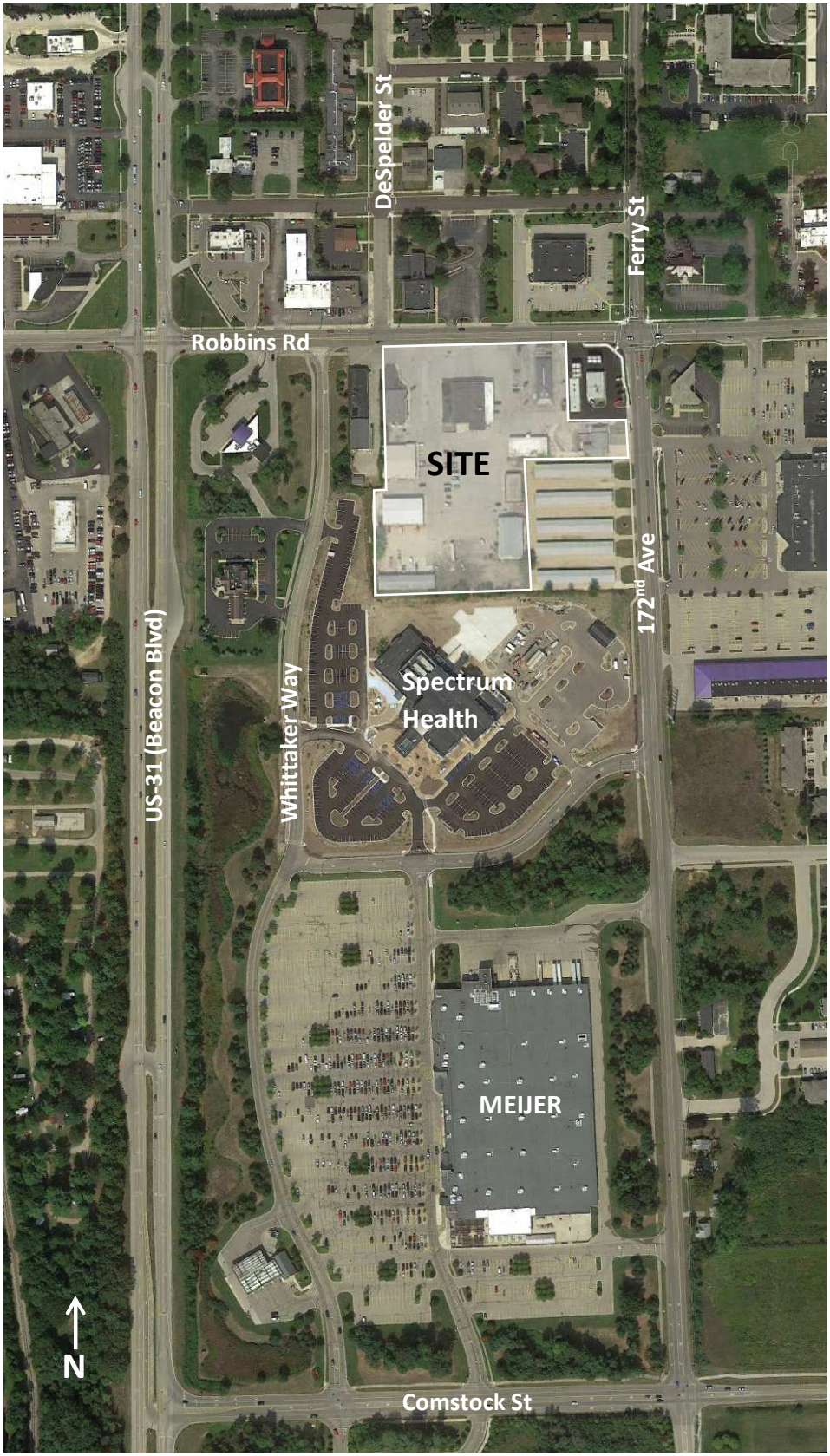


Exhibit 1-2 Approximate Site Area



2.0 METHODOLOGY

The study involved the collection and review of geometric, traffic control, and traffic volume data for roadways and intersections potentially impacted by the proposed commercial development. This data served as input for the highway capacity analyses that were conducted to estimate the traffic impacts of the proposed development. The information collected, and the evaluation procedures used to conduct the analyses, are described in this section.

2.1 TRAFFIC IMPACT STUDY AREA

Based on a review of the road network adjacent to the proposed site and conversations with Grand Haven Charter Township, the impact area for this study was identified. It was agreed upon that the analysis study area would include the following intersections:

- US-31 (Beacon Blvd) & Robbins Road
- US-31 (Beacon Blvd) & NB to SB Crossover North of Robbins Road
- US-31 (Beacon Blvd) & SB to NB Crossover South of Robbins Road
- Robbins Road & Whittaker Way
- Robbins Road & DeSpelder Street
- Robbins Road & 172nd Avenue

Under projected conditions, the three proposed driveways to the project were also included in the analysis. Since the 172nd Avenue access is an existing driveway serving the D&W Quick Stop, it was included in the existing and no build conditions as well.

2.2 DATA COLLECTION

Data collection consisted of obtaining roadway and intersection geometry, existing traffic control devices, and traffic volumes.

Traffic volume collection included obtaining directional vehicle turning movement counts for the weekday morning and weekday afternoon peak periods. These data were collected by Quality Counts, LLC for Wade Trim. Directional turning movements were derived from video taken during the weekday morning peak from 7:00 a.m. to 9:00 a.m. and weekday afternoon peak from 4:00 p.m. to 6:00 p.m.at the study area intersections.

The weekday counts were collected on Thursday, January 18, 2018. All possible vehicle turning movements at these intersection approaches were recorded in 15-minute intervals. During collection of the turning movement data, truck volumes were taken and the number of pedestrians/bicycles crossing the roadway were also recorded for each 15-minute time period. The existing turning movement data are summarized in Appendix B.

Turning movement counts were not collected at the intersection of 172nd Street and Robbins Road as turning movement counts were collected in September of 2017 for this intersection and were provided to us by Grand Haven Charter Township. These counts are summarized in Appendix B as well.

A field review of the intersections and surrounding area were made by Wade Trim personnel to obtain other data needed for the study. For example, traffic control regulations at the intersections, pedestrian accommodations, speed limits, roadway cross-sections, etc. were verified during the field observations.

2.3 SEASONAL ADJUSTMENT FACTOR

Based on the recreational nature of this area, the existing traffic volumes collected during the winter months should be adjusted to normalize the traffic volumes between peak summer months and low volume winter months. Per MDOT's PTR Pattern Assignments, a seasonal adjustment factor of 1.36 based on Pattern 5 – Recreational and the January data collection timeframe is recommended to adjust the traffic volumes in this type of area.

Based on other traffic counts conducted for previous traffic studies in this area, a 1.36 adjustment factor appeared to be on the high side. It was agreed upon with Grand Haven Charter Township that a seasonal adjustment factor of 1.25 would be applied to the US-31 through movements and a factor of 1.18 would be applied to all other movements in the study area.

Although traffic data at the intersection of Robbins Road and 172nd Avenue/Ferry Street was collected in September of 2017, the volumes between this intersection and the adjacent intersections that were recently counted were consistent. It is proposed that these volumes also be adjusted by the 1.18 seasonal adjustment factor, although they were collected in September of 2017. These traffic volumes will be the basis of the existing conditions analysis.

2.4 VOLUME BALANCING

As volume differences exist between some of the study area intersections, typically it was necessary to balance the volumes throughout the network to ensure upstream and downstream traffic volumes maintain continuity. Volume differences can exist for numerous reasons including a natural variation in volumes due to data collection on different days of the week or, as in this case, several additional roads and driveways along each of the corridors, where traffic is added and subtracted to the network. Since all of the volume differences were less than 10% of the approach volumes, dummy nodes were not added to the models.

2.5 OPERATIONAL ANANLYSIS

The traffic impact analysis includes methodology for trip generation, distribution, and traffic assignment based on the Institute of Transportation Engineers (ITE) standard practices. The guidelines suggested in the document ***Evaluating Traffic Impact Studies – A Recommended Practice for Michigan***

Communities, 1994 Edition were used in the preparation of the impact study. Applicable technical standards such as the ***2000***, ***2010,*** and ***6th Edition Highway Capacity Manual***, MDOT Traffic and Safety Notes, and the ***2011 Michigan Manual on Uniform Traffic Control Devices (MMUTCD)*** were also used.

2.5.1 Highway Capacity Analysis

Highway capacity analyses were conducted to determine the existing level of service of the study area intersections, the level of service expected in the year 2023 when background traffic and trips generated by Spectrum Health are added, and the level of service expected in the year 2023 when trips generated by the proposed development are added to future no build volumes. *Synchro 10* was used to conduct the analyses.

Synchro 10 is a software package used for modeling and optimizing traffic signal timing at intersections. The program utilizes the methods of the ***2000 Highway Capacity Manual***, ***2010 Highway Capacity Manual***, and ***6th Edition Highway Capacity Manual*** to calculate capacity. Since the US-31 corridor is a boulevard, boulevard signals are represented by two individual signalized intersections in Synchro – one for each direction of travel of each divided roadway. The two individual signalized intersections must be clustered (grouped) together as they functionally operate using the same controller. In addition, boulevard signal phasing must be coded to replicate the trail green for traffic crossing the divided roadway. The clustering of intersections is not currently supported by the HCM 2010 or HCM 6th Edition, therefore HCM 2000 was utilized for the two signalized intersections along US-31; Robbins Road and the crossover south of Robbins Road. The capacity worksheets for existing year conditions are provided in Appendix C, while the future no build 2023 conditions are given in Appendix F. The worksheets for the projected build conditions in 2023 are provided in Appendix G.

Capacity analyses were conducted to measure the performance of the intersections in terms of level of service. Level of service ranges from level of service A, which represents the best traffic conditions, to level of service F, which is the worst condition. Operations at level of service A through D are generally considered acceptable for signalized intersections while a level of service E is generally considered acceptable for side-street movements at unsignalized intersections. Quantitative measures of level of service are given in the following paragraphs.

The level of service measurement for both signalized and stop controlled intersections is average control delay, which is also quantified in terms of seconds of delay per vehicle. Control delay includes the initial deceleration delay, queue move-up time, stopped delay, and acceleration delay. The level of service criteria for unsignalized and signalized intersections, taken from the ***6th Edition Highway Capacity Manual,*** is shown in Table 2-1.

Table 2-1 Level of Service Criteria for Intersections

Level of Service	Description	Unsignalized Intersections Average Control Delay, Seconds per vehicle	Signalized Intersections Average Control Delay, Seconds per vehicle
A	Little or no delay.	<10.0	<10.0
B	Short traffic delays.	Between 10 and 15	Between 10 and 20
C	Average traffic delays.	Between 15 and 25	Between 20 and 35
D	Long traffic delays.	Between 25 and 35	Between 35 and 55
E	Very long traffic delays.	Between 35 and 50	Between 55 and 80
F	Demand exceeds capacity.	>50	>80

One important factor used in calculating capacity at intersections is the peak-hour factor. The peak hour factor is found by dividing the total hourly volume observed on a road or intersection by four times the highest 15-minute volume. Because manual traffic counts based on 15-minute data were collected for the area intersections, the peak-hour factors used in the existing condition analyses are based on actual count data. Since the existing traffic volumes were increased by a seasonal adjustment factor, the existing peak hour factors were increased by 0.05. The peak hour factors were kept the same for the future no build and projected build analyses. However, it is very likely that as the traffic volumes through this area increase with the proposed development, the peak hour factors will also increase.

3.0 ANALYSIS

The traffic impact study included a review of the study area, an estimation of the amount of peak-period traffic generated by the proposed development, distribution of the site traffic onto the local streets, assignment of traffic volumes to the study area intersections, and capacity analyses to determine the impact of the proposed development on the level of service and operations. Traffic projections were made to estimate future traffic volumes on the area roads in 2023 with and without the proposed commercial development in place.

3.1 EXISTING 2018 CONDITIONS

The existing transportation network in the vicinity of the project site is comprised of the road system and pedestrian facilities. A summary of the existing network is described below.

3.1.1 Road System

US-31 (Beacon Boulevard) is a north/south divided state highway with two lanes in each direction. US-31 traverses the entire Lower Peninsula, from the Indiana State Line, and terminating at I-75 just a few miles south of the Mackinac Bridge. In the study area, US-31 utilizes indirect left-turns, with crossovers north and south of major cross roads instead of accommodating left-turns at the major intersections. The speed limit is 40 mph from the crossover south of Robbins Road to the north. South of this crossover, the posted speed limit is 55 mph.

Robbins Road is an east/west undivided local road in the study area that forms the boundary between the City of Grand Haven and Grand Haven Charter Township. This section of road is under the City of Grand Haven jurisdiction. Robbins Road has a four-lane cross-section immediately east and west of US-31 but narrows to a three-lane cross-section east of Whittaker Way. The speed limit along Robbins Road is 35 mph through the study area.

172nd Avenue/Ferry Street is a north/south road in the study area. 172nd Avenue begins at Robbins Road and continues south. This section of roadway has a three-lane cross-section with an additional turn lane at its intersection with Robbins Road and is under the jurisdiction of Ottawa County Road Commission. The posted speed limit along this stretch is 45 mph. Ferry Street begins at Robbins Road and runs northerly. This section of road has a two-lane cross-section with additional turn lanes at its intersection with Robbins Road and is under the jurisdiction of the City of Grand Haven. The posted speed limit through the study area is 25 mph.

DeSpelder Street is a two-lane residential road that runs between Robbins Road and Arlington Street. DeSpelder Street is under the City of Grand Haven jurisdiction and does not have a posted speed limit.

Whittaker Way is a three-lane north-south connector street that links Robbins Road to the north and the Meijer north access drive to the south. The speed limit is 25 mph along Whittaker Way.

3.1.2 Intersection Geometry and Traffic Control

There are seven intersections in the study area with three of the intersections signalized and four of the intersections stop-controlled. The existing lane configurations for the study area intersections are shown in Exhibit 3-1.

The intersection of US-31 and Robbins Road has four approach legs and is controlled by a semi-actuated coordinated two-phase traffic signal on a 70-second cycle length. The northbound and southbound approaches have two through lanes and a right turn lane while the eastbound and westbound approaches have a through lane and a right turn lane.

The intersection of US-31 and the northbound to southbound crossover north of Robbins Road is stop-controlled for the indirect left-turn movement. The southbound approach consists of two through lanes and a right turn lane that begins for the intersection at Robbins Road. The northbound approach consists of two through lanes and one left turn lane.

The intersection of US-31 and the southbound to northbound crossover south of Robbins Road is controlled by a pretimed two-phase traffic signal on a 70-second cycle length. The southbound approach consists of two through lanes and a left turn lane. The northbound approach consists of two through lanes and a right turn lane that begins for the intersection at Robbins Road. Although a traffic signal controls the southbound approach, the southbound through movement always has a green arrow.

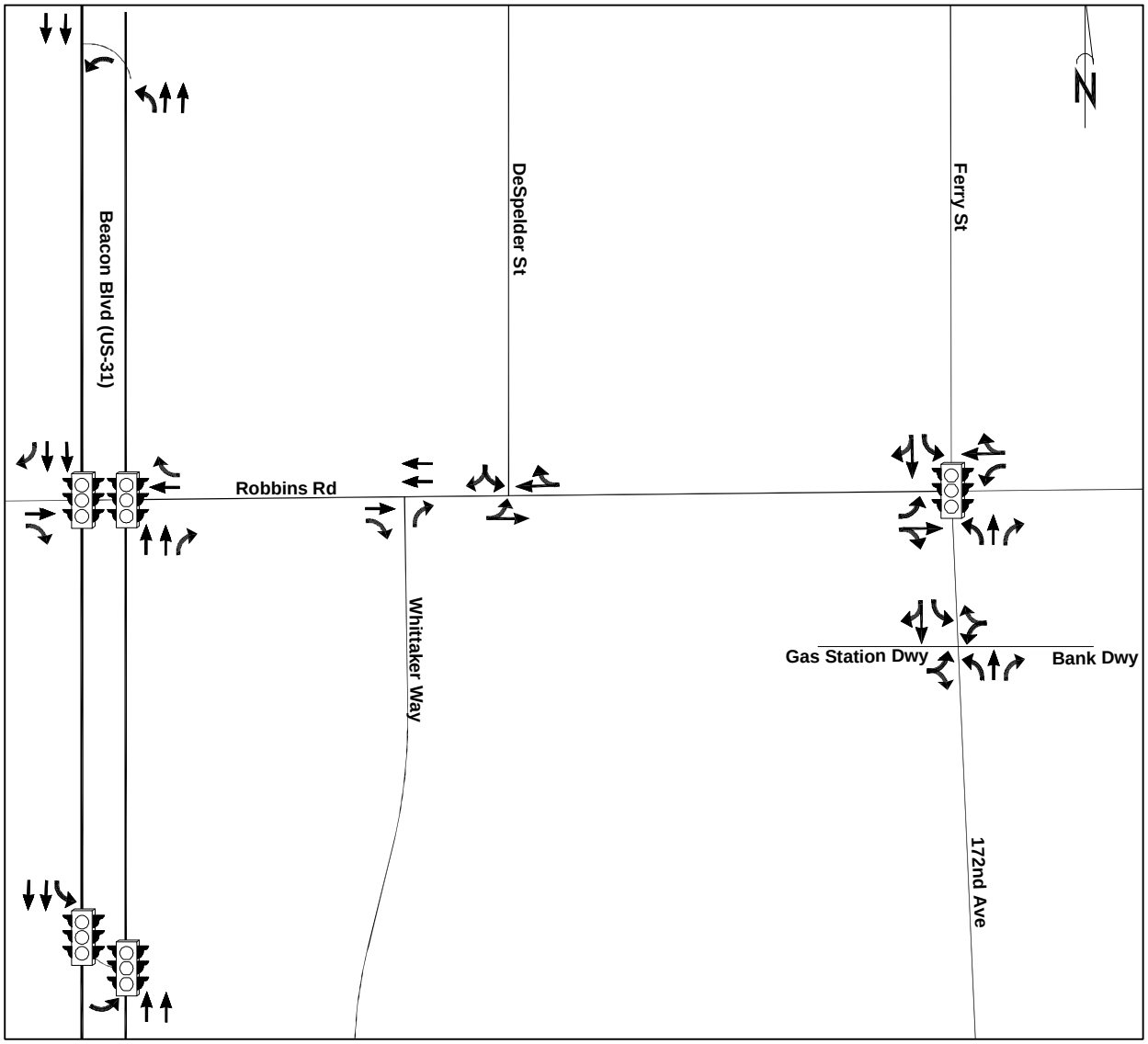
The intersection of Robbins Road and Whittaker Way has three approach legs and is stop-controlled for the Whittaker Way right turn movement. The northbound approach consists of a right turn lane. The eastbound approach consists of one through lane and one right turn lane. The westbound approach consists of two through lanes, one of which is the right turn lane for the US-31 intersection.

The intersection of Robbins Road and DeSpelder Street has three approach legs and is stop-controlled for the DeSpelder Street approach. The southbound approach consists of one lane for all turn movements. The eastbound approach consists of one shared lane for the left-turn and through movements. The westbound approach consists of one through lane and a center left-turn lane.

The intersection of Robbins Road and Ferry Street/172nd Avenue has four approach legs and is controlled by a semi-actuated four-phase traffic signal on a 90-second cycle length. The northbound approach has a left-turn lane, a through lane, and a right turn lane. The southbound, eastbound, and westbound approaches all have a left-turn lane and a shared through/right turn lane.

The intersection of 172nd Avenue and the Quick Stop/Bank Driveway has four approach legs and is stop-controlled for side-street driveways. The southbound approach consists of a left-turn lane and a shared through/right turn lane. The eastbound and westbound driveways consist of one lane for all movements. The northbound approach consists of a left-turn lane, a through lane, and a right turn lane.

Exhibit 3-1 Existing Lane Configuration



3.1.3 Pedestrian and Bicycle Facilities

In the vicinity of the proposed site, Robbins Road has continuous sidewalk along the north side of the road with intermittent sidewalk along the south side. Along the south side, a short path exists east and west of Whittaker Way and then again in front of the Quick Stop. Sidewalk is also present along the south side of Robbins Road, east of 172nd Avenue.

US-31 has continuous sidewalk along both sides of the divided highway, north of Robbins Road. South of Robbins Road, no sidewalk is present. Whittaker Way has a continuous path along the west side of the road from Robbins Road to the Meijer development. DeSpelder Street has sidewalk present along both sides of the roadway as does Ferry Street.

172nd Avenue has continuous sidewalk along the west side of the roadway from Robbins Road to Comstock Street. Along the eastern side of the road, sidewalk is nonexistent except in front of the D&W.

The signalized intersection of 172nd Avenue/Ferry Street and Robbins Road has pedestrian signals and push-buttons for crossing all legs of the intersection. The signalized intersection of US-31 and Robbins Road has pedestrian signals and push-buttons for crossing the north side of the intersection only. No pedestrian signals exist at the crossover south of Robbins Road.

No bicycle facilities were present in the study area.

3.1.4 Traffic Volumes

The traffic impact analysis began with an examination of the weekday morning and weekday afternoon peak hours. The peak hour consists of the four highest consecutive 15-minute intervals within the peak time periods. Based on the intersection counts, the overall morning peak hour was found to occur between the hour of 7:15 a.m. and 8:15 a.m. for the overall study area intersections while the afternoon peak hour was found to occur between the hour of 4:30 p.m. and 5:30 p.m. for the overall study area intersections. These hours were selected for analysis of existing and future year conditions. Exhibits 3-2 and 3-3 illustrate the weekday morning and weekday afternoon peak hour for existing traffic volumes. These volumes have been adjusted by the seasonal adjustment factor.

It should also be noted that traffic from the existing uses on the proposed site were not subtracted from the existing volumes. The existing traffic volumes used in the analysis include traffic from the existing businesses that currently sit at the proposed site.

During the collection of the manual intersection turning movement counts, pedestrian data, bicyclists, passenger car and light truck, and large truck data were recorded. The pedestrian and truck data is also shown in Appendix B. The commercial truck percentages were used in the traffic capacity analyses as well as any pedestrian crossings counted at the study area intersections.

Exhibit 3-2 Existing AM Peak Hour Traffic Volumes

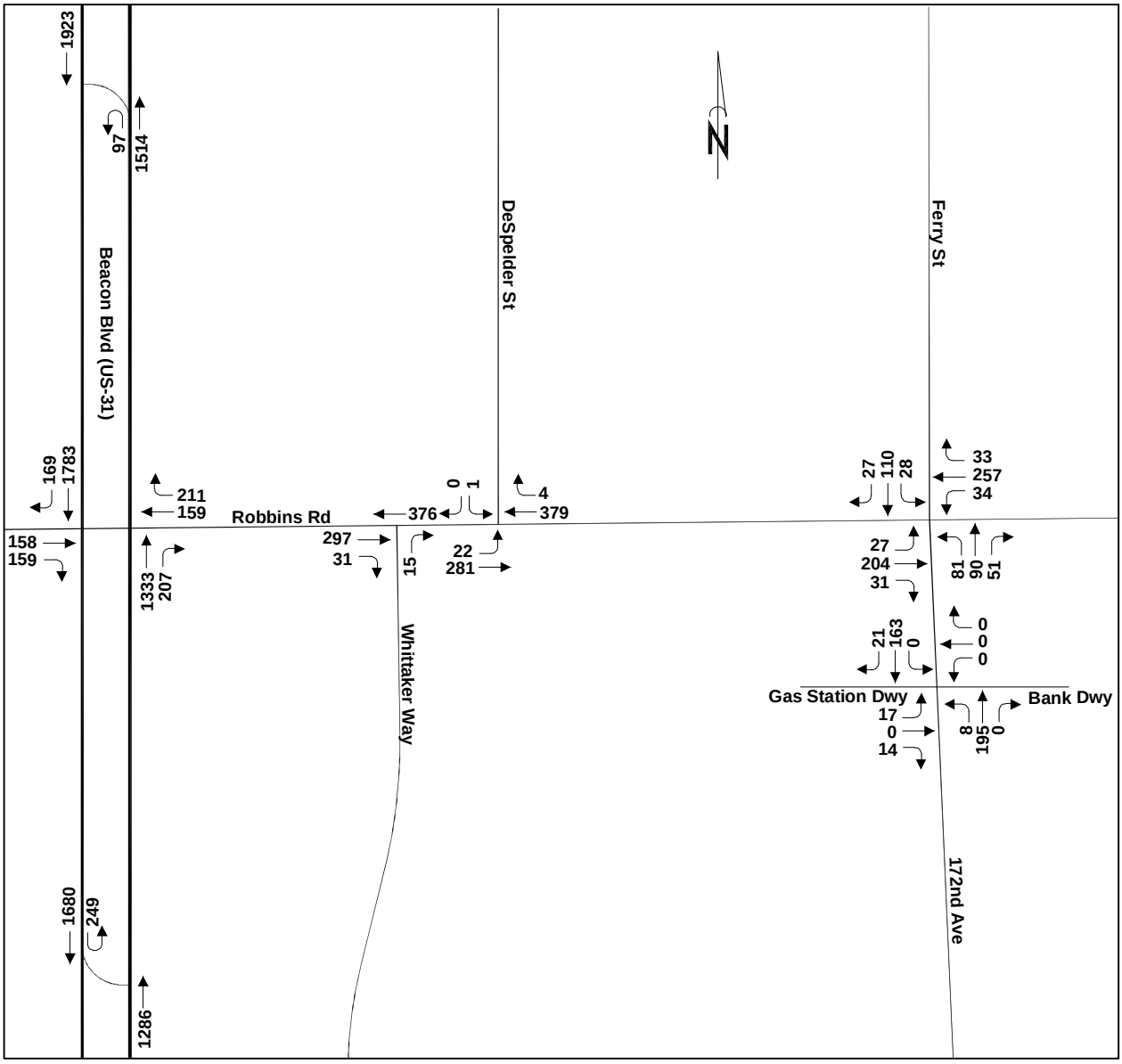
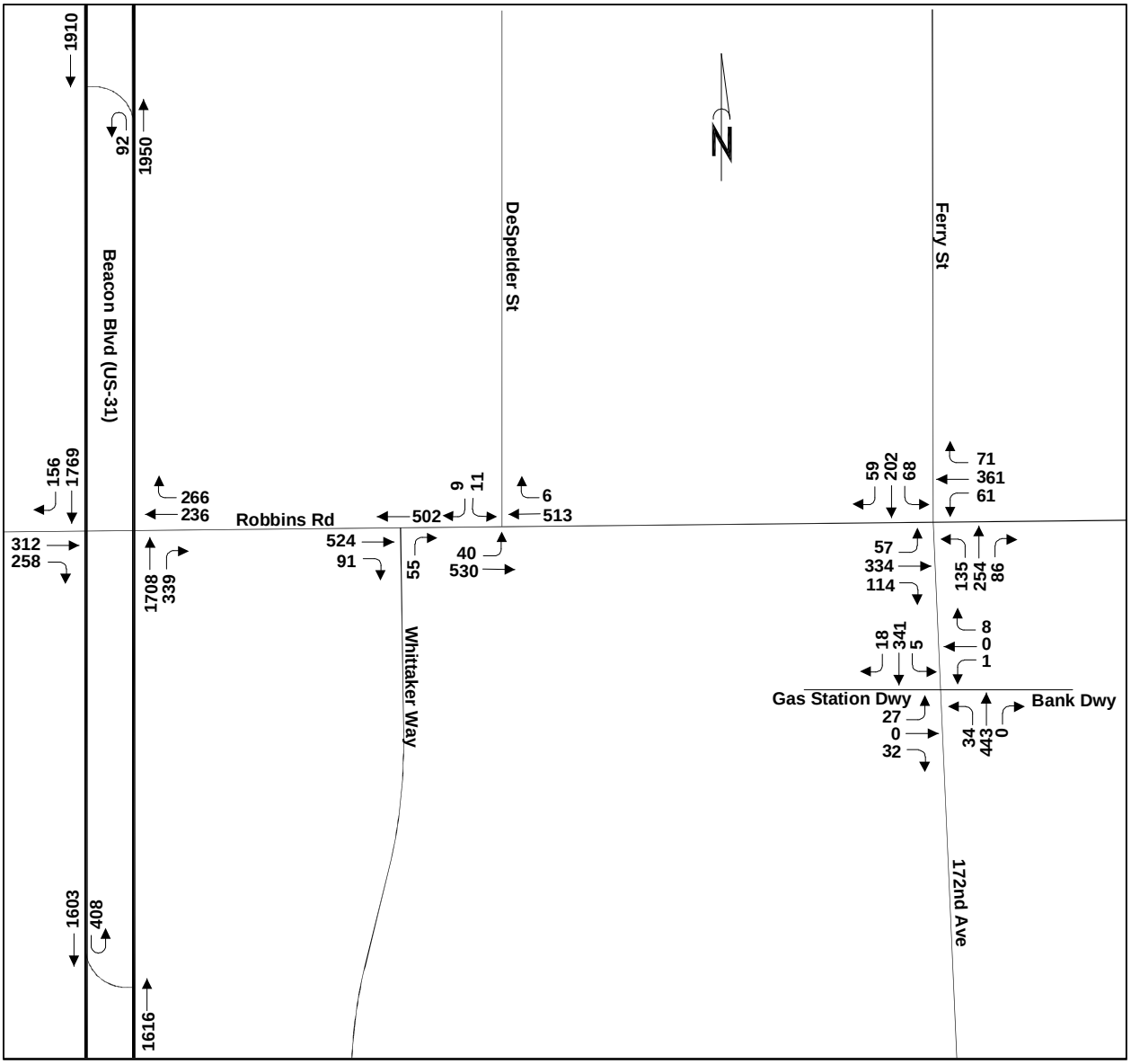


Exhibit 3-3 Existing PM Peak Hour Traffic Volumes



3.1.5 Operational Analysis

The analysis of existing operations was initiated with the preparation of existing condition models using Synchro 10 and the aerial and field obtained geometric data. The road and intersection geometry data were entered followed by the volumes.

Highway capacity analyses were conducted for existing geometric conditions, traffic control, and the seasonally adjusted traffic volumes. The capacity analysis included an examination of the weekday morning and weekday afternoon peak hours. The results of the capacity analyses for existing year 2018 conditions are summarized in Table 3-1. Table 3-1 provides the level of service, delay values, and volume

to capacity ratios at each intersection for each movement and approach that currently exist throughout the study area.

The capacity analyses for existing conditions revealed that all study area intersections and movements operate at an acceptable level of service during both the weekday morning and afternoon peak hours. It should be noted that although the southbound US-31 through movement at Robbins Road operates at a level of service C during both the morning and afternoon peak hours, the volume to capacity (v/c) ratio exceeds 1.0 during both peak hours, indicating that the amount of southbound through traffic exceeds the capacity of the facility.

Table 3-1 Existing 2018 Synchro Analyses Results

Intersection	Lane Movement/ Approach	AM Peak Hour			PM Peak Hour		
		LOS	Delay (sec)	V/C Ratio	LOS	Delay (sec)	V/C Ratio
US-31 (Beacon Blvd) & Robbins Road	EB Thru	C	26.8	0.51	D	42.3	0.85
	EB Right	C	26.5	0.45	C	32.1	0.70
	EB Approach	**C**	**26.6**	**N/A**	**D**	**37.7**	**N/A**
	WB Thru	C	26.7	0.49	C	27.9	0.62
	WB Right	C	30.2	0.61	C	31.5	0.69
	WB Approach	**C**	**28.7**	**N/A**	**C**	**29.8**	**N/A**
	SB Thru	C	31.2	1.03	C	27.8	1.01
	SB Right	A	8.3	0.12	A	8.9	0.10
	SB Approach	**D**	**42.3**	**N/A**	**C**	**26.2**	**N/A**
	NB Thru	A	9.7	0.83	B	18.7	0.97
	NB Right	A	1.2	0.16	A	3.4	0.32
	NB Approach	**A**	**8.6**	**N/A**	**B**	**16.1**	**N/A**
	Overall-West	**C**	**27.0**	**0.89**	**C**	**26.5**	**0.96**
	Overall-East	**B**	**11.3**	**0.78**	**B**	**16.4**	**0.89**
US-31 (Beacon Blvd) & Crossover South of Robbins Road	EB Left	B	11.3	0.490	C	20.1	0.750
	EB Approach	**B**	**11.3**	**N/A**	**C**	**20.1**	**N/A**
	NB Thru	B	15.2	0.800	B	18.0	0.870
	NB Approach	**B**	**15.2**	**N/A**	**B**	**18.0**	**N/A**
	Overall	**B**	**14.6**	**0.7**	**B**	**18.4**	**0.83**
US-31 (Beacon Blvd) & Crossover North of Robbins Road	WB Left	C	20.2	0.374	C	18.1	0.303
	WB Approach	**C**	**20.2**	**N/A**	**C**	**18.1**	**N/A**
	Overall	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Robbins Road & Ferry Street/172nd Avenue	WB Left	B	13.7	0.07	B	16.4	0.18
	WB Thru/Rt	B	19.6	0.40	C	26.1	0.63
	WB Approach	**B**	**19.0**	**N/A**	**C**	**24.9**	**N/A**
	EB Left	B	14.0	0.06	B	16.0	0.16
	EB Thru/Rt	B	19.1	0.35	C	27.4	0.67
	EB Approach	**B**	**18.6**	**N/A**	**C**	**26.1**	**N/A**
	NB Left	C	23.5	0.21	C	25.0	0.43
	NB Thru	C	26.8	0.2	C	34.6	0.57
	NB Right	C	26.1	0.13	C	28.4	0.23
	NB Approach	**C**	**25.5**	**N/A**	**C**	**30.7**	**N/A**
	SB Left	C	24.2	0.07	C	24.0	0.22
	SB Thru/Rt	C	31.2	0.35	D	38.7	0.65
	SB Approach	**C**	**30.0**	**N/A**	**D**	**35.7**	**N/A**
	Overall	**C**	**22.2**	**N/A**	**C**	**28.8**	**N/A**
Robbins Road & Whittaker Way	NB Right	B	10.5	0.032	B	12.8	0.140
	NB Approach	**B**	**10.5**	**N/A**	**B**	**12.8**	**N/A**
	Overall	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Robbins Road & DeSpelder Street	EB Left*	A	8.2	0.011	A	8.7	0.044
	SB Approach	**B**	**12.5**	**0.003**	**C**	**15.1**	**0.069**
	Overall	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
172nd Avenue & Quick Stop/Bank Dwys	NB Left*	A	7.7	0.007	A	8.2	0.031
	EB Approach	**B**	**10.7**	**N/A**	**B**	**14.1**	**N/A**
	SB Left*	A	0.0	0.000	A	8.3	0.005
	WB Approach	**A**	**0.0**	**N/A**	**B**	**11.2**	**N/A**
	Overall	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**

* denotes LOS, delay, and V/C ratio for major street left turn movement

3.1.6 SimTraffic Model Calibration and Validation

The SimTraffic models were calibrated and validated to ensure that they reflected actual field operations before the seasonal adjustment factor was applied. This step is essential to ensuring accuracy of the model and was conducted prior to the analysis and simulation of any future conditions.

The SimTraffic results for existing conditions were calibrated and validated for weekday morning and weekday afternoon peak hour conditions. The process involved comparing the actual traffic volumes collected at each intersection with the SimTraffic Volume Exited report. The models were considered validated when the field counts and model results were within the greater of ±10 percent or ± 20 vehicles.

In order to meet the calibration targets, adjustments can be made to a number of simulation parameters including headway factors, actual link speeds, vehicle and driver options, mandatory lane change distances, and lost time values. When there are differences, changing one or more of these parameters often will bring the model values within the acceptable range of the vehicle counts.

Ten simulations of each peak period were performed and the average of the volumes for each turning movement was reported in a SimTraffic Performance Report. During both peak periods for each turning movement, the differences between the actual field counts and the average values from 10 simulation runs were within the acceptable range. Accordingly, no adjustments to the simulation parameters for these periods were made. The SimTraffic Performance Reports for the peak periods are provided in Appendix D.

3.2 FUTURE NO BUILD 2023 CONDITIONS

An evaluation of traffic impacts associated with the proposed commercial development relies on an understanding of the future traffic conditions in the study area without development of the proposed site. Since traffic volumes in the study area would likely continue to increase with or without the traffic impacts generated by the project, it is necessary to understand the future conditions without the proposed development in order to compare the project impacts against a baseline condition. The following sections describe the study area future no build 2023 traffic impacts without the proposed project.

The traffic impact analysis for future no build 2023 conditions began with the projection of turning movement volumes for the weekday morning and weekday afternoon peak hours. This process was accomplished by applying a traffic growth rate to the current traffic volumes to develop the future 2023 traffic volumes, and adding any traffic from approved developments in the area.

3.2.1 Committed Developments

One committed development was identified as needing to be coordinated along with the Robbins Center Point project; Spectrum Health. The Spectrum Health medical office building has been

constructed but was not occupied at the time traffic counts were collected. The Spectrum Health property lies immediately south of the proposed development and has access to Whittaker Way, 172nd Avenue, and the Meijer North Drive. Spectrum Health consists of a 120,000-square foot medical office building. A traffic study was prepared for Spectrum Health by URS in August of 2015. Trip generation and distribution for this facility was taken directly from their report and is included in Appendix E.

3.2.2 Background Traffic Growth

Traffic volumes on a roadway change over time depending upon shifts in population density, economic fluctuations, and a host of other factors. These changes occur independently of any proposed development in the area, and must be considered in an impact analysis of future conditions. This change is usually known as background traffic growth, which can represent an increase or decrease in existing volumes over time. Per our discussions with Grand Haven Charter Township, a 1.5% per year growth rate was utilized over the five-year study period.

3.2.3 Future No Build 2023 Traffic Volumes

Future traffic volumes were developed for the future 2023 no build scenario based on the background traffic growth and addition of the Spectrum Health traffic. The growth rate was applied to the existing 2018 traffic volumes to project the future 2023 no build volumes during the morning and afternoon peak hours. The traffic projected for the Spectrum Health project was then added to these future no build volumes. The future year 2023 weekday morning and weekday afternoon peak hour traffic volumes without the proposed project are shown in Exhibits 3-4 and 3-5.

Exhibit 3-4 Future No Build 2023 AM Peak Hour Traffic Volumes

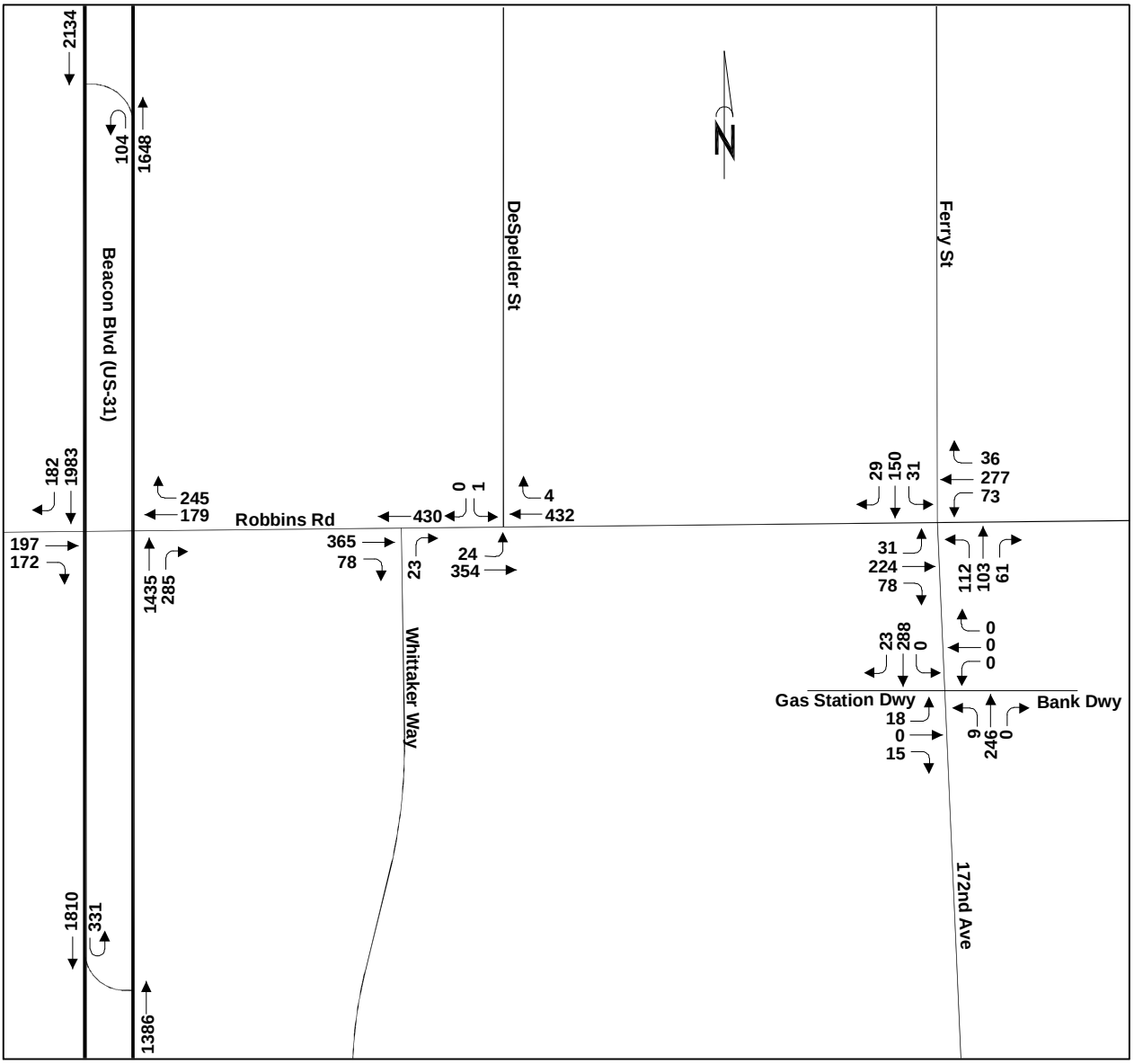
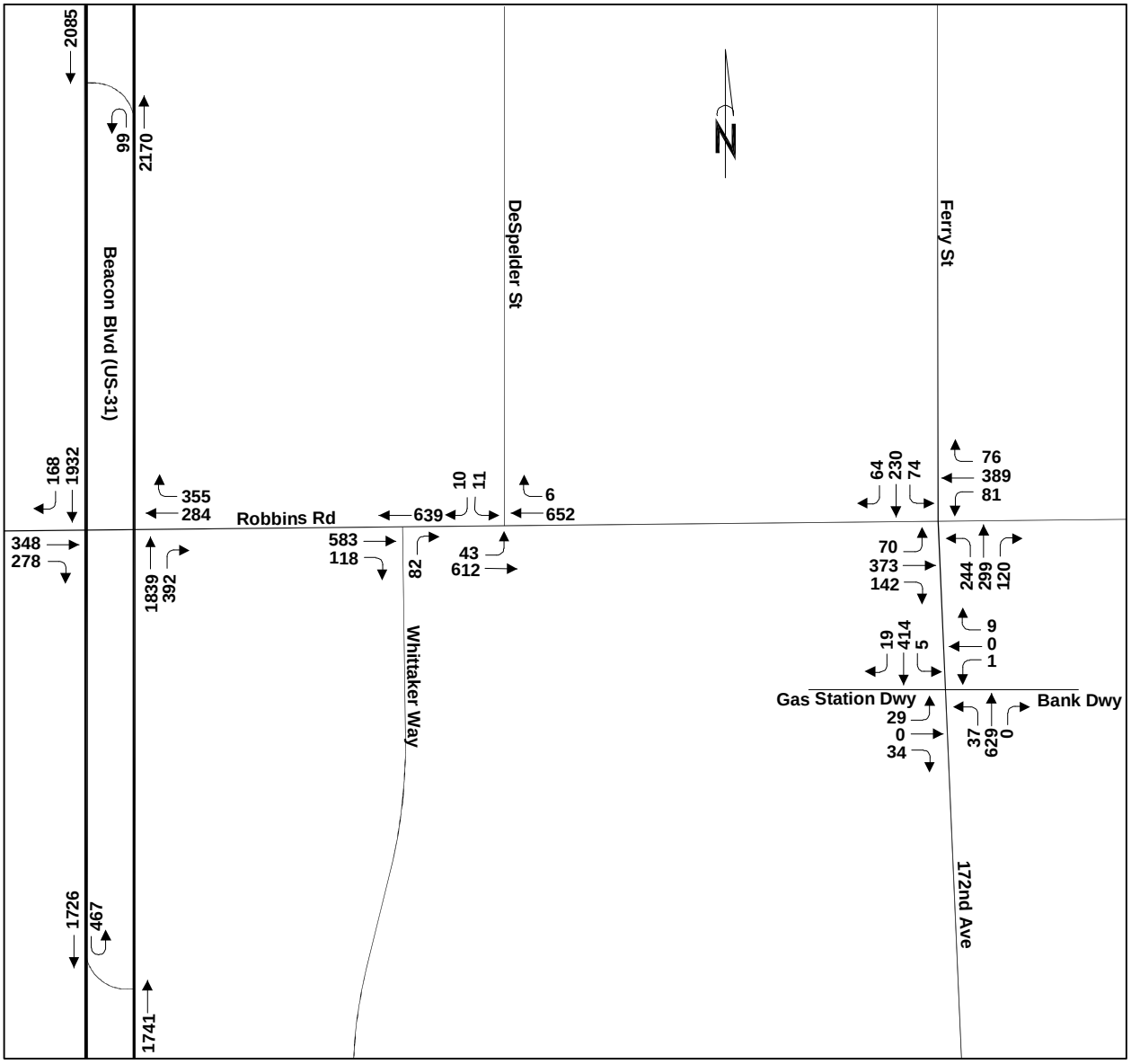


Exhibit 3-5 Future No Build 2023 PM Peak Hour Traffic Volumes



3.2.4 Future No Build 2023 Operational Analysis

Each of the study area intersections were evaluated with the future 2023 no build traffic volumes to determine the future intersection operations without the proposed development project. Highway capacity analyses were conducted for existing geometric conditions and traffic control, and future 2023 no build traffic volumes (without the proposed development), and are summarized in Table 3-2.

The future no build capacity analyses revealed that all of the study area intersections will continue to operate with acceptable levels of service with the exception of the US-31 and Robbins Road intersection. During the morning peak hour, the southbound through movement will operate at a LOS F. During the afternoon peak hour, the southbound through movement and westbound right turn movement will operate at a LOS E.

During the morning peak hour, adjustments to the existing traffic signal timing splits by providing three more seconds to the north/south approaches from the east/west approaches will result in all movements operating acceptably. In order to mitigate the afternoon peak hour, the cycle length will need to be increased to a 90 second cycle length from the existing 70 second cycle length. Increasing the cycle length of the traffic signal and optimizing the splits will result in all movements operating at acceptable levels of service. Since the signalized crossover south of Robbins Road is in coordination with this signalized intersection, the cycle length at that study area intersection will also need to be increased. It should be noted that even with the traffic signal timing adjustments, the southbound through traffic still has v/c ratios exceeding 1.0. During the afternoon peak hour, the v/c ratio for the northbound through movement is 0.99. The results of the mitigated conditions analysis for the two intersections with recommended improvement strategies are provided in Table 3-3.

Table 3-2 Future No Build 2023 Synchro Analyses Results

Intersection	Lane Movement/ Approach	AM Peak Hour			PM Peak Hour		
		LOS	Delay (sec)	V/C Ratio	LOS	Delay (sec)	V/C Ratio
US-31 (Beacon Blvd) & Robbins Road	EB Thru	C	28.3	0.60	D	54.4	0.93
	EB Right	C	26.2	0.48	C	34.7	0.75
	EB Approach	**C**	**27.3**	**N/A**	**D**	**45.7**	**N/A**
	WB Thru	C	26.7	0.53	C	31.9	0.73
	WB Right	C	33.5	0.71	E	61.0	0.95
	WB Approach	**C**	**30.6**	**N/A**	**D**	**48.1**	**N/A**
	SB Thru	F	84.5	1.16	E	66.5	1.11
	SB Right	A	8.8	0.13	B	10.7	0.11
	SB Approach	**E**	**78.1**	**N/A**	**E**	**62.1**	**N/A**
	NB Thru	B	13.3	0.91	D	39.0	1.05
	NB Right	A	1.0	0.12	A	4.6	0.41
	NB Approach	**B**	**11.3**	**N/A**	**C**	**32.9**	**N/A**
	Overall-West	**E**	**65.8**	**1.01**	**D**	**52.7**	**1.06**
	Overall-East	**B**	**13.7**	**0.86**	**C**	**32.2**	**1.02**
US-31 (Beacon Blvd) & Crossover South of Robbins Road	EB Left	B	15.7	0.680	C	27.3	0.870
	EB Approach	**B**	**15.7**	**N/A**	**C**	**27.3**	**N/A**
	NB Thru	B	17.9	0.860	C	23.4	0.940
	NB Approach	**B**	**17.9**	**N/A**	**C**	**23.4**	**N/A**
	Overall	**B**	**17.4**	**0.80**	**C**	**24.3**	**0.91**
US-31 (Beacon Blvd) & Crossover North of Robbins Road	WB Left	C	23.9	0.446	C	20.3	0.355
	WB Approach	**C**	**23.9**	**N/A**	**C**	**20.3**	**N/A**
	Overall	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Robbins Road & Ferry Street/172nd Avenue	WB Left	B	15.0	0.17	B	18.4	0.18
	WB Thru/Rt	C	20.9	0.45	C	28.8	0.63
	WB Approach	**B**	**19.7**	**N/A**	**C**	**27.3**	**N/A**
	EB Left	B	15.1	0.08	B	17.1	0.22
	EB Thru/Rt	C	23.0	0.49	C	33.7	0.79
	EB Approach	**C**	**22.3**	**N/A**	**C**	**31.7**	**N/A**
	NB Left	C	23.9	0.31	D	45.1	0.82
	NB Thru	C	27.0	0.22	D	37.5	0.66
	NB Right	C	26.2	0.15	C	29.5	0.31
	NB Approach	**C**	**25.6**	**N/A**	**D**	**38.8**	**N/A**
	SB Left	C	24.1	0.08	C	24.4	0.26
	SB Thru/Rt	C	33.3	0.46	D	42.4	0.73
	SB Approach	**C**	**31.9**	**N/A**	**D**	**38.8**	**N/A**
	Overall	**C**	**23.9**	**N/A**	**C**	**34.0**	**N/A**
Robbins Road & Whittaker Way	NB Right	B	11.2	0.550	B	14.4	0.226
	NB Approach	**B**	**11.2**	**N/A**	**B**	**14.4**	**N/A**
	Overall	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Robbins Road & DeSpelder Street	EB Left*	A	8.4	0.013	A	9.3	0.053
	SB Approach	**B**	**13.4**	**0.004**	**C**	**17.5**	**0.088**
	Overall	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
172nd Avenue & Quick Stop/Bank Dwys	NB Left*	A	8.1	0.009	A	8.4	0.036
	EB Approach	**B**	**12.6**	**N/A**	**C**	**17.1**	**N/A**
	SB Left*	A	0.0	0.000	A	9.0	0.006
	WB Approach	**A**	**0.0**	**N/A**	**B**	**12.9**	**N/A**
	Overall	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**

* denotes LOS, delay, and V/C ratio for major street left turn movement

Table 3-3 Future No Build 2023 Synchro Analyses Results with Mitigation

Intersection	Lane Movement/ Approach	AM Peak Hour			PM Peak Hour		
		LOS	Delay (sec)	V/C Ratio	LOS	Delay (sec)	V/C Ratio
US-31 (Beacon Blvd) & Robbins Road	EB Thru	C	34.5	0.70	D	45.4	0.84
	EB Right	C	29.5	0.56	D	37.2	0.71
	EB Approach	**C**	**32.2**	**N/A**	**D**	**41.8**	**N/A**
	WB Thru	C	30.9	0.62	C	29.9	0.66
	WB Right	D	46.8	0.82	D	44.7	0.88
	WB Approach	**D**	**40.1**	**N/A**	**D**	**38.1**	**N/A**
	SB Thru	D	54.5	1.10	D	44.6	1.05
	SB Right	A	5.4	0.13	A	2.3	0.12
	SB Approach	**D**	**50.4**	**N/A**	**D**	**41.2**	**N/A**
	NB Thru	A	9.8	0.87	C	24.7	0.99
	NB Right	A	1.5	0.14	A	5.1	0.38
	NB Approach	**A**	**8.4**	**N/A**	**C**	**21.2**	**N/A**
	Overall-West	**D**	**44.5**	**1.01**	**D**	**37.5**	**0.98**
	Overall-East	**B**	**13.2**	**0.86**	**C**	**22.2**	**0.95**
US-31 (Beacon Blvd) & Crossover South of Robbins Road	EB Left	B	15.7	0.680	C	30.7	0.880
	EB Approach	**B**	**15.7**	**N/A**	**C**	**30.7**	**N/A**
	NB Thru	B	17.9	0.860	C	20.0	0.880
	NB Approach	**B**	**17.9**	**N/A**	**C**	**20.0**	**N/A**
	Overall	**B**	**17.4**	**0.80**	**C**	**22.3**	**0.88**

3.3 PROJECTED 2023 BUILD CONDITIONS

The traffic impact analysis for projected year conditions with traffic from the proposed development began with the development of turning movement volumes for the weekday morning and afternoon peak hours. These future traffic volumes were derived from developing the trip generation, distribution and assignment for the proposed development and adding them to traffic volumes projected for 2023 without the proposed development.

Robbins Center Point is expected to have 65,757 square feet of retail development and is anticipated to be complete within a five-year timeframe. The traffic impact study for this proposed commercial development examines the entire development in one phase, with a 2023 horizon year.

3.3.1 Site Access

Access to the development is proposed to be served via three full movement accesses. One access is proposed to Robbins Road at the existing middle curb cut of the five existing curb cuts located along Robbins Road. A second access is proposed to Whittaker Way immediately north of the Spectrum Health parking lot. The third access is to 172nd Avenue through the existing access for the D&W Quick Stop. The

172nd Avenue and Robbins Road accesses currently exist for the property. The proposed Robbins Road access will be reconstructed to consolidate five existing driveways to one main driveway. The 172nd Avenue access would remain as-is since it was just reconstructed for the D&W Quick Stop. The Whittaker Way access would consist of a new curb cut.

3.3.2 Trip Generation

New trips to be generated by the proposed commercial development were estimated based on information and procedures contained in the Institute of Transportation Engineer's (ITE) report *Trip Generation, Tenth Edition, September 2017.* Final build-out of the entire development was anticipated in 2023.

Since tenants for this development are unknown at this time and land uses, as well as building sizes, are not fully defined, the trip estimates for the site were developed with a more general land use and were not specific for each possible use. In addition, two different options exist for the southern portion of the site. Option A consists of 28,182 square feet of general box retail while Option B consists of a 19,000 square foot retail building. To be conservative, the gross leasable area of the land was assumed to be 65,757 square feet (assuming the larger of the two options). Once the tenants are known and a final site plan is completed, the actual square footage may be lower than what is anticipated in this study.

Shopping Center, Land Use Code (820), is an integrated group of commercial establishments that are planned, developed, owned, and managed as a unit. It typically includes uses other than that of general retail such as restaurants, banks, and offices. This land use seemed to cover most anything that would possibly develop on this site. Therefore, trip estimates were based on Land Use Code 820 for the entire site. The weekday morning and afternoon peak hour trip generation estimates are shown in Table 3-4.

Table 3-4 Robbins Center Point PUD Trip Generation

	Total Trips			Pass-by Trips			New Trips		
Time Period	Total	In	Out	Total	In	Out	Total	In	Out
AM Peak Hour	185	115	70	63	39	24	122	76	46
PM Peak Hour	398	191	207	135	65	70	263	126	137

"New Trips" are those that are new to the study area and consist of motorists whose primary destination is the Robbins Center Point development. "Pass-by Trips" involve motorists who are diverted off of the adjacent street system to visit this development. A portion of the trips generated by Robbins Center Point development were assumed to be pass-by trips. These trips divert from existing travel paths to stop at the site and then resume the original trip path. Thus, additional trips are not added to the area road system by these pass-by trips. Pass-by rates were based on information provided in ITE's *Trip Generation Handbook, Tenth Edition.* A pass-by rate of 34% was used for the morning and afternoon peak hours. When examining the pass-by rates for smaller shopping center sizes between 50-85,000

square feet, an average pass-by rate of 44% was calculated, therefore the 34% provides a worse-case scenario for new trips on the street network.

"Internal Trips" are those that will visit more than one use within the site. Since trips for the Robbins Center Point development were estimated with Land Use Code 820, Shopping Center, internal capture rates are not applicable and should not be used to estimate trips for shopping centers. Data has been collected directly for shopping centers as a stand-alone development, therefore, the associated trip generation data presented in the manual already reflect the effects of internal capture and the mixed-use nature of the center.

Internal traffic utilizing Whittaker Way between the Spectrum Health, Meijer, and Robbins Center Point uses was also not included other than the small percentage assigned to Whittaker Way. It is likely that there will be some internal trips on Whittaker Way between these adjacent developments. However, this analysis assumes a worse-case scenario for the overall road network.

Traffic from the existing uses on the proposed site was not subtracted from the existing volumes. The existing traffic volumes used in the analysis include traffic from the existing businesses that currently sit at the proposed site.

3.3.3 Directional Distribution

Trip distribution for the site was determined based on existing peak hour traffic volumes on the study area roadways. The resultant trip distribution pattern for the proposed commercial development is as follows:

- To/from the north on US-31 37%
- To/from the south on US-31 32%
- To/from the west on Robbins Road 8%
- To/from the east on Robbins Road 9%
- To/from the north on Ferry Street 6%
- To/from the south on 172nd Avenue 7%
- To/from the south on Whittaker Way 1%.

3.3.4 Projected 2023 Build Traffic Volumes

The estimated number of weekday morning and afternoon peak hour trips was distributed to the surrounding roadway network using the above distributions. Exhibits 3-6 and 3-7 show the corresponding site generated traffic volumes distributed on the study area network at full build out of the development.

Projected site generated trips were added to the no build 2023 traffic volumes to yield the Projected 2023 Build Conditions. These traffic volumes represent the 1.5% growth over existing traffic volumes,

the addition of Spectrum Health traffic, and the estimated site traffic at full build of the entire development. Exhibits 3-8 and 3-9 illustrate the weekday morning and afternoon hour traffic volumes for the projected 2023 build conditions.

Access Configuration

In order to determine the configurations of the proposed site driveways to Robbins Road, 172nd Avenue, and Whittaker Way, warrants for left and right-turn lanes were evaluated, and a capacity analysis was conducted. Michigan Department of Transportation (MDOT) traffic volume guidelines for right-turn lanes and tapers were reviewed for the necessity of constructing a right turn lane at the proposed site driveways. It was found that the proposed driveway to Whittaker Way does not meet the guidelines for a lane or taper. The existing driveway to 172nd Avenue was found to meet warrants for a right turn deceleration taper only and the proposed driveway to Robbins Road meets guidelines for a full right turn lane. The full right turn lane should be designed in accordance with the City of Grand Haven requirements.

Whittaker Way was examined to determine the need for an exclusive left-turn lane along Whittaker Way at the proposed driveway location. The proposed driveway location is located within the existing taper area prior to the two-way center left-turn lane which begins south of the proposed driveway. It was found that the left-turn volume utilizing this driveway in conjunction with the through volumes do not meet warrants for an exclusive left turn lane.

Exhibit 3-6 Projected 2023 Build AM Peak Hour Site Generated Trips

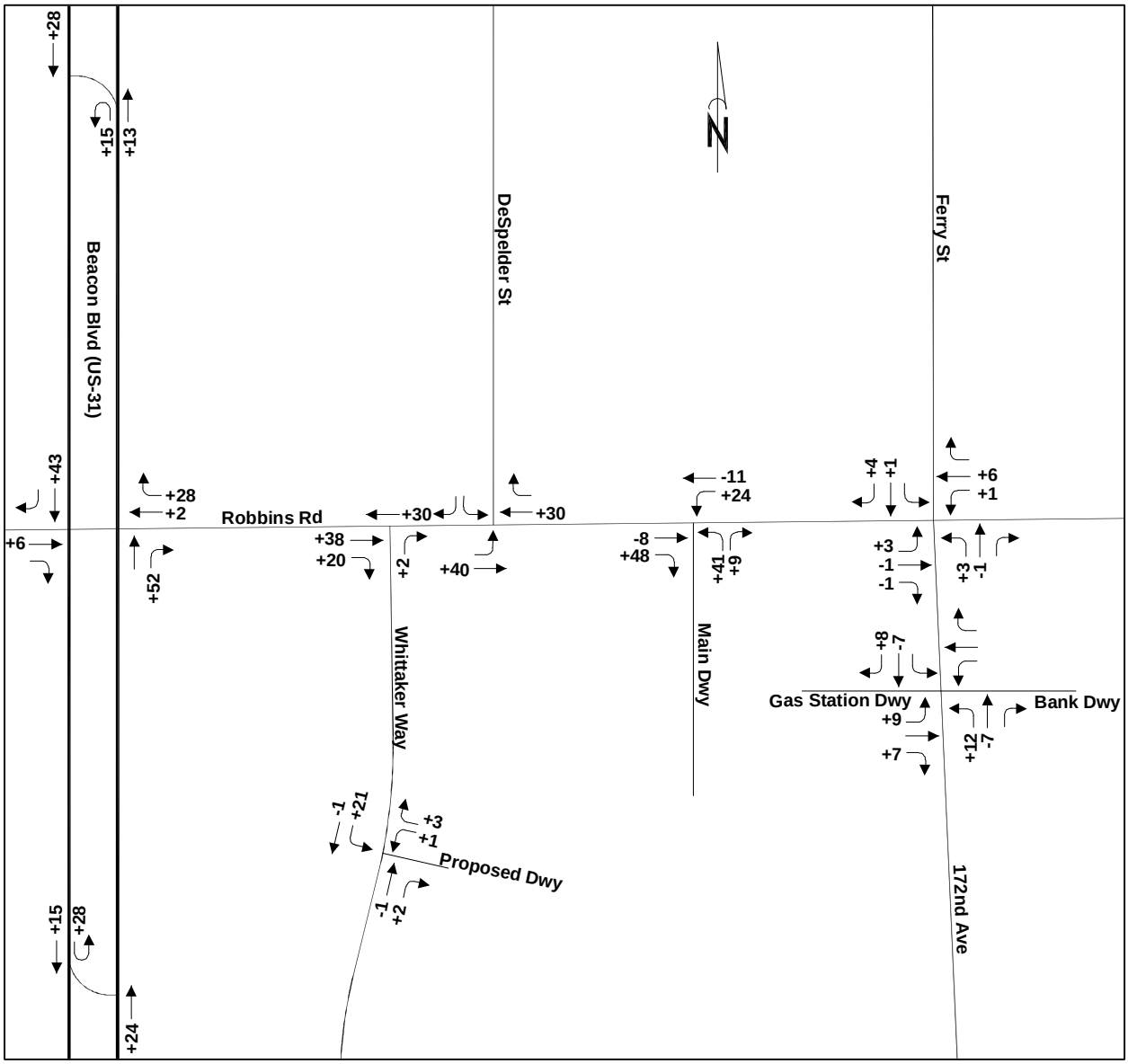


Exhibit 3-7 Projected 2023 Build PM Peak Hour Site Generated Trips

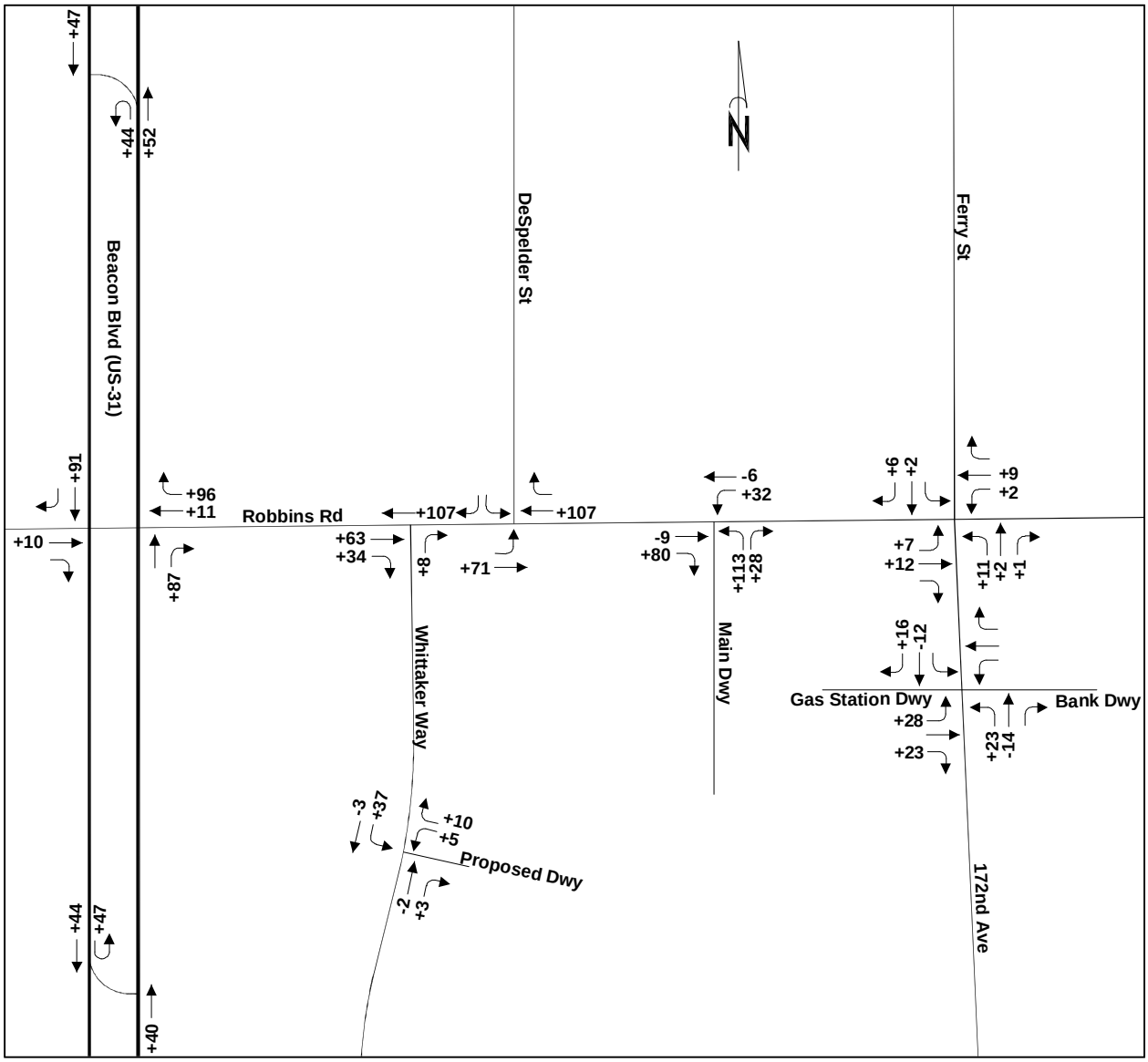


Exhibit 3-8 Projected 2023 Build AM Peak Hour Traffic Volumes

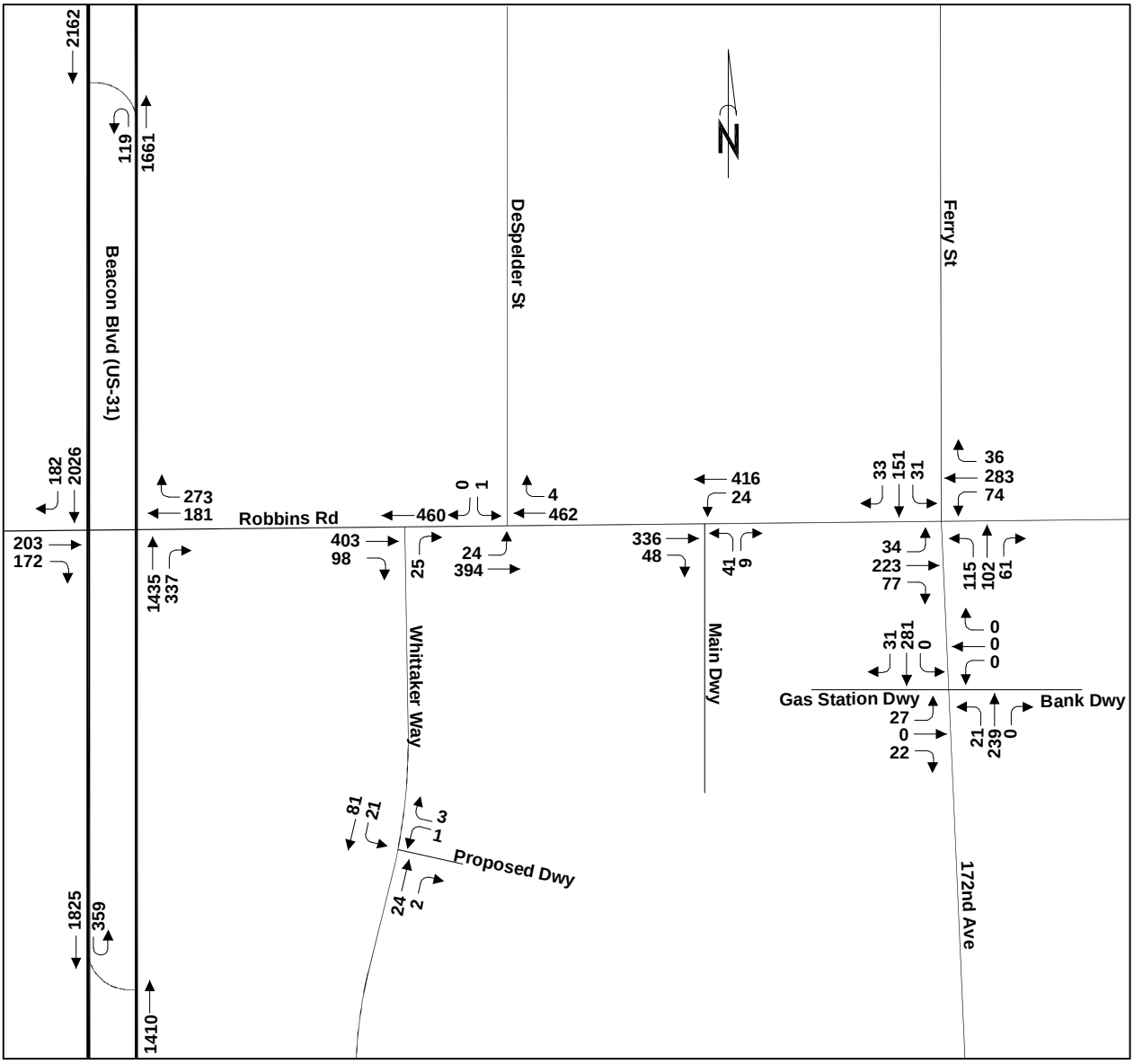
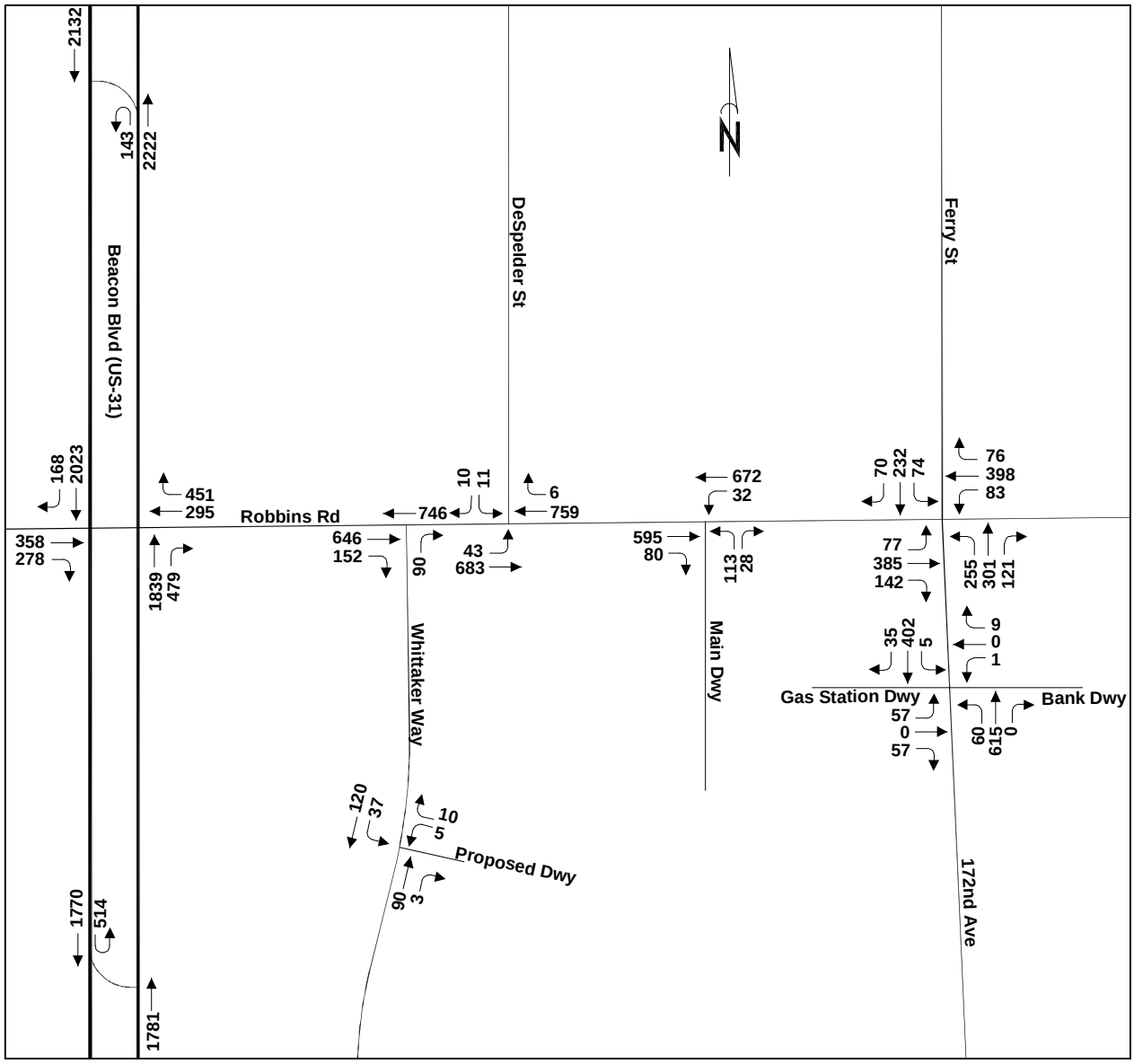


Exhibit 3-9 Projected 2023 Build PM Peak Hour Traffic Volumes



3.3.5 Projected 2023 Build Operational Analysis

Each of the study area intersections were evaluated with the future 2023 build traffic volumes to determine the future intersection operations with the proposed commercial development project. Highway capacity analyses were conducted for existing geometric conditions and traffic control, and 2023 projected traffic volumes, and are summarized in Table 3-5. Improvement strategies presented under the no build conditions were assumed to be in place for the projected 2023 build conditions analyses.

The capacity analysis for the projected 2023 build conditions revealed that all of the study area intersections remained operating at acceptable levels of service with the exception of the US-31 and Robbins Road intersection. During the morning peak hour, the southbound through movement and the westbound right turn movement will both operate at a LOS E. During the afternoon peak hour, the southbound through movement is expected to operate at a LOS E while the westbound right turn movement degrades to a LOS F.

The capacity analysis for the site driveways revealed that all movements at all three site accesses will operate acceptably with the exception of the northbound exiting movement to Robbins Road during the afternoon peak hour. As proposed, the exit lane from the proposed development onto Robbins Road has one lane for all movements. This approach is expected to operate at a level of service E during the afternoon peak hour with a delay of 37.5 seconds.

Table 3-5 Projected 2023 Build Synchro Analyses Results

Intersection	Lane Movement/ Approach	AM Peak Hour			PM Peak Hour		
		LOS	Delay (sec)	V/C Ratio	LOS	Delay (sec)	V/C Ratio
US-31 (Beacon Blvd) & Robbins Road	EB Thru	C	34.0	0.70	D	45.8	0.85
	EB Right	C	28.8	0.54	D	36.2	0.70
	EB Approach	**C**	**31.6**	**N/A**	**D**	**41.6**	**N/A**
	WB Thru	C	30.1	0.60	C	30.7	0.67
	WB Right	E	59.7	0.91	F	110.0	1.12
	WB Approach	**D**	**47.9**	**N/A**	**E**	**78.6**	**N/A**
	SB Thru	E	70.1	1.14	E	67.6	1.1
	SB Right	A	5.5	0.13	A	2.8	0.12
	SB Approach	**E**	**64.8**	**N/A**	**E**	**62.6**	**N/A**
	NB Thru	B	10.3	0.87	C	26.0	0.99
	NB Right	A	2.6	0.18	A	6.5	0.49
	NB Approach	**A**	**8.8**	**N/A**	**C**	**21.9**	**N/A**
	Overall-West	**E**	**55.9**	**1.03**	**D**	**52.3**	**1.02**
	Overall-East	**B**	**15.1**	**0.88**	**C**	**32.0**	**1.03**
US-31 (Beacon Blvd) & Crossover South of Robbins Road	EB Left	B	17.8	0.750	D	43.1	0.970
	EB Approach	**B**	**17.8**	**N/A**	**D**	**43.1**	**N/A**
	NB Thru	B	18.7	0.880	C	21.4	0.900
	NB Approach	**B**	**18.7**	**N/A**	**C**	**21.4**	**N/A**
	Overall	**B**	**18.5**	**0.83**	**C**	**26.3**	**0.92**
US-31 (Beacon Blvd) & Crossover North of Robbins Road	WB Left	D	26.9	0.518	D	25.9	0.525
	WB Approach	**D**	**26.9**	**N/A**	**D**	**25.9**	**N/A**
	Overall	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Robbins Road & Ferry Street/172nd Avenue	WB Left	B	15.0	0.17	B	16.5	0.24
	WB Thru/Rt	C	21.2	0.46	C	29.6	0.71
	WB Approach	**C**	**20.0**	**N/A**	**C**	**27.7**	**N/A**
	EB Left	B	15.1	0.09	B	16.0	0.24
	EB Thru/Rt	C	23.0	0.49	B	18.6	0.81
	EB Approach	**C**	**22.2**	**N/A**	**B**	**18.3**	**N/A**
	NB Left	C	24.0	0.32	D	53.6	0.88
	NB Thru	C	26.9	0.22	D	37.5	0.67
	NB Right	C	26.2	0.15	C	29.5	0.32
	NB Approach	**C**	**25.6**	**N/A**	**D**	**42.2**	**N/A**
	SB Left	C	24.1	0.08	C	24.4	0.26
	SB Thru/Rt	C	33.6	0.47	D	43.9	0.75
	SB Approach	**C**	**32.2**	**N/A**	**D**	**40.0**	**N/A**
	Overall	**C**	**24.0**	**N/A**	**C**	**31.7**	**N/A**
Robbins Road & Whittaker Way	NB Right	B	11.6	0.063	C	15.9	0.272
	NB Approach	**B**	**11.6**	**N/A**	**C**	**15.9**	**N/A**
	Overall	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Robbins Road & DeSpelder Street	EB Left*	A	8.5	0.013	A	9.8	0.059
	SB Approach	**B**	**14.0**	**0.004**	**C**	**19.8**	**0.102**
	Overall	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
172nd Avenue & Quick Stop/Bank Dwys	NB Left*	A	8.1	0.021	A	8.5	0.059
	EB Approach	**B**	**13.2**	**N/A**	**C**	**22.0**	**N/A**
	SB Left*	A	0.0	0.000	A	8.9	0.006
	WB Approach	**A**	**0.0**	**N/A**	**B**	**13.2**	**N/A**
	Overall	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Robbins Road & Main Site Dwy	WB Left*	A	8.3	0.023	A	9.2	0.039
	NB Approach	**B**	**14.2**	**0.0151**	**E**	**37.5**	**0.657**
	Overall	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Whittaker Way & Proposed Site Dwy	SB Left*	A	7.3	0.016	A	7.5	0.027
	WB Approach	**A**	**8.8**	**0.006**	**A**	**9.5**	**0.02**
	Overall	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**

* denotes LOS, delay, and V/C ratio for major street left turn movement

3.3.6 Projected 2023 Build Operational Analysis with Mitigation

In order to mitigate the effects of adding project traffic to the road system, improvements are needed at the US-31 and Robbins Road intersection as well as at the proposed main site driveway to Robbins Road.

Several investigations were conducted to determine mitigation for this intersection. Since the traffic signal has a two-phase operation, any time taken from one direction of travel impacts the other direction of travel and since the intersection has poor levels of service for both directions, adjusting the splits further would not alleviate these delays for one travel direction. Several attempts were made to examine different cycle lengths as well, none of which mitigated all of the unacceptable movements at this intersection. The Robbins Center Pointe P.U.D. Traffic Impact Study Executive Summary that was issued on January 30, 2018 discussed the need for construction of an additional westbound right turn lane. However, since that summary was issued, other options were considered and discussed with the Township.

The following mitigation should be required due to project traffic for full build of the development:

US-31 and Robbins Road

- Restriping of westbound approach to a shared through/right turn lane and a right turn lane.
- Increase the cycle length to 90 seconds for the morning peak hour and optimize the splits/offsets (adjust cycle length at adjacent signalized crossover as well).
- Increase the cycle length to 120 seconds for the afternoon peak hour and optimize the splits/offsets (adjust cycle length at adjacent signalized crossover as well).

Robbins Road and Proposed Main Driveway

- Construction of separate left and right turn exit lanes.
- Construct eastbound right-turn lane along Robbins Road.

Highway capacity analyses were again conducted for projected year 2023 traffic volumes with the identified improvement strategies summarized above. Since the signalized crossover south of Robbins Road is in coordination with the Robbins Road signalized intersection, the cycle length at that study area intersection will also need to be increased for both peak hours. The results of the mitigated conditions analysis are presented in Table 3-6.

All movements will operate acceptably during the morning peak hour with the improvements noted above. During the afternoon peak hour, all movements will operate acceptably with the exception of the shared westbound through/right turn movement which will operate at a level of service E with a delay of 56.7 seconds. The threshold for a level of service D is 55 seconds. This analysis has provided a worse case scenario including adding a seasonal adjustment factor to existing conditions, a 1.5% growth factor to project future volumes, a higher than average pass-by percentage, and lastly no subtraction of existing traffic volumes utilizing this site. It is our recommendation that no further mitigation is required

to improve upon the level of service E. When comparing the overall intersection operations between the no build and build conditions, the overall delays and v/c ratios are improved from the no build condition.

The improvements to the site driveway result in a level of service D for the northbound left turn and level of service B for the northbound right turn lane.

Table 3-6 Projected 2023 Build Synchro Analyses Results with Mitigation

Intersection	Lane Movement/ Approach	AM Peak Hour			PM Peak Hour		
		LOS	Delay (sec)	V/C Ratio	LOS	Delay (sec)	V/C Ratio
US-31 (Beacon Blvd) & Robbins Road	EB Thru	D	42.2	0.71	D	46.7	0.76
	EB Right	D	37.7	0.59	D	41.7	0.65
	EB Approach	**D**	**40.1**	**N/A**	**D**	**44.5**	**N/A**
	WB Thru/Rt	D	53.0	0.84	E	56.7	0.87
	WB Right	D	45.0	0.76	D	54.5	0.83
	WB Approach	**D**	**49.2**	**N/A**	**E**	**55.7**	**N/A**
	SB Thru	C	32.1	1.03	D	54.0	1.06
	SB Right	A	2.0	0.13	A	6.9	0.14
	SB Approach	**C**	**29.6**	**N/A**	**D**	**50.4**	**N/A**
	NB Thru	A	8.8	0.79	C	22.2	0.96
	NB Right	A	2.9	0.31	A	7.5	0.46
	NB Approach	**A**	**7.7**	**N/A**	**B**	**19.2**	**N/A**
	Overall-West	**C**	**29.3**	**0.96**	**D**	**44.5**	**0.96**
	Overall-East	**B**	**14.5**	**0.80**	**C**	**25.1**	**0.93**
US-31 (Beacon Blvd) & Crossover South of Robbins Road	EB Left	C	22.6	0.780	C	29.4	0.860
	EB Approach	**C**	**22.6**	**N/A**	**C**	**29.4**	**N/A**
	NB Thru	B	16.2	0.810	C	27.2	0.900
	NB Approach	**B**	**16.2**	**N/A**	**C**	**27.2**	**N/A**
	Overall	**B**	**17.6**	**0.80**	**C**	**27.7**	**0.89**
Robbins Road & Main Site Dwy	WB Left*	A	8.3	0.023	A	9.2	0.039
	NB Left	B	14.6	0.132	D	34.8	0.577
	NB Right	B	10.5	0.019	B	13.0	0.080
	NB Approach	**B**	**13.9**	**N/A**	**D**	**30.5**	**N/A**
	Overall	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**

4.0 CONCLUSIONS

The existing analyses revealed that all of the study area intersections currently operate at acceptable levels of service. However, the southbound through movement at the US-31 and Robbins Road intersection currently has v/c ratios exceeding 1.0 indicating that this movement is over capacity.

The future no build analyses revealed that movements at the intersection of US-31 and Robbins Road operate at a level of service E or F. Improvements are needed at this study area intersection in order to mitigate the future no build conditions. The improvement strategies for the future no build conditions are summarized below.

- Increase cycle length from 70 to 90 seconds during the afternoon peak hour
- Adjust traffic signal timing splits during both the morning and afternoon peak hours.

The analysis results for the future no build scenario revealed that these signal timing adjustments will result in acceptable levels of service.

The analysis results for the projected build scenario for the proposed commercial development reveal that additional improvements will be needed upon full build out in order to mitigate the traffic impacts caused by adding the project traffic. The improvements that will be required for full build out of the development include the following:

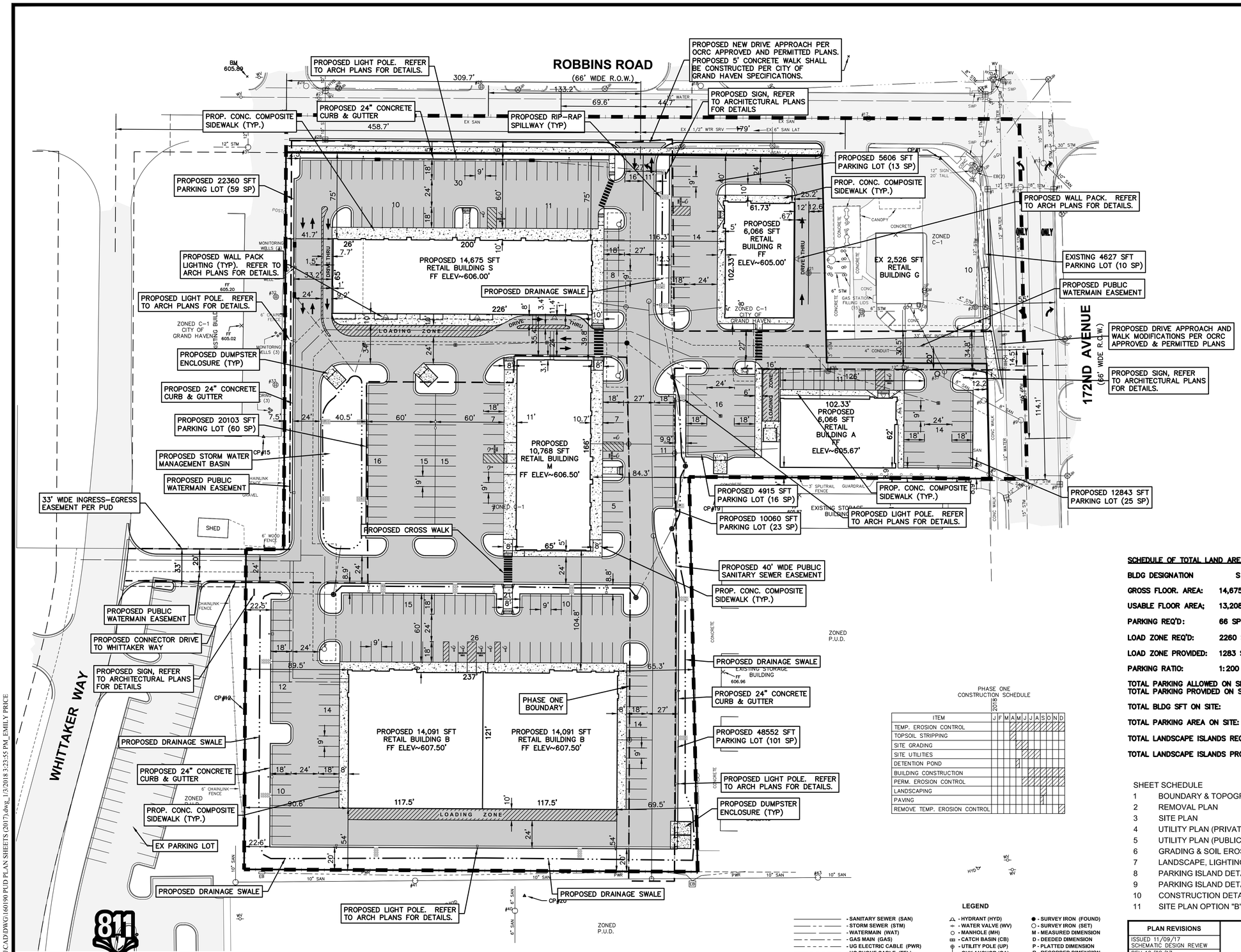
US-31 & Robbins Road

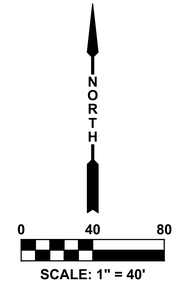
- Restriping of westbound approach to a shared through/right turn lane and a right turn lane.
- Increase the cycle length to 90 seconds for the morning peak hour and optimize the splits/offsets (adjust cycle length at adjacent signalized crossover as well).
- Increase the cycle length to 120 seconds for the afternoon peak hour and optimize the splits/offsets (adjust cycle length at adjacent signalized crossover as well).

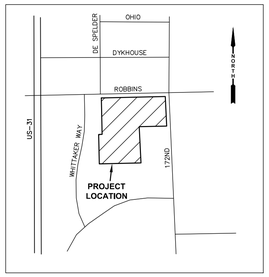
Robbins Road & Main Site Driveway

- Construct eastbound right-turn lane along Robbins Road
- Construct separate left and right turn exit lanes.

APPENDIX A. SITE PLAN







LOCATION MAP
NO SCALE:

SITE PLAN GENERAL NOTES:

1. THE CONTRACTOR SHALL OBTAIN ALL PERMITS AND SURETY AS PART OF THIS WORK.
2. THE CONTRACTOR SHALL CALL MISS DIG 3 WORKING DAYS PRIOR TO THE START OF CONSTRUCTION.
3. THE CONTRACTOR SHALL FURNISH AND PLACE THE DRIVE APPROACH, NEW CURBING, WALK, AND DRIVE CLOSURES WITHIN THE PUBLIC RIGHT OF WAY IN ACCORDANCE WITH OTTAWA COUNTY ROAD COMMISSION PERMITS & STANDARD CONSTRUCTION SPECIFICATIONS.
4. ALL STORM SEWER PIPE SHALL BE ADS N-12 PLASTIC PIPE UNLESS OTHERWISE SPECIFIED.
5. ALL CATCH BASINS AND MANHOLES SHALL BE MINIMUM 4' DIAMETER PRECAST CONCRETE, UNLESS NOTED OTHERWISE.
6. PAVED AREAS SHALL BE CONSTRUCTED WITH:
   12" MDOT CL-2 SAND SUBBASE (C.I.P)
   6" 22-A GRAVEL BASE (C.I.P)
   1 1/2" 3C HMA LEVELING COURSE
   1 1/2" 4C HMA WEARING COURSE
7. THE CONTRACTOR SHALL BED AND BACKFILL ALL UNDERGROUND PIPING WITH MDOT CL-2 SAND TO A MINIMUM OF 95% MAXIMUM DRY DENSITY PER ASTM- 1557.
8. THIS SITE PLAN SHALL NOT BE USED TO STAKE THE LOCATION OF PROPOSED BUILDING COLUMN LINES. THE SURVEYORS ARE TO USE THE BUILDING FOUNDATION PLANS.
9. THE CONTRACTOR SHALL PLACE AND COMPACT FILL UNDER THE PROPOSED BUILDING AREA TO A MINIMUM OF 95% MAXIMUM DRY DENSITY PER ASTM-1557. ALL OTHER AREAS SHALL BE COMPACTED TO A MINIMUM OF 90% MAXIMUM DRY DENSITY.
10. THE CONTRACTOR SHALL REQUEST CONSTRUCTION STAKING BY FAX USING THE MOORE & BRUGGINK, INC. CONTRACTORS CONSTRUCTION STAKING REQUEST FORM. ONLY COMPLETED REQUESTS WILL BE SCHEDULED. NOTE THE PROJECT OWNER WILL PAY THE SURVEYOR TO PLACE STAKES ONLY ONCE. ALL LOST AND DAMAGED STAKES ARE THE CONTRACTORS RESPONSIBILITY
11. REGULATORY AGENCIES AS FOLLOWS:
    GRAND HAVEN CHARTER TOWNSHIP
    CITY OF GRAND HAVEN
    OTTAWA COUNTY ROAD COMMISSION
    OTTAWA COUNTY WATER RESOURCES COMMISSIONER
    OTTAWA COUNTY ENVIRONMENTAL HEALTH DEPARTMENT
    MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY.

SCHEDULE OF TOTAL LAND AREAS:

BLDG DESIGNATION	S	M	B	R	A	G
GROSS FLOOR. AREA:	14,675 SFT	10,768 SFT	28,182 SFT	6,066 SFT	6,066 SFT	2,526 SFT
USABLE FLOOR AREA;	13,208 SFT	9,681 SFT	25,364 SFT	5,459 SFT	5,459 SFT	2,273 SFT
PARKING REQ'D:	66 SPACES	48 SPACES	127 SPACES	27 SPACES	27 SPACES	11 SPACES
LOAD ZONE REQ'D:	2260 SFT	1660 SFT	2370 SFT	620 SFT	620 SFT	608 SFT
LOAD ZONE PROVIDED:	1283 SFT	0	2370 SFT	624 SFT	630 SFT	624 SFT

PARKING RATIO: 1:200 SFT USABLE FLOOR AREA

TOTAL PARKING ALLOWED ON SITE: 306 SPACES
TOTAL PARKING PROVIDED ON SITE: 305 SPACES

TOTAL BLDG SFT ON SITE: 68,283 SFT

TOTAL PARKING AREA ON SITE: 143,989 SFT (/15 = 9599)

TOTAL LANDSCAPE ISLANDS REQ'D: 9599 SFT

TOTAL LANDSCAPE ISLANDS PROVIDED: 9870 SFT

PHASE ONE CONSTRUCTION SCHEDULE

ITEM	2018 J	F	M	A	M	J	J	A	S	O	N	D
TEMP. EROSION CONTROL												
TOPSOIL STRIPPING												
SITE GRADING												
SITE UTILITIES												
DETENTION POND												
BUILDING CONSTRUCTION												
PERM. EROSION CONTROL												
LANDSCAPING												
PAVING												
REMOVE TEMP. EROSION CONTROL												

SHEET SCHEDULE

1 BOUNDARY & TOPOGRAPHIC SURVEY
2 REMOVAL PLAN
3 SITE PLAN
4 UTILITY PLAN (PRIVATE)
5 UTILITY PLAN (PUBLIC)
6 GRADING & SOIL EROSION CONTROL PLAN
7 LANDSCAPE, LIGHTING & SIGNAGE PLAN
8 PARKING ISLAND DETAILS "A" -"O"
9 PARKING ISLAND DETAILS "P" - "T"
10 CONSTRUCTION DETAILS
11 SITE PLAN OPTION "B"

PREPARED FOR:
VISSER BROTHERS, INC
1946 TURNER AVENUE, NW
GRAND RAPIDS, MI 49504
PH (616) 363-3825
FX (616) 363-6477

WWW.VISSERBROTHERS.COM

ATTN: MR BILL MAST

EXISTING ZONING: "C-1" COMMERCIAL
MIN FRONT SETBACK: 50'
MIN SIDE SETBACK: 9'
MIN REAR SETBACK: 20'
MIN LOT AREA: 35,000 SFT
MIN LOT WIDTH: 110'
MAX BLDG HT: 2.5 STORIES/35'

PROPOSED ZONING: P.U.D. PLANNED UNIT DEVELOPMENT

LEGEND

- SANITARY SEWER (SAN)
- STORM SEWER (STM)
- WATERMAIN (WAT)
- GAS MAIN (GAS)
- UG ELECTRIC CABLE (PWR)
- UG PHONE CABLE (TEL)
- AERIAL UTILITY LINE (AERIAL)
- FENCE
- PROPERTY BOUNDARY LINE
- PROPOSED P.U.D. BOUNDARY LINE
- PROPOSED DRAINAGE SWALE
- PROPOSED CURB & GUTTER
- EX BITUMINOUS SURFACE
- PROPOSED BITUMINOUS SURFACE
- PROPOSED CONCRETE SURFACE
- HYDRANT (HYD)
- WATER VALVE (WV)
- MANHOLE (MH)
- CATCH BASIN (CB)
- UTILITY POLE (UP)
- GUY ANCHOR (GA)
- WATER METER (WM)
- WATER STOP BOX (WSB)
- SAN CLEANOUT (CO)
- PHONE RISER (PR)
- GAS METER (GM)
- GAS VALVE (GV)
- ELECTRIC METER (EM)
- ELECTRIC BOX (EB)
- STEEL POST (SP)
- PEDESTRIAN CROSSWALK POLE (CW)
- LIGHT POLE (LP)
- SURVEY IRON (FOUND)
- SURVEY IRON (SET)

M - MEASURED DIMENSION
D - DEEDED DIMENSION
P - PLATTED DIMENSION
R - RECORDED DIMENSION
SWP - SIDEWALK WARNING PAD
FF - FINISHED FLOOR

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

Utility locations are approximate only. Please contact "Miss Dig" three working days prior to the start of construction for exact locations. (1-800-482-7171)

PLAN REVISIONS
ISSUED 11/09/17 SCHEMATIC DESIGN REVIEW
REV 12/28/17 REV PER REVIEW COMMENTS

SITE PLAN
FOR
ROBBINS CENTER POINT P.U.D.
GRAND HAVEN TOWNSHIP, OTTAWA COUNTY, MICHIGAN

MOORE & BRUGGINK, INC.
Consulting Engineers
2020 Monroe Avenue N.W.
Grand Rapids, Michigan 49505-6298
Phone: (616) 363-9801 Web: www.mbce.com

FIELD SURVEY / DATE: M&B-10-05-16
DESIGNED BY: JFL
DESIGN DRAWN BY: FEF
CHECKED BY: JFL
PLAN DATE: 11/6/17
PROJECT NO.: 160190.01
SHEET NUMBER 3 OF 11

P:\160190.1 Visser - Robbins Road\CAD\DWG\160190 PUD PLAN SHEETS (2017).dwg, 1/3/2018 3:23:55 PM, EMILY PRICE

APPENDIX B. EXISTING TRAFFIC DATA

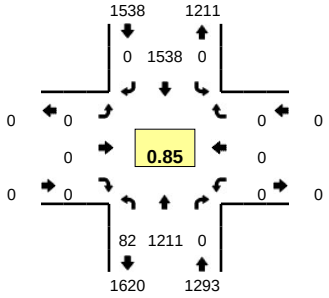
Type of peak hour being reported: System Peak

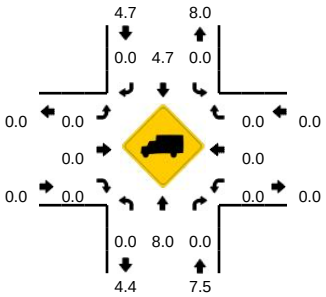
Method for determining peak hour: Total Entering Volume

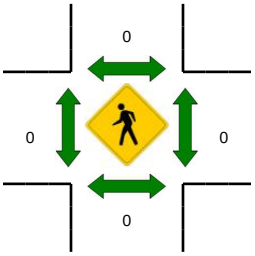
LOCATION: US 31 -- NB to SB Crossover
CITY/STATE: Grand Haven, MI

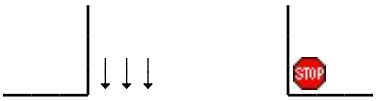
QC JOB #: 14598001
DATE: Thu, Jan 18 2018

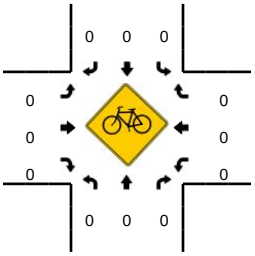
Peak-Hour: 7:15 AM -- 8:15 AM
Peak 15-Min: 7:30 AM -- 7:45 AM

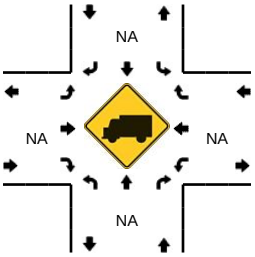


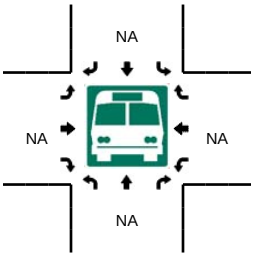












15-Min Count Period Beginning At	US 31 (Northbound)				US 31 (Southbound)				NB to SB Crossover (Eastbound)				NB to SB Crossover (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
7:00 AM	0	238	0	12	0	313	0	0	0	0	0	0	0	0	0	0	563	
7:15 AM	0	308	0	32	0	446	0	0	0	0	0	0	0	0	0	0	786	
7:30 AM	0	383	0	15	0	431	0	0	0	0	0	0	0	0	0	0	829	
7:45 AM	0	297	0	21	0	367	0	0	0	0	0	0	0	0	0	0	685	2863
8:00 AM	0	223	0	14	0	294	0	0	0	0	0	0	0	0	0	0	531	2831
8:15 AM	0	261	0	25	0	264	0	0	0	0	0	0	0	0	0	0	550	2595
8:30 AM	0	231	0	19	0	277	0	0	0	0	0	0	0	0	0	0	527	2293
8:45 AM	0	266	0	19	0	273	0	0	0	0	0	0	0	0	0	0	558	2166

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	0	1532	0	60	0	1724	0	0	0	0	0	0	0	0	0	0	3316
Heavy Trucks	0	120	0		0	92	0		0	0	0		0	0	0		212
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 1/23/2018 5:34 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

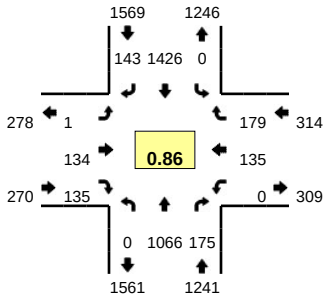
Type of peak hour being reported: System Peak

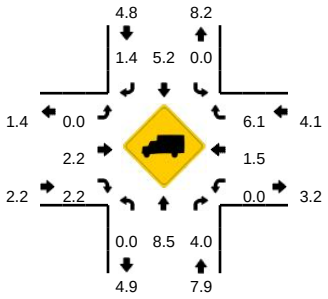
Method for determining peak hour: Total Entering Volume

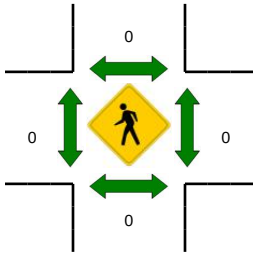
LOCATION: US 31 -- Robbins Rd
CITY/STATE: Grand Haven, MI

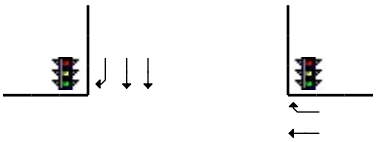
QC JOB #: 14598003
DATE: Thu, Jan 18 2018

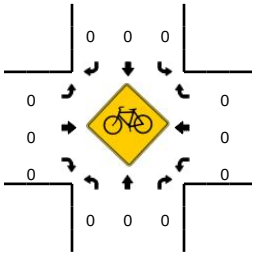
Peak-Hour: 7:15 AM -- 8:15 AM
Peak 15-Min: 7:30 AM -- 7:45 AM

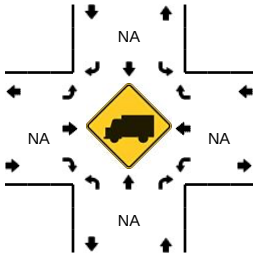


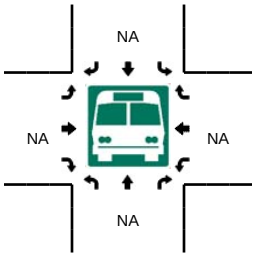












15-Min Count Period Beginning At	US 31 (Northbound)				US 31 (Southbound)				Robbins Rd (Eastbound)				Robbins Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
7:00 AM	0	208	25	0	0	294	17	0	0	23	42	0	0	20	31	0	660	
7:15 AM	0	278	24	0	0	415	36	0	0	24	30	0	0	33	57	0	897	
7:30 AM	0	331	48	0	0	413	32	0	1	34	47	0	0	29	46	0	981	
7:45 AM	0	268	51	0	0	332	42	0	0	36	30	0	0	40	33	0	832	3370
8:00 AM	0	189	52	0	0	266	33	0	0	40	28	0	0	33	43	0	684	3394
8:15 AM	0	248	54	0	0	232	36	0	0	44	36	0	0	49	32	0	731	3228
8:30 AM	0	200	60	0	0	255	31	0	0	48	34	0	0	41	38	0	707	2954
8:45 AM	0	227	67	0	0	245	27	0	0	34	24	0	0	29	43	0	696	2818

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	0	1324	192	0	0	1652	128	0	4	136	188	0	0	116	184	0	3924
Heavy Trucks	0	112	8		0	84	4		0	4	8		0	8	8		236
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 1/23/2018 5:34 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

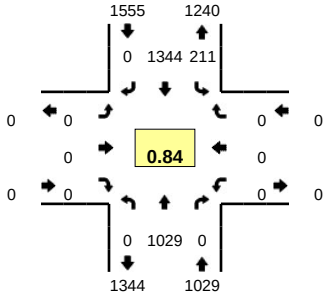
Type of peak hour being reported: System Peak

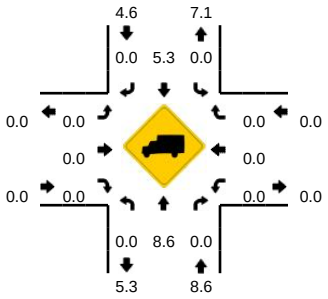
Method for determining peak hour: Total Entering Volume

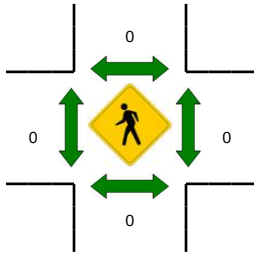
LOCATION: US 31 -- SB to NB Crossover
CITY/STATE: Grand Haven, MI

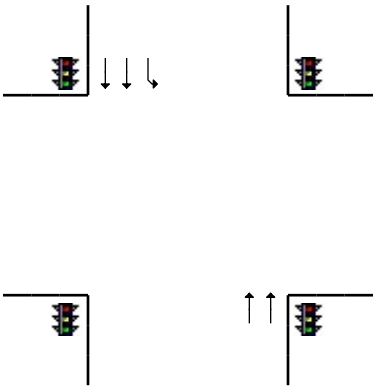
QC JOB #: 14598005
DATE: Thu, Jan 18 2018

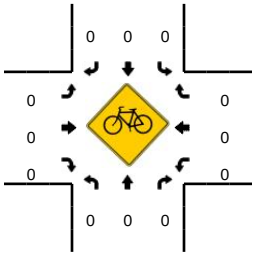
Peak-Hour: 7:15 AM -- 8:15 AM
Peak 15-Min: 7:30 AM -- 7:45 AM

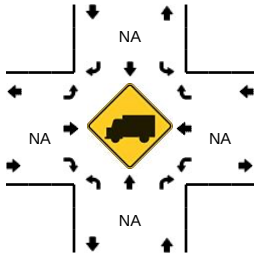


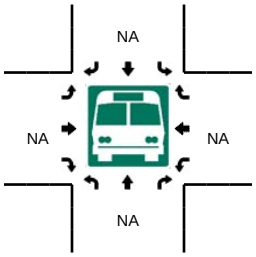












15-Min Count Period Beginning At	US 31 (Northbound)				US 31 (Southbound)				SB to NB Crossover (Eastbound)				SB to NB Crossover (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
7:00 AM	0	197	0	0	0	301	0	43	0	0	0	0	0	0	0	0	541	
7:15 AM	0	264	0	0	0	392	0	41	0	0	0	0	0	0	0	0	697	
7:30 AM	0	315	0	0	0	401	0	57	0	0	0	0	0	0	0	0	773	
7:45 AM	0	267	0	0	0	305	0	68	0	0	0	0	0	0	0	0	640	2651
8:00 AM	0	183	0	0	0	246	0	45	0	0	0	0	0	0	0	0	474	2584
8:15 AM	0	235	0	0	0	190	0	71	0	0	0	0	0	0	0	0	496	2383
8:30 AM	0	193	0	0	0	217	0	66	0	0	0	0	0	0	0	0	476	2086
8:45 AM	0	229	0	0	0	202	0	68	0	0	0	0	0	0	0	0	499	1945

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	0	1260	0	0	0	1604	0	228	0	0	0	0	0	0	0	0	3092
Heavy Trucks	0	116	0		0	88	0		0	0	0		0	0	0		204
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 1/23/2018 5:34 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

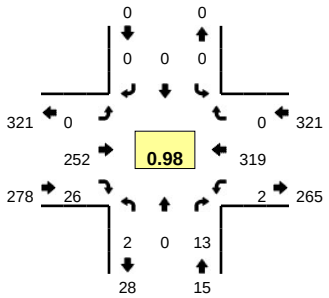
Type of peak hour being reported: System Peak

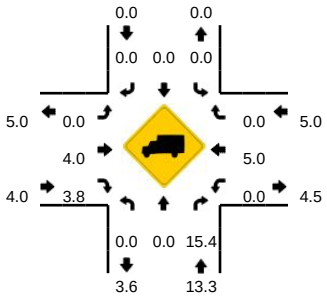
Method for determining peak hour: Total Entering Volume

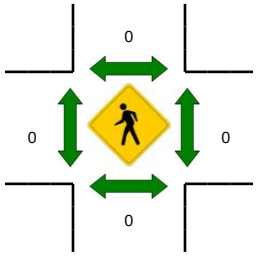
LOCATION: Whittaker Way -- Robbins Rd
CITY/STATE: Grand Haven, MI

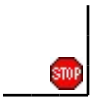
QC JOB #: 14598007
DATE: Thu, Jan 18 2018

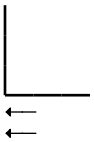
Peak-Hour: 7:15 AM -- 8:15 AM
Peak 15-Min: 7:30 AM -- 7:45 AM

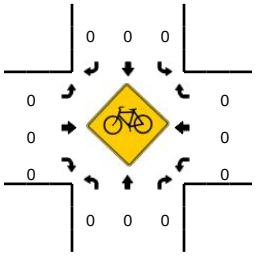


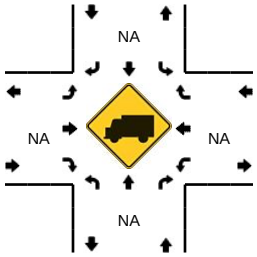


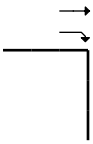


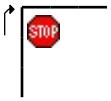


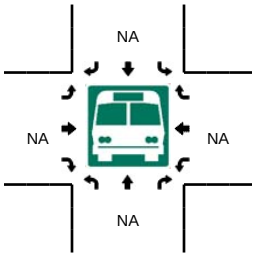












15-Min Count Period Beginning At	Whittaker Way (Northbound)				Whittaker Way (Southbound)				Robbins Rd (Eastbound)				Robbins Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
7:00 AM	1	0	1	0	0	0	0	0	0	32	10	0	0	49	0	0	93	
7:15 AM	0	0	2	0	0	0	0	0	0	40	3	0	0	90	0	0	135	
7:30 AM	1	0	5	0	0	0	0	0	0	62	10	0	0	79	0	0	157	
7:45 AM	0	0	2	0	0	0	0	0	0	74	7	0	1	81	0	0	165	550
8:00 AM	1	0	4	0	0	0	0	0	0	76	6	0	1	69	0	0	157	614
8:15 AM	0	0	4	0	0	0	0	0	0	82	17	0	0	86	0	0	189	668
8:30 AM	1	0	3	0	0	0	0	0	0	89	13	0	0	82	0	0	188	699
8:45 AM	1	0	6	0	0	0	0	0	0	85	15	0	0	77	0	0	184	718

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	4	0	20	0	0	0	0	0	0	248	40	0	0	316	0	0	628
Heavy Trucks	0	0	4		0	0	0		0	12	0		0	24	0		40
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 1/23/2018 5:34 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

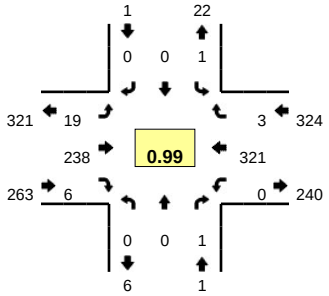
Type of peak hour being reported: System Peak

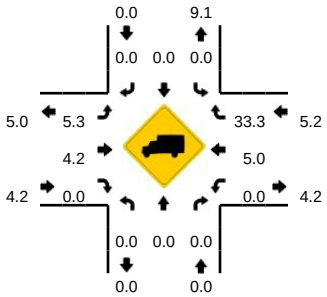
Method for determining peak hour: Total Entering Volume

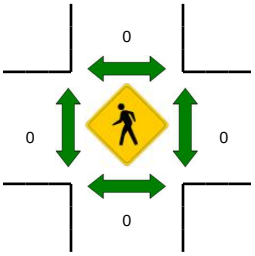
LOCATION: DeSpelder St -- Robbins Rd
CITY/STATE: Grand Haven, MI

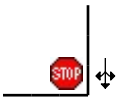
QC JOB #: 14598009
DATE: Thu, Jan 18 2018

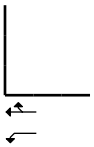
Peak-Hour: 7:15 AM -- 8:15 AM
Peak 15-Min: 7:30 AM -- 7:45 AM

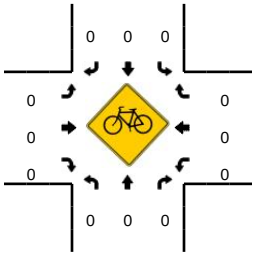


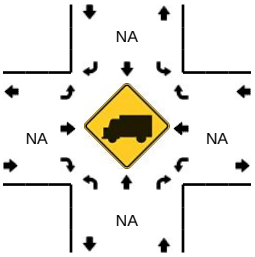


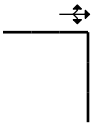


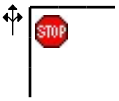


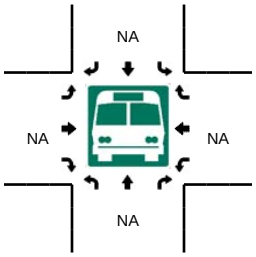












15-Min Count Period Beginning At	DeSpelder St (Northbound)				DeSpelder St (Southbound)				Robbins Rd (Eastbound)				Robbins Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
7:00 AM	0	0	0	0	0	0	0	0	2	34	1	0	0	55	1	0	93	
7:15 AM	0	0	0	0	0	0	0	0	5	36	0	0	0	91	1	0	133	
7:30 AM	0	0	0	0	0	0	0	0	5	62	1	0	0	80	0	0	148	
7:45 AM	0	0	0	0	1	0	0	0	5	66	3	0	0	81	1	0	157	531
8:00 AM	0	0	1	0	0	0	0	0	4	74	2	0	0	69	1	0	151	589
8:15 AM	0	0	0	0	2	0	2	0	4	82	1	0	0	86	1	0	178	634
8:30 AM	0	0	0	0	1	0	1	0	4	80	4	0	0	80	0	0	170	656
8:45 AM	0	0	0	0	0	0	0	0	7	83	3	0	1	77	0	0	171	670

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	0	0	0	0	0	0	0	0	20	248	4	0	0	320	0	0	592
Heavy Trucks	0	0	0		0	0	0		0	20	0		0	24	0		44
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 1/23/2018 5:34 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

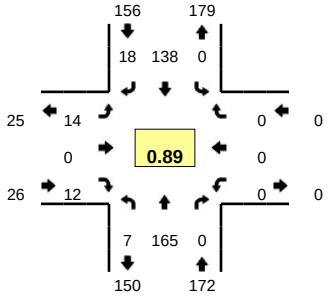
Type of peak hour being reported: System Peak

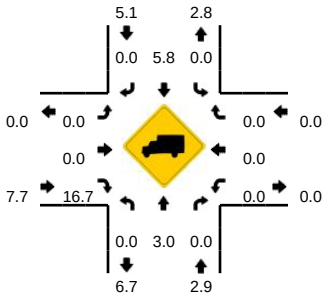
Method for determining peak hour: Total Entering Volume

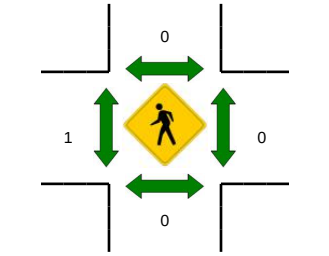
LOCATION: 172nd Ave -- Comerica Bank Dwy
CITY/STATE: Grand Haven, MI

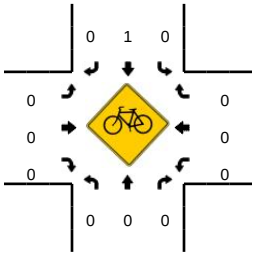
QC JOB #: 14598011
DATE: Thu, Jan 18 2018

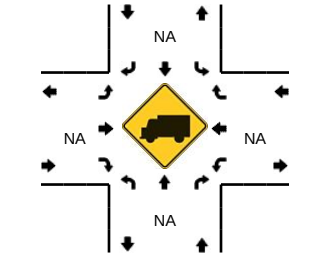
Peak-Hour: 7:15 AM -- 8:15 AM
Peak 15-Min: 7:30 AM -- 7:45 AM

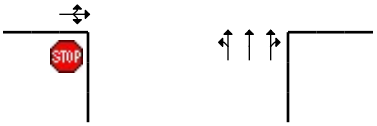


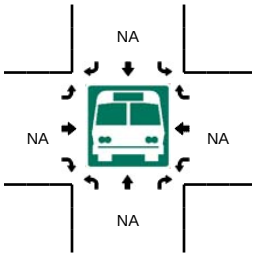












15-Min Count Period Beginning At	172nd Ave (Northbound)				172nd Ave (Southbound)				Comerica Bank Dwy (Eastbound)				Comerica Bank Dwy (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
7:00 AM	1	29	0	0	0	23	0	0	2	0	4	0	0	0	0	0	59	
7:15 AM	3	33	0	0	0	26	6	0	2	0	2	0	0	0	0	0	72	
7:30 AM	2	51	0	0	0	30	3	0	6	0	7	0	0	0	0	0	99	
7:45 AM	1	40	0	0	0	44	4	0	4	0	1	0	0	0	0	0	94	324
8:00 AM	1	41	0	0	0	38	5	0	2	0	2	0	0	0	0	0	89	354
8:15 AM	0	25	0	0	0	63	6	0	2	0	3	0	0	0	0	0	99	381
8:30 AM	4	44	0	0	1	53	4	0	3	0	5	0	0	0	0	0	114	396
8:45 AM	1	31	1	0	1	43	0	0	1	0	4	0	0	0	1	0	83	385

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	8	204	0	0	0	120	12	0	24	0	28	0	0	0	0	0	396
Heavy Trucks	0	0	0		0	4	0		0	0	8		0	0	0		12
Pedestrians		0				0				4				0			4
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 1/23/2018 5:34 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

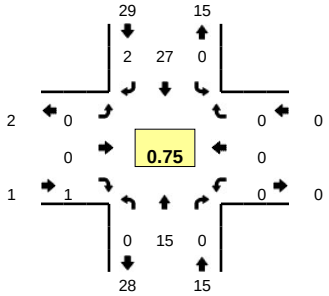
Type of peak hour being reported: System Peak

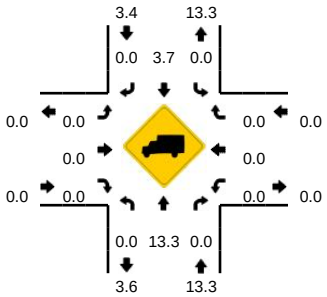
Method for determining peak hour: Total Entering Volume

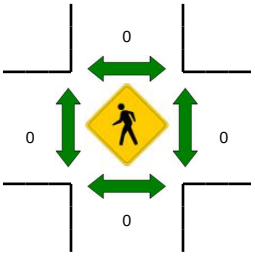
LOCATION: Whittaker Way -- Macatawa Bank Dwy
CITY/STATE: Grand Haven, MI

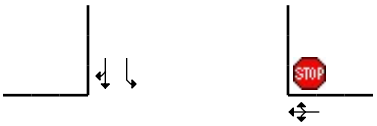
QC JOB #: 14598013
DATE: Thu, Jan 18 2018

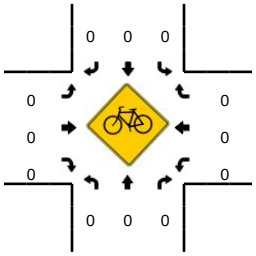
Peak-Hour: 7:15 AM -- 8:15 AM
Peak 15-Min: 7:30 AM -- 7:45 AM

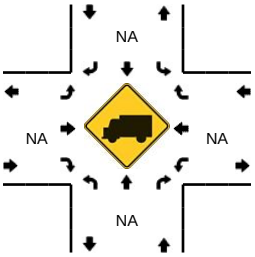


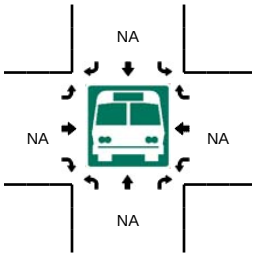












15-Min Count Period Beginning At	Whittaker Way (Northbound)				Whittaker Way (Southbound)				Macatawa Bank Dwy (Eastbound)				Macatawa Bank Dwy (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
7:00 AM	0	2	0	0	0	10	0	0	0	0	0	0	0	0	0	0	12	
7:15 AM	0	2	0	0	0	4	0	0	0	0	0	0	0	0	0	0	6	
7:30 AM	0	6	0	0	0	9	0	0	0	0	0	0	0	0	0	0	15	
7:45 AM	0	2	0	0	0	7	2	0	0	0	1	0	0	0	0	0	12	45
8:00 AM	0	5	0	0	0	7	0	0	0	0	0	0	0	0	0	0	12	45
8:15 AM	0	4	0	0	0	17	0	0	0	0	0	0	0	0	0	0	21	60
8:30 AM	3	4	0	0	0	12	0	0	0	0	0	0	0	0	0	0	19	64
8:45 AM	0	7	0	0	0	15	1	0	0	0	0	0	0	0	0	0	23	75

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	0	24	0	0	0	36	0	0	0	0	0	0	0	0	0	0	60
Heavy Trucks	0	4	0		0	0	0		0	0	0		0	0	0		4
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 1/23/2018 5:34 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

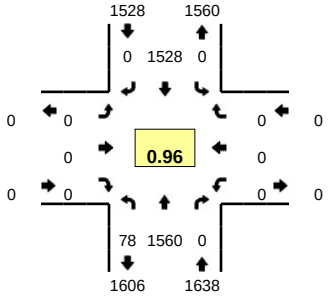
Type of peak hour being reported: System Peak

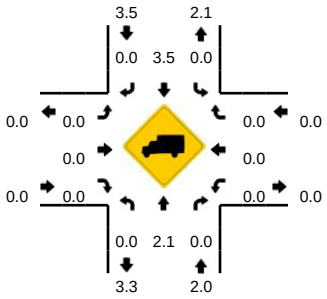
Method for determining peak hour: Total Entering Volume

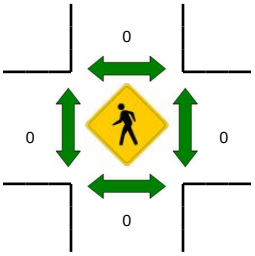
LOCATION: US 31 -- NB to SB Crossover
CITY/STATE: Grand Haven, MI

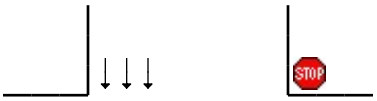
QC JOB #: 14598002
DATE: Thu, Jan 18 2018

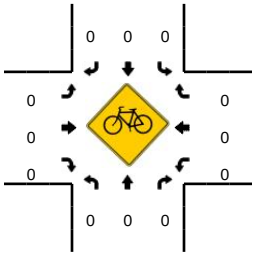
Peak-Hour: 4:30 PM -- 5:30 PM
Peak 15-Min: 5:15 PM -- 5:30 PM

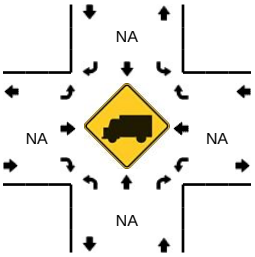


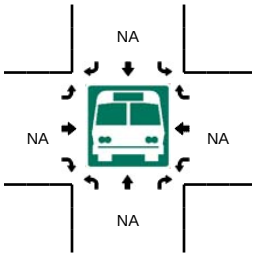












15-Min Count Period Beginning At	US 31 (Northbound)				US 31 (Southbound)				NB to SB Crossover (Eastbound)				NB to SB Crossover (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	0	450	0	32	0	358	0	1	0	0	0	0	0	0	0	0	841	
4:15 PM	0	381	0	21	0	354	0	0	0	0	0	0	0	0	0	0	756	
4:30 PM	0	398	0	27	0	357	0	0	0	0	0	0	0	0	0	0	782	
4:45 PM	0	389	0	16	0	355	0	0	0	0	0	0	0	0	0	0	760	3139
5:00 PM	0	383	0	17	0	401	0	0	0	0	0	0	0	0	0	0	801	3099
5:15 PM	0	390	0	18	0	415	0	0	0	0	0	0	0	0	0	0	823	3166
5:30 PM	0	408	0	24	0	317	0	0	0	0	0	0	0	0	0	0	749	3133
5:45 PM	0	325	0	18	0	359	0	0	0	0	0	0	0	0	0	0	702	3075

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	0	1560	0	72	0	1660	0	0	0	0	0	0	0	0	0	0	3292
Heavy Trucks	0	16	0		0	36	0		0	0	0		0	0	0		52
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 1/23/2018 5:42 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

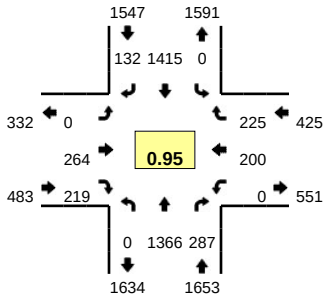
Type of peak hour being reported: System Peak

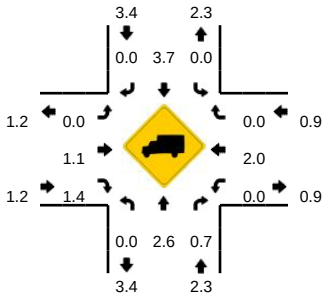
Method for determining peak hour: Total Entering Volume

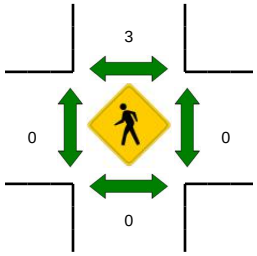
LOCATION: US 31 -- Robbins Rd
CITY/STATE: Grand Haven, MI

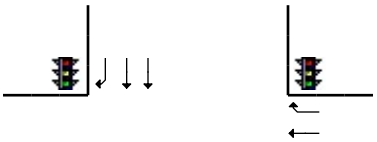
QC JOB #: 14598004
DATE: Thu, Jan 18 2018

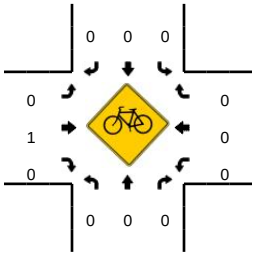
Peak-Hour: 4:30 PM -- 5:30 PM
Peak 15-Min: 5:15 PM -- 5:30 PM

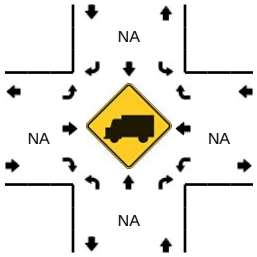


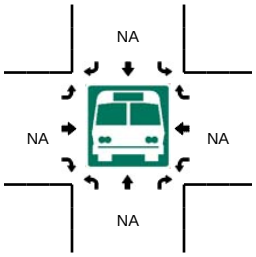












15-Min Count Period Beginning At	US 31 (Northbound)				US 31 (Southbound)				Robbins Rd (Eastbound)				Robbins Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	0	355	81	0	0	332	43	0	0	66	46	0	0	56	91	0	1070	
4:15 PM	0	313	67	0	0	322	40	0	0	49	56	0	0	54	63	0	964	
4:30 PM	0	343	67	0	0	317	32	0	0	81	61	0	0	56	50	0	1007	
4:45 PM	0	327	61	0	0	340	30	0	0	66	44	0	0	52	68	0	988	4029
5:00 PM	0	338	68	0	0	378	35	0	0	53	59	0	0	44	59	0	1034	3993
5:15 PM	0	358	91	0	0	380	35	0	0	64	55	0	0	48	48	0	1079	4108
5:30 PM	0	343	68	0	0	294	44	0	0	48	46	0	0	45	65	0	953	4054
5:45 PM	0	273	67	0	0	322	44	0	0	49	27	0	0	45	55	0	882	3948

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	0	1432	364	0	0	1520	140	0	0	256	220	0	0	192	192	0	4316
Heavy Trucks	0	16	0		0	36	0		0	0	0		0	0	0		52
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 1/23/2018 5:42 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

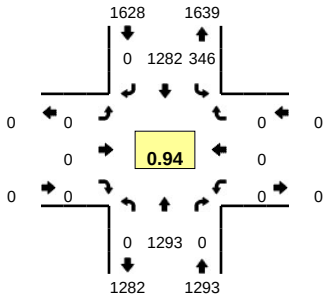
Type of peak hour being reported: System Peak

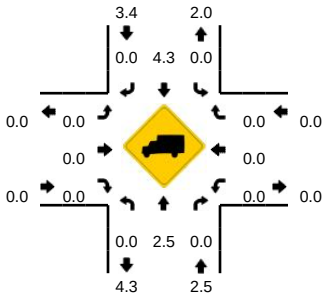
Method for determining peak hour: Total Entering Volume

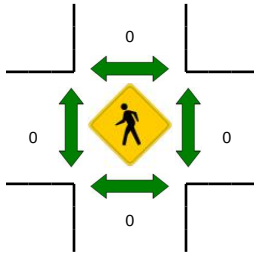
LOCATION: US 31 -- SB to NB Crossover
CITY/STATE: Grand Haven, MI

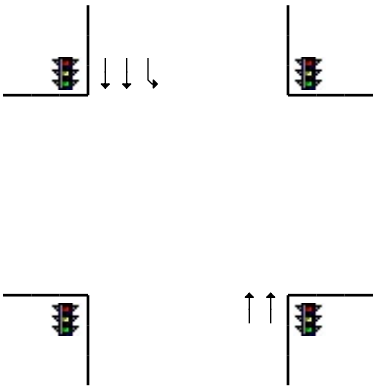
QC JOB #: 14598006
DATE: Thu, Jan 18 2018

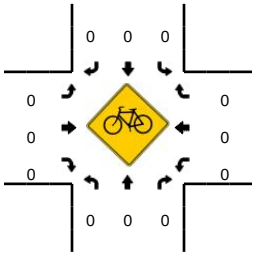
Peak-Hour: 4:30 PM -- 5:30 PM
Peak 15-Min: 5:15 PM -- 5:30 PM

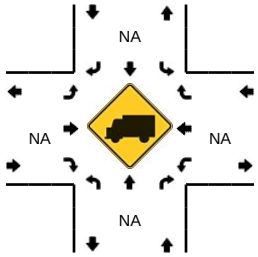


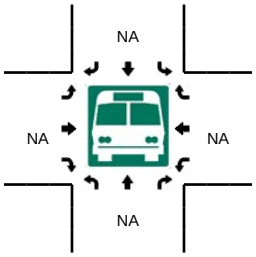












15-Min Count Period Beginning At	US 31 (Northbound)				US 31 (Southbound)				SB to NB Crossover (Eastbound)				SB to NB Crossover (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	0	365	0	0	0	289	0	79	0	0	0	0	0	0	0	0	733	
4:15 PM	0	290	0	0	0	304	0	81	0	0	0	0	0	0	0	0	675	
4:30 PM	0	313	0	0	0	321	0	92	0	0	0	0	0	0	0	0	726	
4:45 PM	0	303	0	0	0	297	0	69	0	0	0	0	0	0	0	0	669	2803
5:00 PM	0	327	0	0	0	334	0	90	0	0	0	0	0	0	0	0	751	2821
5:15 PM	0	350	0	0	0	330	0	95	0	0	0	0	0	0	0	0	775	2921
5:30 PM	0	333	0	0	0	260	0	83	0	0	0	0	0	0	0	0	676	2871
5:45 PM	0	265	0	0	0	278	0	77	0	0	0	0	0	0	0	0	620	2822

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	0	1400	0	0	0	1320	0	380	0	0	0	0	0	0	0	0	3100
Heavy Trucks	0	16	0		0	40	0		0	0	0		0	0	0		56
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 1/23/2018 5:42 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

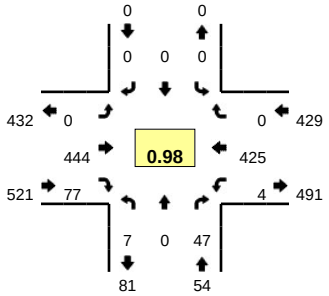
Type of peak hour being reported: System Peak

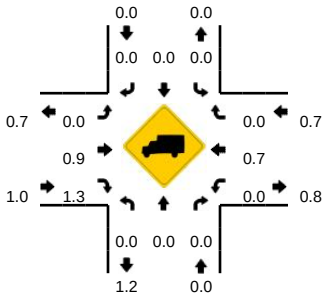
Method for determining peak hour: Total Entering Volume

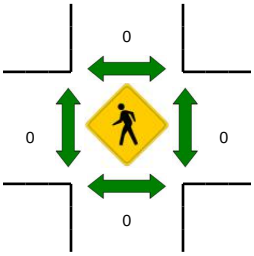
LOCATION: Whittaker Way -- Robbins Rd
CITY/STATE: Grand Haven, MI

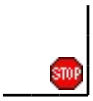
QC JOB #: 14598008
DATE: Thu, Jan 18 2018

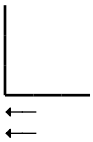
Peak-Hour: 4:30 PM -- 5:30 PM
Peak 15-Min: 5:15 PM -- 5:30 PM

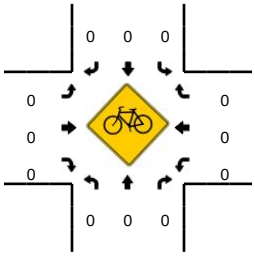


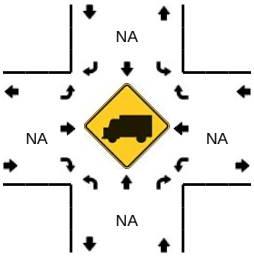


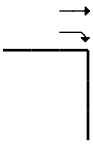


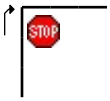


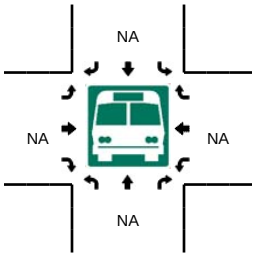












15-Min Count Period Beginning At	Whittaker Way (Northbound)				Whittaker Way (Southbound)				Robbins Rd (Eastbound)				Robbins Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	1	0	10	0	0	0	0	0	0	128	17	0	1	142	0	0	299	
4:15 PM	3	0	12	0	0	0	0	0	0	98	11	0	0	107	0	0	231	
4:30 PM	0	0	20	0	0	0	0	0	0	124	20	0	2	107	0	0	273	
4:45 PM	2	0	7	0	0	0	0	0	0	97	20	0	1	127	0	0	254	1057
5:00 PM	2	0	7	0	0	0	0	0	0	96	20	0	0	96	0	0	221	979
5:15 PM	3	0	13	0	0	0	0	0	0	127	17	0	1	95	0	0	256	1004
5:30 PM	3	0	11	0	0	0	0	0	0	100	12	0	1	102	0	0	229	960
5:45 PM	5	0	13	0	0	0	0	0	0	98	18	0	0	91	0	0	225	931

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	12	0	52	0	0	0	0	0	0	508	68	0	4	380	0	0	1024
Heavy Trucks	0	0	0		0	0	0		0	0	0		0	0	0		0
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 1/23/2018 5:42 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

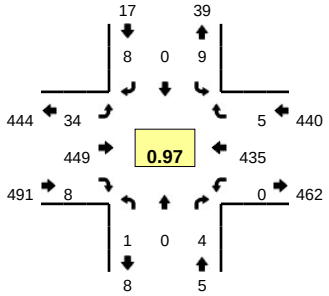
Type of peak hour being reported: System Peak

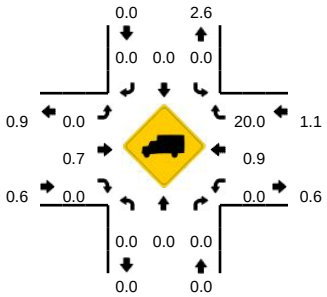
Method for determining peak hour: Total Entering Volume

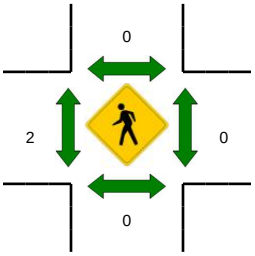
LOCATION: DeSpelder St -- Robbins Rd
CITY/STATE: Grand Haven, MI

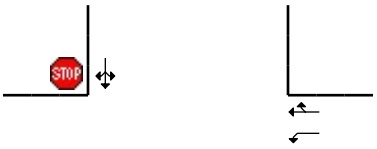
QC JOB #: 14598010
DATE: Thu, Jan 18 2018

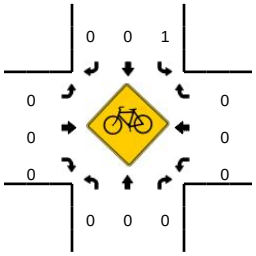
Peak-Hour: 4:30 PM -- 5:30 PM
Peak 15-Min: 5:15 PM -- 5:30 PM

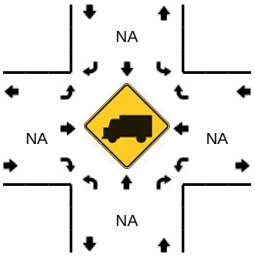


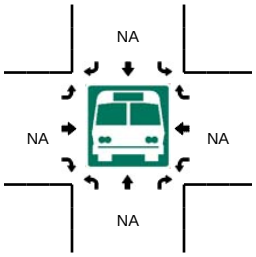












15-Min Count Period Beginning At	DeSpelder St (Northbound)				DeSpelder St (Southbound)				Robbins Rd (Eastbound)				Robbins Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	0	0	0	0	3	0	7	0	8	130	2	0	1	137	2	0	290	
4:15 PM	0	0	0	0	2	1	4	0	7	97	3	0	0	105	1	0	220	
4:30 PM	0	0	0	0	2	0	0	0	17	122	3	0	0	115	1	0	260	
4:45 PM	1	0	2	0	3	0	3	0	8	96	0	0	0	125	3	0	241	1011
5:00 PM	0	0	2	0	1	0	3	0	3	101	2	0	0	95	0	0	207	928
5:15 PM	0	0	0	0	3	0	2	0	6	130	3	0	0	100	1	0	245	953
5:30 PM	1	0	0	0	3	0	2	0	13	95	3	0	0	100	0	0	217	910
5:45 PM	1	0	1	0	1	0	4	0	7	98	3	0	0	88	0	0	203	872

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	0	0	0	0	12	0	8	0	24	520	12	0	0	400	4	0	980
Heavy Trucks	0	0	0		0	0	0		0	0	0		0	0	0		0
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 1/23/2018 5:42 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

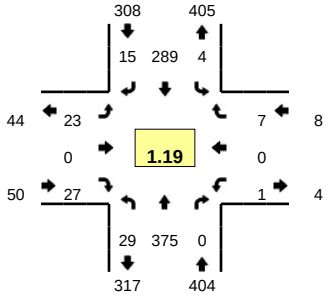
Type of peak hour being reported: System Peak

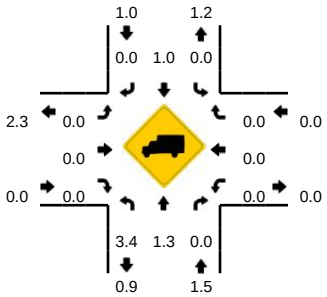
Method for determining peak hour: Total Entering Volume

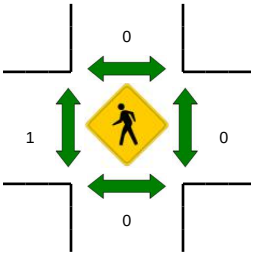
LOCATION: 172nd Ave -- Comerica Bank Dwy
CITY/STATE: Grand Haven, MI

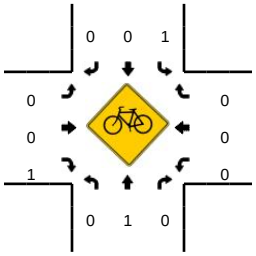
QC JOB #: 14598012
DATE: Thu, Jan 18 2018

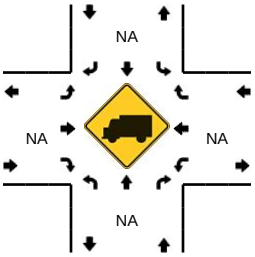
Peak-Hour: 4:30 PM -- 5:30 PM
Peak 15-Min: 5:15 PM -- 5:30 PM

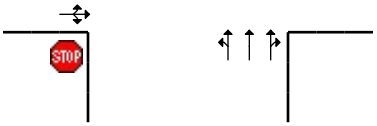


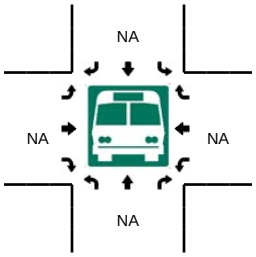












15-Min Count Period Beginning At	172nd Ave (Northbound)				172nd Ave (Southbound)				Comerica Bank Dwy (Eastbound)				Comerica Bank Dwy (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	5	116	0	0	0	101	4	0	6	0	6	0	0	0	0	0	238	
4:15 PM	4	94	0	0	1	58	3	0	3	0	6	0	0	0	2	0	171	
4:30 PM	7	93	0	0	1	78	4	0	7	0	3	0	1	0	0	0	194	
4:45 PM	5	97	0	0	1	77	3	0	9	0	5	0	0	0	3	0	200	803
5:00 PM	10	106	0	0	2	79	2	0	5	0	7	0	0	0	3	0	214	779
5:15 PM	7	79	0	0	0	55	6	0	2	0	12	0	0	0	1	0	162	770
5:30 PM	4	89	0	0	0	91	2	0	3	0	10	0	0	0	0	0	199	775
5:45 PM	3	79	0	0	1	45	1	0	3	0	5	0	0	0	0	0	137	712

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	28	316	0	0	0	220	24	0	8	0	48	0	0	0	4	0	648
Heavy Trucks	0	4	0		0	0	0		0	0	0		0	0	0		4
Pedestrians		0				0				0				0			0
Bicycles	0	1	0		0	0	0		0	0	0		0	0	0		1
Railroad																	
Stopped Buses																	

Comments:

Report generated on 1/23/2018 5:42 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

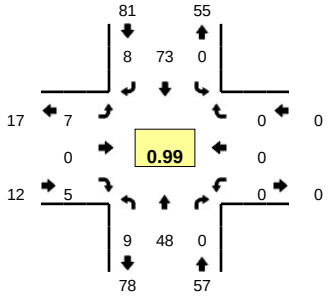
Type of peak hour being reported: System Peak

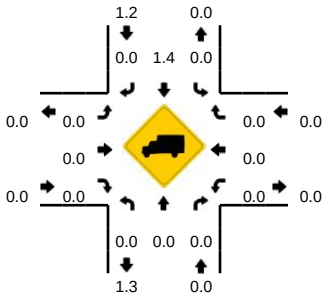
Method for determining peak hour: Total Entering Volume

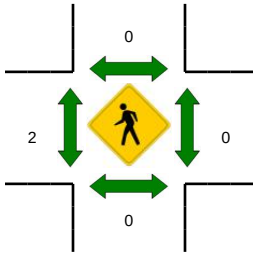
LOCATION: Whittaker Way -- Macatawa Bank Dwy
CITY/STATE: Grand Haven, MI

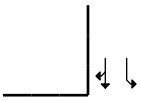
QC JOB #: 14598014
DATE: Thu, Jan 18 2018

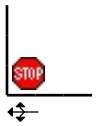
Peak-Hour: 4:30 PM -- 5:30 PM
Peak 15-Min: 5:15 PM -- 5:30 PM

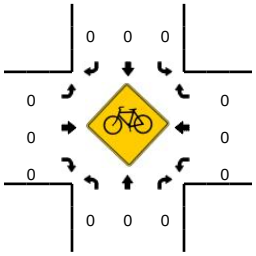


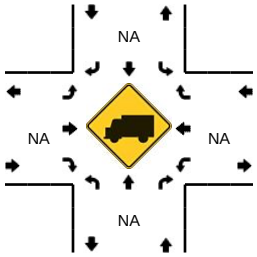


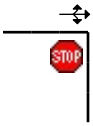


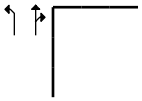


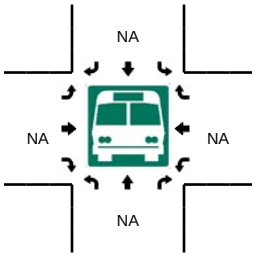












15-Min Count Period Beginning At	Whittaker Way (Northbound)				Whittaker Way (Southbound)				Macatawa Bank Dwy (Eastbound)				Macatawa Bank Dwy (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	1	11	0	0	0	15	2	0	1	0	2	0	0	0	0	0	32	
4:15 PM	2	13	0	0	0	9	2	0	0	0	1	0	0	0	0	0	27	
4:30 PM	3	16	0	0	0	17	5	0	4	0	1	0	0	0	0	0	46	
4:45 PM	4	7	0	0	0	20	1	0	2	0	2	0	0	0	0	0	36	141
5:00 PM	0	8	0	0	0	18	2	0	1	0	1	0	0	0	0	0	30	139
5:15 PM	2	17	0	0	0	18	0	0	0	0	1	0	0	0	0	0	38	150
5:30 PM	2	13	0	0	0	11	0	0	0	0	1	0	0	0	0	0	27	131
5:45 PM	1	18	0	0	0	20	0	0	0	0	0	0	0	0	0	0	39	134

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	8	68	0	0	0	72	0	0	0	0	4	0	0	0	0	0	152
Heavy Trucks	0	0	0		0	0	0		0	0	0		0	0	0		0
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 1/23/2018 5:42 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Traffic Data Collection, LLC

tdccounts.com

Phone: (586) 786-5407

Traffic Study Peformed For:

Fleis & VandenBrink

Project:Grand Haven Traffic Impact Study
Type: 4 Hr. Video Turning Movement Count
Weather:Sunny/Cldy, Dry Deg. 70's
Count By: Miovision Video SCU 3DQ SE

File Name : TMC_1 Robbins & 172nd_9-19-17
Site Code : TMC_1
Start Date : 9/19/2017
Page No : 1

Groups Printed- Pass Cars - Buses - Single Units - Heavy Trucks - Peds. - Bikes

	172nd Ave. Southbound					Robbins Road Westbound					172nd Ave. Northbound					Robbins Road Eastbound					
Start Time	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	3	12	7	1	23	5	51	9	0	65	4	9	8	1	22	6	36	3	1	46	156
07:15 AM	8	16	5	0	29	3	61	3	0	67	6	19	21	0	46	3	34	5	1	43	185
07:30 AM	4	25	5	2	36	9	56	5	1	71	9	25	15	0	49	8	43	10	2	63	219
07:45 AM	5	29	6	0	40	9	46	7	0	62	13	15	23	0	51	10	50	6	0	66	219
Total	20	82	23	3	128	26	214	24	1	265	32	68	67	1	168	27	163	24	4	218	779
08:00 AM	6	23	8	3	40	7	55	14	1	77	15	17	10	0	42	5	46	2	0	53	212
08:15 AM	17	34	11	3	65	9	61	9	1	80	21	17	16	1	55	13	68	5	2	88	288
08:30 AM	8	32	16	1	57	7	61	11	0	79	5	22	19	0	46	12	52	9	1	74	256
08:45 AM	4	27	9	1	41	4	64	8	0	76	9	9	12	0	30	8	67	6	2	83	230
Total	35	116	44	8	203	27	241	42	2	312	50	65	57	1	173	38	233	22	5	298	986
**** BREAK ****																					
02:00 PM	4	39	18	0	61	9	75	12	0	96	13	47	26	0	86	12	57	13	0	82	325
02:15 PM	10	50	19	1	80	12	69	15	1	97	13	54	30	0	97	13	49	12	1	75	349
02:30 PM	8	45	10	1	64	16	79	13	0	108	15	86	38	0	139	20	63	11	2	96	407
02:45 PM	13	37	17	0	67	14	55	19	0	88	17	48	29	0	94	7	79	10	1	97	346
Total	35	171	64	2	272	51	278	59	1	389	58	235	123	0	416	52	248	46	4	350	1427
03:00 PM	5	47	13	1	66	10	63	12	0	85	19	67	27	0	113	24	66	21	1	112	376
03:15 PM	7	43	14	2	66	11	66	14	0	91	24	57	23	0	104	12	68	18	0	98	359
03:30 PM	14	58	18	1	91	13	78	17	0	108	18	80	28	0	126	18	93	6	2	119	444
03:45 PM	11	46	26	1	84	17	66	13	2	98	20	65	26	0	111	15	90	16	2	123	416
Total	37	194	71	5	307	51	273	56	2	382	81	269	104	0	454	69	317	61	5	452	1595
04:00 PM	14	44	17	4	79	13	68	23	3	107	23	60	29	0	112	20	101	16	0	137	435
04:15 PM	12	36	21	5	74	6	63	22	3	94	18	54	25	0	97	15	80	13	0	108	373
04:30 PM	11	46	19	1	77	12	88	12	1	113	23	46	33	0	102	29	77	13	1	120	412
04:45 PM	18	40	16	0	74	16	78	15	1	110	22	56	33	0	111	22	63	12	0	97	392
Total	55	166	73	10	304	47	297	72	8	424	86	216	120	0	422	86	321	54	1	462	1612
05:00 PM	15	39	7	1	62	20	75	16	0	111	13	65	26	0	104	25	79	14	0	118	395
05:15 PM	6	46	16	4	72	12	65	9	3	89	15	48	22	1	86	21	64	9	1	95	342
05:30 PM	4	42	9	2	57	9	54	13	1	77	9	45	21	1	76	11	59	9	1	80	290
05:45 PM	6	26	10	0	42	23	71	6	0	100	16	37	23	3	79	16	69	7	5	97	318
Total	31	153	42	7	233	64	265	44	4	377	53	195	92	5	345	73	271	39	7	390	1345
Grand Total	213	882	317	35	1447	266	1568	297	18	2149	360	1048	563	7	1978	345	1553	246	26	2170	7744
Apprch %	14.7	61	21.9	2.4		12.4	73	13.8	0.8		18.2	53	28.5	0.4		15.9	71.6	11.3	1.2		
Total %	2.8	11.4	4.1	0.5	18.7	3.4	20.2	3.8	0.2	27.8	4.6	13.5	7.3	0.1	25.5	4.5	20.1	3.2	0.3	28	
Pass Cars	207	848	306	0	1361	256	1535	282	0	2073	342	1024	544	0	1910	342	1517	239	0	2098	7442
% Pass Cars	97.2	96.1	96.5	0	94.1	96.2	97.9	94.9	0	96.5	95	97.7	96.6	0	96.6	99.1	97.7	97.2	0	96.7	96.1
Buses	5	26	10	0	41	8	20	9	0	37	14	21	6	0	41	0	20	7	0	27	146
% Buses	2.3	2.9	3.2	0	2.8	3	1.3	3	0	1.7	3.9	2	1.1	0	2.1	0	1.3	2.8	0	1.2	1.9
Single Units	1	7	1	0	9	2	11	3	0	16	4	3	11	0	18	3	11	0	0	14	57
% Single Units	0.5	0.8	0.3	0	0.6	0.8	0.7	1	0	0.7	1.1	0.3	2	0	0.9	0.9	0.7	0	0	0.6	0.7
Heavy Trucks	0	1	0	0	1	0	2	3	0	5	0	0	2	0	2	0	5	0	0	5	13
% Heavy Trucks	0	0.1	0	0	0.1	0	0.1	1	0	0.2	0	0	0.4	0	0.1	0	0.3	0	0	0.2	0.2
Peds.	0	0	0	31	31	0	0	0	18	18	0	0	0	7	7	0	0	0	21	21	77
% Peds.	0	0	0	88.6	2.1	0	0	0	100	0.8	0	0	0	100	0.4	0	0	0	80.8	1	1
Bikes	0	0	0	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	5	5	9
% Bikes	0	0	0	11.4	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	19.2	0.2	0.1

Comments: 4 hour traffic study conducted during typical weekday (Tuesday) from 7:00-9:00 AM morning & 2:00-6:00 PM afternoon peak hours while school was in session. Signalized intersection, with ped. signals for all quadrants. Push buttons exist for east & west legs. Video SCU camera was located within SE intersection quadrant.

Weekday directional vehicle turning movements at Robbins Road & 172nd Avenue/Ferry Street 4:00 to 6:00 p.m.
Existing Conditions - Year 2017

09-19-17	Northbound					Southbound					Eastbound					Westbound					Int.
Time	**Left**	**Thru**	**Right**	**Peds**	**Total**	**Left**	**Thru**	**Right**	**Peds**	**Total**	**Left**	**Thru**	**Right**	**Peds**	**Total**	**Left**	**Thru**	**Right**	**Peds**	**Total**	**Total**
4:00-4:15 PM	29	60	23	0	112	17	44	14	4	79	16	101	20	0	137	23	68	13	3	107	435
4:15-4:30 PM	25	54	18	0	97	21	36	12	5	74	13	80	15	0	108	22	63	6	3	94	373
4:30-4:45 PM	33	46	23	0	102	19	46	11	1	77	13	77	29	1	120	12	88	12	1	113	412
4:45-5:00 PM	33	56	22	0	111	16	40	18	0	74	12	63	22	0	97	15	78	16	1	110	392
5:00-5:15 PM	26	65	13	0	104	7	39	15	1	62	14	79	25	0	118	16	75	20	0	111	395
5:15-5:30 PM	22	48	15	1	86	16	46	6	4	72	9	64	21	1	95	9	65	12	3	89	342
5:30-5:45 PM	21	45	9	1	76	9	42	4	2	57	9	59	11	1	80	13	54	9	1	77	290
5:45-6:00 PM	23	37	16	3	79	10	26	6	0	42	7	69	16	5	97	6	71	23	0	100	318

Existing hourly volume totals from 4:00 to 6:00 p.m.

4:00-5:00 PM	212	411	139	5	422	115	319	86	17	304	93	592	159	8	462	116	562	111	12	424	1,612
4:15-5:15 PM	117	221	76	0	414	63	161	56	7	287	52	299	91	1	443	65	304	54	5	428	1,572
4:30-5:30 PM	114	215	73	1	403	58	171	50	6	285	48	283	97	2	430	52	306	60	5	423	1,541
4:45-5:45 PM	102	214	59	2	377	48	167	43	7	265	44	265	79	2	390	53	272	57	5	387	1,419
5:00-6:00 PM	92	195	53	5	345	42	153	31	7	233	39	271	73	7	390	44	265	64	4	377	1,345

Weekday directional vehicle turning movements at Robbins Road & 172nd Avenue/Ferry Street 4:00 to 6:00 p.m.
Existing Conditions - Year 2017

09-19-17	Northbound					Southbound					Eastbound					Westbound					Int.
Time	**Left**	**Thru**	**Right**	**Peds**	**Total**	**Left**	**Thru**	**Right**	**Peds**	**Total**	**Left**	**Thru**	**Right**	**Peds**	**Total**	**Left**	**Thru**	**Right**	**Peds**	**Total**	**Total**
4:00-4:15 PM	29	60	23	0	112	17	44	14	4	79	16	101	20	0	137	23	68	13	3	107	435
4:15-4:30 PM	25	54	18	0	97	21	36	12	5	74	13	80	15	0	108	22	63	6	3	94	373
4:30-4:45 PM	33	46	23	0	102	19	46	11	1	77	13	77	29	1	120	12	88	12	1	113	412
4:45-5:00 PM	33	56	22	0	111	16	40	18	0	74	12	63	22	0	97	15	78	16	1	110	392
5:00-5:15 PM	26	65	13	0	104	7	39	15	1	62	14	79	25	0	118	16	75	20	0	111	395
5:15-5:30 PM	22	48	15	1	86	16	46	6	4	72	9	64	21	1	95	9	65	12	3	89	342
5:30-5:45 PM	21	45	9	1	76	9	42	4	2	57	9	59	11	1	80	13	54	9	1	77	290
5:45-6:00 PM	23	37	16	3	79	10	26	6	0	42	7	69	16	5	97	6	71	23	0	100	318

Existing hourly volume totals from 4:00 to 6:00 p.m.

4:00-5:00 PM	212	411	139	5	422	115	319	86	17	304	93	592	159	8	462	116	562	111	12	424	1,612
4:15-5:15 PM	117	221	76	0	414	63	161	56	7	287	52	299	91	1	443	65	304	54	5	428	1,572
4:30-5:30 PM	114	215	73	1	403	58	171	50	6	285	48	283	97	2	430	52	306	60	5	423	1,541
4:45-5:45 PM	102	214	59	2	377	48	167	43	7	265	44	265	79	2	390	53	272	57	5	387	1,419
5:00-6:00 PM	92	195	53	5	345	42	153	31	7	233	39	271	73	7	390	44	265	64	4	377	1,345

APPENDIX C. EXISTING 2018 SYNCHRO RESULTS

Lane Group	EBT	EBR	WBT	SBT	SBR
Lane Group Flow (vph)	182	183	173	1938	184
v/c Ratio	0.51	0.52	0.21	1.03	0.20
Control Delay	30.0	22.8	0.5	35.3	2.0
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	30.0	22.8	0.5	35.3	2.0
Queue Length 50th (ft)	69	47	0	~484	4
Queue Length 95th (ft)	119	98	0	m#511	m6
Internal Link Dist (ft)	920		1	549	
Turn Bay Length (ft)					
Base Capacity (vph)	412	393	917	1889	928
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.44	0.47	0.19	1.03	0.20

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	158	159	0	159	0	0	0	0	0	1783	169
Future Volume (vph)	0	158	159	0	159	0	0	0	0	0	1783	169
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		11.5	11.5		8.5						6.5	6.5
Lane Util. Factor		1.00	1.00		0.95						0.95	1.00
Frt		1.00	0.85		1.00						1.00	0.85
Flt Protected		1.00	1.00		1.00						1.00	1.00
Satd. Flow (prot)		1863	1583		3471						3438	1538
Flt Permitted		1.00	1.00		1.00						1.00	1.00
Satd. Flow (perm)		1863	1583		3471						3438	1538
Peak-hour factor, PHF	0.87	0.87	0.87	0.92	0.92	0.92	0.87	0.87	0.87	0.92	0.92	0.92
Adj. Flow (vph)	0	182	183	0	173	0	0	0	0	0	1938	184
RTOR Reduction (vph)	0	0	44	0	0	0	0	0	0	0	0	83
Lane Group Flow (vph)	0	182	139	0	173	0	0	0	0	0	1938	101
Heavy Vehicles (%)	2%	2%	2%	4%	4%	4%	2%	2%	2%	5%	5%	5%
Turn Type		NA	Perm		NA						NA	Perm
Protected Phases		4			8						2	
Permitted Phases			4									2
Actuated Green, G (s)		13.5	13.5		16.5						38.5	38.5
Effective Green, g (s)		13.5	13.5		16.5						38.5	38.5
Actuated g/C Ratio		0.19	0.19		0.24						0.55	0.55
Clearance Time (s)		11.5	11.5		8.5						6.5	6.5
Vehicle Extension (s)		4.0	4.0		4.0						0.2	0.2
Lane Grp Cap (vph)		359	305		818						1890	845
v/s Ratio Prot		c0.10			0.05						c0.56	
v/s Ratio Perm			0.09									0.07
v/c Ratio		0.51	0.45		0.21						1.03	0.12
Uniform Delay, d1		25.3	25.0		21.5						15.8	7.6
Progression Factor		1.00	1.00		0.00						0.68	1.08
Incremental Delay, d2		1.5	1.5		0.2						20.6	0.1
Delay (s)		26.8	26.5		0.2						31.2	8.3
Level of Service		C	C		A						C	A
Approach Delay (s)		26.6			0.2			0.0			29.2	
Approach LOS		C			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	27.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	74.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	NBT
Lane Group Flow (vph)	300	1478
v/c Ratio	0.52	0.80
Control Delay	10.6	15.7
Queue Delay	0.0	0.0
Total Delay	10.6	15.7
Queue Length 50th (ft)	46	236
Queue Length 95th (ft)	46	304
Internal Link Dist (ft)	1	920
Turn Bay Length (ft)		
Base Capacity (vph)	580	1852
Starvation Cap Reductn	0	0
Spillback Cap Reductn	0	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	0.52	0.80

Intersection Summary

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	249	0	0	1286	0	0
Future Volume (vph)	249	0	0	1286	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	16	12	12	11	12	12
Total Lost time (s)	4.0			6.5		
Lane Util. Factor	1.00			0.95		
Frt	1.00			1.00		
Flt Protected	0.95			1.00		
Satd. Flow (prot)	2046			3202		
Flt Permitted	0.95			1.00		
Satd. Flow (perm)	2046			3202		
Peak-hour factor, PHF	0.83	0.83	0.87	0.87	0.92	0.92
Adj. Flow (vph)	300	0	0	1478	0	0
RTOR Reduction (vph)	26	0	0	0	0	0
Lane Group Flow (vph)	275	0	0	1478	0	0
Heavy Vehicles (%)	0%	0%	9%	9%	2%	2%
Turn Type	Prot			NA		
Protected Phases	2			1		
Permitted Phases						
Actuated Green, G (s)	19.0			40.5		
Effective Green, g (s)	19.0			40.5		
Actuated g/C Ratio	0.27			0.58		
Clearance Time (s)	4.0			6.5		
Lane Grp Cap (vph)	555			1852		
v/s Ratio Prot	c0.13			c0.46		
v/s Ratio Perm						
v/c Ratio	0.49			0.80		
Uniform Delay, d1	21.5			11.5		
Progression Factor	0.39			1.00		
Incremental Delay, d2	2.9			3.7		
Delay (s)	11.3			15.2		
Level of Service	B			B		
Approach Delay (s)	11.3			15.2	0.0	
Approach LOS	B			B	A	

Intersection Summary			
HCM 2000 Control Delay	14.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	90.7%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	WBR	NBT	NBR
Lane Group Flow (vph)	182	173	229	1532	238
v/c Ratio	0.22	0.49	0.67	0.83	0.26
Control Delay	0.6	29.7	29.4	11.1	0.6
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	0.6	29.7	29.4	11.1	0.6
Queue Length 50th (ft)	0	65	67	111	1
Queue Length 95th (ft)	0	119	135	204	m0
Internal Link Dist (ft)	1	319		594	
Turn Bay Length (ft)					
Base Capacity (vph)	935	404	386	1837	929
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.19	0.43	0.59	0.83	0.26

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	158	0	0	159	211	0	1333	207	0	0	0
Future Volume (vph)	0	158	0	0	159	211	0	1333	207	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		8.5			11.5	11.5		6.5	6.5			
Lane Util. Factor		0.95			1.00	1.00		0.95	1.00			
Frt		1.00			1.00	0.85		1.00	0.85			
Flt Protected		1.00			1.00	1.00		1.00	1.00			
Satd. Flow (prot)		3539			1827	1553		3343	1495			
Flt Permitted		1.00			1.00	1.00		1.00	1.00			
Satd. Flow (perm)		3539			1827	1553		3343	1495			
Peak-hour factor, PHF	0.87	0.87	0.87	0.92	0.92	0.92	0.87	0.87	0.87	0.92	0.92	0.92
Adj. Flow (vph)	0	182	0	0	173	229	0	1532	238	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	44	0	0	107	0	0	0
Lane Group Flow (vph)	0	182	0	0	173	185	0	1532	131	0	0	0
Heavy Vehicles (%)	2%	2%	2%	4%	4%	4%	8%	8%	8%	2%	2%	2%
Turn Type		NA			NA	Perm		NA	Perm			
Protected Phases		8			4			2				
Permitted Phases						4			2			
Actuated Green, G (s)		16.5			13.5	13.5		38.5	38.5			
Effective Green, g (s)		16.5			13.5	13.5		38.5	38.5			
Actuated g/C Ratio		0.24			0.19	0.19		0.55	0.55			
Clearance Time (s)		8.5			11.5	11.5		6.5	6.5			
Vehicle Extension (s)		4.0			4.0	4.0		0.2	0.2			
Lane Grp Cap (vph)		834			352	299		1838	822			
v/s Ratio Prot		0.05			0.09			c0.46				
v/s Ratio Perm						c0.12			0.09			
v/c Ratio		0.22			0.49	0.62		0.83	0.16			
Uniform Delay, d1		21.6			25.2	25.9		13.1	7.8			
Progression Factor		0.00			1.00	1.00		0.51	0.12			
Incremental Delay, d2		0.2			1.5	4.3		3.0	0.3			
Delay (s)		0.2			26.7	30.2		9.7	1.2			
Level of Service		A			C	C		A	A			
Approach Delay (s)		0.2			28.7			8.6			0.0	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	11.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	74.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Int Delay, s/veh	1.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰					↑↑↑
Traffic Vol, veh/h	97	0	0	0	0	1923
Future Vol, veh/h	97	0	0	0	0	1923
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	16974	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	69	69	92	92	91	91
Heavy Vehicles, %	0	0	2	2	5	5
Mvmt Flow	141	0	0	0	0	2113

Major/Minor	Minor1		Major2	
Conflicting Flow All	845	-	-	-
Stage 1	0	-	-	-
Stage 2	845	-	-	-
Critical Hdwy	5.7	-	-	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	6	-	-	-
Follow-up Hdwy	3.8	-	-	-
Pot Cap-1 Maneuver	376	0	0	-
Stage 1	-	0	0	-
Stage 2	350	0	0	-
Platoon blocked, %				-
Mov Cap-1 Maneuver	376	-	-	-
Mov Cap-2 Maneuver	376	-	-	-
Stage 1	-	-	-	-
Stage 2	350	-	-	-

Approach	WB	SB
HCM Control Delay, s	20.2	0
HCM LOS	C	

Minor Lane/Major Mvmt	WBLn1	SBT
Capacity (veh/h)	376	-
HCM Lane V/C Ratio	0.374	-
HCM Control Delay (s)	20.2	-
HCM Lane LOS	C	-
HCM 95th %tile Q(veh)	1.7	-

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	30	264	36	306	85	95	54	30	147
v/c Ratio	0.06	0.33	0.06	0.38	0.20	0.20	0.10	0.07	0.35
Control Delay	11.1	19.3	11.2	20.3	19.7	27.9	0.4	18.1	28.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	11.1	19.3	11.2	20.3	19.7	27.9	0.4	18.1	28.9
Queue Length 50th (ft)	8	104	10	126	31	44	0	10	63
Queue Length 95th (ft)	21	169	24	202	62	85	0	28	118
Internal Link Dist (ft)		564		899		123			802
Turn Bay Length (ft)	160		170					75	
Base Capacity (vph)	538	809	569	803	424	483	518	441	423
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.06	0.33	0.06	0.38	0.20	0.20	0.10	0.07	0.35

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	27	204	31	34	257	33	81	90	51	28	110	27
Future Volume (veh/h)	27	204	31	34	257	33	81	90	51	28	110	27
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	1841	1841	1841	1826	1826	1826	1856	1856	1856	1841	1841	1841
Adj Flow Rate, veh/h	30	229	35	36	271	35	85	95	54	30	118	29
Peak Hour Factor	0.89	0.89	0.89	0.95	0.95	0.95	0.95	0.95	0.95	0.93	0.93	0.93
Percent Heavy Veh, %	4	4	4	5	5	5	3	3	3	4	4	4
Cap, veh/h	474	653	100	507	671	87	403	484	410	421	333	82
Arrive On Green	0.04	0.42	0.42	0.05	0.42	0.42	0.07	0.26	0.26	0.04	0.23	0.23
Sat Flow, veh/h	1753	1559	238	1739	1584	205	1767	1856	1572	1753	1427	351
Grp Volume(v), veh/h	30	0	264	36	0	306	85	95	54	30	0	147
Grp Sat Flow(s),veh/h/ln	1753	0	1798	1739	0	1789	1767	1856	1572	1753	0	1778
Q Serve(g_s), s	0.8	0.0	9.0	1.0	0.0	10.7	3.2	3.6	2.4	1.1	0.0	6.2
Cycle Q Clear(g_c), s	0.8	0.0	9.0	1.0	0.0	10.7	3.2	3.6	2.4	1.1	0.0	6.2
Prop In Lane	1.00		0.13	1.00		0.11	1.00		1.00	1.00		0.20
Lane Grp Cap(c), veh/h	474	0	753	507	0	758	403	484	410	421	0	415
V/C Ratio(X)	0.06	0.00	0.35	0.07	0.00	0.40	0.21	0.20	0.13	0.07	0.00	0.35
Avail Cap(c_a), veh/h	548	0	753	572	0	758	429	484	410	495	0	415
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	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	14.0	0.0	17.8	13.6	0.0	18.0	23.3	25.9	25.5	24.1	0.0	28.8
Incr Delay (d2), s/veh	0.1	0.0	1.3	0.1	0.0	1.6	0.3	0.9	0.7	0.1	0.0	2.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	0.0	3.8	0.4	0.0	4.5	1.3	1.6	1.0	0.5	0.0	2.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	14.0	0.0	19.1	13.7	0.0	19.6	23.5	26.8	26.1	24.2	0.0	31.2
LnGrp LOS	B	A	B	B	A	B	C	C	C	C	A	C
Approach Vol, veh/h		294			342			234			177	
Approach Delay, s/veh		18.6			19.0			25.5			30.0	
Approach LOS		B			B			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.7	43.7	8.2	29.5	8.2	44.1	10.7	27.0
Change Period (Y+Rc), s	4.5	6.0	4.5	6.0	4.5	6.0	4.5	6.0
Max Green Setting (Gmax), s	7.5	33.0	7.5	21.0	7.5	33.0	7.5	21.0
Max Q Clear Time (g_c+I1), s	3.0	0.0	3.1	0.0	2.8	0.0	5.2	0.0
Green Ext Time (p_c), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Intersection Summary	
HCM 6th Ctrl Delay	22.2
HCM 6th LOS	C

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	1	0	0	0	0	18	0	0	32	2
Future Vol, veh/h	0	0	1	0	0	0	0	18	0	0	32	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	100	-	-	75	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	65	65	65	65	65	65	68	68	68	86	86	86
Heavy Vehicles, %	0	0	0	0	0	0	13	13	13	3	3	3
Mvmt Flow	0	0	2	0	0	0	0	26	0	0	37	2

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	64	64	38	65	65	26	39	0	0	26	0	0
Stage 1	38	38	-	26	26	-	-	-	-	-	-	-
Stage 2	26	26	-	39	39	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.23	-	-	4.13	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.317	-	-	2.227	-	-
Pot Cap-1 Maneuver	935	831	1040	934	830	1056	1503	-	-	1582	-	-
Stage 1	982	867	-	997	878	-	-	-	-	-	-	-
Stage 2	997	878	-	981	866	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	935	831	1040	933	830	1056	1503	-	-	1582	-	-
Mov Cap-2 Maneuver	935	831	-	933	830	-	-	-	-	-	-	-
Stage 1	982	867	-	997	878	-	-	-	-	-	-	-
Stage 2	997	878	-	980	866	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	8.5	0	0	0
HCM LOS	A	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1503	-	-	1040	-	1582	-	-
HCM Lane V/C Ratio	-	-	-	0.001	-	-	-	-
HCM Control Delay (s)	0	-	-	8.5	0	0	-	-
HCM Lane LOS	A	-	-	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0	-	0	-	-

Intersection	
Int Delay, s/veh	0.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↱		↑↑		↱
Traffic Vol, veh/h	297	31	0	376	0	15
Future Vol, veh/h	297	31	0	376	0	15
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	Free	-	None	-	Stop
Storage Length	-	0	-	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	94	94	68	68
Heavy Vehicles, %	4	4	2	5	2	13
Mvmt Flow	330	34	0	400	0	22

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	-	-	-	-	330
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	-	-	-	6.395
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	-	3.4235
Pot Cap-1 Maneuver	-	0	0	-	0	682
Stage 1	-	0	0	-	0	-
Stage 2	-	0	0	-	0	-
Platoon blocked, %	-			-		
Mov Cap-1 Maneuver	-	-	-	-	-	682
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	10.5
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	WBT
Capacity (veh/h)	682	-	-
HCM Lane V/C Ratio	0.032	-	-
HCM Control Delay (s)	10.5	-	-
HCM Lane LOS	B	-	-
HCM 95th %tile Q(veh)	0.1	-	-

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	22	281	379	4	1	0
Future Vol, veh/h	22	281	379	4	1	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	87	87	93	93	65	65
Heavy Vehicles, %	4	4	5	5	0	0
Mvmt Flow	13	323	408	4	2	0

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	412	0	-	0	759	410
Stage 1	-	-	-	-	410	-
Stage 2	-	-	-	-	349	-
Critical Hdwy	4.14	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.236	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1136	-	-	-	377	646
Stage 1	-	-	-	-	674	-
Stage 2	-	-	-	-	719	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1136	-	-	-	372	646
Mov Cap-2 Maneuver	-	-	-	-	482	-
Stage 1	-	-	-	-	665	-
Stage 2	-	-	-	-	719	-

Approach	EB	WB	SB
HCM Control Delay, s	0.3	0	12.5
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1136	-	-	-	482
HCM Lane V/C Ratio	0.011	-	-	-	0.003
HCM Control Delay (s)	8.2	0	-	-	12.5
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0

Intersection	
Int Delay, s/veh	1.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	17	0	14	0	0	0	8	195	0	0	163	21
Future Vol, veh/h	17	0	14	0	0	0	8	195	0	0	163	21
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	100	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	65	65	65	65	65	65	86	86	86	86	86	86
Heavy Vehicles, %	8	8	8	2	2	2	3	3	3	5	5	5
Mvmt Flow	26	0	22	0	0	0	9	227	0	0	190	24

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	334	447	202	458	459	114	214	0	0	227	0	0
Stage 1	202	202	-	245	245	-	-	-	-	-	-	-
Stage 2	132	245	-	213	214	-	-	-	-	-	-	-
Critical Hdwy	7.42	6.62	6.32	7.33	6.53	6.93	4.145	-	-	4.175	-	-
Critical Hdwy Stg 1	6.22	5.62	-	6.53	5.53	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.62	5.62	-	6.13	5.53	-	-	-	-	-	-	-
Follow-up Hdwy	3.576	4.076	3.376	3.519	4.019	3.319	2.2285	-	-	2.2475	-	-
Pot Cap-1 Maneuver	594	495	821	499	498	918	1348	-	-	1320	-	-
Stage 1	784	721	-	738	703	-	-	-	-	-	-	-
Stage 2	843	690	-	788	725	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	591	492	821	484	495	918	1348	-	-	1320	-	-
Mov Cap-2 Maneuver	591	492	-	484	495	-	-	-	-	-	-	-
Stage 1	779	721	-	733	698	-	-	-	-	-	-	-
Stage 2	837	685	-	767	725	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	10.7	0	0.3	0
HCM LOS	B	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1348	-	-	677	-	1320	-	-
HCM Lane V/C Ratio	0.007	-	-	0.07	-	-	-	-
HCM Control Delay (s)	7.7	-	-	10.7	0	0	-	-
HCM Lane LOS	A	-	-	B	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.2	-	0	-	-

Intersection: 1009: US-31 SB & Robbins Rd (Push-Buttons)

Movement	EB	EB	SB	SB	SB
Directions Served	T	R	T	T	R
Maximum Queue (ft)	159	138	524	516	102
Average Queue (ft)	64	60	285	288	35
95th Queue (ft)	122	115	485	494	80
Link Distance (ft)	941	941	566	566	566
Upstream Blk Time (%)			0	0	
Queuing Penalty (veh)			0	1	
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 1209: US-31 NB & X-Over South of Robbins Rd

Movement	EB	NB	NB
Directions Served	L	T	T
Maximum Queue (ft)	31	229	222
Average Queue (ft)	8	126	107
95th Queue (ft)	29	200	188
Link Distance (ft)	14	976	976
Upstream Blk Time (%)	11		
Queuing Penalty (veh)	27		
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 1909: US-31 NB & Robbins Rd (Push-Buttons)

Movement	EB	EB	WB	WB	NB	NB	NB
Directions Served	T	T	T	R	T	T	R
Maximum Queue (ft)	5	2	167	164	168	178	86
Average Queue (ft)	0	0	73	71	88	89	27
95th Queue (ft)	4	2	134	134	144	149	60
Link Distance (ft)	22	22	307	307	610	610	610
Upstream Blk Time (%)	0	0					
Queuing Penalty (veh)	0	0					
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 2909: US-31 SB & X-Over North of Robbins Rd

Movement	WB	SB	SB	SB
Directions Served	L	T	T	T
Maximum Queue (ft)	55	62	69	7
Average Queue (ft)	42	7	9	0
95th Queue (ft)	67	40	44	7
Link Distance (ft)	2	72	72	72
Upstream Blk Time (%)	23	0	0	0
Queuing Penalty (veh)	23	1	1	0
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 3085: 172nd Ave (Push-Buttons)/Ferry St (Push-Buttons) & Robbins Rd (Push-Buttons)

Movement	EB	EB	WB	WB	NB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	T	R	L	TR
Maximum Queue (ft)	54	180	66	197	114	114	61	96	186
Average Queue (ft)	16	81	17	83	46	47	22	22	76
95th Queue (ft)	46	153	48	160	93	96	50	61	146
Link Distance (ft)		576		931	139	139	139		848
Upstream Blk Time (%)					0	0			
Queuing Penalty (veh)					0	0			
Storage Bay Dist (ft)	160		170					75	
Storage Blk Time (%)		1		1				0	14
Queuing Penalty (veh)		0		0				0	4

Intersection: 9002: Whittaker Way & Bank Dwy/Health Dwy

Movement	EB
Directions Served	LTR
Maximum Queue (ft)	21
Average Queue (ft)	1
95th Queue (ft)	10
Link Distance (ft)	193
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 9005: Whittaker Way & Robbins Rd

Movement	
Directions Served	
Maximum Queue (ft)	
Average Queue (ft)	
95th Queue (ft)	
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 9006: Robbins Rd/Robbins Rd (Push-Buttons) & DeSpelder St

Movement	EB	SB
Directions Served	LT	LR
Maximum Queue (ft)	50	21
Average Queue (ft)	4	1
95th Queue (ft)	25	10
Link Distance (ft)	107	620
Upstream Blk Time (%)	0	
Queuing Penalty (veh)	0	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 9012: 172nd Ave/172nd Ave (Push-Buttons) & Gas Station Dwy/Bank Dwy

Movement	EB	NB	NB
Directions Served	LTR	L	T
Maximum Queue (ft)	69	13	2
Average Queue (ft)	23	1	0
95th Queue (ft)	56	7	0
Link Distance (ft)	254		649
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)		100	
Storage Blk Time (%)			
Queuing Penalty (veh)			

Zone Summary

Zone wide Queuing Penalty: 58

Lane Group	EBT	EBR	WBT	SBT	SBR
Lane Group Flow (vph)	347	287	251	1862	164
v/c Ratio	0.85	0.74	0.27	1.01	0.18
Control Delay	47.9	33.7	0.6	30.5	2.1
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	47.9	33.7	0.6	30.5	2.1
Queue Length 50th (ft)	143	92	0	~157	0
Queue Length 95th (ft)	#277	#200	0	m#507	m6
Internal Link Dist (ft)	920		1	549	
Turn Bay Length (ft)					
Base Capacity (vph)	416	396	944	1843	902
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.83	0.72	0.27	1.01	0.18

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	312	258	0	236	0	0	0	0	0	1769	156
Future Volume (vph)	0	312	258	0	236	0	0	0	0	0	1769	156
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		11.5	11.5		8.5						6.5	6.5
Lane Util. Factor		1.00	1.00		0.95						0.95	1.00
Frt		1.00	0.85		1.00						1.00	0.85
Flt Protected		1.00	1.00		1.00						1.00	1.00
Satd. Flow (prot)		1881	1599		3574						3505	1568
Flt Permitted		1.00	1.00		1.00						1.00	1.00
Satd. Flow (perm)		1881	1599		3574						3505	1568
Peak-hour factor, PHF	0.90	0.90	0.90	0.94	0.94	0.94	0.92	0.92	0.92	0.95	0.95	0.95
Adj. Flow (vph)	0	347	287	0	251	0	0	0	0	0	1862	164
RTOR Reduction (vph)	0	0	43	0	0	0	0	0	0	0	0	78
Lane Group Flow (vph)	0	347	244	0	251	0	0	0	0	0	1862	86
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	3%	3%	3%
Turn Type		NA	Perm		NA						NA	Perm
Protected Phases		4			8						2	
Permitted Phases			4									2
Actuated Green, G (s)		15.2	15.2		18.2						36.8	36.8
Effective Green, g (s)		15.2	15.2		18.2						36.8	36.8
Actuated g/C Ratio		0.22	0.22		0.26						0.53	0.53
Clearance Time (s)		11.5	11.5		8.5						6.5	6.5
Vehicle Extension (s)		4.0	4.0		4.0						0.2	0.2
Lane Grp Cap (vph)		408	347		929						1842	824
v/s Ratio Prot		c0.18			0.07						c0.53	
v/s Ratio Perm			0.15									0.05
v/c Ratio		0.85	0.70		0.27						1.01	0.10
Uniform Delay, d1		26.3	25.3		20.6						16.6	8.3
Progression Factor		1.00	1.00		0.00						0.62	1.05
Incremental Delay, d2		16.0	6.8		0.2						17.5	0.1
Delay (s)		42.3	32.1		0.2						27.8	8.9
Level of Service		D	C		A						C	A
Approach Delay (s)		37.7			0.2			0.0			26.2	
Approach LOS		D			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	26.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	80.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	NBT
Lane Group Flow (vph)	429	1701
v/c Ratio	0.75	0.87
Control Delay	20.9	18.9
Queue Delay	0.0	0.0
Total Delay	20.9	18.9
Queue Length 50th (ft)	92	293
Queue Length 95th (ft)	#289	#408
Internal Link Dist (ft)	1	920
Turn Bay Length (ft)		
Base Capacity (vph)	569	1960
Starvation Cap Reductn	0	0
Spillback Cap Reductn	0	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	0.75	0.87

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	408	0	0	1616	0	0
Future Volume (vph)	408	0	0	1616	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	16	12	12	11	12	12
Total Lost time (s)	4.0			6.5		
Lane Util. Factor	1.00			0.95		
Frt	1.00			1.00		
Flt Protected	0.95			1.00		
Satd. Flow (prot)	2046			3388		
Flt Permitted	0.95			1.00		
Satd. Flow (perm)	2046			3388		
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.92	0.92
Adj. Flow (vph)	429	0	0	1701	0	0
RTOR Reduction (vph)	15	0	0	0	0	0
Lane Group Flow (vph)	414	0	0	1701	0	0
Heavy Vehicles (%)	0%	0%	3%	3%	2%	2%
Turn Type	Prot			NA		
Protected Phases	2			1		
Permitted Phases						
Actuated Green, G (s)	19.0			40.5		
Effective Green, g (s)	19.0			40.5		
Actuated g/C Ratio	0.27			0.58		
Clearance Time (s)	4.0			6.5		
Lane Grp Cap (vph)	555			1960		
v/s Ratio Prot	c0.20			c0.50		
v/s Ratio Perm						
v/c Ratio	0.75			0.87		
Uniform Delay, d1	23.3			12.5		
Progression Factor	0.53			1.00		
Incremental Delay, d2	7.7			5.5		
Delay (s)	20.1			18.0		
Level of Service	C			B		
Approach Delay (s)	20.1			18.0	0.0	
Approach LOS	C			B	A	

Intersection Summary			
HCM 2000 Control Delay	18.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	97.7%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	WBR	NBT	NBR
Lane Group Flow (vph)	347	251	283	1798	357
v/c Ratio	0.37	0.62	0.73	0.97	0.39
Control Delay	0.6	32.1	33.0	20.9	2.0
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	0.6	32.1	33.0	20.9	2.0
Queue Length 50th (ft)	0	98	91	283	9
Queue Length 95th (ft)	m0	168	#195	#545	m12
Internal Link Dist (ft)	1	319		594	
Turn Bay Length (ft)					
Base Capacity (vph)	944	416	396	1861	924
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.37	0.60	0.71	0.97	0.39

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	312	0	0	236	266	0	1708	339	0	0	0
Future Volume (vph)	0	312	0	0	236	266	0	1708	339	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		8.5			11.5	11.5		6.5	6.5			
Lane Util. Factor		0.95			1.00	1.00		0.95	1.00			
Frt		1.00			1.00	0.85		1.00	0.85			
Flt Protected		1.00			1.00	1.00		1.00	1.00			
Satd. Flow (prot)		3574			1881	1599		3539	1583			
Flt Permitted		1.00			1.00	1.00		1.00	1.00			
Satd. Flow (perm)		3574			1881	1599		3539	1583			
Peak-hour factor, PHF	0.90	0.90	0.90	0.94	0.94	0.94	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	347	0	0	251	283	0	1798	357	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	43	0	0	92	0	0	0
Lane Group Flow (vph)	0	347	0	0	251	240	0	1798	265	0	0	0
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	3%	3%	3%
Turn Type		NA			NA	Perm		NA	Perm			
Protected Phases		8			4			2				
Permitted Phases						4			2			
Actuated Green, G (s)		18.2			15.2	15.2		36.8	36.8			
Effective Green, g (s)		18.2			15.2	15.2		36.8	36.8			
Actuated g/C Ratio		0.26			0.22	0.22		0.53	0.53			
Clearance Time (s)		8.5			11.5	11.5		6.5	6.5			
Vehicle Extension (s)		4.0			4.0	4.0		0.2	0.2			
Lane Grp Cap (vph)		929			408	347		1860	832			
v/s Ratio Prot		0.10			0.13			c0.51				
v/s Ratio Perm						c0.15			0.17			
v/c Ratio		0.37			0.62	0.69		0.97	0.32			
Uniform Delay, d1		21.2			24.8	25.2		16.0	9.5			
Progression Factor		0.00			1.00	1.00		0.60	0.30			
Incremental Delay, d2		0.2			3.1	6.3		9.1	0.5			
Delay (s)		0.2			27.9	31.5		18.7	3.4			
Level of Service		A			C	C		B	A			
Approach Delay (s)		0.2			29.8			16.1			0.0	
Approach LOS		A			C			B			A	

Intersection Summary			
HCM 2000 Control Delay	16.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	80.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Int Delay, s/veh	1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰					↑↑↑
Traffic Vol, veh/h	92	0	0	0	0	1910
Future Vol, veh/h	92	0	0	0	0	1910
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	16974	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	77	77	92	92	95	95
Heavy Vehicles, %	0	0	2	2	4	4
Mvmt Flow	119	0	0	0	0	2011

Major/Minor	Minor1		Major2	
Conflicting Flow All	804	-	-	-
Stage 1	0	-	-	-
Stage 2	804	-	-	-
Critical Hdwy	5.7	-	-	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	6	-	-	-
Follow-up Hdwy	3.8	-	-	-
Pot Cap-1 Maneuver	394	0	0	-
Stage 1	-	0	0	-
Stage 2	368	0	0	-
Platoon blocked, %				-
Mov Cap-1 Maneuver	394	-	-	-
Mov Cap-2 Maneuver	394	-	-	-
Stage 1	-	-	-	-
Stage 2	368	-	-	-

Approach	WB	SB
HCM Control Delay, s	18.1	0
HCM LOS	C	

Minor Lane/Major Mvmt	WBLn1	SBT
Capacity (veh/h)	394	-
HCM Lane V/C Ratio	0.303	-
HCM Control Delay (s)	18.1	-
HCM Lane LOS	C	-
HCM 95th %tile Q(veh)	1.3	-

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	60	472	64	455	142	267	91	72	275
v/c Ratio	0.16	0.65	0.18	0.62	0.41	0.54	0.17	0.19	0.63
Control Delay	12.1	27.1	12.3	26.7	22.9	34.7	2.1	19.4	36.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	12.1	27.1	12.3	26.7	22.9	34.7	2.1	19.4	36.8
Queue Length 50th (ft)	16	213	17	206	53	136	0	26	133
Queue Length 95th (ft)	36	328	37	316	95	217	12	54	217
Internal Link Dist (ft)		564		899		123			802
Turn Bay Length (ft)	160		170					75	
Base Capacity (vph)	378	729	365	734	345	494	528	376	435
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.16	0.65	0.18	0.62	0.41	0.54	0.17	0.19	0.63

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	57	334	114	61	361	71	135	254	86	68	202	59
Future Volume (veh/h)	57	334	114	61	361	71	135	254	86	68	202	59
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	1885	1885	1885	1885	1885	1885	1900	1900	1900	1885	1885	1885
Adj Flow Rate, veh/h	60	352	120	64	380	75	142	267	91	72	213	62
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	1	1	1	1	1	1	0	0	0	1	1	1
Cap, veh/h	372	528	180	356	603	119	330	469	398	324	327	95
Arrive On Green	0.06	0.39	0.39	0.06	0.39	0.39	0.08	0.25	0.25	0.06	0.23	0.23
Sat Flow, veh/h	1795	1344	458	1795	1529	302	1810	1900	1610	1795	1403	408
Grp Volume(v), veh/h	60	0	472	64	0	455	142	267	91	72	0	275
Grp Sat Flow(s),veh/h/ln	1795	0	1803	1795	0	1831	1810	1900	1610	1795	0	1812
Q Serve(g_s), s	1.7	0.0	19.4	1.8	0.0	18.0	5.3	11.1	4.1	2.6	0.0	12.3
Cycle Q Clear(g_c), s	1.7	0.0	19.4	1.8	0.0	18.0	5.3	11.1	4.1	2.6	0.0	12.3
Prop In Lane	1.00		0.25	1.00		0.16	1.00		1.00	1.00		0.23
Lane Grp Cap(c), veh/h	372	0	708	356	0	722	330	469	398	324	0	423
V/C Ratio(X)	0.16	0.00	0.67	0.18	0.00	0.63	0.43	0.57	0.23	0.22	0.00	0.65
Avail Cap(c_a), veh/h	413	0	708	394	0	722	339	469	398	357	0	423
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	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	15.8	0.0	22.5	16.1	0.0	22.0	24.1	29.7	27.0	23.7	0.0	31.2
Incr Delay (d2), s/veh	0.2	0.0	4.9	0.2	0.0	4.1	0.9	4.9	1.3	0.3	0.0	7.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	0.0	8.7	0.7	0.0	8.1	2.2	5.4	1.7	1.1	0.0	6.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	16.0	0.0	27.4	16.4	0.0	26.1	25.0	34.6	28.4	24.0	0.0	38.7
LnGrp LOS	B	A	C	B	A	C	C	C	C	C	A	D
Approach Vol, veh/h		532			519			500			347	
Approach Delay, s/veh		26.1			24.9			30.7			35.7	
Approach LOS		C			C			C			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	10.1	41.3	10.3	28.2	9.9	41.5	11.6	27.0
Change Period (Y+Rc), s	4.5	6.0	4.5	6.0	4.5	6.0	4.5	6.0
Max Green Setting (Gmax), s	7.5	33.0	7.5	21.0	7.5	33.0	7.5	21.0
Max Q Clear Time (g_c+I1), s	3.8	0.0	4.6	0.0	3.7	0.0	7.3	0.0
Green Ext Time (p_c), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Intersection Summary	
HCM 6th Ctrl Delay	28.8
HCM 6th LOS	C

Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	8	0	6	0	0	0	11	57	0	0	86	9
Future Vol, veh/h	8	0	6	0	0	0	11	57	0	0	86	9
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	100	-	-	75	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	60	60	60	92	92	92	75	75	75	92	92	92
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	1	1	1
Mvmt Flow	13	0	10	0	0	0	15	76	0	0	93	10

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	204	204	98	209	209	76	103	0	0	76	0	0
Stage 1	98	98	-	106	106	-	-	-	-	-	-	-
Stage 2	106	106	-	103	103	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.11	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.209	-	-
Pot Cap-1 Maneuver	758	696	963	753	692	991	1502	-	-	1529	-	-
Stage 1	913	818	-	905	811	-	-	-	-	-	-	-
Stage 2	905	811	-	908	814	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	752	689	963	739	685	991	1502	-	-	1529	-	-
Mov Cap-2 Maneuver	752	689	-	739	685	-	-	-	-	-	-	-
Stage 1	904	818	-	896	803	-	-	-	-	-	-	-
Stage 2	896	803	-	899	814	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	9.5	0	1.2	0
HCM LOS	A	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1502	-	-	830	-	1529	-	-
HCM Lane V/C Ratio	0.01	-	-	0.028	-	-	-	-
HCM Control Delay (s)	7.4	-	-	9.5	0	0	-	-
HCM Lane LOS	A	-	-	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.1	-	0	-	-

Intersection	
Int Delay, s/veh	0.8

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↱		↑↑		↱
Traffic Vol, veh/h	524	91	0	502	0	55
Future Vol, veh/h	524	91	0	502	0	55
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	Free	-	None	-	Stop
Storage Length	-	0	-	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	89	89	73	73
Heavy Vehicles, %	1	1	1	1	0	0
Mvmt Flow	552	96	0	564	0	75

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	-	-	-	-	552
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	-	-	-	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	-	3.3
Pot Cap-1 Maneuver	-	0	0	-	0	537
Stage 1	-	0	0	-	0	-
Stage 2	-	0	0	-	0	-
Platoon blocked, %	-			-		
Mov Cap-1 Maneuver	-	-	-	-	-	537
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

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

Minor Lane/Major Mvmt	NBLn1	EBT	WBT
Capacity (veh/h)	537	-	-
HCM Lane V/C Ratio	0.14	-	-
HCM Control Delay (s)	12.8	-	-
HCM Lane LOS	B	-	-
HCM 95th %tile Q(veh)	0.5	-	-

Intersection	
Int Delay, s/veh	0.6

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	40	530	513	6	11	9
Future Vol, veh/h	40	530	513	6	11	9
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	91	91	91	91	76	76
Heavy Vehicles, %	1	1	1	1	0	0
Mvmt Flow	44	582	564	7	14	12

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	571	0	-	0	1238	568
Stage 1	-	-	-	-	568	-
Stage 2	-	-	-	-	670	-
Critical Hdwy	4.11	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.209	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1007	-	-	-	196	526
Stage 1	-	-	-	-	571	-
Stage 2	-	-	-	-	512	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1007	-	-	-	183	526
Mov Cap-2 Maneuver	-	-	-	-	311	-
Stage 1	-	-	-	-	534	-
Stage 2	-	-	-	-	512	-

Approach	EB	WB	SB
HCM Control Delay, s	0.6	0	15.1
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1007	-	-	-	381
HCM Lane V/C Ratio	0.044	-	-	-	0.069
HCM Control Delay (s)	8.7	0	-	-	15.1
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0.1	-	-	-	0.2

Intersection	
Int Delay, s/veh	1.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	27	0	32	1	0	8	34	443	0	5	341	18
Future Vol, veh/h	27	0	32	1	0	8	34	443	0	5	341	18
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	100	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	72	72	72	92	92	92	95	95	95
Heavy Vehicles, %	0	0	0	0	0	0	2	2	2	1	1	1
Mvmt Flow	29	0	34	1	0	11	37	482	0	5	359	19

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	694	935	369	952	944	241	378	0	0	482	0	0
Stage 1	379	379	-	556	556	-	-	-	-	-	-	-
Stage 2	315	556	-	396	388	-	-	-	-	-	-	-
Critical Hdwy	7.3	6.5	6.2	7.3	6.5	6.9	4.13	-	-	4.115	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.5	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.5	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.219	-	-	2.2095	-	-
Pot Cap-1 Maneuver	346	267	681	229	264	766	1179	-	-	1085	-	-
Stage 1	647	618	-	488	516	-	-	-	-	-	-	-
Stage 2	676	516	-	633	612	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	331	257	681	211	254	766	1179	-	-	1085	-	-
Mov Cap-2 Maneuver	331	257	-	211	254	-	-	-	-	-	-	-
Stage 1	627	614	-	473	500	-	-	-	-	-	-	-
Stage 2	645	500	-	598	608	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	14.1	11.2	0.6	0.1
HCM LOS	B	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1179	-	-	459	593	1085	-	-
HCM Lane V/C Ratio	0.031	-	-	0.137	0.021	0.005	-	-
HCM Control Delay (s)	8.2	-	-	14.1	11.2	8.3	0	-
HCM Lane LOS	A	-	-	B	B	A	A	-
HCM 95th %tile Q(veh)	0.1	-	-	0.5	0.1	0	-	-

Intersection: 1009: US-31 SB & Robbins Rd (Push-Buttons)

Movement	EB	EB	WB	SB	SB	SB
Directions Served	T	R	T	T	T	R
Maximum Queue (ft)	257	182	6	536	516	109
Average Queue (ft)	132	94	0	314	316	31
95th Queue (ft)	219	161	5	529	528	83
Link Distance (ft)	941	941	22	566	566	566
Upstream Blk Time (%)			0	0	0	
Queuing Penalty (veh)			0	1	1	
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 1209: US-31 NB & X-Over South of Robbins Rd

Movement	EB	NB	NB
Directions Served	L	T	T
Maximum Queue (ft)	66	267	279
Average Queue (ft)	30	156	151
95th Queue (ft)	63	234	244
Link Distance (ft)	14	976	976
Upstream Blk Time (%)	41		
Queuing Penalty (veh)	166		
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 1909: US-31 NB & Robbins Rd (Push-Buttons)

Movement	EB	EB	WB	WB	NB	NB	NB
Directions Served	T	T	T	R	T	T	R
Maximum Queue (ft)	20	14	184	202	360	376	95
Average Queue (ft)	2	1	95	106	173	181	43
95th Queue (ft)	11	8	164	182	301	314	74
Link Distance (ft)	22	22	307	307	610	610	610
Upstream Blk Time (%)	2	1					
Queuing Penalty (veh)	3	1					
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 2909: US-31 SB & X-Over North of Robbins Rd

Movement	WB	SB	SB	SB
Directions Served	L	T	T	T
Maximum Queue (ft)	55	72	64	5
Average Queue (ft)	41	10	10	0
95th Queue (ft)	64	49	46	5
Link Distance (ft)	2	72	72	72
Upstream Blk Time (%)	21	0	0	
Queuing Penalty (veh)	20	2	1	
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 3085: 172nd Ave (Push-Buttons)/Ferry St (Push-Buttons) & Robbins Rd (Push-Buttons)

Movement	EB	EB	WB	WB	NB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	T	R	L	TR
Maximum Queue (ft)	184	301	148	299	144	162	74	120	302
Average Queue (ft)	45	162	36	148	68	110	30	50	134
95th Queue (ft)	125	264	99	257	121	170	59	106	243
Link Distance (ft)		576		931	139	139	139		848
Upstream Blk Time (%)					1	6			
Queuing Penalty (veh)					1	9			
Storage Bay Dist (ft)	160		170					75	
Storage Blk Time (%)		9		6				3	34
Queuing Penalty (veh)		5		3				7	23

Intersection: 9002: Whittaker Way & Bank Dwy/Health Dwy

Movement	EB	NB
Directions Served	LTR	L
Maximum Queue (ft)	36	17
Average Queue (ft)	12	1
95th Queue (ft)	36	9
Link Distance (ft)	193	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		100
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 9005: Whittaker Way & Robbins Rd

Movement	EB	NB
Directions Served	T	R
Maximum Queue (ft)	36	25
Average Queue (ft)	2	1
95th Queue (ft)	17	14
Link Distance (ft)	307	426
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 9006: Robbins Rd/Robbins Rd (Push-Buttons) & DeSpelder St

Movement	EB	SB
Directions Served	LT	LR
Maximum Queue (ft)	116	47
Average Queue (ft)	27	16
95th Queue (ft)	82	42
Link Distance (ft)	107	620
Upstream Blk Time (%)	0	
Queuing Penalty (veh)	3	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 9012: 172nd Ave/172nd Ave (Push-Buttons) & Gas Station Dwy/Bank Dwy

Movement	EB	WB	NB	NB	SB
Directions Served	LTR	LTR	L	T	LTR
Maximum Queue (ft)	78	37	34	106	60
Average Queue (ft)	33	8	6	10	3
95th Queue (ft)	65	31	22	55	28
Link Distance (ft)	254	203		649	139
Upstream Blk Time (%)					0
Queuing Penalty (veh)					0
Storage Bay Dist (ft)			100		
Storage Blk Time (%)				0	
Queuing Penalty (veh)				0	

Zone Summary

Zone wide Queuing Penalty: 246

APPENDIX D. SIMTRAFFIC PERFORMANCE REPORT (VALIDATION LOGS)

1009: US-31 SB & Robbins Rd (Push-Buttons) Performance by movement

Movement	EBT	EBR	WBT	SBT	SBR	All
Vehicles Exited	137	140	131	1456	141	2005
Hourly Exit Rate	137	140	131	1456	141	2005
Input Volume	134	135	135	1479	143	2026
% of Volume	102	104	97	98	99	99

1109: US-31 SB & McDonald's Driveway Performance by movement

Movement	EBR	SBT	SBR	All
Vehicles Exited	132	1373	144	1649
Hourly Exit Rate	132	1373	144	1649
Input Volume	128	1410	141	1678
% of Volume	103	97	102	98

1209: US-31 NB & X-Over South of Robbins Rd Performance by movement

Movement	EBL	NBT	All
Vehicles Exited	215	1025	1240
Hourly Exit Rate	215	1025	1240
Input Volume	211	1029	1240
% of Volume	102	100	100

1909: US-31 NB & Robbins Rd (Push-Buttons) Performance by movement

Movement	EBT	WBT	WBR	NBT	NBR	All
Vehicles Exited	137	139	177	1072	174	1699
Hourly Exit Rate	137	139	177	1072	174	1699
Input Volume	134	142	179	1072	175	1701
% of Volume	102	98	99	100	100	100

2209: US-31 SB & X-Over South of Robbins Rd Performance by movement

Movement	SBL	SBT	All
Vehicles Exited	215	1358	1573
Hourly Exit Rate	215	1358	1573
Input Volume	211	1368	1579
% of Volume	102	99	100

2809: US-31 NB & X-Over North of Robbins Rd Performance by movement

Movement	NBL	NBT	All
Vehicles Exited	86	1210	1296
Hourly Exit Rate	86	1210	1296
Input Volume	82	1211	1294
% of Volume	105	100	100

2909: US-31 SB & X-Over North of Robbins Rd Performance by movement

Movement	WBL	SBT	All
Vehicles Exited	86	1514	1600
Hourly Exit Rate	86	1514	1600
Input Volume	82	1546	1628
% of Volume	105	98	98

3085: 172nd Ave (Push-Buttons)/Ferry St (Push-Buttons) & Robbins Rd (Push-Buttons) Performance by

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vehicles Exited	23	193	26	25	209	30	71	84	46	21	93	24
Hourly Exit Rate	23	193	26	25	209	30	71	84	46	21	93	24
Input Volume	23	190	26	29	218	28	69	82	43	24	93	23
% of Volume	99	101	101	86	96	107	103	102	106	88	100	104

3085: 172nd Ave (Push-Buttons)/Ferry St (Push-Buttons) & Robbins Rd (Push-Buttons) Performance by

Movement	All
Vehicles Exited	845
Hourly Exit Rate	845
Input Volume	850
% of Volume	99

9002: Whittaker Way & Bank Dwy/Health Dwy Performance by movement

Movement	EBR	NBT	SBT	SBR	All
Vehicles Exited	1	14	25	1	41
Hourly Exit Rate	1	14	25	1	41
Input Volume	1	15	27	2	45
% of Volume	80	93	93	50	91

9005: Whittaker Way & Robbins Rd Performance by movement

Movement	EBT	EBR	WBT	NBT	NBR	All
Vehicles Exited	286	24	315	3	11	639
Hourly Exit Rate	286	24	315	3	11	639
Input Volume	283	26	321	2	13	644
% of Volume	101	93	98	133	86	99

9006: Robbins Rd/Robbins Rd (Push-Buttons) & DeSpelder St Performance by movement

Movement	EBL	EBT	WBT	WBR	SBL	All
Vehicles Exited	8	256	314	3	2	583
Hourly Exit Rate	8	256	314	3	2	583
Input Volume	10	255	321	3	1	590
% of Volume	82	100	98	100	160	99

9012: 172nd Ave/172nd Ave (Push-Buttons) & Gas Station Dwy/Bank Dwy Performance by movement

Movement	EBL	EBR	NBL	NBT	SBT	SBR	All
Vehicles Exited	13	13	5	171	130	21	353
Hourly Exit Rate	13	13	5	171	130	21	353
Input Volume	14	12	7	165	138	18	354
% of Volume	93	111	74	104	94	115	100

Total Network Performance

Vehicles Exited	3719
Hourly Exit Rate	3719
Input Volume	17187
% of Volume	22

1009: US-31 SB & Robbins Rd (Push-Buttons) Performance by movement

Movement	EBT	EBR	WBT	SBT	SBR	All
Vehicles Exited	254	224	192	1494	129	2293
Hourly Exit Rate	254	224	192	1494	129	2293
Input Volume	264	219	200	1474	132	2289
% of Volume	96	102	96	101	98	100

1109: US-31 SB & McDonald's Driveway Performance by movement

Movement	EBR	SBT	SBR	All
Vehicles Exited	122	1415	139	1676
Hourly Exit Rate	122	1415	139	1676
Input Volume	118	1410	141	1669
% of Volume	104	100	99	100

1209: US-31 NB & X-Over South of Robbins Rd Performance by movement

Movement	EBL	NBT	All
Vehicles Exited	334	1295	1629
Hourly Exit Rate	334	1295	1629
Input Volume	346	1293	1640
% of Volume	96	100	99

1909: US-31 NB & Robbins Rd (Push-Buttons) Performance by movement

Movement	EBT	WBT	WBR	NBT	NBR	All
Vehicles Exited	254	199	231	1367	289	2340
Hourly Exit Rate	254	199	231	1367	289	2340
Input Volume	264	207	225	1371	287	2354
% of Volume	96	96	103	100	101	99

2209: US-31 SB & X-Over South of Robbins Rd Performance by movement

Movement	SBL	SBT	All
Vehicles Exited	334	1329	1663
Hourly Exit Rate	334	1329	1663
Input Volume	346	1296	1642
% of Volume	96	103	101

2809: US-31 NB & X-Over North of Robbins Rd Performance by movement

Movement	NBL	NBT	All
Vehicles Exited	78	1556	1634
Hourly Exit Rate	78	1556	1634
Input Volume	78	1560	1638
% of Volume	100	100	100

2909: US-31 SB & X-Over North of Robbins Rd Performance by movement

Movement	WBL	SBT	All
Vehicles Exited	78	1547	1625
Hourly Exit Rate	78	1547	1625
Input Volume	78	1536	1614
% of Volume	100	101	101

3085: 172nd Ave (Push-Buttons)/Ferry St (Push-Buttons) & Robbins Rd (Push-Buttons) Performance by

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vehicles Exited	49	304	96	48	301	59	115	225	73	58	169	52
Hourly Exit Rate	49	304	96	48	301	59	115	225	73	58	169	52
Input Volume	48	314	97	52	306	60	114	227	73	58	171	50
% of Volume	103	97	99	93	98	99	101	99	100	100	99	103

3085: 172nd Ave (Push-Buttons)/Ferry St (Push-Buttons) & Robbins Rd (Push-Buttons) Performance by

Movement	All
Vehicles Exited	1549
Hourly Exit Rate	1549
Input Volume	1569
% of Volume	99

9002: Whittaker Way & Bank Dwy/Health Dwy Performance by movement

Movement	EBL	EBR	NBL	NBT	SBT	SBR	All
Vehicles Exited	6	4	7	49	72	8	146
Hourly Exit Rate	6	4	7	49	72	8	146
Input Volume	7	5	9	48	73	8	150
% of Volume	89	80	78	102	99	97	97

9005: Whittaker Way & Robbins Rd Performance by movement

Movement	EBT	EBR	WBT	NBT	NBR	All
Vehicles Exited	467	76	445	8	47	1043
Hourly Exit Rate	467	76	445	8	47	1043
Input Volume	474	77	443	8	47	1049
% of Volume	98	99	101	103	99	99

9006: Robbins Rd/Robbins Rd (Push-Buttons) & DeSpelder St Performance by movement

Movement	EBL	EBT	WBT	WBR	SBL	SBR	All
Vehicles Exited	32	450	467	5	8	8	970
Hourly Exit Rate	32	450	467	5	8	8	970
Input Volume	34	458	466	5	9	8	980
% of Volume	94	98	100	95	86	100	99

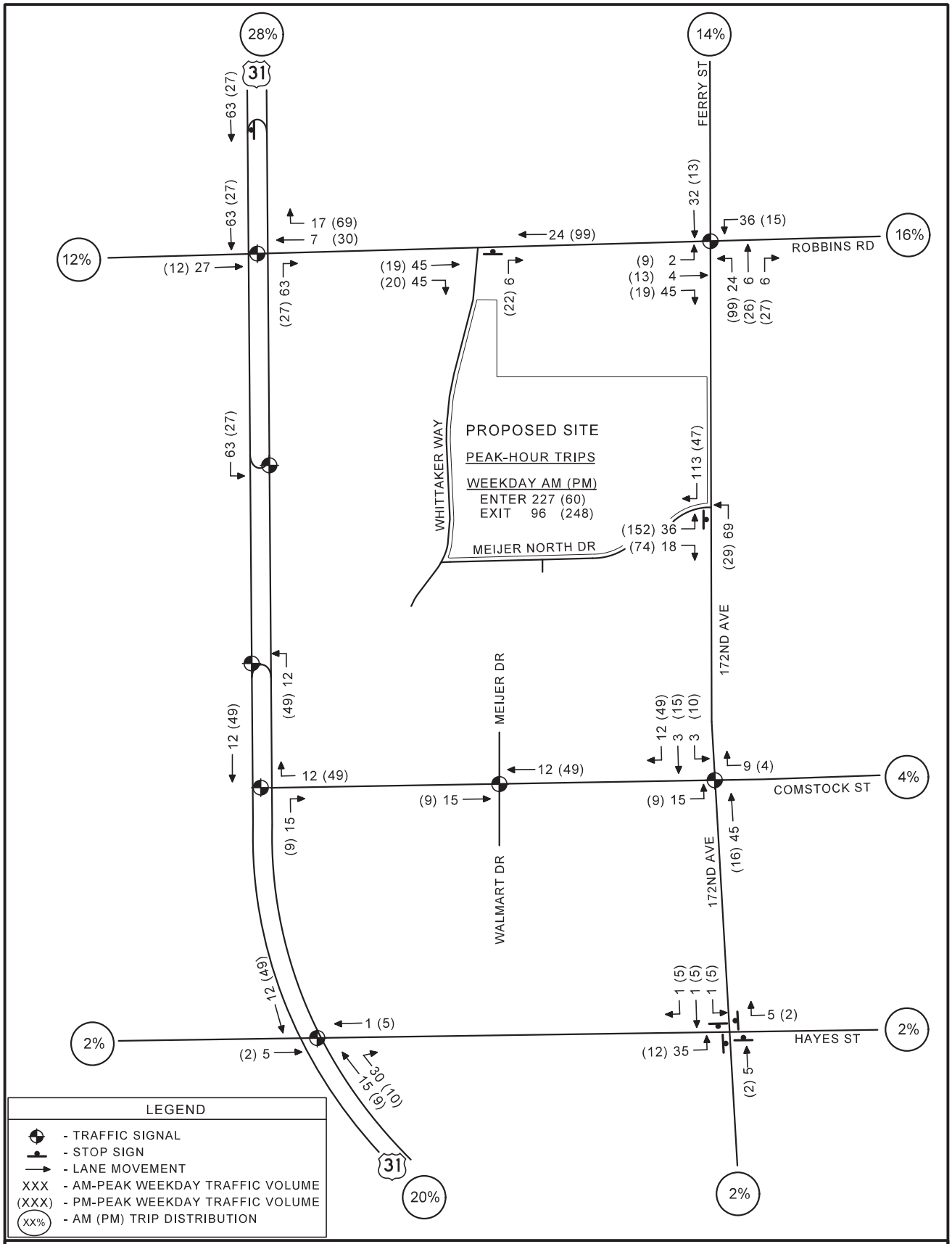
9012: 172nd Ave/172nd Ave (Push-Buttons) & Gas Station Dwy/Bank Dwy Performance by movement

Movement	EBL	EBR	WBL	WBR	NBL	NBT	SBL	SBT	SBR	All
Vehicles Exited	22	29	0	7	26	376	3	295	15	773
Hourly Exit Rate	22	29	0	7	26	376	3	295	15	773
Input Volume	23	27	1	7	29	375	4	300	15	782
% of Volume	96	107	0	100	89	100	75	98	98	99

Total Network Performance

Vehicles Exited	4771
Hourly Exit Rate	4771
Input Volume	21930
% of Volume	22

APPENDIX E. SPECTRUM HEALTH TRIP GENERATION & DISTRIBUTION



SPECTRUM HEALTH - GRAND HAVEN TRAFFIC IMPACT STUDY

NEDERVELD URS

OPENING YEAR (2017) PEAK-HOUR SITE TRIP DISTRIBUTION AND TRAFFIC ASSIGNMENT

FIGURE 6

M:/PROJECTS/12945195/CADD/TRAFFIC/6_OPENING YEAR (2017) PEAK-HOUR SITE TRIP DISTRIBUTION AND TRAFFIC ASSIGNMENT.DGN

APPENDIX F. FUTURE NO BUILD 2023 SYNCHRO RESULTS

Lane Group	EBT	EBR	WBT	SBT	SBR
Lane Group Flow (vph)	226	198	195	2155	198
v/c Ratio	0.60	0.54	0.23	1.16	0.21
Control Delay	32.2	23.5	0.6	89.2	1.8
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	32.2	23.5	0.6	89.2	1.8
Queue Length 50th (ft)	87	53	0	~596	5
Queue Length 95th (ft)	146	107	0	m#520	m5
Internal Link Dist (ft)	920		1	549	
Turn Bay Length (ft)					
Base Capacity (vph)	412	393	917	1858	922
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.55	0.50	0.21	1.16	0.21

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	197	172	0	179	0	0	0	0	0	1983	182
Future Volume (vph)	0	197	172	0	179	0	0	0	0	0	1983	182
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		11.5	11.5		8.5						6.5	6.5
Lane Util. Factor		1.00	1.00		0.95						0.95	1.00
Frt		1.00	0.85		1.00						1.00	0.85
Flt Protected		1.00	1.00		1.00						1.00	1.00
Satd. Flow (prot)		1863	1583		3471						3438	1538
Flt Permitted		1.00	1.00		1.00						1.00	1.00
Satd. Flow (perm)		1863	1583		3471						3438	1538
Peak-hour factor, PHF	0.87	0.87	0.87	0.92	0.92	0.92	0.87	0.87	0.87	0.92	0.92	0.92
Adj. Flow (vph)	0	226	198	0	195	0	0	0	0	0	2155	198
RTOR Reduction (vph)	0	0	44	0	0	0	0	0	0	0	0	91
Lane Group Flow (vph)	0	226	154	0	195	0	0	0	0	0	2155	107
Heavy Vehicles (%)	2%	2%	2%	4%	4%	4%	2%	2%	2%	5%	5%	5%
Turn Type		NA	Perm		NA						NA	Perm
Protected Phases		4			8						2	
Permitted Phases			4									2
Actuated Green, G (s)		14.2	14.2		17.2						37.8	37.8
Effective Green, g (s)		14.2	14.2		17.2						37.8	37.8
Actuated g/C Ratio		0.20	0.20		0.25						0.54	0.54
Clearance Time (s)		11.5	11.5		8.5						6.5	6.5
Vehicle Extension (s)		4.0	4.0		4.0						0.2	0.2
Lane Grp Cap (vph)		377	321		852						1856	830
v/s Ratio Prot		c0.12			0.06						c0.63	
v/s Ratio Perm			0.10									0.07
v/c Ratio		0.60	0.48		0.23						1.16	0.13
Uniform Delay, d1		25.3	24.6		21.1						16.1	8.0
Progression Factor		1.00	1.00		0.00						0.71	1.10
Incremental Delay, d2		3.0	1.5		0.2						73.1	0.0
Delay (s)		28.3	26.2		0.2						84.5	8.8
Level of Service		C	C		A						F	A
Approach Delay (s)		27.3			0.2			0.0			78.1	
Approach LOS		C			A			A			E	

Intersection Summary			
HCM 2000 Control Delay	65.8	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	80.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	NBT
Lane Group Flow (vph)	399	1593
v/c Ratio	0.70	0.86
Control Delay	15.6	18.8
Queue Delay	0.0	0.0
Total Delay	15.6	18.8
Queue Length 50th (ft)	71	272
Queue Length 95th (ft)	70	351
Internal Link Dist (ft)	1	920
Turn Bay Length (ft)		
Base Capacity (vph)	574	1852
Starvation Cap Reductn	0	0
Spillback Cap Reductn	0	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	0.70	0.86

Intersection Summary

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	331	0	0	1386	0	0
Future Volume (vph)	331	0	0	1386	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	16	12	12	11	12	12
Total Lost time (s)	4.0			6.5		
Lane Util. Factor	1.00			0.95		
Frt	1.00			1.00		
Flt Protected	0.95			1.00		
Satd. Flow (prot)	2046			3202		
Flt Permitted	0.95			1.00		
Satd. Flow (perm)	2046			3202		
Peak-hour factor, PHF	0.83	0.83	0.87	0.87	0.92	0.92
Adj. Flow (vph)	399	0	0	1593	0	0
RTOR Reduction (vph)	19	0	0	0	0	0
Lane Group Flow (vph)	380	0	0	1593	0	0
Heavy Vehicles (%)	0%	0%	9%	9%	2%	2%
Turn Type	Prot			NA		
Protected Phases	2			1		
Permitted Phases						
Actuated Green, G (s)	19.0			40.5		
Effective Green, g (s)	19.0			40.5		
Actuated g/C Ratio	0.27			0.58		
Clearance Time (s)	4.0			6.5		
Lane Grp Cap (vph)	555			1852		
v/s Ratio Prot	c0.19			c0.50		
v/s Ratio Perm						
v/c Ratio	0.68			0.86		
Uniform Delay, d1	22.8			12.4		
Progression Factor	0.43			1.00		
Incremental Delay, d2	5.9			5.5		
Delay (s)	15.7			17.9		
Level of Service	B			B		
Approach Delay (s)	15.7			17.9	0.0	
Approach LOS	B			B	A	

Intersection Summary			
HCM 2000 Control Delay	17.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	97.1%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	WBR	NBT	NBR
Lane Group Flow (vph)	226	195	266	1649	328
v/c Ratio	0.26	0.53	0.74	0.91	0.34
Control Delay	0.6	30.2	34.5	15.4	0.6
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	0.6	30.2	34.5	15.4	0.6
Queue Length 50th (ft)	0	74	83	228	1
Queue Length 95th (ft)	0	133	#181	#464	m0
Internal Link Dist (ft)	1	319		594	
Turn Bay Length (ft)					
Base Capacity (vph)	935	404	386	1807	958
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.24	0.48	0.69	0.91	0.34

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	197	0	0	179	245	0	1435	285	0	0	0
Future Volume (vph)	0	197	0	0	179	245	0	1435	285	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		8.5			11.5	11.5		6.5	6.5			
Lane Util. Factor		0.95			1.00	1.00		0.95	1.00			
Frt		1.00			1.00	0.85		1.00	0.85			
Flt Protected		1.00			1.00	1.00		1.00	1.00			
Satd. Flow (prot)		3539			1827	1553		3343	1495			
Flt Permitted		1.00			1.00	1.00		1.00	1.00			
Satd. Flow (perm)		3539			1827	1553		3343	1495			
Peak-hour factor, PHF	0.87	0.87	0.87	0.92	0.92	0.92	0.87	0.87	0.87	0.92	0.92	0.92
Adj. Flow (vph)	0	226	0	0	195	266	0	1649	328	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	44	0	0	151	0	0	0
Lane Group Flow (vph)	0	226	0	0	195	222	0	1649	177	0	0	0
Heavy Vehicles (%)	2%	2%	2%	4%	4%	4%	8%	8%	8%	2%	2%	2%
Turn Type		NA			NA	Perm		NA	Perm			
Protected Phases		8			4			2				
Permitted Phases						4			2			
Actuated Green, G (s)		17.2			14.2	14.2		37.8	37.8			
Effective Green, g (s)		17.2			14.2	14.2		37.8	37.8			
Actuated g/C Ratio		0.25			0.20	0.20		0.54	0.54			
Clearance Time (s)		8.5			11.5	11.5		6.5	6.5			
Vehicle Extension (s)		4.0			4.0	4.0		0.2	0.2			
Lane Grp Cap (vph)		869			370	315		1805	807			
v/s Ratio Prot		0.06			0.11			c0.49				
v/s Ratio Perm						c0.14			0.12			
v/c Ratio		0.26			0.53	0.71		0.91	0.22			
Uniform Delay, d1		21.3			24.9	26.0		14.6	8.4			
Progression Factor		0.00			1.00	1.00		0.57	0.08			
Incremental Delay, d2		0.2			1.8	7.5		5.0	0.3			
Delay (s)		0.2			26.7	33.5		13.3	1.0			
Level of Service		A			C	C		B	A			
Approach Delay (s)		0.2			30.6			11.3			0.0	
Approach LOS		A			C			B			A	

Intersection Summary			
HCM 2000 Control Delay	13.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	80.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Int Delay, s/veh	1.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰					↑↑↑
Traffic Vol, veh/h	104	0	0	0	0	2134
Future Vol, veh/h	104	0	0	0	0	2134
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	16974	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	69	69	92	92	91	91
Heavy Vehicles, %	0	0	2	2	5	5
Mvmt Flow	151	0	0	0	0	2345

Major/Minor	Minor1		Major2	
Conflicting Flow All	938	-	-	-
Stage 1	0	-	-	-
Stage 2	938	-	-	-
Critical Hdwy	5.7	-	-	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	6	-	-	-
Follow-up Hdwy	3.8	-	-	-
Pot Cap-1 Maneuver	338	0	0	-
Stage 1	-	0	0	-
Stage 2	313	0	0	-
Platoon blocked, %				-
Mov Cap-1 Maneuver	338	-	-	-
Mov Cap-2 Maneuver	338	-	-	-
Stage 1	-	-	-	-
Stage 2	313	-	-	-

Approach	WB	SB
HCM Control Delay, s	23.9	0
HCM LOS	C	

Minor Lane/Major Mvmt	WBLn1	SBT
Capacity (veh/h)	338	-
HCM Lane V/C Ratio	0.446	-
HCM Control Delay (s)	23.9	-
HCM Lane LOS	C	-
HCM 95th %tile Q(veh)	2.2	-

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	35	340	77	330	118	108	64	33	192
v/c Ratio	0.07	0.48	0.17	0.44	0.29	0.20	0.12	0.07	0.45
Control Delay	11.3	22.8	12.2	21.6	20.7	27.8	0.4	18.1	32.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	11.3	22.8	12.2	21.6	20.7	27.8	0.4	18.1	32.0
Queue Length 50th (ft)	9	139	21	138	44	50	0	12	89
Queue Length 95th (ft)	24	217	43	220	81	95	0	30	154
Internal Link Dist (ft)		564		899		123			802
Turn Bay Length (ft)	160		170					75	
Base Capacity (vph)	490	707	446	757	400	530	553	458	423
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.07	0.48	0.17	0.44	0.29	0.20	0.12	0.07	0.45

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	31	224	78	73	277	36	112	103	61	31	150	29
Future Volume (veh/h)	31	224	78	73	277	36	112	103	61	31	150	29
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	1841	1841	1841	1826	1826	1826	1856	1856	1856	1841	1841	1841
Adj Flow Rate, veh/h	35	252	88	77	292	38	118	108	64	33	161	31
Peak Hour Factor	0.89	0.89	0.89	0.95	0.95	0.95	0.95	0.95	0.95	0.93	0.93	0.93
Percent Heavy Veh, %	4	4	4	5	5	5	3	3	3	4	4	4
Cap, veh/h	451	513	179	447	656	85	377	489	414	417	350	67
Arrive On Green	0.05	0.39	0.39	0.07	0.41	0.41	0.07	0.26	0.26	0.04	0.23	0.23
Sat Flow, veh/h	1753	1304	455	1739	1583	206	1767	1856	1572	1753	1500	289
Grp Volume(v), veh/h	35	0	340	77	0	330	118	108	64	33	0	192
Grp Sat Flow(s),veh/h/ln	1753	0	1759	1739	0	1789	1767	1856	1572	1753	0	1789
Q Serve(g_s), s	1.0	0.0	13.1	2.3	0.0	11.9	4.4	4.1	2.8	1.2	0.0	8.3
Cycle Q Clear(g_c), s	1.0	0.0	13.1	2.3	0.0	11.9	4.4	4.1	2.8	1.2	0.0	8.3
Prop In Lane	1.00		0.26	1.00		0.12	1.00		1.00	1.00		0.16
Lane Grp Cap(c), veh/h	451	0	692	447	0	741	377	489	414	417	0	417
V/C Ratio(X)	0.08	0.00	0.49	0.17	0.00	0.45	0.31	0.22	0.15	0.08	0.00	0.46
Avail Cap(c_a), veh/h	517	0	692	477	0	741	394	489	414	486	0	417
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	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	15.1	0.0	20.5	14.8	0.0	18.9	23.5	25.9	25.5	24.0	0.0	29.6
Incr Delay (d2), s/veh	0.1	0.0	2.5	0.2	0.0	1.9	0.5	1.0	0.8	0.1	0.0	3.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.0	5.6	0.9	0.0	5.1	1.8	1.8	1.1	0.5	0.0	4.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	15.1	0.0	23.0	15.0	0.0	20.9	23.9	27.0	26.2	24.1	0.0	33.3
LnGrp LOS	B	A	C	B	A	C	C	C	C	C	A	C
Approach Vol, veh/h		375			407			290			225	
Approach Delay, s/veh		22.3			19.7			25.6			31.9	
Approach LOS		C			B			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	10.5	41.4	8.4	29.7	8.6	43.3	11.1	27.0
Change Period (Y+Rc), s	4.5	6.0	4.5	6.0	4.5	6.0	4.5	6.0
Max Green Setting (Gmax), s	7.5	33.0	7.5	21.0	7.5	33.0	7.5	21.0
Max Q Clear Time (g_c+I1), s	4.3	0.0	3.2	0.0	3.0	0.0	6.4	0.0
Green Ext Time (p_c), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Intersection Summary	
HCM 6th Ctrl Delay	23.9
HCM 6th LOS	C

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	1	0	0	1	0	24	0	5	74	3
Future Vol, veh/h	0	0	1	0	0	1	0	24	0	5	74	3
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	100	-	-	75	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	65	65	65	65	65	65	68	68	68	86	86	86
Heavy Vehicles, %	0	0	0	0	0	0	13	13	13	3	3	3
Mvmt Flow	0	0	2	0	0	2	0	35	0	6	86	3

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	136	135	88	136	136	35	89	0	0	35	0	0
Stage 1	100	100	-	35	35	-	-	-	-	-	-	-
Stage 2	36	35	-	101	101	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.23	-	-	4.13	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.317	-	-	2.227	-	-
Pot Cap-1 Maneuver	840	760	976	840	759	1044	1440	-	-	1570	-	-
Stage 1	911	816	-	986	870	-	-	-	-	-	-	-
Stage 2	985	870	-	910	815	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	837	757	976	837	756	1044	1440	-	-	1570	-	-
Mov Cap-2 Maneuver	837	757	-	837	756	-	-	-	-	-	-	-
Stage 1	911	813	-	986	870	-	-	-	-	-	-	-
Stage 2	984	870	-	905	812	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	8.7	8.5	0	0.4
HCM LOS	A	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1440	-	-	976	1044	1570	-	-
HCM Lane V/C Ratio	-	-	-	0.002	0.001	0.004	-	-
HCM Control Delay (s)	0	-	-	8.7	8.5	7.3	-	-
HCM Lane LOS	A	-	-	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0	0	0	-	-

Intersection	
Int Delay, s/veh	0.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↱		↑↑		↱
Traffic Vol, veh/h	365	78	0	430	0	23
Future Vol, veh/h	365	78	0	430	0	23
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	Free	-	None	-	Stop
Storage Length	-	0	-	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	94	94	68	68
Heavy Vehicles, %	4	4	2	5	2	13
Mvmt Flow	406	87	0	457	0	34

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	-	-	-	-	406
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	-	-	-	6.395
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	-	3.4235
Pot Cap-1 Maneuver	-	0	0	-	0	616
Stage 1	-	0	0	-	0	-
Stage 2	-	0	0	-	0	-
Platoon blocked, %	-			-		
Mov Cap-1 Maneuver	-	-	-	-	-	616
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	11.2
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	WBT
Capacity (veh/h)	616	-	-
HCM Lane V/C Ratio	0.055	-	-
HCM Control Delay (s)	11.2	-	-
HCM Lane LOS	B	-	-
HCM 95th %tile Q(veh)	0.2	-	-

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	24	354	432	4	1	0
Future Vol, veh/h	24	354	432	4	1	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	87	87	93	93	65	65
Heavy Vehicles, %	4	4	5	5	0	0
Mvmt Flow	14	407	465	4	2	0

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	469	0	-	0	902	467
Stage 1	-	-	-	-	467	-
Stage 2	-	-	-	-	435	-
Critical Hdwy	4.14	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.236	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1082	-	-	-	311	600
Stage 1	-	-	-	-	635	-
Stage 2	-	-	-	-	657	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1082	-	-	-	306	600
Mov Cap-2 Maneuver	-	-	-	-	429	-
Stage 1	-	-	-	-	624	-
Stage 2	-	-	-	-	657	-

Approach	EB	WB	SB
HCM Control Delay, s	0.3	0	13.4
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1082	-	-	-	429
HCM Lane V/C Ratio	0.013	-	-	-	0.004
HCM Control Delay (s)	8.4	0	-	-	13.4
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0

Intersection	
Int Delay, s/veh	1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	18	0	15	0	0	0	9	246	0	0	288	23
Future Vol, veh/h	18	0	15	0	0	0	9	246	0	0	288	23
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	100	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	65	65	65	65	65	65	86	86	86	86	86	86
Heavy Vehicles, %	8	8	8	2	2	2	3	3	3	5	5	5
Mvmt Flow	28	0	23	0	0	0	10	286	0	0	335	27

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	512	655	349	666	668	143	362	0	0	286	0	0
Stage 1	349	349	-	306	306	-	-	-	-	-	-	-
Stage 2	163	306	-	360	362	-	-	-	-	-	-	-
Critical Hdwy	7.42	6.62	6.32	7.33	6.53	6.93	4.145	-	-	4.175	-	-
Critical Hdwy Stg 1	6.22	5.62	-	6.53	5.53	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.62	5.62	-	6.13	5.53	-	-	-	-	-	-	-
Follow-up Hdwy	3.576	4.076	3.376	3.519	4.019	3.319	2.2285	-	-	2.2475	-	-
Pot Cap-1 Maneuver	447	375	678	359	378	879	1189	-	-	1255	-	-
Stage 1	652	620	-	679	661	-	-	-	-	-	-	-
Stage 2	808	648	-	657	624	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	444	372	678	345	375	879	1189	-	-	1255	-	-
Mov Cap-2 Maneuver	444	372	-	345	375	-	-	-	-	-	-	-
Stage 1	647	620	-	674	656	-	-	-	-	-	-	-
Stage 2	801	643	-	635	624	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	12.6	0	0.3	0
HCM LOS	B	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1189	-	-	527	-	1255	-	-
HCM Lane V/C Ratio	0.009	-	-	0.096	-	-	-	-
HCM Control Delay (s)	8.1	-	-	12.6	0	0	-	-
HCM Lane LOS	A	-	-	B	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.3	-	0	-	-

Intersection: 1009: US-31 SB & Robbins Rd (Push-Buttons)

Movement	EB	EB	SB	SB	SB
Directions Served	T	R	T	T	R
Maximum Queue (ft)	168	167	581	589	190
Average Queue (ft)	85	68	485	492	38
95th Queue (ft)	148	129	599	609	110
Link Distance (ft)	941	941	566	566	566
Upstream Blk Time (%)			0	1	
Queuing Penalty (veh)			3	6	
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 1209: US-31 NB & X-Over South of Robbins Rd

Movement	EB	NB	NB
Directions Served	L	T	T
Maximum Queue (ft)	33	240	228
Average Queue (ft)	13	130	116
95th Queue (ft)	36	207	199
Link Distance (ft)	14	976	976
Upstream Blk Time (%)	18		
Queuing Penalty (veh)	59		
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 1909: US-31 NB & Robbins Rd (Push-Buttons)

Movement	EB	EB	WB	WB	NB	NB	NB
Directions Served	T	T	T	R	T	T	R
Maximum Queue (ft)	7	4	183	195	186	203	92
Average Queue (ft)	0	0	79	91	97	101	37
95th Queue (ft)	6	4	143	158	162	166	70
Link Distance (ft)	22	22	307	307	610	610	610
Upstream Blk Time (%)	0	0					
Queuing Penalty (veh)	0	0					
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 2909: US-31 SB & X-Over North of Robbins Rd

Movement	WB	SB	SB	SB
Directions Served	L	T	T	T
Maximum Queue (ft)	55	81	86	40
Average Queue (ft)	44	35	32	1
95th Queue (ft)	68	88	85	17
Link Distance (ft)	2	72	72	72
Upstream Blk Time (%)	28	1	1	0
Queuing Penalty (veh)	31	7	6	0
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 3085: 172nd Ave (Push-Buttons)/Ferry St (Push-Buttons) & Robbins Rd (Push-Buttons)

Movement	EB	EB	WB	WB	NB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	T	R	L	TR
Maximum Queue (ft)	102	238	116	226	131	114	61	91	210
Average Queue (ft)	21	110	34	103	62	55	24	22	100
95th Queue (ft)	64	195	79	188	110	104	51	65	174
Link Distance (ft)		576		931	139	139	139		848
Upstream Blk Time (%)					0	0			
Queuing Penalty (veh)					0	0			
Storage Bay Dist (ft)	160		170					75	
Storage Blk Time (%)	0	2		1				0	23
Queuing Penalty (veh)	0	1		1				1	7

Intersection: 9002: Whittaker Way & Bank Dwy/Health Dwy

Movement	EB	WB	SB
Directions Served	LTR	LTR	L
Maximum Queue (ft)	24	30	3
Average Queue (ft)	2	2	0
95th Queue (ft)	13	13	3
Link Distance (ft)	193	57	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			75
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 9005: Whittaker Way & Robbins Rd

Movement	EB	NB
Directions Served	T	R
Maximum Queue (ft)	8	5
Average Queue (ft)	0	0
95th Queue (ft)	9	5
Link Distance (ft)	307	426
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 9006: Robbins Rd/Robbins Rd (Push-Buttons) & DeSpelder St

Movement	EB	SB
Directions Served	LT	LR
Maximum Queue (ft)	72	24
Average Queue (ft)	7	1
95th Queue (ft)	37	10
Link Distance (ft)	107	620
Upstream Blk Time (%)	0	
Queuing Penalty (veh)	0	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 9012: 172nd Ave/172nd Ave (Push-Buttons) & Gas Station Dwy/Bank Dwy

Movement	EB	NB	NB
Directions Served	LTR	L	T
Maximum Queue (ft)	58	16	8
Average Queue (ft)	22	1	0
95th Queue (ft)	52	10	7
Link Distance (ft)	254		649
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)		100	
Storage Blk Time (%)			
Queuing Penalty (veh)			

Zone Summary

Zone wide Queuing Penalty: 122

Lane Group	EBT	EBR	WBT	SBT	SBR
Lane Group Flow (vph)	387	309	302	2034	177
v/c Ratio	0.93	0.78	0.32	1.11	0.20
Control Delay	59.5	37.0	0.6	70.4	2.3
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	59.5	37.0	0.6	70.4	2.3
Queue Length 50th (ft)	164	103	0	~530	4
Queue Length 95th (ft)	#320	#225	m0	m#556	m7
Internal Link Dist (ft)	920		1	549	
Turn Bay Length (ft)					
Base Capacity (vph)	416	396	944	1827	902
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.93	0.78	0.32	1.11	0.20

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	348	278	0	284	0	0	0	0	0	1932	168
Future Volume (vph)	0	348	278	0	284	0	0	0	0	0	1932	168
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		11.5	11.5		8.5						6.5	6.5
Lane Util. Factor		1.00	1.00		0.95						0.95	1.00
Frt		1.00	0.85		1.00						1.00	0.85
Flt Protected		1.00	1.00		1.00						1.00	1.00
Satd. Flow (prot)		1881	1599		3574						3505	1568
Flt Permitted		1.00	1.00		1.00						1.00	1.00
Satd. Flow (perm)		1881	1599		3574						3505	1568
Peak-hour factor, PHF	0.90	0.90	0.90	0.94	0.94	0.94	0.92	0.92	0.92	0.95	0.95	0.95
Adj. Flow (vph)	0	387	309	0	302	0	0	0	0	0	2034	177
RTOR Reduction (vph)	0	0	43	0	0	0	0	0	0	0	0	85
Lane Group Flow (vph)	0	387	266	0	302	0	0	0	0	0	2034	92
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	3%	3%	3%
Turn Type		NA	Perm		NA						NA	Perm
Protected Phases		4			8						2	
Permitted Phases			4									2
Actuated Green, G (s)		15.5	15.5		18.5						36.5	36.5
Effective Green, g (s)		15.5	15.5		18.5						36.5	36.5
Actuated g/C Ratio		0.22	0.22		0.26						0.52	0.52
Clearance Time (s)		11.5	11.5		8.5						6.5	6.5
Vehicle Extension (s)		4.0	4.0		4.0						0.2	0.2
Lane Grp Cap (vph)		416	354		944						1827	817
v/s Ratio Prot		c0.21			0.08						c0.58	
v/s Ratio Perm			0.17									0.06
v/c Ratio		0.93	0.75		0.32						1.11	0.11
Uniform Delay, d1		26.7	25.5		20.7						16.8	8.5
Progression Factor		1.00	1.00		0.00						0.70	1.24
Incremental Delay, d2		27.7	9.3		0.2						54.8	0.1
Delay (s)		54.4	34.7		0.2						66.5	10.7
Level of Service		D	C		A						E	B
Approach Delay (s)		45.7			0.2			0.0			62.1	
Approach LOS		D			A			A			E	

Intersection Summary			
HCM 2000 Control Delay	52.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.06		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	87.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	NBT
Lane Group Flow (vph)	492	1833
v/c Ratio	0.87	0.94
Control Delay	29.7	24.8
Queue Delay	0.0	0.0
Total Delay	29.7	24.8
Queue Length 50th (ft)	154	343
Queue Length 95th (ft)	#342	#542
Internal Link Dist (ft)	1	920
Turn Bay Length (ft)		
Base Capacity (vph)	565	1960
Starvation Cap Reductn	0	0
Spillback Cap Reductn	0	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	0.87	0.94

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	467	0	0	1741	0	0
Future Volume (vph)	467	0	0	1741	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	16	12	12	11	12	12
Total Lost time (s)	4.0			6.5		
Lane Util. Factor	1.00			0.95		
Frt	1.00			1.00		
Flt Protected	0.95			1.00		
Satd. Flow (prot)	2046			3388		
Flt Permitted	0.95			1.00		
Satd. Flow (perm)	2046			3388		
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.92	0.92
Adj. Flow (vph)	492	0	0	1833	0	0
RTOR Reduction (vph)	10	0	0	0	0	0
Lane Group Flow (vph)	482	0	0	1833	0	0
Heavy Vehicles (%)	0%	0%	3%	3%	2%	2%
Turn Type	Prot			NA		
Protected Phases	2			1		
Permitted Phases						
Actuated Green, G (s)	19.0			40.5		
Effective Green, g (s)	19.0			40.5		
Actuated g/C Ratio	0.27			0.58		
Clearance Time (s)	4.0			6.5		
Lane Grp Cap (vph)	555			1960		
v/s Ratio Prot	c0.24			c0.54		
v/s Ratio Perm						
v/c Ratio	0.87			0.94		
Uniform Delay, d1	24.3			13.5		
Progression Factor	0.54			1.00		
Incremental Delay, d2	14.1			9.9		
Delay (s)	27.3			23.4		
Level of Service	C			C		
Approach Delay (s)	27.3			23.4	0.0	
Approach LOS	C			C	A	

Intersection Summary			
HCM 2000 Control Delay	24.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	104.6%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	WBR	NBT	NBR
Lane Group Flow (vph)	387	302	378	1936	413
v/c Ratio	0.41	0.73	0.95	1.05	0.46
Control Delay	0.5	37.3	61.5	42.3	3.2
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	0.5	37.3	61.5	42.3	3.2
Queue Length 50th (ft)	0	121	140	~489	17
Queue Length 95th (ft)	m0	#227	#302	m#562	m23
Internal Link Dist (ft)	1	319		594	
Turn Bay Length (ft)					
Base Capacity (vph)	944	416	396	1845	901
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.41	0.73	0.95	1.05	0.46

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	348	0	0	284	355	0	1839	392	0	0	0
Future Volume (vph)	0	348	0	0	284	355	0	1839	392	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		8.5			11.5	11.5		6.5	6.5			
Lane Util. Factor		0.95			1.00	1.00		0.95	1.00			
Frt		1.00			1.00	0.85		1.00	0.85			
Flt Protected		1.00			1.00	1.00		1.00	1.00			
Satd. Flow (prot)		3574			1881	1599		3539	1583			
Flt Permitted		1.00			1.00	1.00		1.00	1.00			
Satd. Flow (perm)		3574			1881	1599		3539	1583			
Peak-hour factor, PHF	0.90	0.90	0.90	0.94	0.94	0.94	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	387	0	0	302	378	0	1936	413	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	43	0	0	76	0	0	0
Lane Group Flow (vph)	0	387	0	0	302	335	0	1936	337	0	0	0
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	3%	3%	3%
Turn Type		NA			NA	Perm		NA	Perm			
Protected Phases		8			4			2				
Permitted Phases						4			2			
Actuated Green, G (s)		18.5			15.5	15.5		36.5	36.5			
Effective Green, g (s)		18.5			15.5	15.5		36.5	36.5			
Actuated g/C Ratio		0.26			0.22	0.22		0.52	0.52			
Clearance Time (s)		8.5			11.5	11.5		6.5	6.5			
Vehicle Extension (s)		4.0			4.0	4.0		0.2	0.2			
Lane Grp Cap (vph)		944			416	354		1845	825			
v/s Ratio Prot		0.11			0.16			c0.55				
v/s Ratio Perm						c0.21			0.21			
v/c Ratio		0.41			0.73	0.95		1.05	0.41			
Uniform Delay, d1		21.2			25.3	26.8		16.8	10.2			
Progression Factor		0.00			1.00	1.00		0.62	0.39			
Incremental Delay, d2		0.1			6.6	34.2		28.5	0.6			
Delay (s)		0.1			31.9	61.0		39.0	4.6			
Level of Service		A			C	E		D	A			
Approach Delay (s)		0.1			48.1			32.9			0.0	
Approach LOS		A			D			C			A	

Intersection Summary			
HCM 2000 Control Delay	32.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	87.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Int Delay, s/veh	1.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰					↑↑↑
Traffic Vol, veh/h	99	0	0	0	0	2085
Future Vol, veh/h	99	0	0	0	0	2085
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	16974	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	77	77	92	92	95	95
Heavy Vehicles, %	0	0	2	2	4	4
Mvmt Flow	129	0	0	0	0	2195

Major/Minor	Minor1		Major2	
Conflicting Flow All	878	-	-	-
Stage 1	0	-	-	-
Stage 2	878	-	-	-
Critical Hdwy	5.7	-	-	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	6	-	-	-
Follow-up Hdwy	3.8	-	-	-
Pot Cap-1 Maneuver	362	0	0	-
Stage 1	-	0	0	-
Stage 2	336	0	0	-
Platoon blocked, %				-
Mov Cap-1 Maneuver	362	-	-	-
Mov Cap-2 Maneuver	362	-	-	-
Stage 1	-	-	-	-
Stage 2	336	-	-	-

Approach	WB	SB
HCM Control Delay, s	20.3	0
HCM LOS	C	

Minor Lane/Major Mvmt	WBLn1	SBT
Capacity (veh/h)	362	-
HCM Lane V/C Ratio	0.355	-
HCM Control Delay (s)	20.3	-
HCM Lane LOS	C	-
HCM 95th %tile Q(veh)	1.6	-

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	74	542	85	489	257	315	126	78	309
v/c Ratio	0.22	0.75	0.28	0.67	0.81	0.64	0.24	0.23	0.71
Control Delay	12.7	31.3	13.7	28.3	44.5	37.6	5.0	20.0	40.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	12.7	31.3	13.7	28.3	44.5	37.6	5.0	20.0	40.6
Queue Length 50th (ft)	20	261	23	229	103	165	0	28	155
Queue Length 95th (ft)	42	#431	47	347	#218	#263	34	57	#254
Internal Link Dist (ft)		564		899		123			802
Turn Bay Length (ft)	160		170					75	
Base Capacity (vph)	348	726	306	731	316	496	529	336	435
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.21	0.75	0.28	0.67	0.81	0.64	0.24	0.23	0.71

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	70	373	142	81	389	76	244	299	120	74	230	64
Future Volume (veh/h)	70	373	142	81	389	76	244	299	120	74	230	64
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	1885	1885	1885	1885	1885	1885	1900	1900	1900	1885	1885	1885
Adj Flow Rate, veh/h	74	393	149	85	409	80	257	315	126	78	242	67
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	1	1	1	1	1	1	0	0	0	1	1	1
Cap, veh/h	344	497	188	302	589	115	313	475	402	296	332	92
Arrive On Green	0.07	0.38	0.38	0.07	0.38	0.38	0.08	0.25	0.25	0.07	0.23	0.23
Sat Flow, veh/h	1795	1302	494	1795	1532	300	1810	1900	1610	1795	1421	393
Grp Volume(v), veh/h	74	0	542	85	0	489	257	315	126	78	0	309
Grp Sat Flow(s),veh/h/ln	1795	0	1796	1795	0	1831	1810	1900	1610	1795	0	1814
Q Serve(g_s), s	2.1	0.0	24.1	2.5	0.0	20.2	7.5	13.4	5.7	2.9	0.0	14.2
Cycle Q Clear(g_c), s	2.1	0.0	24.1	2.5	0.0	20.2	7.5	13.4	5.7	2.9	0.0	14.2
Prop In Lane	1.00		0.27	1.00		0.16	1.00		1.00	1.00		0.22
Lane Grp Cap(c), veh/h	344	0	685	302	0	704	313	475	402	296	0	423
V/C Ratio(X)	0.22	0.00	0.79	0.28	0.00	0.69	0.82	0.66	0.31	0.26	0.00	0.73
Avail Cap(c_a), veh/h	376	0	685	329	0	704	313	475	402	326	0	423
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	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	16.7	0.0	24.7	17.9	0.0	23.3	29.4	30.3	27.5	23.9	0.0	31.9
Incr Delay (d2), s/veh	0.3	0.0	9.1	0.5	0.0	5.6	15.7	7.1	2.0	0.5	0.0	10.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.9	0.0	11.3	1.0	0.0	9.3	3.0	6.7	2.4	1.2	0.0	7.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	17.1	0.0	33.7	18.4	0.0	28.8	45.1	37.5	29.5	24.4	0.0	42.4
LnGrp LOS	B	A	C	B	A	C	D	D	C	C	A	D
Approach Vol, veh/h		616			574			698			387	
Approach Delay, s/veh		31.7			27.3			38.8			38.8	
Approach LOS		C			C			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	10.7	40.3	10.5	28.5	10.4	40.6	12.0	27.0
Change Period (Y+Rc), s	4.5	6.0	4.5	6.0	4.5	6.0	4.5	6.0
Max Green Setting (Gmax), s	7.5	33.0	7.5	21.0	7.5	33.0	7.5	21.0
Max Q Clear Time (g_c+I1), s	4.5	0.0	4.9	0.0	4.1	0.0	9.5	0.0
Green Ext Time (p_c), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Intersection Summary	
HCM 6th Ctrl Delay	34.0
HCM 6th LOS	C

Intersection	
Int Delay, s/veh	1.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	9	0	6	0	0	2	11	81	0	2	111	10
Future Vol, veh/h	9	0	6	0	0	2	11	81	0	2	111	10
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	100	-	-	75	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	60	60	60	92	92	92	75	75	75	92	92	92
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	1	1	1
Mvmt Flow	15	0	10	0	0	2	15	108	0	2	121	11

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	270	269	127	274	274	108	132	0	0	108	0	0
Stage 1	131	131	-	138	138	-	-	-	-	-	-	-
Stage 2	139	138	-	136	136	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.11	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.209	-	-
Pot Cap-1 Maneuver	687	641	929	683	637	951	1466	-	-	1489	-	-
Stage 1	877	792	-	870	786	-	-	-	-	-	-	-
Stage 2	869	786	-	872	788	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	679	634	929	670	630	951	1466	-	-	1489	-	-
Mov Cap-2 Maneuver	679	634	-	670	630	-	-	-	-	-	-	-
Stage 1	868	791	-	861	778	-	-	-	-	-	-	-
Stage 2	858	778	-	861	787	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	9.9	8.8	0.9	0.1
HCM LOS	A	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1466	-	-	761	951	1489	-	-
HCM Lane V/C Ratio	0.01	-	-	0.033	0.002	0.001	-	-
HCM Control Delay (s)	7.5	-	-	9.9	8.8	7.4	-	-
HCM Lane LOS	A	-	-	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0	0	-	-

Intersection	
Int Delay, s/veh	1.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↱		↑↑		↱
Traffic Vol, veh/h	583	118	0	639	0	82
Future Vol, veh/h	583	118	0	639	0	82
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	Free	-	None	-	Stop
Storage Length	-	0	-	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	89	89	73	73
Heavy Vehicles, %	1	1	1	1	0	0
Mvmt Flow	614	124	0	718	0	112

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	-	-	-	-	614
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	-	-	-	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	-	3.3
Pot Cap-1 Maneuver	-	0	0	-	0	496
Stage 1	-	0	0	-	0	-
Stage 2	-	0	0	-	0	-
Platoon blocked, %	-			-		
Mov Cap-1 Maneuver	-	-	-	-	-	496
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

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

Minor Lane/Major Mvmt	NBLn1	EBT	WBT
Capacity (veh/h)	496	-	-
HCM Lane V/C Ratio	0.226	-	-
HCM Control Delay (s)	14.4	-	-
HCM Lane LOS	B	-	-
HCM 95th %tile Q(veh)	0.9	-	-

Intersection	
Int Delay, s/veh	0.6

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	43	612	652	6	11	10
Future Vol, veh/h	43	612	652	6	11	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	91	91	91	91	76	76
Heavy Vehicles, %	1	1	1	1	0	0
Mvmt Flow	47	673	716	7	14	13

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	723	0	-	0	1487	720
Stage 1	-	-	-	-	720	-
Stage 2	-	-	-	-	767	-
Critical Hdwy	4.11	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.209	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	884	-	-	-	138	431
Stage 1	-	-	-	-	486	-
Stage 2	-	-	-	-	462	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	884	-	-	-	126	431
Mov Cap-2 Maneuver	-	-	-	-	253	-
Stage 1	-	-	-	-	445	-
Stage 2	-	-	-	-	462	-

Approach	EB	WB	SB
HCM Control Delay, s	0.6	0	17.5
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	884	-	-	-	315
HCM Lane V/C Ratio	0.053	-	-	-	0.088
HCM Control Delay (s)	9.3	0	-	-	17.5
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0.2	-	-	-	0.3

Intersection	
Int Delay, s/veh	1.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	29	0	34	1	0	9	37	629	0	5	414	19
Future Vol, veh/h	29	0	34	1	0	9	37	629	0	5	414	19
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	100	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	72	72	72	92	92	92	95	95	95
Heavy Vehicles, %	0	0	0	0	0	0	2	2	2	1	1	1
Mvmt Flow	31	0	36	1	0	13	40	684	0	5	436	20

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	878	1220	446	1238	1230	342	456	0	0	684	0	0
Stage 1	456	456	-	764	764	-	-	-	-	-	-	-
Stage 2	422	764	-	474	466	-	-	-	-	-	-	-
Critical Hdwy	7.3	6.5	6.2	7.3	6.5	6.9	4.13	-	-	4.115	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.5	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.5	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.219	-	-	2.2095	-	-
Pot Cap-1 Maneuver	258	182	617	144	179	660	1103	-	-	913	-	-
Stage 1	588	572	-	367	416	-	-	-	-	-	-	-
Stage 2	585	416	-	575	566	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	245	174	617	131	171	660	1103	-	-	913	-	-
Mov Cap-2 Maneuver	245	174	-	131	171	-	-	-	-	-	-	-
Stage 1	567	568	-	354	401	-	-	-	-	-	-	-
Stage 2	553	401	-	538	562	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	17.1	12.9	0.5	0.1
HCM LOS	C	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1103	-	-	363	470	913	-	-
HCM Lane V/C Ratio	0.036	-	-	0.185	0.03	0.006	-	-
HCM Control Delay (s)	8.4	-	-	17.1	12.9	9	0	-
HCM Lane LOS	A	-	-	C	B	A	A	-
HCM 95th %tile Q(veh)	0.1	-	-	0.7	0.1	0	-	-

Intersection: 1009: US-31 SB & Robbins Rd (Push-Buttons)

Movement	EB	EB	WB	WB	SB	SB	SB
Directions Served	T	R	T	T	T	T	R
Maximum Queue (ft)	310	207	6	14	589	592	238
Average Queue (ft)	159	102	0	1	490	488	42
95th Queue (ft)	276	176	4	9	661	658	136
Link Distance (ft)	941	941	22	22	566	566	566
Upstream Blk Time (%)			0	1	1	1	
Queuing Penalty (veh)			1	2	8	8	
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 1209: US-31 NB & X-Over South of Robbins Rd

Movement	EB	NB	NB
Directions Served	L	T	T
Maximum Queue (ft)	66	535	526
Average Queue (ft)	36	265	260
95th Queue (ft)	65	553	550
Link Distance (ft)	14	976	976
Upstream Blk Time (%)	49	1	1
Queuing Penalty (veh)	231	0	0
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 1909: US-31 NB & Robbins Rd (Push-Buttons)

Movement	EB	EB	WB	WB	NB	NB	NB
Directions Served	T	T	T	R	T	T	R
Maximum Queue (ft)	21	18	257	270	532	536	226
Average Queue (ft)	2	1	122	142	328	334	60
95th Queue (ft)	14	9	210	232	587	585	153
Link Distance (ft)	22	22	307	307	610	610	610
Upstream Blk Time (%)	3	1	0	0	0	0	
Queuing Penalty (veh)	6	2	1	1	1	1	
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 2909: US-31 SB & X-Over North of Robbins Rd

Movement	WB	SB	SB	SB
Directions Served	L	T	T	T
Maximum Queue (ft)	55	85	79	4
Average Queue (ft)	44	46	37	0
95th Queue (ft)	68	101	89	5
Link Distance (ft)	2	72	72	72
Upstream Blk Time (%)	29	2	1	
Queuing Penalty (veh)	30	14	7	
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 3085: 172nd Ave (Push-Buttons)/Ferry St (Push-Buttons) & Robbins Rd (Push-Buttons)

Movement	EB	EB	WB	WB	NB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	T	R	L	TR
Maximum Queue (ft)	184	384	183	350	162	163	91	120	318
Average Queue (ft)	57	201	48	170	129	116	39	58	167
95th Queue (ft)	145	325	122	292	183	181	72	123	281
Link Distance (ft)		576		931	139	139	139		848
Upstream Blk Time (%)					24	10	0		
Queuing Penalty (veh)					55	23	0		
Storage Bay Dist (ft)	160		170					75	
Storage Blk Time (%)	0	16		8				3	41
Queuing Penalty (veh)	0	11		7				8	31

Intersection: 9002: Whittaker Way & Bank Dwy/Health Dwy

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	L	L
Maximum Queue (ft)	36	28	18	6
Average Queue (ft)	12	2	1	0
95th Queue (ft)	36	15	10	4
Link Distance (ft)	193	57		
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)			100	75
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 9005: Whittaker Way & Robbins Rd

Movement	EB	WB	WB	NB
Directions Served	T	T	T	R
Maximum Queue (ft)	35	11	14	66
Average Queue (ft)	2	1	1	5
95th Queue (ft)	17	14	12	34
Link Distance (ft)	307	107	107	426
Upstream Blk Time (%)		0		
Queuing Penalty (veh)		0		
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 9006: Robbins Rd/Robbins Rd (Push-Buttons) & DeSpelder St

Movement	EB	SB
Directions Served	LT	LR
Maximum Queue (ft)	130	47
Average Queue (ft)	33	16
95th Queue (ft)	100	43
Link Distance (ft)	107	620
Upstream Blk Time (%)	1	
Queuing Penalty (veh)	9	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 9012: 172nd Ave/172nd Ave (Push-Buttons) & Gas Station Dwy/Bank Dwy

Movement	EB	WB	NB	NB	NB	SB
Directions Served	LTR	LTR	L	T	TR	LTR
Maximum Queue (ft)	106	45	98	343	114	100
Average Queue (ft)	38	12	17	90	6	5
95th Queue (ft)	83	38	70	285	84	42
Link Distance (ft)	254	203		649	649	139
Upstream Blk Time (%)				0	0	0
Queuing Penalty (veh)				0	0	1
Storage Bay Dist (ft)			100			
Storage Blk Time (%)			0	11		
Queuing Penalty (veh)			0	4		

Zone Summary

Zone wide Queuing Penalty: 460

Lane Group	EBT	EBR	WBT	SBT	SBR
Lane Group Flow (vph)	226	198	195	2155	198
v/c Ratio	0.70	0.62	0.26	1.10	0.21
Control Delay	40.4	28.4	0.7	59.4	1.1
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	40.4	28.4	0.7	59.4	1.1
Queue Length 50th (ft)	92	56	0	~558	2
Queue Length 95th (ft)	#169	114	0	m#166	m2
Internal Link Dist (ft)	920		1	549	
Turn Bay Length (ft)					
Base Capacity (vph)	332	327	768	1958	961
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.68	0.61	0.25	1.10	0.21

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	197	172	0	179	0	0	0	0	0	1983	182
Future Volume (vph)	0	197	172	0	179	0	0	0	0	0	1983	182
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		11.5	11.5		8.5						6.5	6.5
Lane Util. Factor		1.00	1.00		0.95						0.95	1.00
Frt		1.00	0.85		1.00						1.00	0.85
Flt Protected		1.00	1.00		1.00						1.00	1.00
Satd. Flow (prot)		1863	1583		3471						3438	1538
Flt Permitted		1.00	1.00		1.00						1.00	1.00
Satd. Flow (perm)		1863	1583		3471						3438	1538
Peak-hour factor, PHF	0.87	0.87	0.87	0.92	0.92	0.92	0.87	0.87	0.87	0.92	0.92	0.92
Adj. Flow (vph)	0	226	198	0	195	0	0	0	0	0	2155	198
RTOR Reduction (vph)	0	0	45	0	0	0	0	0	0	0	0	85
Lane Group Flow (vph)	0	226	153	0	195	0	0	0	0	0	2155	113
Heavy Vehicles (%)	2%	2%	2%	4%	4%	4%	2%	2%	2%	5%	5%	5%
Turn Type		NA	Perm		NA						NA	Perm
Protected Phases		4			8						2	
Permitted Phases			4									2
Actuated Green, G (s)		12.1	12.1		15.1						39.9	39.9
Effective Green, g (s)		12.1	12.1		15.1						39.9	39.9
Actuated g/C Ratio		0.17	0.17		0.22						0.57	0.57
Clearance Time (s)		11.5	11.5		8.5						6.5	6.5
Vehicle Extension (s)		4.0	4.0		4.0						0.2	0.2
Lane Grp Cap (vph)		322	273		748						1959	876
v/s Ratio Prot		c0.12			0.06						c0.63	
v/s Ratio Perm			0.10									0.07
v/c Ratio		0.70	0.56		0.26						1.10	0.13
Uniform Delay, d1		27.3	26.5		22.8						15.1	7.0
Progression Factor		1.00	1.00		0.00						0.57	0.77
Incremental Delay, d2		7.2	3.0		0.2						45.9	0.0
Delay (s)		34.5	29.5		0.2						54.5	5.4
Level of Service		C	C		A						D	A
Approach Delay (s)		32.2			0.2			0.0			50.4	
Approach LOS		C			A			A			D	

Intersection Summary			
HCM 2000 Control Delay	44.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	80.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	NBT
Lane Group Flow (vph)	399	1593
v/c Ratio	0.70	0.86
Control Delay	15.6	18.8
Queue Delay	0.0	0.0
Total Delay	15.6	18.8
Queue Length 50th (ft)	73	272
Queue Length 95th (ft)	72	351
Internal Link Dist (ft)	1	920
Turn Bay Length (ft)		
Base Capacity (vph)	574	1852
Starvation Cap Reductn	0	0
Spillback Cap Reductn	0	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	0.70	0.86

Intersection Summary

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	331	0	0	1386	0	0
Future Volume (vph)	331	0	0	1386	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	16	12	12	11	12	12
Total Lost time (s)	4.0			6.5		
Lane Util. Factor	1.00			0.95		
Frt	1.00			1.00		
Flt Protected	0.95			1.00		
Satd. Flow (prot)	2046			3202		
Flt Permitted	0.95			1.00		
Satd. Flow (perm)	2046			3202		
Peak-hour factor, PHF	0.83	0.83	0.87	0.87	0.92	0.92
Adj. Flow (vph)	399	0	0	1593	0	0
RTOR Reduction (vph)	19	0	0	0	0	0
Lane Group Flow (vph)	380	0	0	1593	0	0
Heavy Vehicles (%)	0%	0%	9%	9%	2%	2%
Turn Type	Prot			NA		
Protected Phases	2			1		
Permitted Phases						
Actuated Green, G (s)	19.0			40.5		
Effective Green, g (s)	19.0			40.5		
Actuated g/C Ratio	0.27			0.58		
Clearance Time (s)	4.0			6.5		
Lane Grp Cap (vph)	555			1852		
v/s Ratio Prot	c0.19			c0.50		
v/s Ratio Perm						
v/c Ratio	0.68			0.86		
Uniform Delay, d1	22.8			12.4		
Progression Factor	0.43			1.00		
Incremental Delay, d2	5.9			5.5		
Delay (s)	15.7			17.9		
Level of Service	B			B		
Approach Delay (s)	15.7			17.9	0.0	
Approach LOS	B			B	A	

Intersection Summary			
HCM 2000 Control Delay	17.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	97.1%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	WBR	NBT	NBR
Lane Group Flow (vph)	226	195	266	1649	328
v/c Ratio	0.30	0.62	0.85	0.87	0.34
Control Delay	0.7	35.9	48.1	10.8	0.8
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	0.7	35.9	48.1	10.8	0.8
Queue Length 50th (ft)	0	78	88	155	2
Queue Length 95th (ft)	m0	141	#211	200	m1
Internal Link Dist (ft)	1	319		594	
Turn Bay Length (ft)					
Base Capacity (vph)	783	326	322	1903	975
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.29	0.60	0.83	0.87	0.34

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	197	0	0	179	245	0	1435	285	0	0	0
Future Volume (vph)	0	197	0	0	179	245	0	1435	285	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		8.5			11.5	11.5		6.5	6.5			
Lane Util. Factor		0.95			1.00	1.00		0.95	1.00			
Frt		1.00			1.00	0.85		1.00	0.85			
Flt Protected		1.00			1.00	1.00		1.00	1.00			
Satd. Flow (prot)		3539			1827	1553		3343	1495			
Flt Permitted		1.00			1.00	1.00		1.00	1.00			
Satd. Flow (perm)		3539			1827	1553		3343	1495			
Peak-hour factor, PHF	0.87	0.87	0.87	0.92	0.92	0.92	0.87	0.87	0.87	0.92	0.92	0.92
Adj. Flow (vph)	0	226	0	0	195	266	0	1649	328	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	45	0	0	124	0	0	0
Lane Group Flow (vph)	0	226	0	0	195	221	0	1649	204	0	0	0
Heavy Vehicles (%)	2%	2%	2%	4%	4%	4%	8%	8%	8%	2%	2%	2%
Turn Type		NA			NA	Perm		NA	Perm			
Protected Phases		8			4			2				
Permitted Phases						4			2			
Actuated Green, G (s)		15.1			12.1	12.1		39.9	39.9			
Effective Green, g (s)		15.1			12.1	12.1		39.9	39.9			
Actuated g/C Ratio		0.22			0.17	0.17		0.57	0.57			
Clearance Time (s)		8.5			11.5	11.5		6.5	6.5			
Vehicle Extension (s)		4.0			4.0	4.0		0.2	0.2			
Lane Grp Cap (vph)		763			315	268		1905	852			
v/s Ratio Prot		0.06			0.11			c0.49				
v/s Ratio Perm						c0.14			0.14			
v/c Ratio		0.30			0.62	0.82		0.87	0.24			
Uniform Delay, d1		23.0			26.8	27.9		12.8	7.5			
Progression Factor		0.00			1.00	1.00		0.52	0.15			
Incremental Delay, d2		0.2			4.1	18.9		3.1	0.4			
Delay (s)		0.2			30.9	46.8		9.8	1.5			
Level of Service		A			C	D		A	A			
Approach Delay (s)		0.2			40.1			8.4			0.0	
Approach LOS		A			D			A			A	

Intersection Summary			
HCM 2000 Control Delay	13.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	80.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Int Delay, s/veh	1.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰					↑↑↑
Traffic Vol, veh/h	104	0	0	0	0	2134
Future Vol, veh/h	104	0	0	0	0	2134
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	16974	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	69	69	92	92	91	91
Heavy Vehicles, %	0	0	2	2	5	5
Mvmt Flow	151	0	0	0	0	2345

Major/Minor	Minor1		Major2	
Conflicting Flow All	938	-	-	-
Stage 1	0	-	-	-
Stage 2	938	-	-	-
Critical Hdwy	5.7	-	-	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	6	-	-	-
Follow-up Hdwy	3.8	-	-	-
Pot Cap-1 Maneuver	338	0	0	-
Stage 1	-	0	0	-
Stage 2	313	0	0	-
Platoon blocked, %				-
Mov Cap-1 Maneuver	338	-	-	-
Mov Cap-2 Maneuver	338	-	-	-
Stage 1	-	-	-	-
Stage 2	313	-	-	-

Approach	WB	SB
HCM Control Delay, s	23.9	0
HCM LOS	C	

Minor Lane/Major Mvmt	WBLn1	SBT
Capacity (veh/h)	338	-
HCM Lane V/C Ratio	0.446	-
HCM Control Delay (s)	23.9	-
HCM Lane LOS	C	-
HCM 95th %tile Q(veh)	2.2	-

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	35	340	77	330	118	108	64	33	192
v/c Ratio	0.07	0.48	0.17	0.44	0.29	0.20	0.12	0.07	0.45
Control Delay	11.3	22.8	12.2	21.6	20.7	27.8	0.4	18.1	32.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	11.3	22.8	12.2	21.6	20.7	27.8	0.4	18.1	32.0
Queue Length 50th (ft)	9	139	21	138	44	50	0	12	89
Queue Length 95th (ft)	24	217	43	220	81	95	0	30	154
Internal Link Dist (ft)		564		899		123			802
Turn Bay Length (ft)	160		170					75	
Base Capacity (vph)	490	707	446	757	400	530	553	458	423
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.07	0.48	0.17	0.44	0.29	0.20	0.12	0.07	0.45

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	31	224	78	73	277	36	112	103	61	31	150	29
Future Volume (veh/h)	31	224	78	73	277	36	112	103	61	31	150	29
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	1841	1841	1841	1826	1826	1826	1856	1856	1856	1841	1841	1841
Adj Flow Rate, veh/h	35	252	88	77	292	38	118	108	64	33	161	31
Peak Hour Factor	0.89	0.89	0.89	0.95	0.95	0.95	0.95	0.95	0.95	0.93	0.93	0.93
Percent Heavy Veh, %	4	4	4	5	5	5	3	3	3	4	4	4
Cap, veh/h	451	513	179	447	656	85	377	489	414	417	350	67
Arrive On Green	0.05	0.39	0.39	0.07	0.41	0.41	0.07	0.26	0.26	0.04	0.23	0.23
Sat Flow, veh/h	1753	1304	455	1739	1583	206	1767	1856	1572	1753	1500	289
Grp Volume(v), veh/h	35	0	340	77	0	330	118	108	64	33	0	192
Grp Sat Flow(s),veh/h/ln	1753	0	1759	1739	0	1789	1767	1856	1572	1753	0	1789
Q Serve(g_s), s	1.0	0.0	13.1	2.3	0.0	11.9	4.4	4.1	2.8	1.2	0.0	8.3
Cycle Q Clear(g_c), s	1.0	0.0	13.1	2.3	0.0	11.9	4.4	4.1	2.8	1.2	0.0	8.3
Prop In Lane	1.00		0.26	1.00		0.12	1.00		1.00	1.00		0.16
Lane Grp Cap(c), veh/h	451	0	692	447	0	741	377	489	414	417	0	417
V/C Ratio(X)	0.08	0.00	0.49	0.17	0.00	0.45	0.31	0.22	0.15	0.08	0.00	0.46
Avail Cap(c_a), veh/h	517	0	692	477	0	741	394	489	414	486	0	417
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	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	15.1	0.0	20.5	14.8	0.0	18.9	23.5	25.9	25.5	24.0	0.0	29.6
Incr Delay (d2), s/veh	0.1	0.0	2.5	0.2	0.0	1.9	0.5	1.0	0.8	0.1	0.0	3.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.0	5.6	0.9	0.0	5.1	1.8	1.8	1.1	0.5	0.0	4.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	15.1	0.0	23.0	15.0	0.0	20.9	23.9	27.0	26.2	24.1	0.0	33.3
LnGrp LOS	B	A	C	B	A	C	C	C	C	C	A	C
Approach Vol, veh/h		375			407			290			225	
Approach Delay, s/veh		22.3			19.7			25.6			31.9	
Approach LOS		C			B			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	10.5	41.4	8.4	29.7	8.6	43.3	11.1	27.0
Change Period (Y+Rc), s	4.5	6.0	4.5	6.0	4.5	6.0	4.5	6.0
Max Green Setting (Gmax), s	7.5	33.0	7.5	21.0	7.5	33.0	7.5	21.0
Max Q Clear Time (g_c+I1), s	4.3	0.0	3.2	0.0	3.0	0.0	6.4	0.0
Green Ext Time (p_c), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Intersection Summary	
HCM 6th Ctrl Delay	23.9
HCM 6th LOS	C

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	1	0	0	1	0	24	0	5	74	3
Future Vol, veh/h	0	0	1	0	0	1	0	24	0	5	74	3
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	100	-	-	75	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	65	65	65	65	65	65	68	68	68	86	86	86
Heavy Vehicles, %	0	0	0	0	0	0	13	13	13	3	3	3
Mvmt Flow	0	0	2	0	0	2	0	35	0	6	86	3

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	136	135	88	136	136	35	89	0	0	35	0	0
Stage 1	100	100	-	35	35	-	-	-	-	-	-	-
Stage 2	36	35	-	101	101	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.23	-	-	4.13	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.317	-	-	2.227	-	-
Pot Cap-1 Maneuver	840	760	976	840	759	1044	1440	-	-	1570	-	-
Stage 1	911	816	-	986	870	-	-	-	-	-	-	-
Stage 2	985	870	-	910	815	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	837	757	976	837	756	1044	1440	-	-	1570	-	-
Mov Cap-2 Maneuver	837	757	-	837	756	-	-	-	-	-	-	-
Stage 1	911	813	-	986	870	-	-	-	-	-	-	-
Stage 2	984	870	-	905	812	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	8.7	8.5	0	0.4
HCM LOS	A	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1440	-	-	976	1044	1570	-	-
HCM Lane V/C Ratio	-	-	-	0.002	0.001	0.004	-	-
HCM Control Delay (s)	0	-	-	8.7	8.5	7.3	-	-
HCM Lane LOS	A	-	-	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0	0	0	-	-

Intersection	
Int Delay, s/veh	0.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↱		↑↑		↱
Traffic Vol, veh/h	365	78	0	430	0	23
Future Vol, veh/h	365	78	0	430	0	23
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	Free	-	None	-	Stop
Storage Length	-	0	-	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	94	94	68	68
Heavy Vehicles, %	4	4	2	5	2	13
Mvmt Flow	406	87	0	457	0	34

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	-	-	-	-	406
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	-	-	-	6.395
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	-	3.4235
Pot Cap-1 Maneuver	-	0	0	-	0	616
Stage 1	-	0	0	-	0	-
Stage 2	-	0	0	-	0	-
Platoon blocked, %	-			-		
Mov Cap-1 Maneuver	-	-	-	-	-	616
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	11.2
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	WBT
Capacity (veh/h)	616	-	-
HCM Lane V/C Ratio	0.055	-	-
HCM Control Delay (s)	11.2	-	-
HCM Lane LOS	B	-	-
HCM 95th %tile Q(veh)	0.2	-	-

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	24	354	432	4	1	0
Future Vol, veh/h	24	354	432	4	1	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	87	87	93	93	65	65
Heavy Vehicles, %	4	4	5	5	0	0
Mvmt Flow	14	407	465	4	2	0

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	469	0	-	0	902	467
Stage 1	-	-	-	-	467	-
Stage 2	-	-	-	-	435	-
Critical Hdwy	4.14	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.236	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1082	-	-	-	311	600
Stage 1	-	-	-	-	635	-
Stage 2	-	-	-	-	657	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1082	-	-	-	306	600
Mov Cap-2 Maneuver	-	-	-	-	429	-
Stage 1	-	-	-	-	624	-
Stage 2	-	-	-	-	657	-

Approach	EB	WB	SB
HCM Control Delay, s	0.3	0	13.4
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1082	-	-	-	429
HCM Lane V/C Ratio	0.013	-	-	-	0.004
HCM Control Delay (s)	8.4	0	-	-	13.4
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0

Intersection	
Int Delay, s/veh	1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	18	0	15	0	0	0	9	246	0	0	288	23
Future Vol, veh/h	18	0	15	0	0	0	9	246	0	0	288	23
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	100	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	65	65	65	65	65	65	86	86	86	86	86	86
Heavy Vehicles, %	8	8	8	2	2	2	3	3	3	5	5	5
Mvmt Flow	28	0	23	0	0	0	10	286	0	0	335	27

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	512	655	349	666	668	143	362	0	0	286	0	0
Stage 1	349	349	-	306	306	-	-	-	-	-	-	-
Stage 2	163	306	-	360	362	-	-	-	-	-	-	-
Critical Hdwy	7.42	6.62	6.32	7.33	6.53	6.93	4.145	-	-	4.175	-	-
Critical Hdwy Stg 1	6.22	5.62	-	6.53	5.53	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.62	5.62	-	6.13	5.53	-	-	-	-	-	-	-
Follow-up Hdwy	3.576	4.076	3.376	3.519	4.019	3.319	2.2285	-	-	2.2475	-	-
Pot Cap-1 Maneuver	447	375	678	359	378	879	1189	-	-	1255	-	-
Stage 1	652	620	-	679	661	-	-	-	-	-	-	-
Stage 2	808	648	-	657	624	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	444	372	678	345	375	879	1189	-	-	1255	-	-
Mov Cap-2 Maneuver	444	372	-	345	375	-	-	-	-	-	-	-
Stage 1	647	620	-	674	656	-	-	-	-	-	-	-
Stage 2	801	643	-	635	624	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	12.6	0	0.3	0
HCM LOS	B	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1189	-	-	527	-	1255	-	-
HCM Lane V/C Ratio	0.009	-	-	0.096	-	-	-	-
HCM Control Delay (s)	8.1	-	-	12.6	0	0	-	-
HCM Lane LOS	A	-	-	B	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.3	-	0	-	-

Intersection: 1009: US-31 SB & Robbins Rd (Push-Buttons)

Movement	EB	EB	WB	WB	SB	SB	SB
Directions Served	T	R	T	T	T	T	R
Maximum Queue (ft)	186	142	2	11	529	542	83
Average Queue (ft)	88	68	0	0	351	359	35
95th Queue (ft)	157	122	4	6	507	522	69
Link Distance (ft)	941	941	22	22	566	566	566
Upstream Blk Time (%)			0	1	0	0	
Queuing Penalty (veh)			0	1	0	0	
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 1209: US-31 NB & X-Over South of Robbins Rd

Movement	EB	NB	NB
Directions Served	L	T	T
Maximum Queue (ft)	31	270	270
Average Queue (ft)	14	128	118
95th Queue (ft)	37	212	210
Link Distance (ft)	14	976	976
Upstream Blk Time (%)	20		
Queuing Penalty (veh)	67		
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 1909: US-31 NB & Robbins Rd (Push-Buttons)

Movement	EB	EB	WB	WB	NB	NB	NB
Directions Served	T	T	T	R	T	T	R
Maximum Queue (ft)	16	9	168	206	163	174	88
Average Queue (ft)	1	0	78	93	74	82	34
95th Queue (ft)	10	5	142	168	126	134	67
Link Distance (ft)	22	22	307	307	610	610	610
Upstream Blk Time (%)	2	0					
Queuing Penalty (veh)	2	0					
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 2909: US-31 SB & X-Over North of Robbins Rd

Movement	WB	SB	SB
Directions Served	L	T	T
Maximum Queue (ft)	55	64	68
Average Queue (ft)	43	7	11
95th Queue (ft)	68	36	48
Link Distance (ft)	2	72	72
Upstream Blk Time (%)	24	0	0
Queuing Penalty (veh)	27	0	1
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 3085: 172nd Ave (Push-Buttons)/Ferry St (Push-Buttons) & Robbins Rd (Push-Buttons)

Movement	EB	EB	WB	WB	NB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	T	R	L	TR
Maximum Queue (ft)	108	245	134	238	125	123	54	113	227
Average Queue (ft)	23	109	33	101	58	55	24	24	103
95th Queue (ft)	69	195	83	192	103	105	49	74	186
Link Distance (ft)		576		931	139	139	139		848
Upstream Blk Time (%)					0	0			
Queuing Penalty (veh)					0	0			
Storage Bay Dist (ft)	160		170					75	
Storage Blk Time (%)		2	0	1				1	24
Queuing Penalty (veh)		1	0	1				1	7

Intersection: 9002: Whittaker Way & Bank Dwy/Health Dwy

Movement	EB	WB
Directions Served	LTR	LTR
Maximum Queue (ft)	24	16
Average Queue (ft)	2	1
95th Queue (ft)	13	10
Link Distance (ft)	193	57
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 9005: Whittaker Way & Robbins Rd

Movement	NB
Directions Served	R
Maximum Queue (ft)	15
Average Queue (ft)	1
95th Queue (ft)	9
Link Distance (ft)	426
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 9006: Robbins Rd/Robbins Rd (Push-Buttons) & DeSpelder St

Movement	EB	WB	SB
Directions Served	LT	TR	LR
Maximum Queue (ft)	64	2	18
Average Queue (ft)	6	0	1
95th Queue (ft)	33	2	10
Link Distance (ft)	107	576	620
Upstream Blk Time (%)	0		
Queuing Penalty (veh)	0		
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 9012: 172nd Ave/172nd Ave (Push-Buttons) & Gas Station Dwy/Bank Dwy

Movement	EB	NB	NB
Directions Served	LTR	L	T
Maximum Queue (ft)	62	14	7
Average Queue (ft)	23	1	0
95th Queue (ft)	53	6	5
Link Distance (ft)	254		649
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)		100	
Storage Blk Time (%)			
Queuing Penalty (veh)			

Zone Summary

Zone wide Queuing Penalty: 109

Lane Group	EBT	EBR	WBT	SBT	SBR
Lane Group Flow (vph)	387	309	302	2034	177
v/c Ratio	0.84	0.73	0.30	1.05	0.19
Control Delay	50.0	38.2	0.6	47.0	0.7
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	50.0	38.2	0.6	47.0	0.7
Queue Length 50th (ft)	208	139	0	~676	3
Queue Length 95th (ft)	#356	#252	0	#807	m4
Internal Link Dist (ft)	920		1	549	
Turn Bay Length (ft)					
Base Capacity (vph)	470	431	1012	1943	942
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.82	0.72	0.30	1.05	0.19

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	348	278	0	284	0	0	0	0	0	1932	168
Future Volume (vph)	0	348	278	0	284	0	0	0	0	0	1932	168
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		11.5	11.5		8.5						6.5	6.5
Lane Util. Factor		1.00	1.00		0.95						0.95	1.00
Frt		1.00	0.85		1.00						1.00	0.85
Flt Protected		1.00	1.00		1.00						1.00	1.00
Satd. Flow (prot)		1881	1599		3574						3505	1568
Flt Permitted		1.00	1.00		1.00						1.00	1.00
Satd. Flow (perm)		1881	1599		3574						3505	1568
Peak-hour factor, PHF	0.90	0.90	0.90	0.94	0.94	0.94	0.92	0.92	0.92	0.95	0.95	0.95
Adj. Flow (vph)	0	387	309	0	302	0	0	0	0	0	2034	177
RTOR Reduction (vph)	0	0	32	0	0	0	0	0	0	0	0	72
Lane Group Flow (vph)	0	387	277	0	302	0	0	0	0	0	2034	105
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	3%	3%	3%
Turn Type		NA	Perm		NA						NA	Perm
Protected Phases		4			8						2	
Permitted Phases			4									2
Actuated Green, G (s)		22.1	22.1		25.1						49.9	49.9
Effective Green, g (s)		22.1	22.1		25.1						49.9	49.9
Actuated g/C Ratio		0.25	0.25		0.28						0.55	0.55
Clearance Time (s)		11.5	11.5		8.5						6.5	6.5
Vehicle Extension (s)		4.0	4.0		4.0						0.2	0.2
Lane Grp Cap (vph)		461	392		996						1943	869
v/s Ratio Prot		c0.21			0.08						c0.58	
v/s Ratio Perm			0.17									0.07
v/c Ratio		0.84	0.71		0.30						1.05	0.12
Uniform Delay, d1		32.3	31.0		25.6						20.1	9.6
Progression Factor		1.00	1.00		0.00						0.73	0.22
Incremental Delay, d2		13.2	6.2		0.2						30.1	0.2
Delay (s)		45.4	37.2		0.2						44.6	2.3
Level of Service		D	D		A						D	A
Approach Delay (s)		41.8			0.2			0.0			41.2	
Approach LOS		D			A			A			D	

Intersection Summary			
HCM 2000 Control Delay	37.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	87.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	NBT
Lane Group Flow (vph)	492	1833
v/c Ratio	0.88	0.88
Control Delay	32.2	20.8
Queue Delay	0.0	2.0
Total Delay	32.2	22.8
Queue Length 50th (ft)	289	416
Queue Length 95th (ft)	#422	541
Internal Link Dist (ft)	1	920
Turn Bay Length (ft)		
Base Capacity (vph)	559	2089
Starvation Cap Reductn	0	0
Spillback Cap Reductn	0	140
Storage Cap Reductn	0	0
Reduced v/c Ratio	0.88	0.94

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	467	0	0	1741	0	0
Future Volume (vph)	467	0	0	1741	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	16	12	12	11	12	12
Total Lost time (s)	4.0			6.5		
Lane Util. Factor	1.00			0.95		
Frt	1.00			1.00		
Flt Protected	0.95			1.00		
Satd. Flow (prot)	2046			3388		
Flt Permitted	0.95			1.00		
Satd. Flow (perm)	2046			3388		
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.92	0.92
Adj. Flow (vph)	492	0	0	1833	0	0
RTOR Reduction (vph)	14	0	0	0	0	0
Lane Group Flow (vph)	478	0	0	1833	0	0
Heavy Vehicles (%)	0%	0%	3%	3%	2%	2%
Turn Type	Prot			NA		
Protected Phases	2			1		
Permitted Phases						
Actuated Green, G (s)	24.0			55.5		
Effective Green, g (s)	24.0			55.5		
Actuated g/C Ratio	0.27			0.62		
Clearance Time (s)	4.0			6.5		
Lane Grp Cap (vph)	545			2089		
v/s Ratio Prot	c0.23			c0.54		
v/s Ratio Perm						
v/c Ratio	0.88			0.88		
Uniform Delay, d1	31.6			14.4		
Progression Factor	0.51			1.00		
Incremental Delay, d2	14.6			5.6		
Delay (s)	30.7			20.0		
Level of Service	C			C		
Approach Delay (s)	30.7			20.0	0.0	
Approach LOS	C			C	A	

Intersection Summary			
HCM 2000 Control Delay	22.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	104.6%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	WBR	NBT	NBR
Lane Group Flow (vph)	387	302	378	1936	413
v/c Ratio	0.39	0.66	0.89	0.99	0.43
Control Delay	0.6	32.7	45.6	26.4	3.2
Queue Delay	0.0	0.0	0.0	2.2	0.0
Total Delay	0.6	32.7	45.6	28.6	3.2
Queue Length 50th (ft)	0	152	121	574	21
Queue Length 95th (ft)	m0	m221	m#276	#737	m26
Internal Link Dist (ft)	1	319		594	
Turn Bay Length (ft)					
Base Capacity (vph)	1012	470	431	1963	959
Starvation Cap Reductn	0	0	0	22	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.38	0.64	0.88	1.00	0.43

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	348	0	0	284	355	0	1839	392	0	0	0
Future Volume (vph)	0	348	0	0	284	355	0	1839	392	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		8.5			11.5	11.5		6.5	6.5			
Lane Util. Factor		0.95			1.00	1.00		0.95	1.00			
Frt		1.00			1.00	0.85		1.00	0.85			
Flt Protected		1.00			1.00	1.00		1.00	1.00			
Satd. Flow (prot)		3574			1881	1599		3539	1583			
Flt Permitted		1.00			1.00	1.00		1.00	1.00			
Satd. Flow (perm)		3574			1881	1599		3539	1583			
Peak-hour factor, PHF	0.90	0.90	0.90	0.94	0.94	0.94	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	387	0	0	302	378	0	1936	413	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	32	0	0	81	0	0	0
Lane Group Flow (vph)	0	387	0	0	302	346	0	1936	332	0	0	0
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	3%	3%	3%
Turn Type		NA			NA	Perm		NA	Perm			
Protected Phases		8			4			2				
Permitted Phases						4			2			
Actuated Green, G (s)		25.1			22.1	22.1		49.9	49.9			
Effective Green, g (s)		25.1			22.1	22.1		49.9	49.9			
Actuated g/C Ratio		0.28			0.25	0.25		0.55	0.55			
Clearance Time (s)		8.5			11.5	11.5		6.5	6.5			
Vehicle Extension (s)		4.0			4.0	4.0		0.2	0.2			
Lane Grp Cap (vph)		996			461	392		1962	877			
v/s Ratio Prot		0.11			0.16			c0.55				
v/s Ratio Perm						c0.22			0.21			
v/c Ratio		0.39			0.66	0.88		0.99	0.38			
Uniform Delay, d1		26.2			30.5	32.7		19.7	11.3			
Progression Factor		0.00			0.89	0.90		0.69	0.40			
Incremental Delay, d2		0.2			2.6	15.4		11.1	0.6			
Delay (s)		0.2			29.9	44.7		24.7	5.1			
Level of Service		A			C	D		C	A			
Approach Delay (s)		0.2			38.1			21.2			0.0	
Approach LOS		A			D			C			A	

Intersection Summary			
HCM 2000 Control Delay	22.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	87.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Int Delay, s/veh	1.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰					↑↑↑
Traffic Vol, veh/h	99	0	0	0	0	2085
Future Vol, veh/h	99	0	0	0	0	2085
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	16974	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	77	77	92	92	95	95
Heavy Vehicles, %	0	0	2	2	4	4
Mvmt Flow	129	0	0	0	0	2195

Major/Minor	Minor1		Major2	
Conflicting Flow All	878	-	-	-
Stage 1	0	-	-	-
Stage 2	878	-	-	-
Critical Hdwy	5.7	-	-	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	6	-	-	-
Follow-up Hdwy	3.8	-	-	-
Pot Cap-1 Maneuver	362	0	0	-
Stage 1	-	0	0	-
Stage 2	336	0	0	-
Platoon blocked, %				-
Mov Cap-1 Maneuver	362	-	-	-
Mov Cap-2 Maneuver	362	-	-	-
Stage 1	-	-	-	-
Stage 2	336	-	-	-

Approach	WB	SB
HCM Control Delay, s	20.3	0
HCM LOS	C	

Minor Lane/Major Mvmt	WBLn1	SBT
Capacity (veh/h)	362	-
HCM Lane V/C Ratio	0.355	-
HCM Control Delay (s)	20.3	-
HCM Lane LOS	C	-
HCM 95th %tile Q(veh)	1.6	-

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	74	542	85	489	257	315	126	78	309
v/c Ratio	0.22	0.75	0.28	0.67	0.81	0.64	0.24	0.23	0.71
Control Delay	11.5	26.7	13.7	28.3	44.5	37.6	5.0	20.0	40.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	11.5	26.7	13.7	28.3	44.5	37.6	5.0	20.0	40.6
Queue Length 50th (ft)	18	213	23	229	103	165	0	28	155
Queue Length 95th (ft)	35	#445	47	347	#218	#263	34	57	#254
Internal Link Dist (ft)		564		899		123			802
Turn Bay Length (ft)	160		170					75	
Base Capacity (vph)	348	726	306	731	316	496	529	336	435
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.21	0.75	0.28	0.67	0.81	0.64	0.24	0.23	0.71

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	70	373	142	81	389	76	244	299	120	74	230	64
Future Volume (veh/h)	70	373	142	81	389	76	244	299	120	74	230	64
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	1885	1885	1885	1885	1885	1885	1900	1900	1900	1885	1885	1885
Adj Flow Rate, veh/h	74	393	149	85	409	80	257	315	126	78	242	67
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	1	1	1	1	1	1	0	0	0	1	1	1
Cap, veh/h	344	497	188	378	589	115	313	475	402	296	332	92
Arrive On Green	0.13	0.76	0.76	0.07	0.38	0.38	0.08	0.25	0.25	0.07	0.23	0.23
Sat Flow, veh/h	1795	1302	494	1795	1532	300	1810	1900	1610	1795	1421	393
Grp Volume(v), veh/h	74	0	542	85	0	489	257	315	126	78	0	309
Grp Sat Flow(s),veh/h/ln	1795	0	1796	1795	0	1831	1810	1900	1610	1795	0	1814
Q Serve(g_s), s	2.1	0.0	16.2	2.5	0.0	20.2	7.5	13.4	5.7	2.9	0.0	14.2
Cycle Q Clear(g_c), s	2.1	0.0	16.2	2.5	0.0	20.2	7.5	13.4	5.7	2.9	0.0	14.2
Prop In Lane	1.00		0.27	1.00		0.16	1.00		1.00	1.00		0.22
Lane Grp Cap(c), veh/h	344	0	685	378	0	704	313	475	402	296	0	423
V/C Ratio(X)	0.22	0.00	0.79	0.22	0.00	0.69	0.82	0.66	0.31	0.26	0.00	0.73
Avail Cap(c_a), veh/h	376	0	685	405	0	704	313	475	402	326	0	423
HCM Platoon Ratio	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	15.5	0.0	8.5	15.9	0.0	23.3	29.4	30.3	27.5	23.9	0.0	31.9
Incr Delay (d2), s/veh	0.3	0.0	9.1	0.3	0.0	5.6	15.7	7.1	2.0	0.5	0.0	10.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	0.0	4.6	1.0	0.0	9.3	3.0	6.7	2.4	1.2	0.0	7.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	15.9	0.0	17.6	16.2	0.0	28.8	45.1	37.5	29.5	24.4	0.0	42.4
LnGrp LOS	B	A	B	B	A	C	D	D	C	C	A	D
Approach Vol, veh/h		616			574			698			387	
Approach Delay, s/veh		17.4			27.0			38.8			38.8	
Approach LOS		B			C			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	10.7	40.3	10.5	28.5	10.4	40.6	12.0	27.0
Change Period (Y+Rc), s	4.5	6.0	4.5	6.0	4.5	6.0	4.5	6.0
Max Green Setting (Gmax), s	7.5	33.0	7.5	21.0	7.5	33.0	7.5	21.0
Max Q Clear Time (g_c+I1), s	4.5	0.0	4.9	0.0	4.1	0.0	9.5	0.0
Green Ext Time (p_c), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Intersection Summary	
HCM 6th Ctrl Delay	30.0
HCM 6th LOS	C

Intersection	
Int Delay, s/veh	1.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	9	0	6	0	0	2	11	81	0	2	111	10
Future Vol, veh/h	9	0	6	0	0	2	11	81	0	2	111	10
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	100	-	-	75	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	60	60	60	92	92	92	75	75	75	92	92	92
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	1	1	1
Mvmt Flow	15	0	10	0	0	2	15	108	0	2	121	11

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	270	269	127	274	274	108	132	0	0	108	0	0
Stage 1	131	131	-	138	138	-	-	-	-	-	-	-
Stage 2	139	138	-	136	136	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.11	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.209	-	-
Pot Cap-1 Maneuver	687	641	929	683	637	951	1466	-	-	1489	-	-
Stage 1	877	792	-	870	786	-	-	-	-	-	-	-
Stage 2	869	786	-	872	788	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	679	634	929	670	630	951	1466	-	-	1489	-	-
Mov Cap-2 Maneuver	679	634	-	670	630	-	-	-	-	-	-	-
Stage 1	868	791	-	861	778	-	-	-	-	-	-	-
Stage 2	858	778	-	861	787	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	9.9	8.8	0.9	0.1
HCM LOS	A	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1466	-	-	761	951	1489	-	-
HCM Lane V/C Ratio	0.01	-	-	0.033	0.002	0.001	-	-
HCM Control Delay (s)	7.5	-	-	9.9	8.8	7.4	-	-
HCM Lane LOS	A	-	-	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0	0	-	-

Intersection	
Int Delay, s/veh	1.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↱		↑↑		↱
Traffic Vol, veh/h	583	118	0	639	0	82
Future Vol, veh/h	583	118	0	639	0	82
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	Free	-	None	-	Stop
Storage Length	-	0	-	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	89	89	73	73
Heavy Vehicles, %	1	1	1	1	0	0
Mvmt Flow	614	124	0	718	0	112

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	-	-	-	-	614
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	-	-	-	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	-	3.3
Pot Cap-1 Maneuver	-	0	0	-	0	496
Stage 1	-	0	0	-	0	-
Stage 2	-	0	0	-	0	-
Platoon blocked, %	-			-		
Mov Cap-1 Maneuver	-	-	-	-	-	496
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

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

Minor Lane/Major Mvmt	NBLn1	EBT	WBT
Capacity (veh/h)	496	-	-
HCM Lane V/C Ratio	0.226	-	-
HCM Control Delay (s)	14.4	-	-
HCM Lane LOS	B	-	-
HCM 95th %tile Q(veh)	0.9	-	-

Intersection	
Int Delay, s/veh	0.6

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	43	612	652	6	11	10
Future Vol, veh/h	43	612	652	6	11	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	91	91	91	91	76	76
Heavy Vehicles, %	1	1	1	1	0	0
Mvmt Flow	47	673	716	7	14	13

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	723	0	-	0	1487	720
Stage 1	-	-	-	-	720	-
Stage 2	-	-	-	-	767	-
Critical Hdwy	4.11	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.209	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	884	-	-	-	138	431
Stage 1	-	-	-	-	486	-
Stage 2	-	-	-	-	462	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	884	-	-	-	126	431
Mov Cap-2 Maneuver	-	-	-	-	253	-
Stage 1	-	-	-	-	445	-
Stage 2	-	-	-	-	462	-

Approach	EB	WB	SB
HCM Control Delay, s	0.6	0	17.5
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	884	-	-	-	315
HCM Lane V/C Ratio	0.053	-	-	-	0.088
HCM Control Delay (s)	9.3	0	-	-	17.5
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0.2	-	-	-	0.3

Intersection	
Int Delay, s/veh	1.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	29	0	34	1	0	9	37	629	0	5	414	19
Future Vol, veh/h	29	0	34	1	0	9	37	629	0	5	414	19
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	100	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	72	72	72	92	92	92	95	95	95
Heavy Vehicles, %	0	0	0	0	0	0	2	2	2	1	1	1
Mvmt Flow	31	0	36	1	0	13	40	684	0	5	436	20

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	878	1220	446	1238	1230	342	456	0	0	684	0	0
Stage 1	456	456	-	764	764	-	-	-	-	-	-	-
Stage 2	422	764	-	474	466	-	-	-	-	-	-	-
Critical Hdwy	7.3	6.5	6.2	7.3	6.5	6.9	4.13	-	-	4.115	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.5	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.5	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.219	-	-	2.2095	-	-
Pot Cap-1 Maneuver	258	182	617	144	179	660	1103	-	-	913	-	-
Stage 1	588	572	-	367	416	-	-	-	-	-	-	-
Stage 2	585	416	-	575	566	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	245	174	617	131	171	660	1103	-	-	913	-	-
Mov Cap-2 Maneuver	245	174	-	131	171	-	-	-	-	-	-	-
Stage 1	567	568	-	354	401	-	-	-	-	-	-	-
Stage 2	553	401	-	538	562	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	17.1	12.9	0.5	0.1
HCM LOS	C	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1103	-	-	363	470	913	-	-
HCM Lane V/C Ratio	0.036	-	-	0.185	0.03	0.006	-	-
HCM Control Delay (s)	8.4	-	-	17.1	12.9	9	0	-
HCM Lane LOS	A	-	-	C	B	A	A	-
HCM 95th %tile Q(veh)	0.1	-	-	0.7	0.1	0	-	-

Intersection: 1009: US-31 SB & Robbins Rd (Push-Buttons)

Movement	EB	EB	WB	WB	SB	SB	SB
Directions Served	T	R	T	T	T	T	R
Maximum Queue (ft)	318	239	6	4	593	595	68
Average Queue (ft)	169	118	0	0	502	497	28
95th Queue (ft)	282	206	4	4	707	702	56
Link Distance (ft)	941	941	22	22	566	566	566
Upstream Blk Time (%)			0	0	5	5	
Queuing Penalty (veh)			1	0	39	35	
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 1209: US-31 NB & X-Over South of Robbins Rd

Movement	EB	NB	NB
Directions Served	L	T	T
Maximum Queue (ft)	66	346	347
Average Queue (ft)	36	200	193
95th Queue (ft)	72	304	308
Link Distance (ft)	14	976	976
Upstream Blk Time (%)	51		
Queuing Penalty (veh)	239		
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 1909: US-31 NB & Robbins Rd (Push-Buttons)

Movement	EB	WB	WB	NB	NB	NB
Directions Served	T	T	R	T	T	R
Maximum Queue (ft)	15	264	298	459	462	146
Average Queue (ft)	1	141	163	214	227	50
95th Queue (ft)	8	232	268	402	414	115
Link Distance (ft)	22	307	307	610	610	610
Upstream Blk Time (%)	1	0	0	0	0	
Queuing Penalty (veh)	2	0	1	0	0	
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 2909: US-31 SB & X-Over North of Robbins Rd

Movement	WB	SB	SB	SB
Directions Served	L	T	T	T
Maximum Queue (ft)	55	88	90	27
Average Queue (ft)	46	53	46	1
95th Queue (ft)	70	111	104	15
Link Distance (ft)	2	72	72	72
Upstream Blk Time (%)	50	7	4	0
Queuing Penalty (veh)	50	46	28	1
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 3085: 172nd Ave (Push-Buttons)/Ferry St (Push-Buttons) & Robbins Rd (Push-Buttons)

Movement	EB	EB	WB	WB	NB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	T	R	L	TR
Maximum Queue (ft)	184	360	194	374	164	167	85	120	349
Average Queue (ft)	50	178	50	173	130	118	39	59	175
95th Queue (ft)	128	299	129	308	180	181	70	121	300
Link Distance (ft)		576		931	139	139	139		848
Upstream Blk Time (%)					23	9			
Queuing Penalty (veh)					51	21			
Storage Bay Dist (ft)	160		170					75	
Storage Blk Time (%)		13		9				2	43
Queuing Penalty (veh)		9		7				7	32

Intersection: 9002: Whittaker Way & Bank Dwy/Health Dwy

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	L	L
Maximum Queue (ft)	34	22	20	8
Average Queue (ft)	11	2	1	0
95th Queue (ft)	35	13	10	5
Link Distance (ft)	193	57		
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)			100	75
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 9005: Whittaker Way & Robbins Rd

Movement	EB	WB	WB	NB
Directions Served	T	T	T	R
Maximum Queue (ft)	94	8	28	64
Average Queue (ft)	5	0	1	6
95th Queue (ft)	42	3	17	38
Link Distance (ft)	307	107	107	426
Upstream Blk Time (%)		0	0	
Queuing Penalty (veh)		0	0	
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 9006: Robbins Rd/Robbins Rd (Push-Buttons) & DeSpelder St

Movement	EB	WB	SB
Directions Served	LT	TR	LR
Maximum Queue (ft)	142	10	45
Average Queue (ft)	38	0	16
95th Queue (ft)	112	6	42
Link Distance (ft)	107	576	620
Upstream Blk Time (%)	2		
Queuing Penalty (veh)	13		
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 9012: 172nd Ave/172nd Ave (Push-Buttons) & Gas Station Dwy/Bank Dwy

Movement	EB	WB	NB	NB	NB	SB
Directions Served	LTR	LTR	L	T	TR	LTR
Maximum Queue (ft)	137	49	105	340	120	83
Average Queue (ft)	42	12	13	88	14	6
95th Queue (ft)	105	42	56	303	160	44
Link Distance (ft)	254	203		649	649	139
Upstream Blk Time (%)	0			1	0	0
Queuing Penalty (veh)	0			0	0	0
Storage Bay Dist (ft)			100			
Storage Blk Time (%)			0	10		
Queuing Penalty (veh)			0	4		

Zone Summary

Zone wide Queuing Penalty: 588

APPENDIX G. PROJECTED 2023 BUILD SYNCHRO RESULTS

Lane Group	EBT	EBR	WBT	SBT	SBR
Lane Group Flow (vph)	233	198	197	2202	198
v/c Ratio	0.70	0.61	0.26	1.14	0.21
Control Delay	40.3	27.7	0.6	75.1	1.0
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	40.3	27.7	0.6	75.1	1.0
Queue Length 50th (ft)	95	56	0	~582	2
Queue Length 95th (ft)	#177	114	m0	m#242	m2
Internal Link Dist (ft)	920		1	549	
Turn Bay Length (ft)					
Base Capacity (vph)	332	327	768	1940	954
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.70	0.61	0.26	1.14	0.21

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	203	172	0	181	0	0	0	0	0	2026	182
Future Volume (vph)	0	203	172	0	181	0	0	0	0	0	2026	182
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		11.5	11.5		8.5						6.5	6.5
Lane Util. Factor		1.00	1.00		0.95						0.95	1.00
Frt		1.00	0.85		1.00						1.00	0.85
Flt Protected		1.00	1.00		1.00						1.00	1.00
Satd. Flow (prot)		1863	1583		3471						3438	1538
Flt Permitted		1.00	1.00		1.00						1.00	1.00
Satd. Flow (perm)		1863	1583		3471						3438	1538
Peak-hour factor, PHF	0.87	0.87	0.87	0.92	0.92	0.92	0.87	0.87	0.87	0.92	0.92	0.92
Adj. Flow (vph)	0	233	198	0	197	0	0	0	0	0	2202	198
RTOR Reduction (vph)	0	0	45	0	0	0	0	0	0	0	0	86
Lane Group Flow (vph)	0	233	153	0	197	0	0	0	0	0	2202	112
Heavy Vehicles (%)	2%	2%	2%	4%	4%	4%	2%	2%	2%	5%	5%	5%
Turn Type		NA	Perm		NA						NA	Perm
Protected Phases		4			8						2	
Permitted Phases			4									2
Actuated Green, G (s)		12.5	12.5		15.5						39.5	39.5
Effective Green, g (s)		12.5	12.5		15.5						39.5	39.5
Actuated g/C Ratio		0.18	0.18		0.22						0.56	0.56
Clearance Time (s)		11.5	11.5		8.5						6.5	6.5
Vehicle Extension (s)		4.0	4.0		4.0						0.2	0.2
Lane Grp Cap (vph)		332	282		768						1940	867
v/s Ratio Prot		c0.13			0.06						c0.64	
v/s Ratio Perm			0.10									0.07
v/c Ratio		0.70	0.54		0.26						1.14	0.13
Uniform Delay, d1		27.0	26.1		22.5						15.2	7.2
Progression Factor		1.00	1.00		0.00						0.57	0.76
Incremental Delay, d2		7.0	2.7		0.2						61.5	0.0
Delay (s)		34.0	28.8		0.2						70.1	5.5
Level of Service		C	C		A						E	A
Approach Delay (s)		31.6			0.2			0.0			64.8	
Approach LOS		C			A			A			E	

Intersection Summary			
HCM 2000 Control Delay	55.9	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.03		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	81.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	NBT
Lane Group Flow (vph)	433	1621
v/c Ratio	0.76	0.88
Control Delay	18.7	19.8
Queue Delay	0.0	0.0
Total Delay	18.7	19.8
Queue Length 50th (ft)	82	282
Queue Length 95th (ft)	81	364
Internal Link Dist (ft)	1	920
Turn Bay Length (ft)		
Base Capacity (vph)	572	1852
Starvation Cap Reductn	0	0
Spillback Cap Reductn	0	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	0.76	0.88

Intersection Summary

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	359	0	0	1410	0	0
Future Volume (vph)	359	0	0	1410	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	16	12	12	11	12	12
Total Lost time (s)	4.0			6.5		
Lane Util. Factor	1.00			0.95		
Frt	1.00			1.00		
Flt Protected	0.95			1.00		
Satd. Flow (prot)	2046			3202		
Flt Permitted	0.95			1.00		
Satd. Flow (perm)	2046			3202		
Peak-hour factor, PHF	0.83	0.83	0.87	0.87	0.92	0.92
Adj. Flow (vph)	433	0	0	1621	0	0
RTOR Reduction (vph)	17	0	0	0	0	0
Lane Group Flow (vph)	416	0	0	1621	0	0
Heavy Vehicles (%)	0%	0%	9%	9%	2%	2%
Turn Type	Prot			NA		
Protected Phases	2			1		
Permitted Phases						
Actuated Green, G (s)	19.0			40.5		
Effective Green, g (s)	19.0			40.5		
Actuated g/C Ratio	0.27			0.58		
Clearance Time (s)	4.0			6.5		
Lane Grp Cap (vph)	555			1852		
v/s Ratio Prot	c0.20			c0.51		
v/s Ratio Perm						
v/c Ratio	0.75			0.88		
Uniform Delay, d1	23.3			12.6		
Progression Factor	0.43			1.00		
Incremental Delay, d2	7.7			6.1		
Delay (s)	17.8			18.7		
Level of Service	B			B		
Approach Delay (s)	17.8			18.7	0.0	
Approach LOS	B			B	A	

Intersection Summary			
HCM 2000 Control Delay	18.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	98.2%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	WBR	NBT	NBR
Lane Group Flow (vph)	233	197	297	1649	387
v/c Ratio	0.30	0.60	0.92	0.87	0.40
Control Delay	0.7	35.2	60.3	11.3	1.3
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	0.7	35.2	60.3	11.3	1.3
Queue Length 50th (ft)	0	79	104	167	7
Queue Length 95th (ft)	m0	#143	#246	215	m6
Internal Link Dist (ft)	1	319		594	
Turn Bay Length (ft)					
Base Capacity (vph)	783	326	322	1886	964
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.30	0.60	0.92	0.87	0.40

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	203	0	0	181	273	0	1435	337	0	0	0
Future Volume (vph)	0	203	0	0	181	273	0	1435	337	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		8.5			11.5	11.5		6.5	6.5			
Lane Util. Factor		0.95			1.00	1.00		0.95	1.00			
Frt		1.00			1.00	0.85		1.00	0.85			
Flt Protected		1.00			1.00	1.00		1.00	1.00			
Satd. Flow (prot)		3539			1827	1553		3343	1495			
Flt Permitted		1.00			1.00	1.00		1.00	1.00			
Satd. Flow (perm)		3539			1827	1553		3343	1495			
Peak-hour factor, PHF	0.87	0.87	0.87	0.92	0.92	0.92	0.87	0.87	0.87	0.92	0.92	0.92
Adj. Flow (vph)	0	233	0	0	197	297	0	1649	387	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	45	0	0	121	0	0	0
Lane Group Flow (vph)	0	233	0	0	197	252	0	1649	266	0	0	0
Heavy Vehicles (%)	2%	2%	2%	4%	4%	4%	8%	8%	8%	2%	2%	2%
Turn Type		NA			NA	Perm		NA	Perm			
Protected Phases		8			4			2				
Permitted Phases						4			2			
Actuated Green, G (s)		15.5			12.5	12.5		39.5	39.5			
Effective Green, g (s)		15.5			12.5	12.5		39.5	39.5			
Actuated g/C Ratio		0.22			0.18	0.18		0.56	0.56			
Clearance Time (s)		8.5			11.5	11.5		6.5	6.5			
Vehicle Extension (s)		4.0			4.0	4.0		0.2	0.2			
Lane Grp Cap (vph)		783			326	277		1886	843			
v/s Ratio Prot		0.07			0.11			c0.49				
v/s Ratio Perm						c0.16			0.18			
v/c Ratio		0.30			0.60	0.91		0.87	0.32			
Uniform Delay, d1		22.7			26.5	28.2		13.1	8.1			
Progression Factor		0.00			1.00	1.00		0.54	0.26			
Incremental Delay, d2		0.2			3.6	31.6		3.1	0.5			
Delay (s)		0.2			30.1	59.7		10.3	2.6			
Level of Service		A			C	E		B	A			
Approach Delay (s)		0.2			47.9			8.8			0.0	
Approach LOS		A			D			A			A	

Intersection Summary			
HCM 2000 Control Delay	15.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	81.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Int Delay, s/veh	1.8

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰					↑↑↑
Traffic Vol, veh/h	119	0	0	0	0	2162
Future Vol, veh/h	119	0	0	0	0	2162
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	16974	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	69	69	92	92	91	91
Heavy Vehicles, %	0	0	2	2	5	5
Mvmt Flow	172	0	0	0	0	2376

Major/Minor	Minor1		Major2	
Conflicting Flow All	950	-	-	-
Stage 1	0	-	-	-
Stage 2	950	-	-	-
Critical Hdwy	5.7	-	-	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	6	-	-	-
Follow-up Hdwy	3.8	-	-	-
Pot Cap-1 Maneuver	333	0	0	-
Stage 1	-	0	0	-
Stage 2	308	0	0	-
Platoon blocked, %				-
Mov Cap-1 Maneuver	333	-	-	-
Mov Cap-2 Maneuver	333	-	-	-
Stage 1	-	-	-	-
Stage 2	308	-	-	-

Approach	WB	SB
HCM Control Delay, s	26.9	0
HCM LOS	D	

Minor Lane/Major Mvmt	WBLn1	SBT
Capacity (veh/h)	333	-
HCM Lane V/C Ratio	0.518	-
HCM Control Delay (s)	26.9	-
HCM Lane LOS	D	-
HCM 95th %tile Q(veh)	2.8	-

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	38	338	78	336	121	107	64	33	197
v/c Ratio	0.08	0.48	0.17	0.44	0.31	0.20	0.12	0.07	0.47
Control Delay	11.4	22.7	12.2	21.8	20.9	27.8	0.4	18.1	32.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	11.4	22.7	12.2	21.8	20.9	27.8	0.4	18.1	32.2
Queue Length 50th (ft)	10	138	21	141	45	49	0	12	91
Queue Length 95th (ft)	25	216	44	224	83	95	0	30	157
Internal Link Dist (ft)		268		899		123			802
Turn Bay Length (ft)	160		170					75	
Base Capacity (vph)	485	707	448	757	397	530	553	458	423
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.08	0.48	0.17	0.44	0.30	0.20	0.12	0.07	0.47

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	34	223	77	74	283	36	115	102	61	31	151	33
Future Volume (veh/h)	34	223	77	74	283	36	115	102	61	31	151	33
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	1841	1841	1841	1826	1826	1826	1856	1856	1856	1841	1841	1841
Adj Flow Rate, veh/h	38	251	87	78	298	38	121	107	64	33	162	35
Peak Hour Factor	0.89	0.89	0.89	0.95	0.95	0.95	0.95	0.95	0.95	0.93	0.93	0.93
Percent Heavy Veh, %	4	4	4	5	5	5	3	3	3	4	4	4
Cap, veh/h	447	513	178	449	653	83	373	489	415	418	342	74
Arrive On Green	0.05	0.39	0.39	0.07	0.41	0.41	0.07	0.26	0.26	0.04	0.23	0.23
Sat Flow, veh/h	1753	1306	453	1739	1587	202	1767	1856	1572	1753	1467	317
Grp Volume(v), veh/h	38	0	338	78	0	336	121	107	64	33	0	197
Grp Sat Flow(s),veh/h/ln	1753	0	1759	1739	0	1789	1767	1856	1572	1753	0	1784
Q Serve(g_s), s	1.1	0.0	13.0	2.3	0.0	12.2	4.6	4.1	2.8	1.2	0.0	8.6
Cycle Q Clear(g_c), s	1.1	0.0	13.0	2.3	0.0	12.2	4.6	4.1	2.8	1.2	0.0	8.6
Prop In Lane	1.00		0.26	1.00		0.11	1.00		1.00	1.00		0.18
Lane Grp Cap(c), veh/h	447	0	691	449	0	737	373	489	415	418	0	416
V/C Ratio(X)	0.09	0.00	0.49	0.17	0.00	0.46	0.32	0.22	0.15	0.08	0.00	0.47
Avail Cap(c_a), veh/h	509	0	691	477	0	737	390	489	415	487	0	416
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	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	15.0	0.0	20.5	14.8	0.0	19.2	23.5	25.9	25.4	24.0	0.0	29.7
Incr Delay (d2), s/veh	0.1	0.0	2.5	0.2	0.0	2.0	0.5	1.0	0.8	0.1	0.0	3.8
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	0.0	5.5	0.9	0.0	5.2	1.8	1.8	1.1	0.5	0.0	4.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	15.1	0.0	23.0	15.0	0.0	21.2	24.0	26.9	26.2	24.1	0.0	33.6
LnGrp LOS	B	A	C	B	A	C	C	C	C	C	A	C
Approach Vol, veh/h		376			414			292			230	
Approach Delay, s/veh		22.2			20.0			25.6			32.2	
Approach LOS		C			C			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	10.5	41.3	8.4	29.7	8.8	43.0	11.2	27.0
Change Period (Y+Rc), s	4.5	6.0	4.5	6.0	4.5	6.0	4.5	6.0
Max Green Setting (Gmax), s	7.5	33.0	7.5	21.0	7.5	33.0	7.5	21.0
Max Q Clear Time (g_c+I1), s	4.3	0.0	3.2	0.0	3.1	0.0	6.6	0.0
Green Ext Time (p_c), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Intersection Summary	
HCM 6th Ctrl Delay	24.0
HCM 6th LOS	C

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	1	0	0	1	0	25	0	5	74	3
Future Vol, veh/h	0	0	1	0	0	1	0	25	0	5	74	3
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	100	-	-	0	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	65	65	65	65	65	65	68	68	68	86	86	86
Heavy Vehicles, %	0	0	0	0	0	0	13	13	13	3	3	3
Mvmt Flow	0	0	2	0	0	2	0	37	0	6	86	3

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	138	137	88	138	138	37	89	0	0	37	0	0
Stage 1	100	100	-	37	37	-	-	-	-	-	-	-
Stage 2	38	37	-	101	101	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.23	-	-	4.13	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.317	-	-	2.227	-	-
Pot Cap-1 Maneuver	837	758	976	837	757	1041	1440	-	-	1567	-	-
Stage 1	911	816	-	984	868	-	-	-	-	-	-	-
Stage 2	982	868	-	910	815	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	834	755	976	834	754	1041	1440	-	-	1567	-	-
Mov Cap-2 Maneuver	834	755	-	834	754	-	-	-	-	-	-	-
Stage 1	911	813	-	984	868	-	-	-	-	-	-	-
Stage 2	981	868	-	905	812	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	8.7	8.5	0	0.4
HCM LOS	A	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1440	-	-	976	1041	1567	-	-
HCM Lane V/C Ratio	-	-	-	0.002	0.001	0.004	-	-
HCM Control Delay (s)	0	-	-	8.7	8.5	7.3	-	-
HCM Lane LOS	A	-	-	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0	0	0	-	-

Intersection	
Int Delay, s/veh	0.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↱		↑↑		↱
Traffic Vol, veh/h	403	98	0	460	0	25
Future Vol, veh/h	403	98	0	460	0	25
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	Free	-	None	-	Stop
Storage Length	-	0	-	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	94	94	68	68
Heavy Vehicles, %	4	4	2	5	2	13
Mvmt Flow	448	109	0	489	0	37

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	-	-	-	-	448
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	-	-	-	6.395
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	-	3.4235
Pot Cap-1 Maneuver	-	0	0	-	0	583
Stage 1	-	0	0	-	0	-
Stage 2	-	0	0	-	0	-
Platoon blocked, %	-			-		
Mov Cap-1 Maneuver	-	-	-	-	-	583
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	11.6
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	WBT
Capacity (veh/h)	583	-	-
HCM Lane V/C Ratio	0.063	-	-
HCM Control Delay (s)	11.6	-	-
HCM Lane LOS	B	-	-
HCM 95th %tile Q(veh)	0.2	-	-

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	24	394	462	4	1	0
Future Vol, veh/h	24	394	462	4	1	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	87	87	93	93	65	65
Heavy Vehicles, %	4	4	5	5	0	0
Mvmt Flow	14	453	497	4	2	0

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	501	0	-	0	980	499
Stage 1	-	-	-	-	499	-
Stage 2	-	-	-	-	481	-
Critical Hdwy	4.14	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.236	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1053	-	-	-	279	576
Stage 1	-	-	-	-	614	-
Stage 2	-	-	-	-	626	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1053	-	-	-	274	576
Mov Cap-2 Maneuver	-	-	-	-	402	-
Stage 1	-	-	-	-	603	-
Stage 2	-	-	-	-	626	-

Approach	EB	WB	SB
HCM Control Delay, s	0.3	0	14
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1053	-	-	-	402
HCM Lane V/C Ratio	0.013	-	-	-	0.004
HCM Control Delay (s)	8.5	0	-	-	14
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0

Intersection	
Int Delay, s/veh	1.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	336	48	24	416	41	9
Future Vol, veh/h	336	48	24	416	41	9
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	150	25	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	93	93	72	72
Heavy Vehicles, %	4	2	2	5	0	0
Mvmt Flow	378	54	26	447	57	13

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	432	0	877	378
Stage 1	-	-	-	-	378	-
Stage 2	-	-	-	-	499	-
Critical Hdwy	-	-	4.12	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.218	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	1128	-	322	673
Stage 1	-	-	-	-	697	-
Stage 2	-	-	-	-	614	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1128	-	315	673
Mov Cap-2 Maneuver	-	-	-	-	430	-
Stage 1	-	-	-	-	681	-
Stage 2	-	-	-	-	614	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.5	14.2
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	460	-	-	1128	-
HCM Lane V/C Ratio	0.151	-	-	0.023	-
HCM Control Delay (s)	14.2	-	-	8.3	-
HCM Lane LOS	B	-	-	A	-
HCM 95th %tile Q(veh)	0.5	-	-	0.1	-

Intersection	
Int Delay, s/veh	1.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	27	0	22	0	0	0	21	239	0	0	281	31
Future Vol, veh/h	27	0	22	0	0	0	21	239	0	0	281	31
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	200	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	65	65	65	65	65	65	86	86	86	86	86	86
Heavy Vehicles, %	8	8	8	2	2	2	3	3	3	5	5	5
Mvmt Flow	42	0	34	0	0	0	24	278	0	0	327	36

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	532	671	345	688	689	139	363	0	0	278	0	0
Stage 1	345	345	-	326	326	-	-	-	-	-	-	-
Stage 2	187	326	-	362	363	-	-	-	-	-	-	-
Critical Hdwy	7.42	6.62	6.32	7.33	6.53	6.93	4.145	-	-	4.175	-	-
Critical Hdwy Stg 1	6.22	5.62	-	6.53	5.53	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.62	5.62	-	6.13	5.53	-	-	-	-	-	-	-
Follow-up Hdwy	3.576	4.076	3.376	3.519	4.019	3.319	2.2285	-	-	2.2475	-	-
Pot Cap-1 Maneuver	433	367	681	346	368	884	1188	-	-	1264	-	-
Stage 1	655	623	-	661	648	-	-	-	-	-	-	-
Stage 2	782	635	-	656	624	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	427	360	681	324	361	884	1188	-	-	1264	-	-
Mov Cap-2 Maneuver	427	360	-	324	361	-	-	-	-	-	-	-
Stage 1	642	623	-	648	635	-	-	-	-	-	-	-
Stage 2	766	622	-	623	624	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	13.2	0	0.7	0
HCM LOS	B	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1188	-	-	513	-	1264	-	-
HCM Lane V/C Ratio	0.021	-	-	0.147	-	-	-	-
HCM Control Delay (s)	8.1	-	-	13.2	0	0	-	-
HCM Lane LOS	A	-	-	B	A	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	0.5	-	0	-	-

Intersection	
Int Delay, s/veh	1.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	1	3	24	2	21	81
Future Vol, veh/h	1	3	24	2	21	81
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	65	65	68	68	86	86
Heavy Vehicles, %	2	2	13	2	2	3
Mvmt Flow	2	5	35	3	24	94

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	179	37	0	0	38	0
Stage 1	37	-	-	-	-	-
Stage 2	142	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	811	1035	-	-	1572	-
Stage 1	985	-	-	-	-	-
Stage 2	885	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	798	1035	-	-	1572	-
Mov Cap-2 Maneuver	798	-	-	-	-	-
Stage 1	969	-	-	-	-	-
Stage 2	885	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	8.8	0	1.5
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	963	1572	-
HCM Lane V/C Ratio	-	-	0.006	0.016	-
HCM Control Delay (s)	-	-	8.8	7.3	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0	0	-

Intersection: 1009: US-31 SB & Robbins Rd (Push-Buttons)

Movement	EB	EB	WB	WB	SB	SB	SB
Directions Served	T	R	T	T	T	T	R
Maximum Queue (ft)	196	146	2	16	562	563	214
Average Queue (ft)	89	67	0	1	396	402	39
95th Queue (ft)	161	127	3	8	549	556	121
Link Distance (ft)	941	941	22	22	566	566	566
Upstream Blk Time (%)			0	1	0	0	
Queuing Penalty (veh)			0	1	0	1	
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 1209: US-31 NB & X-Over South of Robbins Rd

Movement	EB	NB	NB
Directions Served	L	T	T
Maximum Queue (ft)	37	230	245
Average Queue (ft)	16	129	119
95th Queue (ft)	40	196	202
Link Distance (ft)	14	976	976
Upstream Blk Time (%)	22		
Queuing Penalty (veh)	78		
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 1909: US-31 NB & Robbins Rd (Push-Buttons)

Movement	EB	EB	WB	WB	NB	NB	NB
Directions Served	T	T	T	R	T	T	R
Maximum Queue (ft)	21	12	190	208	156	142	93
Average Queue (ft)	1	1	89	104	80	81	38
95th Queue (ft)	10	6	159	184	129	129	72
Link Distance (ft)	22	22	313	313	610	610	610
Upstream Blk Time (%)	2	1					
Queuing Penalty (veh)	2	1					
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 2909: US-31 SB & X-Over North of Robbins Rd

Movement	WB	SB	SB	SB
Directions Served	L	T	T	T
Maximum Queue (ft)	55	75	72	12
Average Queue (ft)	47	12	12	1
95th Queue (ft)	67	49	51	11
Link Distance (ft)	2	72	72	72
Upstream Blk Time (%)	33	0	0	0
Queuing Penalty (veh)	41	1	1	0
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 3085: 172nd Ave (Push-Buttons)/Ferry St (Push-Buttons) & Robbins Rd (Push-Buttons)

Movement	EB	EB	WB	WB	NB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	T	R	L	TR
Maximum Queue (ft)	106	224	93	214	129	112	61	96	214
Average Queue (ft)	24	105	32	102	61	50	23	25	96
95th Queue (ft)	67	194	70	183	111	95	51	71	172
Link Distance (ft)		291		931	139	139	139		848
Upstream Blk Time (%)		0			0	0			
Queuing Penalty (veh)		0			0	0			
Storage Bay Dist (ft)	160		170					75	
Storage Blk Time (%)		2		1				0	20
Queuing Penalty (veh)		1		1				0	6

Intersection: 9002: Whittaker Way & Bank Dwy/Health Dwy

Movement	EB	WB	SB
Directions Served	LTR	LTR	L
Maximum Queue (ft)	22	24	3
Average Queue (ft)	1	1	0
95th Queue (ft)	12	9	3
Link Distance (ft)	193	57	33
Upstream Blk Time (%)			0
Queuing Penalty (veh)			0
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 9005: Whittaker Way & Robbins Rd

Movement	NB
Directions Served	R
Maximum Queue (ft)	20
Average Queue (ft)	1
95th Queue (ft)	12
Link Distance (ft)	337
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 9006: Robbins Rd/Robbins Rd (Push-Buttons) & DeSpelder St

Movement	EB	SB
Directions Served	LT	LR
Maximum Queue (ft)	53	18
Average Queue (ft)	5	1
95th Queue (ft)	29	11
Link Distance (ft)	113	620
Upstream Blk Time (%)	0	
Queuing Penalty (veh)	0	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 9008: Main Site Dwy & Robbins Rd (Push-Buttons)

Movement	EB	WB	WB	NB
Directions Served	R	L	T	LR
Maximum Queue (ft)	4	35	24	62
Average Queue (ft)	0	9	1	23
95th Queue (ft)	3	33	13	49
Link Distance (ft)			291	282
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	150	25		
Storage Blk Time (%)		1	0	
Queuing Penalty (veh)		4	0	

Intersection: 9012: 172nd Ave/172nd Ave (Push-Buttons) & Gas Station Dwy/Bank Dwy

Movement	EB	NB	NB	SB
Directions Served	LTR	L	T	LTR
Maximum Queue (ft)	79	16	6	5
Average Queue (ft)	29	3	0	0
95th Queue (ft)	65	13	6	4
Link Distance (ft)	254		649	139
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)		200		
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 9016: Whittaker Way & New Dwy

Movement	WB	NB	SB
Directions Served	LR	TR	LT
Maximum Queue (ft)	32	3	14
Average Queue (ft)	3	0	1
95th Queue (ft)	19	3	8
Link Distance (ft)	224	33	337
Upstream Blk Time (%)		0	
Queuing Penalty (veh)		0	
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Zone Summary

Zone wide Queuing Penalty: 139

Lane Group	EBT	EBR	WBT	SBT	SBR
Lane Group Flow (vph)	398	309	314	2129	177
v/c Ratio	0.85	0.72	0.31	1.10	0.19
Control Delay	50.5	37.3	0.6	70.5	0.9
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	50.5	37.3	0.6	70.5	0.9
Queue Length 50th (ft)	216	139	0	~737	3
Queue Length 95th (ft)	#370	#252	0	#869	m4
Internal Link Dist (ft)	920		1	549	
Turn Bay Length (ft)					
Base Capacity (vph)	470	431	1012	1927	931
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.85	0.72	0.31	1.10	0.19

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	358	278	0	295	0	0	0	0	0	2023	168
Future Volume (vph)	0	358	278	0	295	0	0	0	0	0	2023	168
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		11.5	11.5		8.5						6.5	6.5
Lane Util. Factor		1.00	1.00		0.95						0.95	1.00
Frt		1.00	0.85		1.00						1.00	0.85
Flt Protected		1.00	1.00		1.00						1.00	1.00
Satd. Flow (prot)		1881	1599		3574						3505	1568
Flt Permitted		1.00	1.00		1.00						1.00	1.00
Satd. Flow (perm)		1881	1599		3574						3505	1568
Peak-hour factor, PHF	0.90	0.90	0.90	0.94	0.94	0.94	0.92	0.92	0.92	0.95	0.95	0.95
Adj. Flow (vph)	0	398	309	0	314	0	0	0	0	0	2129	177
RTOR Reduction (vph)	0	0	32	0	0	0	0	0	0	0	0	69
Lane Group Flow (vph)	0	398	278	0	314	0	0	0	0	0	2129	108
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	3%	3%	3%
Turn Type		NA	Perm		NA						NA	Perm
Protected Phases		4			8						2	
Permitted Phases			4									2
Actuated Green, G (s)		22.5	22.5		25.5						49.5	49.5
Effective Green, g (s)		22.5	22.5		25.5						49.5	49.5
Actuated g/C Ratio		0.25	0.25		0.28						0.55	0.55
Clearance Time (s)		11.5	11.5		8.5						6.5	6.5
Vehicle Extension (s)		4.0	4.0		4.0						0.2	0.2
Lane Grp Cap (vph)		470	399		1012						1927	862
v/s Ratio Prot		c0.21			0.09						c0.61	
v/s Ratio Perm			0.17									0.07
v/c Ratio		0.85	0.70		0.31						1.10	0.12
Uniform Delay, d1		32.1	30.6		25.3						20.2	9.8
Progression Factor		1.00	1.00		0.00						0.74	0.26
Incremental Delay, d2		13.7	5.6		0.2						52.6	0.2
Delay (s)		45.8	36.2		0.2						67.6	2.8
Level of Service		D	D		A						E	A
Approach Delay (s)		41.6			0.2			0.0			62.6	
Approach LOS		D			A			A			E	

Intersection Summary			
HCM 2000 Control Delay	52.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	93.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	NBT
Lane Group Flow (vph)	541	1875
v/c Ratio	0.97	0.90
Control Delay	45.5	22.2
Queue Delay	0.0	3.4
Total Delay	45.5	25.7
Queue Length 50th (ft)	320	437
Queue Length 95th (ft)	#477	#574
Internal Link Dist (ft)	1	920
Turn Bay Length (ft)		
Base Capacity (vph)	558	2089
Starvation Cap Reductn	0	0
Spillback Cap Reductn	0	145
Storage Cap Reductn	0	0
Reduced v/c Ratio	0.97	0.96

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	514	0	0	1781	0	0
Future Volume (vph)	514	0	0	1781	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	16	12	12	11	12	12
Total Lost time (s)	4.0			6.5		
Lane Util. Factor	1.00			0.95		
Frt	1.00			1.00		
Flt Protected	0.95			1.00		
Satd. Flow (prot)	2046			3388		
Flt Permitted	0.95			1.00		
Satd. Flow (perm)	2046			3388		
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.92	0.92
Adj. Flow (vph)	541	0	0	1875	0	0
RTOR Reduction (vph)	12	0	0	0	0	0
Lane Group Flow (vph)	529	0	0	1875	0	0
Heavy Vehicles (%)	0%	0%	3%	3%	2%	2%
Turn Type	Prot			NA		
Protected Phases	2			1		
Permitted Phases						
Actuated Green, G (s)	24.0			55.5		
Effective Green, g (s)	24.0			55.5		
Actuated g/C Ratio	0.27			0.62		
Clearance Time (s)	4.0			6.5		
Lane Grp Cap (vph)	545			2089		
v/s Ratio Prot	c0.26			c0.55		
v/s Ratio Perm						
v/c Ratio	0.97			0.90		
Uniform Delay, d1	32.6			14.8		
Progression Factor	0.51			1.00		
Incremental Delay, d2	26.5			6.6		
Delay (s)	43.1			21.4		
Level of Service	D			C		
Approach Delay (s)	43.1			21.4	0.0	
Approach LOS	D			C	A	

Intersection Summary			
HCM 2000 Control Delay	26.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	106.9%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	WBR	NBT	NBR
Lane Group Flow (vph)	398	314	480	1936	504
v/c Ratio	0.39	0.67	1.11	0.99	0.53
Control Delay	0.6	34.1	103.2	27.6	4.7
Queue Delay	0.0	0.0	0.0	3.1	0.0
Total Delay	0.6	34.1	103.2	30.8	4.7
Queue Length 50th (ft)	0	157	~304	575	36
Queue Length 95th (ft)	m0	m229	m#460	m#716	m43
Internal Link Dist (ft)	1	319		594	
Turn Bay Length (ft)					
Base Capacity (vph)	1012	470	431	1946	948
Starvation Cap Reductn	0	0	0	25	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.39	0.67	1.11	1.01	0.53

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	358	0	0	295	451	0	1839	479	0	0	0
Future Volume (vph)	0	358	0	0	295	451	0	1839	479	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		8.5			11.5	11.5		6.5	6.5			
Lane Util. Factor		0.95			1.00	1.00		0.95	1.00			
Frt		1.00			1.00	0.85		1.00	0.85			
Flt Protected		1.00			1.00	1.00		1.00	1.00			
Satd. Flow (prot)		3574			1881	1599		3539	1583			
Flt Permitted		1.00			1.00	1.00		1.00	1.00			
Satd. Flow (perm)		3574			1881	1599		3539	1583			
Peak-hour factor, PHF	0.90	0.90	0.90	0.94	0.94	0.94	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	398	0	0	314	480	0	1936	504	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	32	0	0	77	0	0	0
Lane Group Flow (vph)	0	398	0	0	314	449	0	1936	427	0	0	0
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	3%	3%	3%
Turn Type		NA			NA	Perm		NA	Perm			
Protected Phases		8			4			2				
Permitted Phases						4			2			
Actuated Green, G (s)		25.5			22.5	22.5		49.5	49.5			
Effective Green, g (s)		25.5			22.5	22.5		49.5	49.5			
Actuated g/C Ratio		0.28			0.25	0.25		0.55	0.55			
Clearance Time (s)		8.5			11.5	11.5		6.5	6.5			
Vehicle Extension (s)		4.0			4.0	4.0		0.2	0.2			
Lane Grp Cap (vph)		1012			470	399		1946	870			
v/s Ratio Prot		0.11			0.17			c0.55				
v/s Ratio Perm						c0.28			0.27			
v/c Ratio		0.39			0.67	1.12		0.99	0.49			
Uniform Delay, d1		26.0			30.4	33.8		20.1	12.5			
Progression Factor		0.00			0.91	0.92		0.70	0.46			
Incremental Delay, d2		0.2			3.2	79.0		11.9	0.8			
Delay (s)		0.2			30.7	110.0		26.0	6.5			
Level of Service		A			C	F		C	A			
Approach Delay (s)		0.2			78.6			21.9			0.0	
Approach LOS		A			E			C			A	

Intersection Summary			
HCM 2000 Control Delay	32.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	1.03		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	93.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Int Delay, s/veh	2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰					↑↑↑
Traffic Vol, veh/h	143	0	0	0	0	2132
Future Vol, veh/h	143	0	0	0	0	2132
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	16974	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	77	77	92	92	95	95
Heavy Vehicles, %	0	0	2	2	4	4
Mvmt Flow	186	0	0	0	0	2244

Major/Minor	Minor1		Major2	
Conflicting Flow All	898	-	-	-
Stage 1	0	-	-	-
Stage 2	898	-	-	-
Critical Hdwy	5.7	-	-	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	6	-	-	-
Follow-up Hdwy	3.8	-	-	-
Pot Cap-1 Maneuver	354	0	0	-
Stage 1	-	0	0	-
Stage 2	328	0	0	-
Platoon blocked, %				-
Mov Cap-1 Maneuver	354	-	-	-
Mov Cap-2 Maneuver	354	-	-	-
Stage 1	-	-	-	-
Stage 2	328	-	-	-

Approach	WB	SB
HCM Control Delay, s	25.9	0
HCM LOS	D	

Minor Lane/Major Mvmt	WBLn1	SBT
Capacity (veh/h)	354	-
HCM Lane V/C Ratio	0.525	-
HCM Control Delay (s)	25.9	-
HCM Lane LOS	D	-
HCM 95th %tile Q(veh)	2.9	-

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	81	554	87	499	268	317	127	78	318
v/c Ratio	0.24	0.76	0.30	0.68	0.87	0.64	0.24	0.24	0.73
Control Delay	12.8	29.7	14.0	28.9	51.9	37.8	5.1	20.0	41.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	12.8	29.7	14.0	28.9	51.9	37.8	5.1	20.0	41.6
Queue Length 50th (ft)	22	254	24	236	108	167	0	28	159
Queue Length 95th (ft)	m41	#460	48	356	#238	#266	35	57	#275
Internal Link Dist (ft)		266		899		123			802
Turn Bay Length (ft)	160		170					75	
Base Capacity (vph)	340	726	296	731	309	496	529	335	435
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.24	0.76	0.29	0.68	0.87	0.64	0.24	0.23	0.73

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	77	385	142	83	398	76	255	301	121	74	232	70
Future Volume (veh/h)	77	385	142	83	398	76	255	301	121	74	232	70
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	1885	1885	1885	1885	1885	1885	1900	1900	1900	1885	1885	1885
Adj Flow Rate, veh/h	81	405	149	87	419	80	268	317	127	78	244	74
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	1	1	1	1	1	1	0	0	0	1	1	1
Cap, veh/h	338	501	184	367	588	112	306	475	402	295	324	98
Arrive On Green	0.14	0.76	0.76	0.07	0.38	0.38	0.08	0.25	0.25	0.07	0.23	0.23
Sat Flow, veh/h	1795	1315	484	1795	1539	294	1810	1900	1610	1795	1388	421
Grp Volume(v), veh/h	81	0	554	87	0	499	268	317	127	78	0	318
Grp Sat Flow(s),veh/h/ln	1795	0	1798	1795	0	1832	1810	1900	1610	1795	0	1809
Q Serve(g_s), s	2.3	0.0	17.2	2.5	0.0	20.8	7.5	13.5	5.8	2.9	0.0	14.7
Cycle Q Clear(g_c), s	2.3	0.0	17.2	2.5	0.0	20.8	7.5	13.5	5.8	2.9	0.0	14.7
Prop In Lane	1.00		0.27	1.00		0.16	1.00		1.00	1.00		0.23
Lane Grp Cap(c), veh/h	338	0	685	367	0	701	306	475	402	295	0	422
V/C Ratio(X)	0.24	0.00	0.81	0.24	0.00	0.71	0.88	0.67	0.32	0.26	0.00	0.75
Avail Cap(c_a), veh/h	367	0	685	393	0	701	306	475	402	325	0	422
HCM Platoon Ratio	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	15.7	0.0	8.7	16.1	0.0	23.6	30.2	30.4	27.5	23.9	0.0	32.1
Incr Delay (d2), s/veh	0.4	0.0	9.9	0.3	0.0	6.1	23.4	7.3	2.0	0.5	0.0	11.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.9	0.0	4.9	1.0	0.0	9.6	4.0	6.7	2.4	1.2	0.0	7.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	16.0	0.0	18.6	16.5	0.0	29.6	53.6	37.6	29.5	24.4	0.0	43.9
LnGrp LOS	B	A	B	B	A	C	D	D	C	C	A	D
Approach Vol, veh/h		635			586			712			396	
Approach Delay, s/veh		18.3			27.7			42.2			40.0	
Approach LOS		B			C			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	10.7	40.3	10.5	28.5	10.6	40.4	12.0	27.0
Change Period (Y+Rc), s	4.5	6.0	4.5	6.0	4.5	6.0	4.5	6.0
Max Green Setting (Gmax), s	7.5	33.0	7.5	21.0	7.5	33.0	7.5	21.0
Max Q Clear Time (g_c+I1), s	4.5	0.0	4.9	0.0	4.3	0.0	9.5	0.0
Green Ext Time (p_c), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Intersection Summary	
HCM 6th Ctrl Delay	31.7
HCM 6th LOS	C

Intersection	
Int Delay, s/veh	1.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	9	0	6	0	0	2	11	82	0	2	113	10
Future Vol, veh/h	9	0	6	0	0	2	11	82	0	2	113	10
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	100	-	-	0	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	60	60	60	92	92	92	75	75	75	92	92	92
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	1	1	1
Mvmt Flow	15	0	10	0	0	2	15	109	0	2	123	11

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	273	272	129	277	277	109	134	0	0	109	0	0
Stage 1	133	133	-	139	139	-	-	-	-	-	-	-
Stage 2	140	139	-	138	138	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.11	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.209	-	-
Pot Cap-1 Maneuver	684	638	926	679	634	950	1463	-	-	1488	-	-
Stage 1	875	790	-	869	785	-	-	-	-	-	-	-
Stage 2	868	785	-	870	786	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	676	631	926	665	627	950	1463	-	-	1488	-	-
Mov Cap-2 Maneuver	676	631	-	665	627	-	-	-	-	-	-	-
Stage 1	866	789	-	860	777	-	-	-	-	-	-	-
Stage 2	857	777	-	859	785	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	9.9	8.8	0.9	0.1
HCM LOS	A	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1463	-	-	758	950	1488	-	-
HCM Lane V/C Ratio	0.01	-	-	0.033	0.002	0.001	-	-
HCM Control Delay (s)	7.5	-	-	9.9	8.8	7.4	-	-
HCM Lane LOS	A	-	-	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0	0	-	-

Intersection	
Int Delay, s/veh	1.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↱		↑↑		↱
Traffic Vol, veh/h	646	152	0	746	0	90
Future Vol, veh/h	646	152	0	746	0	90
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	Free	-	None	-	Stop
Storage Length	-	0	-	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	89	89	73	73
Heavy Vehicles, %	1	1	1	1	0	0
Mvmt Flow	680	160	0	838	0	123

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	-	-	-	-	680
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	-	-	-	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	-	3.3
Pot Cap-1 Maneuver	-	0	0	-	0	454
Stage 1	-	0	0	-	0	-
Stage 2	-	0	0	-	0	-
Platoon blocked, %	-			-		
Mov Cap-1 Maneuver	-	-	-	-	-	454
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

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

Minor Lane/Major Mvmt	NBLn1	EBT	WBT
Capacity (veh/h)	454	-	-
HCM Lane V/C Ratio	0.272	-	-
HCM Control Delay (s)	15.9	-	-
HCM Lane LOS	C	-	-
HCM 95th %tile Q(veh)	1.1	-	-

Intersection	
Int Delay, s/veh	0.6

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	43	683	759	6	11	10
Future Vol, veh/h	43	683	759	6	11	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	91	91	91	91	76	76
Heavy Vehicles, %	1	1	1	1	0	0
Mvmt Flow	47	751	834	7	14	13

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	841	0	-	0	1683	838
Stage 1	-	-	-	-	838	-
Stage 2	-	-	-	-	845	-
Critical Hdwy	4.11	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.209	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	799	-	-	-	105	369
Stage 1	-	-	-	-	428	-
Stage 2	-	-	-	-	425	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	799	-	-	-	94	369
Mov Cap-2 Maneuver	-	-	-	-	217	-
Stage 1	-	-	-	-	385	-
Stage 2	-	-	-	-	425	-

Approach	EB	WB	SB
HCM Control Delay, s	0.6	0	19.8
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	799	-	-	-	270
HCM Lane V/C Ratio	0.059	-	-	-	0.102
HCM Control Delay (s)	9.8	0	-	-	19.8
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0.2	-	-	-	0.3

Intersection	
Int Delay, s/veh	4.6

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	595	80	32	672	113	28
Future Vol, veh/h	595	80	32	672	113	28
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	150	25	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	91	91	72	72
Heavy Vehicles, %	1	1	1	1	0	0
Mvmt Flow	626	84	35	738	157	39

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	710	0	1434	626
Stage 1	-	-	-	-	626	-
Stage 2	-	-	-	-	808	-
Critical Hdwy	-	-	4.11	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.209	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	894	-	~ 149	488
Stage 1	-	-	-	-	537	-
Stage 2	-	-	-	-	442	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	894	-	~ 143	488
Mov Cap-2 Maneuver	-	-	-	-	272	-
Stage 1	-	-	-	-	516	-
Stage 2	-	-	-	-	442	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.4	37.5
HCM LOS			E

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	298	-	-	894	-
HCM Lane V/C Ratio	0.657	-	-	0.039	-
HCM Control Delay (s)	37.5	-	-	9.2	-
HCM Lane LOS	E	-	-	A	-
HCM 95th %tile Q(veh)	4.3	-	-	0.1	-

Notes

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

Intersection	
Int Delay, s/veh	2.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	57	0	57	1	0	9	60	615	0	5	402	35
Future Vol, veh/h	57	0	57	1	0	9	60	615	0	5	402	35
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	200	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	72	72	72	92	92	92	95	95	95
Heavy Vehicles, %	0	0	0	0	0	0	2	2	2	1	1	1
Mvmt Flow	61	0	61	1	0	13	65	668	0	5	423	37

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	916	1250	442	1280	1268	334	460	0	0	668	0	0
Stage 1	452	452	-	798	798	-	-	-	-	-	-	-
Stage 2	464	798	-	482	470	-	-	-	-	-	-	-
Critical Hdwy	7.3	6.5	6.2	7.3	6.5	6.9	4.13	-	-	4.115	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.5	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.5	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.219	-	-	2.2095	-	-
Pot Cap-1 Maneuver	242	174	620	134	170	668	1099	-	-	926	-	-
Stage 1	591	574	-	350	401	-	-	-	-	-	-	-
Stage 2	553	401	-	569	563	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	226	163	620	115	159	668	1099	-	-	926	-	-
Mov Cap-2 Maneuver	226	163	-	115	159	-	-	-	-	-	-	-
Stage 1	556	570	-	329	377	-	-	-	-	-	-	-
Stage 2	511	377	-	510	559	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	22	13.2	0.8	0.1
HCM LOS	C	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1099	-	-	331	451	926	-	-
HCM Lane V/C Ratio	0.059	-	-	0.366	0.031	0.006	-	-
HCM Control Delay (s)	8.5	-	-	22	13.2	8.9	0	-
HCM Lane LOS	A	-	-	C	B	A	A	-
HCM 95th %tile Q(veh)	0.2	-	-	1.6	0.1	0	-	-

Intersection	
Int Delay, s/veh	1.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	5	10	90	3	37	120
Future Vol, veh/h	5	10	90	3	37	120
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	74	74	92	92
Heavy Vehicles, %	0	0	0	0	1	1
Mvmt Flow	5	11	122	4	40	130

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	334	124	0	0	126	0
Stage 1	124	-	-	-	-	-
Stage 2	210	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.11	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.209	-
Pot Cap-1 Maneuver	665	932	-	-	1467	-
Stage 1	907	-	-	-	-	-
Stage 2	830	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	646	932	-	-	1467	-
Mov Cap-2 Maneuver	646	-	-	-	-	-
Stage 1	881	-	-	-	-	-
Stage 2	830	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.5	0	1.8
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	812	1467	-
HCM Lane V/C Ratio	-	-	0.02	0.027	-
HCM Control Delay (s)	-	-	9.5	7.5	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0.1	0.1	-

Intersection: 1009: US-31 SB & Robbins Rd (Push-Buttons)

Movement	EB	EB	SB	SB	SB
Directions Served	T	R	T	T	R
Maximum Queue (ft)	328	236	593	602	105
Average Queue (ft)	172	116	569	568	30
95th Queue (ft)	282	198	618	625	86
Link Distance (ft)	941	941	566	566	566
Upstream Blk Time (%)			9	9	0
Queuing Penalty (veh)			68	69	0
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 1209: US-31 NB & X-Over South of Robbins Rd

Movement	EB	NB	NB
Directions Served	L	T	T
Maximum Queue (ft)	66	370	386
Average Queue (ft)	38	202	209
95th Queue (ft)	68	315	333
Link Distance (ft)	14	976	976
Upstream Blk Time (%)	59		
Queuing Penalty (veh)	306		
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 1909: US-31 NB & Robbins Rd (Push-Buttons)

Movement	EB	EB	WB	WB	NB	NB	NB
Directions Served	T	T	T	R	T	T	R
Maximum Queue (ft)	11	9	252	325	438	456	148
Average Queue (ft)	1	0	137	240	213	222	55
95th Queue (ft)	7	5	222	355	389	398	106
Link Distance (ft)	22	22	313	313	610	610	610
Upstream Blk Time (%)	1	0		7	0	0	
Queuing Penalty (veh)	2	1		26	0	0	
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 2909: US-31 SB & X-Over North of Robbins Rd

Movement	WB	SB	SB	SB
Directions Served	L	T	T	T
Maximum Queue (ft)	55	99	104	35
Average Queue (ft)	52	75	71	2
95th Queue (ft)	65	103	106	21
Link Distance (ft)	2	72	72	72
Upstream Blk Time (%)	71	12	9	0
Queuing Penalty (veh)	101	87	63	0
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 3085: 172nd Ave (Push-Buttons)/Ferry St (Push-Buttons) & Robbins Rd (Push-Buttons)

Movement	EB	EB	WB	WB	NB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	T	R	L	TR
Maximum Queue (ft)	184	298	194	368	164	163	101	120	374
Average Queue (ft)	57	193	56	175	130	118	42	58	186
95th Queue (ft)	146	305	141	309	185	186	77	121	325
Link Distance (ft)		290		931	139	139	139		848
Upstream Blk Time (%)		2			29	12	0		
Queuing Penalty (veh)		11			66	27	0		
Storage Bay Dist (ft)	160		170					75	
Storage Blk Time (%)		16	0	9				3	45
Queuing Penalty (veh)		13	0	8				9	33

Intersection: 9002: Whittaker Way & Bank Dwy/Health Dwy

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	L	L
Maximum Queue (ft)	30	25	25	3
Average Queue (ft)	13	2	2	0
95th Queue (ft)	37	15	12	3
Link Distance (ft)	193	57		35
Upstream Blk Time (%)				0
Queuing Penalty (veh)				0
Storage Bay Dist (ft)			100	
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 9005: Whittaker Way & Robbins Rd

Movement	EB	WB	NB
Directions Served	T	T	R
Maximum Queue (ft)	94	92	91
Average Queue (ft)	7	20	11
95th Queue (ft)	49	85	55
Link Distance (ft)	313	113	335
Upstream Blk Time (%)		2	
Queuing Penalty (veh)		8	
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 9006: Robbins Rd/Robbins Rd (Push-Buttons) & DeSpelder St

Movement	EB	WB	SB
Directions Served	LT	TR	LR
Maximum Queue (ft)	155	94	58
Average Queue (ft)	48	10	17
95th Queue (ft)	129	81	47
Link Distance (ft)	113	230	620
Upstream Blk Time (%)	3	0	
Queuing Penalty (veh)	25	3	
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 9008: Main Site Dwy & Robbins Rd (Push-Buttons)

Movement	EB	EB	WB	WB	NB
Directions Served	T	R	L	T	LR
Maximum Queue (ft)	118	26	40	75	239
Average Queue (ft)	12	1	15	6	91
95th Queue (ft)	73	18	41	42	206
Link Distance (ft)	230			290	269
Upstream Blk Time (%)	0				3
Queuing Penalty (veh)	0				0
Storage Bay Dist (ft)		150	25		
Storage Blk Time (%)	0		4	0	
Queuing Penalty (veh)	0		29	0	

Intersection: 9012: 172nd Ave/172nd Ave (Push-Buttons) & Gas Station Dwy/Bank Dwy

Movement	EB	WB	NB	NB	NB	SB
Directions Served	LTR	LTR	L	T	TR	LTR
Maximum Queue (ft)	213	63	158	444	285	76
Average Queue (ft)	89	16	32	140	37	5
95th Queue (ft)	207	64	132	446	263	35
Link Distance (ft)	254	203		649	649	139
Upstream Blk Time (%)	4	0		2	0	0
Queuing Penalty (veh)	0	0		0	0	0
Storage Bay Dist (ft)			200			
Storage Blk Time (%)			0	12		
Queuing Penalty (veh)			0	7		

Intersection: 9016: Whittaker Way & New Dwy

Movement	WB	NB	SB
Directions Served	LR	TR	LT
Maximum Queue (ft)	34	3	35
Average Queue (ft)	13	0	2
95th Queue (ft)	37	3	17
Link Distance (ft)	244	35	335
Upstream Blk Time (%)		0	
Queuing Penalty (veh)		0	
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Zone Summary

Zone wide Queuing Penalty: 962

Lane Group	EBT	EBR	WBT	SBT	SBR
Lane Group Flow (vph)	233	198	197	2202	198
v/c Ratio	0.71	0.63	0.27	1.03	0.19
Control Delay	47.6	36.5	2.3	35.1	0.5
Queue Delay	0.0	0.0	0.0	0.8	0.0
Total Delay	47.6	36.5	2.3	35.9	0.5
Queue Length 50th (ft)	125	82	2	~722	3
Queue Length 95th (ft)	196	146	m2	#852	m3
Internal Link Dist (ft)	920		1	549	
Turn Bay Length (ft)					
Base Capacity (vph)	341	324	752	2141	1031
Starvation Cap Reductn	0	0	0	5	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.68	0.61	0.26	1.03	0.19

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	203	172	0	181	0	0	0	0	0	2026	182
Future Volume (vph)	0	203	172	0	181	0	0	0	0	0	2026	182
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		11.5	11.5		8.5						6.5	6.5
Lane Util. Factor		1.00	1.00		0.95						0.95	1.00
Frt		1.00	0.85		1.00						1.00	0.85
Flt Protected		1.00	1.00		1.00						1.00	1.00
Satd. Flow (prot)		1863	1583		3471						3438	1538
Flt Permitted		1.00	1.00		1.00						1.00	1.00
Satd. Flow (perm)		1863	1583		3471						3438	1538
Peak-hour factor, PHF	0.87	0.87	0.87	0.92	0.92	0.92	0.87	0.87	0.87	0.92	0.92	0.92
Adj. Flow (vph)	0	233	198	0	197	0	0	0	0	0	2202	198
RTOR Reduction (vph)	0	0	35	0	0	0	0	0	0	0	0	74
Lane Group Flow (vph)	0	233	163	0	197	0	0	0	0	0	2202	124
Heavy Vehicles (%)	2%	2%	2%	4%	4%	4%	2%	2%	2%	5%	5%	5%
Turn Type		NA	Perm		NA						NA	Perm
Protected Phases		4			8						2	
Permitted Phases			4									2
Actuated Green, G (s)		15.9	15.9		18.9						56.1	56.1
Effective Green, g (s)		15.9	15.9		18.9						56.1	56.1
Actuated g/C Ratio		0.18	0.18		0.21						0.62	0.62
Clearance Time (s)		11.5	11.5		8.5						6.5	6.5
Vehicle Extension (s)		4.0	4.0		4.0						0.2	0.2
Lane Grp Cap (vph)		329	279		728						2143	958
v/s Ratio Prot		c0.13			0.06						c0.64	
v/s Ratio Perm			0.10									0.08
v/c Ratio		0.71	0.59		0.27						1.03	0.13
Uniform Delay, d1		34.9	34.0		29.8						16.9	6.9
Progression Factor		1.00	1.00		0.06						0.61	0.27
Incremental Delay, d2		7.3	3.7		0.1						21.7	0.1
Delay (s)		42.2	37.7		1.9						32.1	2.0
Level of Service		D	D		A						C	A
Approach Delay (s)		40.1			1.9			0.0			29.6	
Approach LOS		D			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	29.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	81.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	NBT
Lane Group Flow (vph)	433	1621
v/c Ratio	0.79	0.81
Control Delay	22.9	16.7
Queue Delay	0.0	0.0
Total Delay	22.9	16.7
Queue Length 50th (ft)	97	330
Queue Length 95th (ft)	95	400
Internal Link Dist (ft)	1	920
Turn Bay Length (ft)		
Base Capacity (vph)	547	2010
Starvation Cap Reductn	0	0
Spillback Cap Reductn	0	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	0.79	0.81

Intersection Summary

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	359	0	0	1410	0	0
Future Volume (vph)	359	0	0	1410	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	16	12	12	11	12	12
Total Lost time (s)	4.0			6.5		
Lane Util. Factor	1.00			0.95		
Frt	1.00			1.00		
Flt Protected	0.95			1.00		
Satd. Flow (prot)	2046			3202		
Flt Permitted	0.95			1.00		
Satd. Flow (perm)	2046			3202		
Peak-hour factor, PHF	0.83	0.83	0.87	0.87	0.92	0.92
Adj. Flow (vph)	433	0	0	1621	0	0
RTOR Reduction (vph)	25	0	0	0	0	0
Lane Group Flow (vph)	408	0	0	1621	0	0
Heavy Vehicles (%)	0%	0%	9%	9%	2%	2%
Turn Type	Prot			NA		
Protected Phases	2			1		
Permitted Phases						
Actuated Green, G (s)	23.0			56.5		
Effective Green, g (s)	23.0			56.5		
Actuated g/C Ratio	0.26			0.63		
Clearance Time (s)	4.0			6.5		
Lane Grp Cap (vph)	522			2010		
v/s Ratio Prot	c0.20			c0.51		
v/s Ratio Perm						
v/c Ratio	0.78			0.81		
Uniform Delay, d1	31.2			12.6		
Progression Factor	0.44			1.00		
Incremental Delay, d2	8.9			3.6		
Delay (s)	22.6			16.2		
Level of Service	C			B		
Approach Delay (s)	22.6			16.2	0.0	
Approach LOS	C			B	A	

Intersection Summary			
HCM 2000 Control Delay	17.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	98.2%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	WBR	NBT	NBR
Lane Group Flow (vph)	233	262	232	1649	387
v/c Ratio	0.31	0.85	0.79	0.79	0.37
Control Delay	0.8	56.5	46.1	9.2	1.4
Queue Delay	0.0	0.0	0.0	0.1	0.0
Total Delay	0.8	56.5	46.1	9.3	1.4
Queue Length 50th (ft)	0	145	113	185	10
Queue Length 95th (ft)	0	#283	#231	214	m14
Internal Link Dist (ft)	1	319		594	
Turn Bay Length (ft)					
Base Capacity (vph)	766	319	304	2082	1033
Starvation Cap Reductn	0	0	0	49	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.30	0.82	0.76	0.81	0.37

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	203	0	0	181	273	0	1435	337	0	0	0
Future Volume (vph)	0	203	0	0	181	273	0	1435	337	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		8.5			11.5	11.5		6.5	6.5			
Lane Util. Factor		0.95			0.95	0.95		0.95	1.00			
Frt		1.00			0.96	0.85		1.00	0.85			
Flt Protected		1.00			1.00	1.00		1.00	1.00			
Satd. Flow (prot)		3539			1671	1475		3343	1495			
Flt Permitted		1.00			1.00	1.00		1.00	1.00			
Satd. Flow (perm)		3539			1671	1475		3343	1495			
Peak-hour factor, PHF	0.87	0.87	0.87	0.92	0.92	0.92	0.87	0.87	0.87	0.92	0.92	0.92
Adj. Flow (vph)	0	233	0	0	197	297	0	1649	387	0	0	0
RTOR Reduction (vph)	0	0	0	0	13	35	0	0	101	0	0	0
Lane Group Flow (vph)	0	233	0	0	249	197	0	1649	286	0	0	0
Heavy Vehicles (%)	2%	2%	2%	4%	4%	4%	8%	8%	8%	2%	2%	2%
Turn Type		NA			NA	Perm		NA	Perm			
Protected Phases		8			4			2				
Permitted Phases						4			2			
Actuated Green, G (s)		18.9			15.9	15.9		56.1	56.1			
Effective Green, g (s)		18.9			15.9	15.9		56.1	56.1			
Actuated g/C Ratio		0.21			0.18	0.18		0.62	0.62			
Clearance Time (s)		8.5			11.5	11.5		6.5	6.5			
Vehicle Extension (s)		4.0			4.0	4.0		0.2	0.2			
Lane Grp Cap (vph)		743			295	260		2083	931			
v/s Ratio Prot		0.07			c0.15			c0.49				
v/s Ratio Perm						0.13			0.19			
v/c Ratio		0.31			0.84	0.76		0.79	0.31			
Uniform Delay, d1		30.1			35.8	35.2		12.6	7.9			
Progression Factor		0.00			0.94	0.93		0.56	0.30			
Incremental Delay, d2		0.2			19.2	12.2		1.8	0.5			
Delay (s)		0.2			53.0	45.0		8.8	2.9			
Level of Service		A			D	D		A	A			
Approach Delay (s)		0.2			49.2			7.7			0.0	
Approach LOS		A			D			A			A	

Intersection Summary			
HCM 2000 Control Delay	14.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	81.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Int Delay, s/veh	1.8

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰					↑↑↑
Traffic Vol, veh/h	119	0	0	0	0	2162
Future Vol, veh/h	119	0	0	0	0	2162
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	16974	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	69	69	92	92	91	91
Heavy Vehicles, %	0	0	2	2	5	5
Mvmt Flow	172	0	0	0	0	2376

Major/Minor	Minor1		Major2	
Conflicting Flow All	950	-	-	-
Stage 1	0	-	-	-
Stage 2	950	-	-	-
Critical Hdwy	5.7	-	-	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	6	-	-	-
Follow-up Hdwy	3.8	-	-	-
Pot Cap-1 Maneuver	333	0	0	-
Stage 1	-	0	0	-
Stage 2	308	0	0	-
Platoon blocked, %				-
Mov Cap-1 Maneuver	333	-	-	-
Mov Cap-2 Maneuver	333	-	-	-
Stage 1	-	-	-	-
Stage 2	308	-	-	-

Approach	WB	SB
HCM Control Delay, s	26.9	0
HCM LOS	D	

Minor Lane/Major Mvmt	WBLn1	SBT
Capacity (veh/h)	333	-
HCM Lane V/C Ratio	0.518	-
HCM Control Delay (s)	26.9	-
HCM Lane LOS	D	-
HCM 95th %tile Q(veh)	2.8	-

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	38	338	78	336	121	107	64	33	197
v/c Ratio	0.08	0.48	0.17	0.44	0.31	0.20	0.12	0.07	0.47
Control Delay	10.1	20.3	12.2	21.8	20.9	27.8	0.4	18.1	32.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	10.1	20.3	12.2	21.8	20.9	27.8	0.4	18.1	32.2
Queue Length 50th (ft)	9	107	21	141	45	49	0	12	91
Queue Length 95th (ft)	21	204	44	224	83	95	0	30	157
Internal Link Dist (ft)		268		899		123			802
Turn Bay Length (ft)	160		170					75	
Base Capacity (vph)	485	707	448	757	397	530	553	458	423
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.08	0.48	0.17	0.44	0.30	0.20	0.12	0.07	0.47

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	34	223	77	74	283	36	115	102	61	31	151	33
Future Volume (veh/h)	34	223	77	74	283	36	115	102	61	31	151	33
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	1841	1841	1841	1826	1826	1826	1856	1856	1856	1841	1841	1841
Adj Flow Rate, veh/h	38	251	87	78	298	38	121	107	64	33	162	35
Peak Hour Factor	0.89	0.89	0.89	0.95	0.95	0.95	0.95	0.95	0.95	0.93	0.93	0.93
Percent Heavy Veh, %	4	4	4	5	5	5	3	3	3	4	4	4
Cap, veh/h	447	513	178	527	653	83	373	489	415	418	342	74
Arrive On Green	0.10	0.79	0.79	0.07	0.41	0.41	0.07	0.26	0.26	0.04	0.23	0.23
Sat Flow, veh/h	1753	1306	453	1739	1587	202	1767	1856	1572	1753	1467	317
Grp Volume(v), veh/h	38	0	338	78	0	336	121	107	64	33	0	197
Grp Sat Flow(s),veh/h/ln	1753	0	1759	1739	0	1789	1767	1856	1572	1753	0	1784
Q Serve(g_s), s	1.1	0.0	6.0	2.3	0.0	12.2	4.6	4.1	2.8	1.2	0.0	8.6
Cycle Q Clear(g_c), s	1.1	0.0	6.0	2.3	0.0	12.2	4.6	4.1	2.8	1.2	0.0	8.6
Prop In Lane	1.00		0.26	1.00		0.11	1.00		1.00	1.00		0.18
Lane Grp Cap(c), veh/h	447	0	691	527	0	737	373	489	415	418	0	416
V/C Ratio(X)	0.09	0.00	0.49	0.15	0.00	0.46	0.32	0.22	0.15	0.08	0.00	0.47
Avail Cap(c_a), veh/h	509	0	691	556	0	737	390	489	415	487	0	416
HCM Platoon Ratio	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	14.3	0.0	6.5	14.0	0.0	19.2	23.5	25.9	25.4	24.0	0.0	29.7
Incr Delay (d2), s/veh	0.1	0.0	2.5	0.1	0.0	2.0	0.5	1.0	0.8	0.1	0.0	3.8
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	0.0	2.0	0.9	0.0	5.2	1.8	1.8	1.1	0.5	0.0	4.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	14.4	0.0	9.0	14.1	0.0	21.2	24.0	26.9	26.2	24.1	0.0	33.6
LnGrp LOS	B	A	A	B	A	C	C	C	C	C	A	C
Approach Vol, veh/h		376			414			292			230	
Approach Delay, s/veh		9.5			19.9			25.6			32.2	
Approach LOS		A			B			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	10.5	41.3	8.4	29.7	8.8	43.0	11.2	27.0
Change Period (Y+Rc), s	4.5	6.0	4.5	6.0	4.5	6.0	4.5	6.0
Max Green Setting (Gmax), s	7.5	33.0	7.5	21.0	7.5	33.0	7.5	21.0
Max Q Clear Time (g_c+I1), s	4.3	0.0	3.2	0.0	3.1	0.0	6.6	0.0
Green Ext Time (p_c), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Intersection Summary	
HCM 6th Ctrl Delay	20.3
HCM 6th LOS	C

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	1	0	0	1	0	25	0	5	74	3
Future Vol, veh/h	0	0	1	0	0	1	0	25	0	5	74	3
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	100	-	-	0	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	65	65	65	65	65	65	68	68	68	86	86	86
Heavy Vehicles, %	0	0	0	0	0	0	13	13	13	3	3	3
Mvmt Flow	0	0	2	0	0	2	0	37	0	6	86	3

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	138	137	88	138	138	37	89	0	0	37	0	0
Stage 1	100	100	-	37	37	-	-	-	-	-	-	-
Stage 2	38	37	-	101	101	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.23	-	-	4.13	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.317	-	-	2.227	-	-
Pot Cap-1 Maneuver	837	758	976	837	757	1041	1440	-	-	1567	-	-
Stage 1	911	816	-	984	868	-	-	-	-	-	-	-
Stage 2	982	868	-	910	815	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	834	755	976	834	754	1041	1440	-	-	1567	-	-
Mov Cap-2 Maneuver	834	755	-	834	754	-	-	-	-	-	-	-
Stage 1	911	813	-	984	868	-	-	-	-	-	-	-
Stage 2	981	868	-	905	812	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	8.7	8.5	0	0.4
HCM LOS	A	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1440	-	-	976	1041	1567	-	-
HCM Lane V/C Ratio	-	-	-	0.002	0.001	0.004	-	-
HCM Control Delay (s)	0	-	-	8.7	8.5	7.3	-	-
HCM Lane LOS	A	-	-	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0	0	0	-	-

Intersection	
Int Delay, s/veh	0.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↱		↑↑		↱
Traffic Vol, veh/h	403	98	0	460	0	25
Future Vol, veh/h	403	98	0	460	0	25
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	Free	-	None	-	Stop
Storage Length	-	0	-	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	94	94	68	68
Heavy Vehicles, %	4	4	2	5	2	13
Mvmt Flow	448	109	0	489	0	37

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	-	-	-	-	448
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	-	-	-	6.395
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	-	3.4235
Pot Cap-1 Maneuver	-	0	0	-	0	583
Stage 1	-	0	0	-	0	-
Stage 2	-	0	0	-	0	-
Platoon blocked, %	-			-		
Mov Cap-1 Maneuver	-	-	-	-	-	583
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	11.6
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	WBT
Capacity (veh/h)	583	-	-
HCM Lane V/C Ratio	0.063	-	-
HCM Control Delay (s)	11.6	-	-
HCM Lane LOS	B	-	-
HCM 95th %tile Q(veh)	0.2	-	-

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	24	394	462	4	1	0
Future Vol, veh/h	24	394	462	4	1	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	87	87	93	93	65	65
Heavy Vehicles, %	4	4	5	5	0	0
Mvmt Flow	14	453	497	4	2	0

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	501	0	-	0	980	499
Stage 1	-	-	-	-	499	-
Stage 2	-	-	-	-	481	-
Critical Hdwy	4.14	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.236	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1053	-	-	-	279	576
Stage 1	-	-	-	-	614	-
Stage 2	-	-	-	-	626	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1053	-	-	-	274	576
Mov Cap-2 Maneuver	-	-	-	-	402	-
Stage 1	-	-	-	-	603	-
Stage 2	-	-	-	-	626	-

Approach	EB	WB	SB
HCM Control Delay, s	0.3	0	14
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1053	-	-	-	402
HCM Lane V/C Ratio	0.013	-	-	-	0.004
HCM Control Delay (s)	8.5	0	-	-	14
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0

Intersection	
Int Delay, s/veh	1.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↱	↰	↑	↰	↱
Traffic Vol, veh/h	336	48	24	416	41	9
Future Vol, veh/h	336	48	24	416	41	9
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	150	25	-	0	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	93	93	72	72
Heavy Vehicles, %	4	2	2	5	0	0
Mvmt Flow	378	54	26	447	57	13

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	432	0	877	378
Stage 1	-	-	-	-	378	-
Stage 2	-	-	-	-	499	-
Critical Hdwy	-	-	4.12	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.218	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	1128	-	322	673
Stage 1	-	-	-	-	697	-
Stage 2	-	-	-	-	614	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1128	-	315	673
Mov Cap-2 Maneuver	-	-	-	-	430	-
Stage 1	-	-	-	-	681	-
Stage 2	-	-	-	-	614	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.5	13.9
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	430	673	-	-	1128	-
HCM Lane V/C Ratio	0.132	0.019	-	-	0.023	-
HCM Control Delay (s)	14.6	10.5	-	-	8.3	-
HCM Lane LOS	B	B	-	-	A	-
HCM 95th %tile Q(veh)	0.5	0.1	-	-	0.1	-

Intersection	
Int Delay, s/veh	1.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	27	0	22	0	0	0	21	239	0	0	281	31
Future Vol, veh/h	27	0	22	0	0	0	21	239	0	0	281	31
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	200	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	65	65	65	65	65	65	86	86	86	86	86	86
Heavy Vehicles, %	8	8	8	2	2	2	3	3	3	5	5	5
Mvmt Flow	42	0	34	0	0	0	24	278	0	0	327	36

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	532	671	345	688	689	139	363	0	0	278	0	0
Stage 1	345	345	-	326	326	-	-	-	-	-	-	-
Stage 2	187	326	-	362	363	-	-	-	-	-	-	-
Critical Hdwy	7.42	6.62	6.32	7.33	6.53	6.93	4.145	-	-	4.175	-	-
Critical Hdwy Stg 1	6.22	5.62	-	6.53	5.53	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.62	5.62	-	6.13	5.53	-	-	-	-	-	-	-
Follow-up Hdwy	3.576	4.076	3.376	3.519	4.019	3.319	2.2285	-	-	2.2475	-	-
Pot Cap-1 Maneuver	433	367	681	346	368	884	1188	-	-	1264	-	-
Stage 1	655	623	-	661	648	-	-	-	-	-	-	-
Stage 2	782	635	-	656	624	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	427	360	681	324	361	884	1188	-	-	1264	-	-
Mov Cap-2 Maneuver	427	360	-	324	361	-	-	-	-	-	-	-
Stage 1	642	623	-	648	635	-	-	-	-	-	-	-
Stage 2	766	622	-	623	624	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	13.2	0	0.7	0
HCM LOS	B	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1188	-	-	513	-	1264	-	-
HCM Lane V/C Ratio	0.021	-	-	0.147	-	-	-	-
HCM Control Delay (s)	8.1	-	-	13.2	0	0	-	-
HCM Lane LOS	A	-	-	B	A	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	0.5	-	0	-	-

Intersection	
Int Delay, s/veh	1.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	1	3	24	2	21	81
Future Vol, veh/h	1	3	24	2	21	81
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	65	65	68	68	86	86
Heavy Vehicles, %	2	2	13	2	2	3
Mvmt Flow	2	5	35	3	24	94

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	179	37	0	0	38	0
Stage 1	37	-	-	-	-	-
Stage 2	142	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	811	1035	-	-	1572	-
Stage 1	985	-	-	-	-	-
Stage 2	885	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	798	1035	-	-	1572	-
Mov Cap-2 Maneuver	798	-	-	-	-	-
Stage 1	969	-	-	-	-	-
Stage 2	885	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	8.8	0	1.5
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	963	1572	-
HCM Lane V/C Ratio	-	-	0.006	0.016	-
HCM Control Delay (s)	-	-	8.8	7.3	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0	0	-

Intersection: 1009: US-31 SB & Robbins Rd (Push-Buttons)

Movement	EB	EB	WB	WB	SB	SB	SB
Directions Served	T	R	T	T	T	T	R
Maximum Queue (ft)	224	168	25	24	485	491	59
Average Queue (ft)	103	79	2	2	239	243	25
95th Queue (ft)	181	143	17	12	461	468	51
Link Distance (ft)	941	941	22	22	566	566	566
Upstream Blk Time (%)			3	2	0	0	
Queuing Penalty (veh)			3	2	1	2	
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 1209: US-31 NB & X-Over South of Robbins Rd

Movement	EB	NB	NB
Directions Served	L	T	T
Maximum Queue (ft)	35	248	258
Average Queue (ft)	11	142	128
95th Queue (ft)	34	216	215
Link Distance (ft)	14	976	976
Upstream Blk Time (%)	18		
Queuing Penalty (veh)	65		
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 1909: US-31 NB & Robbins Rd (Push-Buttons)

Movement	EB	EB	WB	WB	NB	NB	NB
Directions Served	T	T	TR	R	T	T	R
Maximum Queue (ft)	7	7	226	175	155	166	90
Average Queue (ft)	0	0	131	88	92	98	36
95th Queue (ft)	5	4	204	152	140	149	70
Link Distance (ft)	22	22	313	313	610	610	610
Upstream Blk Time (%)	1	0					
Queuing Penalty (veh)	1	0					
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 2909: US-31 SB & X-Over North of Robbins Rd

Movement	WB	SB	SB	SB
Directions Served	L	T	T	T
Maximum Queue (ft)	55	51	62	5
Average Queue (ft)	49	7	8	0
95th Queue (ft)	69	40	43	5
Link Distance (ft)	2	72	72	72
Upstream Blk Time (%)	52	0	0	
Queuing Penalty (veh)	64	3	2	
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 3085: 172nd Ave (Push-Buttons)/Ferry St (Push-Buttons) & Robbins Rd (Push-Buttons)

Movement	EB	EB	WB	WB	NB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	T	R	L	TR
Maximum Queue (ft)	75	193	144	226	132	117	60	105	205
Average Queue (ft)	18	91	34	97	61	52	25	25	99
95th Queue (ft)	54	166	82	183	112	101	50	69	173
Link Distance (ft)		279		931	139	139	139		848
Upstream Blk Time (%)					0	0			
Queuing Penalty (veh)					0	0			
Storage Bay Dist (ft)	160		170					75	
Storage Blk Time (%)		1		1				0	23
Queuing Penalty (veh)		0		1				0	7

Intersection: 9002: Whittaker Way & Bank Dwy/Health Dwy

Movement	EB	WB
Directions Served	LTR	LTR
Maximum Queue (ft)	19	16
Average Queue (ft)	1	1
95th Queue (ft)	10	9
Link Distance (ft)	193	57
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 9005: Whittaker Way & Robbins Rd

Movement	NB
Directions Served	R
Maximum Queue (ft)	20
Average Queue (ft)	1
95th Queue (ft)	11
Link Distance (ft)	337
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 9006: Robbins Rd/Robbins Rd (Push-Buttons) & DeSpelder St

Movement	EB	SB
Directions Served	LT	LR
Maximum Queue (ft)	60	21
Average Queue (ft)	6	2
95th Queue (ft)	33	13
Link Distance (ft)	113	620
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 9008: Main Site Dwy & Robbins Rd (Push-Buttons)

Movement	EB	WB	WB	NB	NB
Directions Served	R	L	T	L	R
Maximum Queue (ft)	4	40	31	50	24
Average Queue (ft)	0	9	2	22	6
95th Queue (ft)	3	32	18	43	22
Link Distance (ft)			279	283	283
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	150	25			
Storage Blk Time (%)		1	0		
Queuing Penalty (veh)		5	0		

Intersection: 9012: 172nd Ave/172nd Ave (Push-Buttons) & Gas Station Dwy/Bank Dwy

Movement	EB	NB	NB	SB
Directions Served	LTR	L	T	LTR
Maximum Queue (ft)	80	24	6	2
Average Queue (ft)	29	4	0	0
95th Queue (ft)	63	16	4	2
Link Distance (ft)	254		649	139
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)		200		
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 9016: Whittaker Way & New Dwy

Movement	WB	NB	SB
Directions Served	LR	TR	LT
Maximum Queue (ft)	32	3	16
Average Queue (ft)	4	0	1
95th Queue (ft)	22	3	8
Link Distance (ft)	224	33	337
Upstream Blk Time (%)		0	
Queuing Penalty (veh)		0	
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Zone Summary

Zone wide Queuing Penalty: 158

Lane Group	EBT	EBR	WBT	SBT	SBR
Lane Group Flow (vph)	398	309	314	2129	177
v/c Ratio	0.76	0.66	0.29	1.06	0.19
Control Delay	50.3	41.7	1.1	55.8	2.8
Queue Delay	0.0	0.0	0.0	10.6	0.0
Total Delay	50.3	41.7	1.1	66.3	2.8
Queue Length 50th (ft)	279	188	2	~974	6
Queue Length 95th (ft)	397	289	m2	#1103	m18
Internal Link Dist (ft)	920		1	549	
Turn Bay Length (ft)					
Base Capacity (vph)	540	482	1116	2007	949
Starvation Cap Reductn	0	0	0	47	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.74	0.64	0.28	1.09	0.19

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	358	278	0	295	0	0	0	0	0	2023	168
Future Volume (vph)	0	358	278	0	295	0	0	0	0	0	2023	168
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		11.5	11.5		8.5						6.5	6.5
Lane Util. Factor		1.00	1.00		0.95						0.95	1.00
Frt		1.00	0.85		1.00						1.00	0.85
Flt Protected		1.00	1.00		1.00						1.00	1.00
Satd. Flow (prot)		1881	1599		3574						3505	1568
Flt Permitted		1.00	1.00		1.00						1.00	1.00
Satd. Flow (perm)		1881	1599		3574						3505	1568
Peak-hour factor, PHF	0.90	0.90	0.90	0.94	0.94	0.94	0.92	0.92	0.92	0.95	0.95	0.95
Adj. Flow (vph)	0	398	309	0	314	0	0	0	0	0	2129	177
RTOR Reduction (vph)	0	0	23	0	0	0	0	0	0	0	0	51
Lane Group Flow (vph)	0	398	286	0	314	0	0	0	0	0	2129	126
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	3%	3%	3%
Turn Type		NA	Perm		NA						NA	Perm
Protected Phases		4			8						2	
Permitted Phases			4									2
Actuated Green, G (s)		33.3	33.3		36.3						68.7	68.7
Effective Green, g (s)		33.3	33.3		36.3						68.7	68.7
Actuated g/C Ratio		0.28	0.28		0.30						0.57	0.57
Clearance Time (s)		11.5	11.5		8.5						6.5	6.5
Vehicle Extension (s)		4.0	4.0		4.0						0.2	0.2
Lane Grp Cap (vph)		521	443		1081						2006	897
v/s Ratio Prot		c0.21			0.09						c0.61	
v/s Ratio Perm			0.18									0.08
v/c Ratio		0.76	0.65		0.29						1.06	0.14
Uniform Delay, d1		39.7	38.2		32.0						25.6	11.9
Progression Factor		1.00	1.00		0.02						0.73	0.56
Incremental Delay, d2		7.0	3.6		0.1						35.3	0.2
Delay (s)		46.7	41.7		0.8						54.0	6.9
Level of Service		D	D		A						D	A
Approach Delay (s)		44.5			0.8			0.0			50.4	
Approach LOS		D			A			A			D	

Intersection Summary			
HCM 2000 Control Delay	44.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	90.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	NBT
Lane Group Flow (vph)	541	1875
v/c Ratio	0.87	0.90
Control Delay	30.1	27.8
Queue Delay	0.0	7.0
Total Delay	30.1	34.8
Queue Length 50th (ft)	423	622
Queue Length 95th (ft)	#567	758
Internal Link Dist (ft)	1	920
Turn Bay Length (ft)		
Base Capacity (vph)	625	2075
Starvation Cap Reductn	0	0
Spillback Cap Reductn	0	182
Storage Cap Reductn	0	0
Reduced v/c Ratio	0.87	0.99

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	514	0	0	1781	0	0
Future Volume (vph)	514	0	0	1781	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	16	12	12	11	12	12
Total Lost time (s)	4.0			6.5		
Lane Util. Factor	1.00			0.95		
Frt	1.00			1.00		
Flt Protected	0.95			1.00		
Satd. Flow (prot)	2046			3388		
Flt Permitted	0.95			1.00		
Satd. Flow (perm)	2046			3388		
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.92	0.92
Adj. Flow (vph)	541	0	0	1875	0	0
RTOR Reduction (vph)	12	0	0	0	0	0
Lane Group Flow (vph)	529	0	0	1875	0	0
Heavy Vehicles (%)	0%	0%	3%	3%	2%	2%
Turn Type	Prot			NA		
Protected Phases	2			1		
Permitted Phases						
Actuated Green, G (s)	36.0			73.5		
Effective Green, g (s)	36.0			73.5		
Actuated g/C Ratio	0.30			0.61		
Clearance Time (s)	4.0			6.5		
Lane Grp Cap (vph)	613			2075		
v/s Ratio Prot	c0.26			c0.55		
v/s Ratio Perm						
v/c Ratio	0.86			0.90		
Uniform Delay, d1	39.7			20.2		
Progression Factor	0.46			1.00		
Incremental Delay, d2	11.2			7.0		
Delay (s)	29.4			27.2		
Level of Service	C			C		
Approach Delay (s)	29.4			27.2	0.0	
Approach LOS	C			C	A	

Intersection Summary			
HCM 2000 Control Delay	27.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	106.9%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	WBR	NBT	NBR
Lane Group Flow (vph)	398	420	374	1936	504
v/c Ratio	0.37	0.87	0.84	0.96	0.51
Control Delay	0.6	59.3	55.1	23.5	4.9
Queue Delay	0.0	0.0	0.0	14.5	0.3
Total Delay	0.6	59.3	55.1	37.9	5.1
Queue Length 50th (ft)	0	314	262	637	49
Queue Length 95th (ft)	0	#494	#427	#930	m77
Internal Link Dist (ft)	1	319		594	
Turn Bay Length (ft)					
Base Capacity (vph)	1116	501	459	2026	994
Starvation Cap Reductn	0	0	0	141	118
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.36	0.84	0.81	1.03	0.58

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	358	0	0	295	451	0	1839	479	0	0	0
Future Volume (vph)	0	358	0	0	295	451	0	1839	479	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		8.5			11.5	11.5		6.5	6.5			
Lane Util. Factor		0.95			0.95	0.95		0.95	1.00			
Frt		1.00			0.96	0.85		1.00	0.85			
Flt Protected		1.00			1.00	1.00		1.00	1.00			
Satd. Flow (prot)		3574			1719	1519		3539	1583			
Flt Permitted		1.00			1.00	1.00		1.00	1.00			
Satd. Flow (perm)		3574			1719	1519		3539	1583			
Peak-hour factor, PHF	0.90	0.90	0.90	0.94	0.94	0.94	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	398	0	0	314	480	0	1936	504	0	0	0
RTOR Reduction (vph)	0	0	0	0	7	23	0	0	88	0	0	0
Lane Group Flow (vph)	0	398	0	0	413	351	0	1936	416	0	0	0
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	3%	3%	3%
Turn Type		NA			NA	Perm		NA	Perm			
Protected Phases		8			4			2				
Permitted Phases						4			2			
Actuated Green, G (s)		36.3			33.3	33.3		68.7	68.7			
Effective Green, g (s)		36.3			33.3	33.3		68.7	68.7			
Actuated g/C Ratio		0.30			0.28	0.28		0.57	0.57			
Clearance Time (s)		8.5			11.5	11.5		6.5	6.5			
Vehicle Extension (s)		4.0			4.0	4.0		0.2	0.2			
Lane Grp Cap (vph)		1081			477	421		2026	906			
v/s Ratio Prot		0.11			c0.24			c0.55				
v/s Ratio Perm						0.23			0.26			
v/c Ratio		0.37			0.87	0.83		0.96	0.46			
Uniform Delay, d1		32.8			41.2	40.7		24.2	14.9			
Progression Factor		0.00			1.00	1.00		0.65	0.45			
Incremental Delay, d2		0.2			15.5	13.8		6.4	0.7			
Delay (s)		0.2			56.7	54.5		22.2	7.5			
Level of Service		A			E	D		C	A			
Approach Delay (s)		0.2			55.7			19.2			0.0	
Approach LOS		A			E			B			A	

Intersection Summary			
HCM 2000 Control Delay	25.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	90.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Int Delay, s/veh	2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰					↑↑↑
Traffic Vol, veh/h	143	0	0	0	0	2132
Future Vol, veh/h	143	0	0	0	0	2132
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	16974	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	77	77	92	92	95	95
Heavy Vehicles, %	0	0	2	2	4	4
Mvmt Flow	186	0	0	0	0	2244

Major/Minor	Minor1		Major2	
Conflicting Flow All	898	-	-	-
Stage 1	0	-	-	-
Stage 2	898	-	-	-
Critical Hdwy	5.7	-	-	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	6	-	-	-
Follow-up Hdwy	3.8	-	-	-
Pot Cap-1 Maneuver	354	0	0	-
Stage 1	-	0	0	-
Stage 2	328	0	0	-
Platoon blocked, %				-
Mov Cap-1 Maneuver	354	-	-	-
Mov Cap-2 Maneuver	354	-	-	-
Stage 1	-	-	-	-
Stage 2	328	-	-	-

Approach	WB	SB
HCM Control Delay, s	25.9	0
HCM LOS	D	

Minor Lane/Major Mvmt	WBLn1	SBT
Capacity (veh/h)	354	-
HCM Lane V/C Ratio	0.525	-
HCM Control Delay (s)	25.9	-
HCM Lane LOS	D	-
HCM 95th %tile Q(veh)	2.9	-

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	81	554	87	499	268	317	127	78	318
v/c Ratio	0.24	0.76	0.30	0.68	0.87	0.64	0.24	0.24	0.73
Control Delay	13.1	32.2	14.0	28.9	51.9	37.8	5.1	20.0	41.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	13.1	32.2	14.0	28.9	51.9	37.8	5.1	20.0	41.6
Queue Length 50th (ft)	22	270	24	236	108	167	0	28	159
Queue Length 95th (ft)	45	#447	48	356	#238	#266	35	57	#275
Internal Link Dist (ft)		266		899		123			802
Turn Bay Length (ft)	160		170					75	
Base Capacity (vph)	340	726	296	731	309	496	529	335	435
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.24	0.76	0.29	0.68	0.87	0.64	0.24	0.23	0.73

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	77	385	142	83	398	76	255	301	121	74	232	70
Future Volume (veh/h)	77	385	142	83	398	76	255	301	121	74	232	70
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	1885	1885	1885	1885	1885	1885	1900	1900	1900	1885	1885	1885
Adj Flow Rate, veh/h	81	405	149	87	419	80	268	317	127	78	244	74
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	1	1	1	1	1	1	0	0	0	1	1	1
Cap, veh/h	338	501	184	295	588	112	306	475	402	295	324	98
Arrive On Green	0.07	0.38	0.38	0.07	0.38	0.38	0.08	0.25	0.25	0.07	0.23	0.23
Sat Flow, veh/h	1795	1315	484	1795	1539	294	1810	1900	1610	1795	1388	421
Grp Volume(v), veh/h	81	0	554	87	0	499	268	317	127	78	0	318
Grp Sat Flow(s),veh/h/ln	1795	0	1798	1795	0	1832	1810	1900	1610	1795	0	1809
Q Serve(g_s), s	2.3	0.0	24.8	2.5	0.0	20.8	7.5	13.5	5.8	2.9	0.0	14.7
Cycle Q Clear(g_c), s	2.3	0.0	24.8	2.5	0.0	20.8	7.5	13.5	5.8	2.9	0.0	14.7
Prop In Lane	1.00		0.27	1.00		0.16	1.00		1.00	1.00		0.23
Lane Grp Cap(c), veh/h	338	0	685	295	0	701	306	475	402	295	0	422
V/C Ratio(X)	0.24	0.00	0.81	0.30	0.00	0.71	0.88	0.67	0.32	0.26	0.00	0.75
Avail Cap(c_a), veh/h	367	0	685	320	0	701	306	475	402	325	0	422
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	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	16.9	0.0	24.9	18.1	0.0	23.6	30.2	30.4	27.5	23.9	0.0	32.1
Incr Delay (d2), s/veh	0.4	0.0	9.9	0.6	0.0	6.1	23.4	7.3	2.0	0.5	0.0	11.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.9	0.0	11.8	1.0	0.0	9.6	4.0	6.7	2.4	1.2	0.0	7.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	17.3	0.0	34.9	18.7	0.0	29.6	53.6	37.6	29.5	24.4	0.0	43.9
LnGrp LOS	B	A	C	B	A	C	D	D	C	C	A	D
Approach Vol, veh/h		635			586			712			396	
Approach Delay, s/veh		32.6			28.0			42.2			40.0	
Approach LOS		C			C			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	10.7	40.3	10.5	28.5	10.6	40.4	12.0	27.0
Change Period (Y+Rc), s	4.5	6.0	4.5	6.0	4.5	6.0	4.5	6.0
Max Green Setting (Gmax), s	7.5	33.0	7.5	21.0	7.5	33.0	7.5	21.0
Max Q Clear Time (g_c+I1), s	4.5	0.0	4.9	0.0	4.3	0.0	9.5	0.0
Green Ext Time (p_c), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Intersection Summary	
HCM 6th Ctrl Delay	35.7
HCM 6th LOS	D

Intersection	
Int Delay, s/veh	1.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	9	0	6	0	0	2	11	82	0	2	113	10
Future Vol, veh/h	9	0	6	0	0	2	11	82	0	2	113	10
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	100	-	-	0	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	60	60	60	92	92	92	75	75	75	92	92	92
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	1	1	1
Mvmt Flow	15	0	10	0	0	2	15	109	0	2	123	11

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	273	272	129	277	277	109	134	0	0	109	0	0
Stage 1	133	133	-	139	139	-	-	-	-	-	-	-
Stage 2	140	139	-	138	138	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.11	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.209	-	-
Pot Cap-1 Maneuver	684	638	926	679	634	950	1463	-	-	1488	-	-
Stage 1	875	790	-	869	785	-	-	-	-	-	-	-
Stage 2	868	785	-	870	786	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	676	631	926	665	627	950	1463	-	-	1488	-	-
Mov Cap-2 Maneuver	676	631	-	665	627	-	-	-	-	-	-	-
Stage 1	866	789	-	860	777	-	-	-	-	-	-	-
Stage 2	857	777	-	859	785	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	9.9	8.8	0.9	0.1
HCM LOS	A	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1463	-	-	758	950	1488	-	-
HCM Lane V/C Ratio	0.01	-	-	0.033	0.002	0.001	-	-
HCM Control Delay (s)	7.5	-	-	9.9	8.8	7.4	-	-
HCM Lane LOS	A	-	-	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0	0	-	-

Intersection	
Int Delay, s/veh	1.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↱		↑↑		↱
Traffic Vol, veh/h	646	152	0	746	0	90
Future Vol, veh/h	646	152	0	746	0	90
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	Free	-	None	-	Stop
Storage Length	-	0	-	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	89	89	73	73
Heavy Vehicles, %	1	1	1	1	0	0
Mvmt Flow	680	160	0	838	0	123

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	-	-	-	-	680
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	-	-	-	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	-	3.3
Pot Cap-1 Maneuver	-	0	0	-	0	454
Stage 1	-	0	0	-	0	-
Stage 2	-	0	0	-	0	-
Platoon blocked, %	-			-		
Mov Cap-1 Maneuver	-	-	-	-	-	454
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

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

Minor Lane/Major Mvmt	NBLn1	EBT	WBT
Capacity (veh/h)	454	-	-
HCM Lane V/C Ratio	0.272	-	-
HCM Control Delay (s)	15.9	-	-
HCM Lane LOS	C	-	-
HCM 95th %tile Q(veh)	1.1	-	-

Intersection	
Int Delay, s/veh	0.6

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	43	683	759	6	11	10
Future Vol, veh/h	43	683	759	6	11	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	91	91	91	91	76	76
Heavy Vehicles, %	1	1	1	1	0	0
Mvmt Flow	47	751	834	7	14	13

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	841	0	-	0	1683	838
Stage 1	-	-	-	-	838	-
Stage 2	-	-	-	-	845	-
Critical Hdwy	4.11	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.209	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	799	-	-	-	105	369
Stage 1	-	-	-	-	428	-
Stage 2	-	-	-	-	425	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	799	-	-	-	94	369
Mov Cap-2 Maneuver	-	-	-	-	217	-
Stage 1	-	-	-	-	385	-
Stage 2	-	-	-	-	425	-

Approach	EB	WB	SB
HCM Control Delay, s	0.6	0	19.8
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	799	-	-	-	270
HCM Lane V/C Ratio	0.059	-	-	-	0.102
HCM Control Delay (s)	9.8	0	-	-	19.8
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0.2	-	-	-	0.3

Intersection	
Int Delay, s/veh	3.7

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↱	↰	↑	↰	↱
Traffic Vol, veh/h	595	80	32	672	113	28
Future Vol, veh/h	595	80	32	672	113	28
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	150	25	-	0	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	91	91	72	72
Heavy Vehicles, %	1	1	1	1	0	0
Mvmt Flow	626	84	35	738	157	39

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	710	0	1434	626
Stage 1	-	-	-	-	626	-
Stage 2	-	-	-	-	808	-
Critical Hdwy	-	-	4.11	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.209	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	894	-	~ 149	488
Stage 1	-	-	-	-	537	-
Stage 2	-	-	-	-	442	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	894	-	~ 143	488
Mov Cap-2 Maneuver	-	-	-	-	272	-
Stage 1	-	-	-	-	516	-
Stage 2	-	-	-	-	442	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.4	30.5
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	272	488	-	-	894	-
HCM Lane V/C Ratio	0.577	0.08	-	-	0.039	-
HCM Control Delay (s)	34.8	13	-	-	9.2	-
HCM Lane LOS	D	B	-	-	A	-
HCM 95th %tile Q(veh)	3.3	0.3	-	-	0.1	-

Notes

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

Intersection	
Int Delay, s/veh	2.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	57	0	57	1	0	9	60	615	0	5	402	35
Future Vol, veh/h	57	0	57	1	0	9	60	615	0	5	402	35
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	200	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	72	72	72	92	92	92	95	95	95
Heavy Vehicles, %	0	0	0	0	0	0	2	2	2	1	1	1
Mvmt Flow	61	0	61	1	0	13	65	668	0	5	423	37

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	916	1250	442	1280	1268	334	460	0	0	668	0	0
Stage 1	452	452	-	798	798	-	-	-	-	-	-	-
Stage 2	464	798	-	482	470	-	-	-	-	-	-	-
Critical Hdwy	7.3	6.5	6.2	7.3	6.5	6.9	4.13	-	-	4.115	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.5	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.5	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.219	-	-	2.2095	-	-
Pot Cap-1 Maneuver	242	174	620	134	170	668	1099	-	-	926	-	-
Stage 1	591	574	-	350	401	-	-	-	-	-	-	-
Stage 2	553	401	-	569	563	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	226	163	620	115	159	668	1099	-	-	926	-	-
Mov Cap-2 Maneuver	226	163	-	115	159	-	-	-	-	-	-	-
Stage 1	556	570	-	329	377	-	-	-	-	-	-	-
Stage 2	511	377	-	510	559	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	22	13.2	0.8	0.1
HCM LOS	C	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1099	-	-	331	451	926	-	-
HCM Lane V/C Ratio	0.059	-	-	0.366	0.031	0.006	-	-
HCM Control Delay (s)	8.5	-	-	22	13.2	8.9	0	-
HCM Lane LOS	A	-	-	C	B	A	A	-
HCM 95th %tile Q(veh)	0.2	-	-	1.6	0.1	0	-	-

Intersection	
Int Delay, s/veh	1.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	5	10	90	3	37	120
Future Vol, veh/h	5	10	90	3	37	120
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	74	74	92	92
Heavy Vehicles, %	0	0	0	0	1	1
Mvmt Flow	5	11	122	4	40	130

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	334	124	0	0	126	0
Stage 1	124	-	-	-	-	-
Stage 2	210	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.11	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.209	-
Pot Cap-1 Maneuver	665	932	-	-	1467	-
Stage 1	907	-	-	-	-	-
Stage 2	830	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	646	932	-	-	1467	-
Mov Cap-2 Maneuver	646	-	-	-	-	-
Stage 1	881	-	-	-	-	-
Stage 2	830	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.5	0	1.8
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	812	1467	-
HCM Lane V/C Ratio	-	-	0.02	0.027	-
HCM Control Delay (s)	-	-	9.5	7.5	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0.1	0.1	-

Intersection: 1009: US-31 SB & Robbins Rd (Push-Buttons)

Movement	EB	EB	WB	WB	SB	SB	SB
Directions Served	T	R	T	T	T	T	R
Maximum Queue (ft)	362	272	21	25	593	609	287
Average Queue (ft)	196	142	1	2	562	565	47
95th Queue (ft)	321	243	10	14	647	655	186
Link Distance (ft)	941	941	22	22	566	566	566
Upstream Blk Time (%)			2	3	12	12	0
Queuing Penalty (veh)			3	4	88	88	0
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 1209: US-31 NB & X-Over South of Robbins Rd

Movement	EB	NB	NB
Directions Served	L	T	T
Maximum Queue (ft)	66	609	607
Average Queue (ft)	30	372	376
95th Queue (ft)	68	758	767
Link Distance (ft)	14	976	976
Upstream Blk Time (%)	40	6	7
Queuing Penalty (veh)	206	0	0
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 1909: US-31 NB & Robbins Rd (Push-Buttons)

Movement	EB	EB	WB	WB	NB	NB	NB
Directions Served	T	T	TR	R	T	T	R
Maximum Queue (ft)	7	4	322	281	551	555	230
Average Queue (ft)	0	0	226	171	329	342	70
95th Queue (ft)	7	4	316	260	590	592	152
Link Distance (ft)	22	22	313	313	610	610	610
Upstream Blk Time (%)	0	0	3	0	2	2	
Queuing Penalty (veh)	1	0	12	1	17	17	
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 2909: US-31 SB & X-Over North of Robbins Rd

Movement	WB	SB	SB	SB
Directions Served	L	T	T	T
Maximum Queue (ft)	55	92	90	22
Average Queue (ft)	53	74	71	2
95th Queue (ft)	66	101	102	23
Link Distance (ft)	2	72	72	72
Upstream Blk Time (%)	80	12	10	0
Queuing Penalty (veh)	115	82	69	2
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 3085: 172nd Ave (Push-Buttons)/Ferry St (Push-Buttons) & Robbins Rd (Push-Buttons)

Movement	EB	EB	WB	WB	NB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	T	R	L	TR
Maximum Queue (ft)	176	292	191	368	164	163	96	120	431
Average Queue (ft)	65	204	55	173	137	119	42	65	205
95th Queue (ft)	165	317	139	319	181	184	76	128	373
Link Distance (ft)		278		931	139	139	139		848
Upstream Blk Time (%)		3		0	33	12	0		0
Queuing Penalty (veh)		19		0	76	27	0		0
Storage Bay Dist (ft)	160		170					75	
Storage Blk Time (%)		17	0	8				4	48
Queuing Penalty (veh)		13	0	7				11	35

Intersection: 9002: Whittaker Way & Bank Dwy/Health Dwy

Movement	EB	WB	NB
Directions Served	LTR	LTR	L
Maximum Queue (ft)	32	22	25
Average Queue (ft)	13	1	1
95th Queue (ft)	37	12	11
Link Distance (ft)	193	57	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			100
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 9005: Whittaker Way & Robbins Rd

Movement	EB	EB	WB	WB	NB
Directions Served	T	R	T	T	R
Maximum Queue (ft)	128	5	52	20	75
Average Queue (ft)	12	0	6	1	10
95th Queue (ft)	68	5	46	22	49
Link Distance (ft)	313	313	113	113	335
Upstream Blk Time (%)			2	0	
Queuing Penalty (veh)			8	0	
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 9006: Robbins Rd/Robbins Rd (Push-Buttons) & DeSpelder St

Movement	EB	WB	SB
Directions Served	LT	TR	LR
Maximum Queue (ft)	154	39	60
Average Queue (ft)	47	7	19
95th Queue (ft)	128	71	49
Link Distance (ft)	113	230	620
Upstream Blk Time (%)	3	2	
Queuing Penalty (veh)	23	12	
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 9008: Main Site Dwy & Robbins Rd (Push-Buttons)

Movement	EB	EB	WB	WB	NB	NB
Directions Served	T	R	L	T	L	R
Maximum Queue (ft)	159	69	43	96	215	85
Average Queue (ft)	19	3	16	10	90	18
95th Queue (ft)	89	35	42	81	213	69
Link Distance (ft)	230			278	270	270
Upstream Blk Time (%)	0			1	3	0
Queuing Penalty (veh)	0			7	0	0
Storage Bay Dist (ft)		150	25			
Storage Blk Time (%)	0	0	4	2		
Queuing Penalty (veh)	0	0	29	1		

Intersection: 9012: 172nd Ave/172nd Ave (Push-Buttons) & Gas Station Dwy/Bank Dwy

Movement	EB	WB	NB	NB	NB	SB
Directions Served	LTR	LTR	L	T	TR	LTR
Maximum Queue (ft)	222	53	190	495	353	112
Average Queue (ft)	101	13	32	145	28	9
95th Queue (ft)	235	42	136	425	205	55
Link Distance (ft)	254	203		649	649	139
Upstream Blk Time (%)	12			1	0	0
Queuing Penalty (veh)	0			0	0	1
Storage Bay Dist (ft)			200			
Storage Blk Time (%)			0	13		
Queuing Penalty (veh)			0	8		

Intersection: 9016: Whittaker Way & New Dwy

Movement	WB	NB	SB
Directions Served	LR	TR	LT
Maximum Queue (ft)	36	3	30
Average Queue (ft)	13	0	3
95th Queue (ft)	37	3	16
Link Distance (ft)	244	35	335
Upstream Blk Time (%)		0	
Queuing Penalty (veh)		0	
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Zone Summary

Zone wide Queuing Penalty: 983

February 21, 2018

Mr. Derek Gajdos
Director of Public Works
City of Grand Haven
1120 Jackson Street
Grand Haven, MI 49417

RE: Robbins Center Point PUD – Review Comments

Dear Mr. Gajdos:

Per your request, we have reviewed the following documents regarding the Robbins Center Point PUD Submittal:

- Robbins Center Point PUD – Traffic Impact Study (Preliminary Report – Executive Summary)
- Robbins Center Point PUD – Traffic Impact Study (Final report)
- Robbins Center Point PUD drawings (dated 01/18/18)
- Robbins Center Point PUD drawings (dated 02/16/18)
- Joint Robbins Road Corridor Plan (dated 2011)
- Email from Stacy Fedewa regarding Grand Haven Township's conditional approval of the PUD plans

While generally we concur with the findings, we offer the following comments and considerations:

1. Traffic projections have been very conservatively estimated for the overall project. These include seasonal adjustments for existing traffic data, 1.5% growth factor, and not subtracting the existing traffic that uses the site. In addition, it is unclear if pass-by trips were actually considered – there is discussion on page 31, but the total site entering and exiting traffic on Exhibits 3-6 and 3-7 reflects the total trips without subtracting pass by trips.
   <u>Discussion:</u>
   Over-estimating trips for the site will give a very conservative estimate of the impacts to site driveways and intersections within the study area. However, this may also paint a picture that is not realistic. For example, the study recommends conversion to a dual right turn lane scenario for westbound Robbins Road at US-31. Dual right turn lanes introduce the potential for increased side swipe accidents and erratic lane changes. We would recommend consultation with MDOT and perhaps taking a wait-and-see approach before making this change.

2. The preliminary traffic impact study recommended constructing an additional westbound turn lane, but the final study recommended restriping the westbound approach to a shared through/right turn lane and a right turn lane
   Discussion:
   We are unclear what changed between the preliminary and final report, but suspect that the cost of constructing a new right turn lane became burdensome. Obviously shared lanes do not operated as effectively as an exclusive lane. Therefore, a provision should be in place to construct a right turn lane in the future at no cost to the city should the need occur.

3. The Robbins and Ferry intersection appears to operate at acceptable levels of service in the 2023 build-out scenario. However, timing changes are recommended at the Robbins/US-31 intersection.
   Discussion:
   MDOT will have to review and approve any timing changes at the Robbins/US-31 intersection(s).

4. The development proposes elimination of multiple curb cuts on Robbins Road and replacement with one main driveway. However, the proposed driveway does not line up with the driveway across the street.
   Discussion:
   While we agree that elimination of the multiple existing driveways and replacement with one driveway is great access management practice, we are concerned about left-turn lock up with the proposed driveway location. Left-turn lock up occurs when driveways are improperly offset across from each other. In this situation head-on conflicts will be introduced due to opposing left turning vehicles, which is a safety concern. Three things should be considered for this situation:
   - Line-up the driveway with the Walgreens driveway
   - Relocate the driveway farther to the west to provide an adequate gap between it and the Walgreens driveway
   - Restrict westbound left turns into the site driveway. The email from Stacy Fedewa suggests constructing a "pork chop" to restrict entering left turns if crash data indicates incidences relating to left turn conflicts. In my experience, constructing islands to restrict turning movements has been unsuccessful unless then are designed with extreme radii. Constructing something of this nature after-the-fact may prove difficult.

5. The Traffic impact study recommends constructing an eastbound right turn lane along Robbins Road at the site driveway.
   Discussion:
   We agree with this recommendation. No dimensions for this turn lane were provided on the drawings. It should be constructed with an adequate taper and deceleration length per City of Grand Haven and/or MDOT standards.

6. The Traffic impact study recommends constructing separate left and right turn exit lanes for the site driveway on Robbins Road.
   Discussion:
   We agree with this recommendation.

If you have any questions or comments regarding our review, please let me know.

Sincerely,
Abonmarche Consultants, Inc.

Timothy R. Drews, PE, PTOE
Vice President

cc. Pat McGinnis, City of Grand Haven
Jennifer Howland, City of Grand Haven

NORTH

0 100 200

SCALE: 1" = 100'

LOCATION MAP
NO SCALE:

PREPARED FOR:
VISSER BROTHERS, INC.
1946 TURNER AVENUE, NW
GRAND RAPIDS, MI 49504

ATTN: BILL MAST
PH: (616) 363-3825
FAX: (616) 363-6477
WWW.VISSERBROTHERS.COM

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Utility locations are approximate only. Please contact "Miss Dig" three working days prior to the start of construction for exact locations. (1-800-482-7171)

PLAN REVISIONS
ISSUED 11/09/17 SCHEMATIC DESIGN REVIEW
REV 01/18/18 REV PER REVIEW COMMENTS
REV 03/07/18 REV PER TWP COMMENTS

DRIVE EXHIBIT MAP

FOR

ROBBINS CENTER POINT PUD

GRAND HAVEN TOWNSHIP, OTTAWA , MICHIGAN

MOORE & BRUGGINK, INC.
Consulting Engineers
2020 Monroe Avenue N.W.
Grand Rapids, Michigan 49505-6298
Phone: (616) 363-9801 Web: www.mbce.com

FIELD SURVEY / DATE:	REGIS-10-25-17
DESIGNED BY:	--
DESIGN DRAWN BY:	FEF
CHECKED BY:	JFL
PLAN DATE:	11/1/2017
PROJECT NO.:	160190.01
SHEET NUMBER	1 OF 1

P:\160190.1 Visser - Robbins Road\CAD\DWG\160190_GIS BASE.dwg_3/6/2018 3:30:15 PM_LISA FRIZZELL