

VILLAGE OF GERMANTOWN
N112 W17001 MEQUON ROAD
GERMANTOWN, WI 53022

*****AMENDED*****

MEETING: **PUBLIC WORKS & HIGHWAY COMMITTEE**

DATE AND TIME: **WEDNESDAY, September 4th, 2019** *****6:00 P.M.*****

LOCATION: **Germantown Village Hall Board Room**

- I. **CALL TO ORDER:** This meeting has been given public notice in accordance with Wisconsin Statutes, Section 19.83 and 19.84 in such form that will apprise the general public and news media of subject matter that is intended for consideration and action.
- II. **ROLL CALL:** Chairman Kaminski, Trustees Hughes, Warren and Zabel
- III. **APPROVAL OF MINUTES:** August 7th, 2019
- IV. **PUBLIC COMMENT:** Please be advised per State Statute Section 19.84(2), information will be received from the public. It is the policy of this municipality that there be a three minute time period, per person, with time extensions per the Chief Presiding Officer's discretion; be further advised that there may be limited discussion on the information received, however, NO ACTION will be taken under public comments.
- V. **NEW BUSINESS:**
 - A. Tower #3 – Paint Color Scheme
 - B. Retaining Wall Quotes – N116 W16421 Main Street
 - C. Amy Belle Road – Right of Way Maintenance
 - D. Topsoil Removal – Wrenwood Subdivision
 - E. DPW Campus Stormwater Pollution Prevention Plan
 - F. Freistadt Road & Maple Road Intersection
 - G. 2020 Roadway CIP Recommendations
 - *** H. Drainage Ditches & Culvert Replacement
 - I. Development Handbook
- VI. **PROJECTS UPDATE:**
- VII. **NEXT MEETING DATE:** Set October, 2019 Meeting Date and Time
- VIII. **ANNOUNCEMENTS:**
- XI. **ADJOURNMENT:**

UPON REASONABLE NOTICE, efforts will be made to accommodate the needs of disabled individuals through appropriate aids and services. For additional information or to request this service please contact the Village Clerk at (262)250-4740 at least 2 days prior to the meeting.

*** Notice is given that a majority of the Village Board may attend this meeting to gather information about an agenda item over which they have decision making responsibility. This may constitute a meeting of the Village Board per State ex rel. Badke v. Greendale Village Board, even though the Village Board will not take formal action at this meeting.

PUBLIC WORKS & HIGHWAY COMMITTEE MEETING MINUTES

August 7, 2019
Village Hall Board Room

CALL: Chm. Kaminski called the meeting to order at 6:00 p.m.

ROLL CALL: Chm. Kaminski, Trustee Members Hughes, Warren (absent & excused) and Zabel. Also present were Dir. Ratayczak, Engr. Nitschke (absent and excused) and Secretary Wick.

APPROVAL OF MINUTES: **MOTION made by Zabel, seconded by Hughes to approve the Minutes of July 17th, 2019.**

Motion carried unanimously.

PUBLIC COMMENT: None

COUNTRY AIRE – MEQUON ROAD WATERMAIN EXTENSION & RELOCATION – RETAINER RELEASE:

MOTION made by Zabel, seconded by Hughes authorizing the release of the contract retainer for the Country Aire-Mequon Road Watermain Extension & Relocation to Mid-City Corporation in the total amount of \$8,164.80.

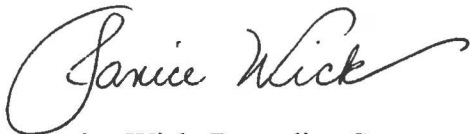
Motion carried unanimously.

PROJECTS UPDATE: Dir. Ratayczak provided the Committee with a list of Village projects with associated updates and answered questions.

NEXT MEETING DATE: The next Public Works and Highway Committee meeting will be held WEDNESDAY, September 4th, 2019 at 6:00 p.m.

ANNOUNCEMENTS: None.

ADJOURNMENT: There being no further business, the meeting was adjourned at 6:06 p.m.



Janice Wick, Recording Secretary

**BUSINESS OF THE PUBLIC WORKS & HIGHWAYS COMMITTEE
GERMANTOWN, WI**

MEETING DATE: Sept 4th, 2019

AGENDA ITEM: New Business

ITEM TITLE: Discussion and consideration for painting color and logo on Tower #3 on Mequon Rd.

SUBMITTED BY: Paul Haugen, Water Utility Superintendent

SUMMARY EXPLANATION:

The water utility would like to discuss and view consideration for the painting color scheme and logo for Tower #3 on Mequon Rd.

On the screen and in front of you we will look at various color views along with different font or logo styles.

ATTACHMENT: ORDINANCE ____ RESOLUTION ____ OTHER ____

RECOMMENDATION:

The Public Works Committee will determine the color scheme and Logo for Tower #3

COMMITTEE ACTION:

Proper parliamentary procedure to deny a request is to have a motion made in the affirmative and by voting NAY would deny the request if a majority vote.

**BUSINESS OF THE PUBLIC WORKS & HIGHWAYS COMMITTEE
GERMANTOWN, WI**

MEETING DATE: Wednesday September 4th, 2019

AGENDA ITEM: New Business

ITEM TITLE: Retaining Wall - Kaul Residence
N116 W16421 Main St.

SUBMITTED BY: Jay Olszewski, Highway Superintendent

SUMMARY EXPLANATION:

Staff is presenting pricing it obtained from local landscapers for the removal and replacement of a retaining wall at N116 W16421 Main St. The results are as follows:

TLC	\$4,650
Creek View Landscape	TBD
Wendland Nursery	TBD
David J Frank	TBD

ATTACHMENT: ORDINANCE _____ RESOLUTION _____ OTHER _____

RECOMMENDATION:

Staff will follow Committee's direction regarding this project.

COMMITTEE ACTION:

Proper parliamentary procedure to deny a request is to have a motion made in the affirmative and by voting NAY would deny the request if a majority vote.

**BUSINESS OF THE PUBLIC WORKS & HIGHWAYS COMMITTEE
GERMANTOWN, WI**

MEETING DATE: Wednesday September 4th, 2019

AGENDA ITEM: New Business

ITEM TITLE: Maintenance Amy Belle Road-
Drainage Concern - Rims Edge Orchard

SUBMITTED BY: Jay Olszewski, Highway Superintendent

SUMMARY EXPLANATION:

Staff is requesting direction on maintenance responsibilities within the right of way of Amy Belle Drive from Willow Creek road north to Appleton Ave. Amy Belle is a boarder road. West side residents are in the Village of Richfield east side Village of Germantown. Historically this road and the adjacent right of way has been maintained by the Village of Richfield, regardless of residency. Recently there has been some question as it relates to maintenance responsibilities. Staff has attempted many times to find records or documentation detailing the agreement between Richfield and Germantown. Nothing has ever been located. The same situation exists on Wasaukee Road from Freistadt to south of Trillium Way. In this situation the Village maintains the road and right of way even though the east side of Wasuakee is occupied by Mequon residents.

Currently there is a request for ditch maintenance on the east side of Amy Belle. The owners of Rims Edge Apple Orchard have a drainage situation that requires attention as determined by Village Engineering staff. Staff is requesting guidance on how to proceed with this request. In addition, staff is asking for direction regarding any future maintenance requests.

ATTACHMENT: ORDINANCE_____ RESOLUTION_____ OTHER_____

RECOMMENDATION:

Staff will follow Committee's direction regarding this situation.

COMMITTEE ACTION:

Proper parliamentary procedure to deny a request is to have a motion made in the affirmative and by voting NAY would deny the request if a majority vote.

**BUSINESS OF THE PUBLIC WORKS & HIGHWAYS COMMITTEE
GERMANTOWN, WI**

MEETING DATE: September 4, 2019

AGENDA ITEM: New Business

ITEM TITLE: Remove Excess Topsoil / Wrenwood Development

SUBMITTED BY: Lawrence W Ratayczak, P.E., Director of Public Works

SUMMARY EXPLANATION:

Pursuant to Village of Germantown Municipal Code Section 17.441 (Protection of Topsoil Resource) Steve DeCleene of the Neumann Companies, Developer of the Wrenwood Subd., has submitted a request to remove 36,000 cubic yards of excess topsoil from the project site. Total calculated topsoil volume is 68,000 CY with topsoil to be replaced of 32,000 CY and the request is to remove the balance of 36,000 CY. Soil Borings indicate 12 inches of topsoil across the development site.

ATTACHMENT: ORDINANCE____ RESOLUTION____ OTHER ____

RECOMMENDATION:

Staff recommends approval by the Public Works & Highway Committee for the Request by Neumann Companies to remove 36,000 cubic yards of excess topsoil.

COMMITTEE ACTION:

Proper parliamentary procedure to deny a request is to have a motion made in the affirmative and by voting NAY would deny the request if a majority vote.

**BUSINESS OF THE PUBLIC WORKS AND HIGHWAY COMMITTEE
GERMANTOWN, WI**

MEETING DATE: September 4, 2019

AGENDA ITEM: New Business

ITEM TITLE: Discussion and possible action regarding the DPW Campus Storm Water Pollution Prevention Plan

SUBMITTED BY: Eric Nitschke, P.E., Village Engineer

EN

SUMMARY EXPLANATION:

On April 18, 2019, WisDNR issued a Notice of Violation (NOV) for illicit discharges that were occurring at the Department of Public Works (DPW) campus. As part of the efforts to address the NOV, a Storm Water Pollution Prevention Plan (SWPPP) was submitted to WisDNR on August 1, 2019. WisDNR reviewed the SWPPP and provided no recommended changes. WisDNR indicated that there would be future annual audits to verify adherence to the SWPPP. Therefore, it is requested that the Public Works and Highway Committee formally approve the use of the updated DPW Campus SWPPP.

ATTACHMENT: ORDINANCE____ RESOLUTION____ OTHER X

Germantown's DPW Campus SWPPP

RECOMMENDATION:

Staff recommends that the Public Works and Highway Committee and Village Board approve the use of the revised DPW Campus SWPPP.

COMMITTEE ACTION:

Proper parliamentary procedure to deny a request is to have a motion made in the affirmative and by voting NAY would deny the request if a majority vote.

Village of Germantown

Facility Name:

DPW Campus

Facility Address:

N122 W17177 Fond du Lac Ave

7/31/2019

Storm Water Pollution Prevention Plan

Authored by: Lauren Justus

Revised by: Eric Nitschke

Date: December 31, 2008

Date: July 31, 2019

1. STORM WATER POLLUTION PREVENTION PLAN (SWPPP) OVERVIEW

This Storm Water Pollution Prevention Plan:

- Identifies the SWPPP team with a description of the team's duties;
- Describes the facility, with information on location and activities, a site map, and a description of the storm water drainage system;
- Identifies potential storm water contaminants;
- Describes storm water management controls and various Best Management Practices (BMP's) needed to reduce pollutants in storm water discharges;
- Describes the facility's monitoring plan; and
- Describes the implementation schedule and provisions for amendment of the plan.

2. PLANNING AND ORGANIZATION

SWPPP Coordinator and Team

Team Leader: Public Works Director

Office Phone: (262) 250-4721

Name: Lawrence Ratayczak, P.E.

Responsibilities: Oversight of the Public Works Garage SWPPP. Responsible for SWPPP updates and implementation. Keeps all records and ensures reports are submitted as required.

Assistant Team Leader: Village Engineer

Office Phone: (262) 250-4724

Name: Eric Nitschke, P.E.

Responsibilities: Assist the team leader in managing the SWPPP.

Illicit Discharge Inspector: Project Engineer

Office Phone: (262) 250-4723

Name: Ryan Ehlerding

Responsibilities: Manages the sampling program.

Operations Manager: Superintendent of Streets

Office Phone: (414) 745-8243

Title: Jay Olszewski

Responsibilities: Implement the preventative maintenance and operations program. Oversee housekeeping activities. Coordinate and implement employee training programs and facility inspections. Serve as the spill response coordinator.

3. ASSESSMENT

Site Description and Map

The facility is the Village of Germantown Department of Public Works (DPW) Campus, which is located at N122 W17177 Fond du Lac Avenue with additional properties located across Division Rd. The total area for both sites is 9.32 acres. The buildings located on these properties are listed below:

- Main office for DPW employees, building 1, with attached mechanics garage.
- 6 – Storage buildings, building 2 to 7, for various departments' equipment. Building 2 contains a vehicle wash area.
- Dome for salt storage.
- Small building housing communication equipment with tower.

The vehicle fueling bay is next to building 1. The outfalls for storm water are shown on the site map attached in Appendix A. Also attached in Appendix B are the equipment lists for each department and storage area.

Material Inventory

Materials used at the DPW Campus that are exposed to storm water runoff are listed in Appendix C.

Vehicle Wash Water and Wastewater

Vehicle washing currently takes place inside building 2. Wash water then drains to an internal catch basin and out to the Division Road ditch. The catch basin outlet is to be capped to eliminate any discharge from the building. Wash water will be pumped to a portable tank and discharged to the sanitary system. Also, DPW staff have been instructed to wash all equipment and vehicles inside building 2. Appendix K provides a complete summary of equipment and vehicle washing operations.

Salt Storage

The Village salt piles are enclosed by a dome located at the southwest corner of Division Road and Fond du Lac Avenue. This prevents exposure to precipitation at all times during storage.

Spills and Leaks

There is a history of illicit discharges at the DPW Campus. Most recently, a discharge was self-reported to WisDNR in November of 2018. The Germantown Village Board has directed staff resources to address the illicit discharge problems. Additionally, \$50,000 in emergency funds were allocated by the Village Board in May of 2019 to implement additional BMP's.

Non-Storm Water Discharges

The outfall pipes discharging to Division Road ditch will remain in the annual Illicit Discharge Detection & Elimination screening of major outfalls. The test parameter will be as follows.

- pH
- Detergents
- Total Residual Chlorine
- Phenols
- Total Copper

Allowable Non-Storm Water Discharges

All allowable non-storm water discharges are identified as follows.

- Water line flushing
- Potable water discharge
- Compressor condensate
- Irrigation drainage
- Landscape irrigation
- Lawn watering
- Pavement washing without detergents
- Exterior building washing without detergents
- Uncontaminated groundwater infiltration
- Uncontaminated pumped groundwater
- Foundation Drains
- Air conditioning condensate
- Fire fighting

Existing Storm Water Monitoring Data

Monitoring of this outfall will be completed in 2019 as part of the major outfall inspection and sampling.

Site Summary (of Pollution Sources)

Potential sources of storm water pollution are attached in Appendix E. The list includes areas, activities, and materials that could pose a threat to storm water.

4. IMPLEMENTATION

This section describes practices that are in place or that will be implemented to control pollutants that have the potential to contaminate storm water.

Good Housekeeping

The following is a list of good housekeeping practices followed at the DPW Campus:

- Discontinue the use of detergents & degreasers when washing equipment and vehicles.
- Spills are immediately cleaned up with an absorbent. (See Spill Prevention and Response Procedures Section Below)
- All fluid products and wastes are kept indoors.
- Waste oil drums are stored in mechanics garage (Building 1).
- Used antifreeze is kept in a covered container.
- All changing of fluids is done indoors in the maintenance garage.
- Spillages occurring during addition or removal from salt storage piles or sand pile mixing are promptly cleaned up.
- Liquid and dry material storage is located indoors with proper containment and separation of potentially volatile materials.
- Spigots/funnels will be used to minimize drips and leaks.
- Drip pans are used when changing fluids.
- Above ground tanks have secondary containment.

Preventive Maintenance

The following is a list of preventive maintenance procedures practiced at the DPW Campus:

- There is a written spill prevention and response policy.
- All staff are aware of spill prevention and response procedures
- Spill response equipment is located at all potential spill areas.
- All transfers to and from the tank are observed by qualified personnel trained in spill response procedures.
- Catch basins and sediment chambers are checked and cleaned annually.
- Drainage swales are kept clear.
- Underground storage tank filling areas are inspected monthly for signs of spills.
- Hydraulic equipment is kept in good repair to prevent leaks.
- Fueling areas are inspected monthly for signs of spills or leaks. Hoses and fittings are also a part of the monthly inspections.
- All materials, waste storage areas, drains, tanks and cans are properly labeled.
- Above ground storage tanks are regularly inspected for signs of corrosion or leaks.

Best Management Practices (BMP's)

The following management practices for runoff are used at the DPW Campus.

- Drainage outfalls discharge to riprap pads.
- Impervious runoff from the site discharges to vegetative ditches.

Sediment and Erosion Control

Below is a list of measures to prevent erosion.

- Management practices to prevent erosion.
 - Seed non vegetated areas as needed.
 - Riprap at storm sewer discharge points.

Management of Storm Water Runoff

The following management practices for runoff are used at the DPW Campus.

- Drainage outfalls discharge to riprap pads.
- Runoff from the site drains to vegetated ditches.

Spill Prevention and Response

Attached in Appendix F is a copy of the Spill Prevention and Response Procedures for tanks, fuel pumps, or hazardous materials.

Employee Training

The topics below will be covered at employee training sessions. All Public Works Employees stationed at the Public Works Garage will be trained annually. Attached in Appendix G is a sample form that will track attendance by employees and topics covered during training session.

- Spill Prevention and Response
- Good Housekeeping
- Materials Management Practices

5. EVALUATION

Quarterly Visual Monitoring

Every three months (quarterly) visual inspections of the storm water outfalls will be completed. These inspections will be completed during day light hours and within 30 minutes after storm water begins to runoff. Contaminations or problems will be documented with the date and time. The source shall be determined and action shall be taken to eliminate the problem. See Appendix H for a sample log.

Annual Site Inspection

An annual inspection of the entire site will be completed. This inspection will include evaluating BMPs, looking for evidence of pollution, and equipment inspection. The site inspection report will include date of inspection, name of personnel conducting the inspection, observations, assessment of BMPs, corrective actions taken, and a signed certification. See Appendix I for annual site inspection form.

Recordkeeping and Reporting

Records described in this report shall be kept on site for 5 years. These reports shall be made available to Wisconsin Department of Natural Resources (WDNR) upon request.

Plan Revisions

If the DPW Campus expands its operations, or changes any significant material handling or storage practices which could impact storm water, this SWPPP will be amended. The amended SWPPP will describe the new activities that contribute to increased pollution and planned control measures.

This SWPPP will also be amended if WDNR determines that it is not effective in controlling storm water pollutants discharged to waterways.

6. ENDANGERED SPECIES

The WDNR Bureau of Endangered Resources map for Washington County shows no aquatic or terrestrial occurrences at the DPW Campus, see Appendix J.

7. HISTORIC PLACES

No historic site is listed or registered on this property per www.nr.nps.gov.

8. CERTIFICATIONS

This Storm Water Pollution Prevention Plan has been prepared in accordance with good engineering practices. The information in this SWPPP, to the best of my knowledge, is accurate and complete. Further, this SWPPP was adapted by the Germantown Village Board by Resolution No. _____ on _____, 2019.

Author:

X  June 7, 2019

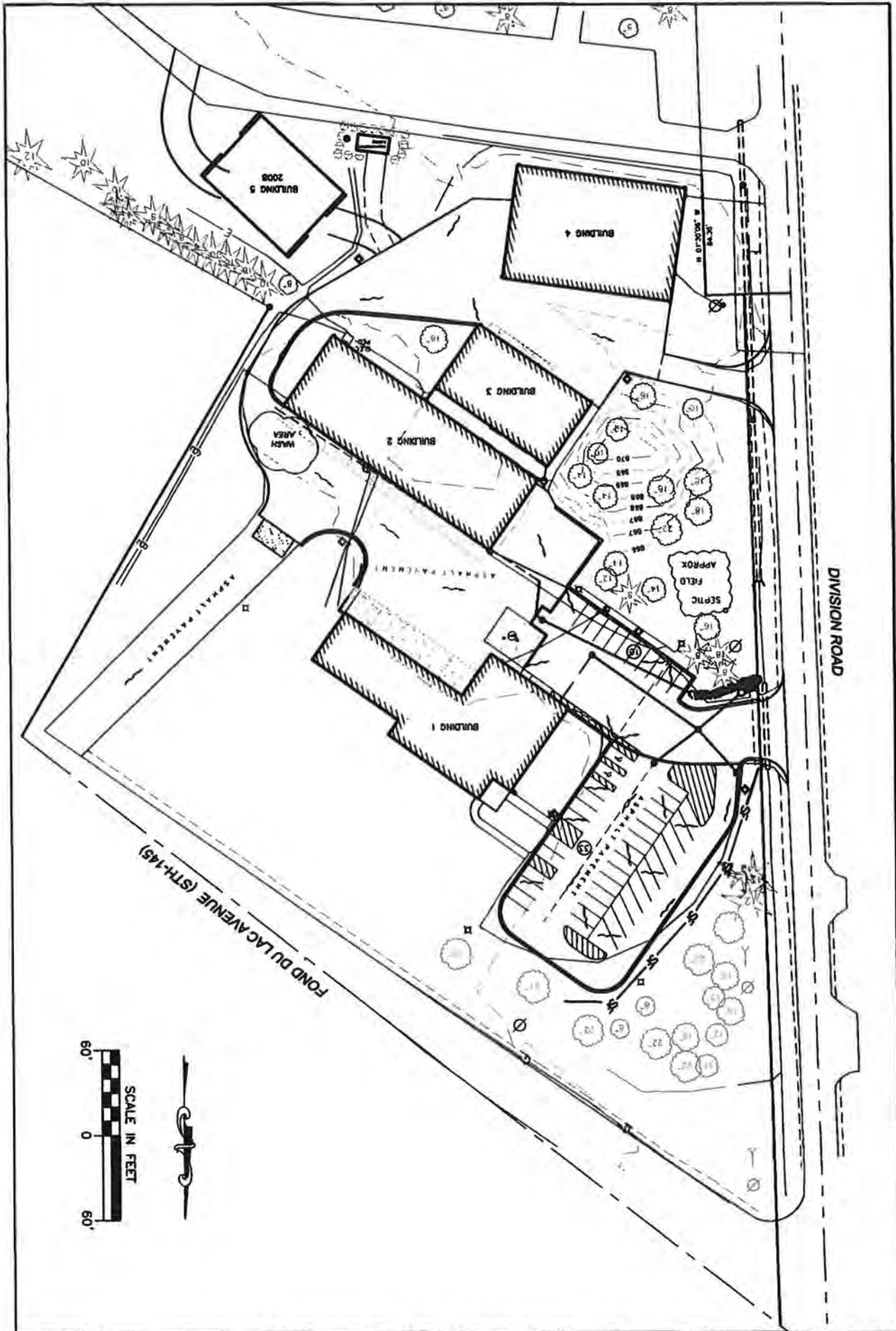
Eric Nitschke, P.E.

Date: June 7, 2019

Village Engineer

APPENDIX A

SITE MAP



		STORM WATER POLLUTION PREVENTION PLAN SITE MAP VILLAGE OF GERMANTOWN, WI		DESIGNED BY: _____ DATE: _____ DRAWN BY: _____ DATE: _____ APPROVED BY: _____ DATE: _____ CHECKED BY: _____ DATE: _____ REVISION: _____ DATE: _____ BY: _____
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SW Corner of Division Rd & Fond du Lac Ave



APPENDIX B

EQUIPMENT LIST

Asset List

Administrator: 5/22/2019

Asset ID	Description	Budget
FIRE		
1740	2016 Ford Explorer	FIRE
1741	2013 Chevy Caprice	FIRE
1752	2011 INT'L 4300 SBA	FIRE
1754	2017 Ford F450	FIRE
1756	2017 Ford F450	FIRE
1760	2007 Pierce Dash	FIRE
1762	2015 PIERCE VELOCITY PUMPER	FIRE
1764	2011 PIERCE	FIRE
1771	2001 PIERCE AERIAL PUMPER	FIRE
1771A	NP 75 Generator	FIRE
1785	2013 2500HD Chevy	FIRE
1790	1994 FREIGHTLINER FL70	FIRE
HIGHWAY		
0001	1990 JOHN DEERE 624 LOADER	HIGHWAY
0001A	1991 KLAUER BLOWER	HIGHWAY
0009	1985 CLARK 55C LOADER	HIGHWAY
0010	1998 WACKER 1550AW PLATE	HIGHWAY
0011	1989 CASE 580K BACKHOE LOADER	HIGHWAY
0013	1974 HYSTER RUBBER TIRE ROLLER	HIGHWAY
0014	HONDA GENERATOR	HIGHWAY
0015	1999 CASE 621C LOADER	HIGHWAY
0015A	1980 KLAUER VP3D BLOWER	HIGHWAY
0016	2013 WP 1550 AW Plate compactor	HIGHWAY
0018	1998 WARNING SIGNAL TRAILER	HIGHWAY
0018A	1998 WARNING SIGNAL TRAILER	HIGHWAY
0021	2008 DIAMOND CONCRETE SAW	HIGHWAY
0022	1991 AGRIMETAL BAIL CHOPPER	HIGHWAY
0023	2014 Crafc0 SS125D Crack Filler	HIGHWAY
0024	1996 I-RAND P-185 AIR COMP	HIGHWAY
0028	1996 WINPOWER 7500W GENERATOR	HIGHWAY
0029	FEDERAL MOBILE ARROW BOARD	HIGHWAY
0033	2014 CRAFTCO ROUTER	HIGHWAY
0035	2014 TRITON POWERLINER	HIGHWAY
0036	MORSPEED 3 1/2 CEMENT MIXER	HIGHWAY
0037	2004 Spaulding RMV Hot Patcher	HIGHWAY
0047	HOMELITE 4800 GENERATOR	HIGHWAY
0048	WINCO K1600 GENERATOR	HIGHWAY
0049	1999 GENERAC 80/40KW GENERATOR	HIGHWAY
0051A	TR60 Worksite Pro	HIGHWAY
0054	2012 JOHN DEERE 6430	HIGHWAY
0055	12,000LBS LIFT	HIGHWAY
0056	SEFAC TRUCK LIFT	HIGHWAY
0058	2002 LIEBHERR A904	HIGHWAY

#1 = GARAGE #1
 #2 = GARAGE #2
 #2U = GARAGE #2 UTILITY SIDE
 #3 = CRACK CR. #3
 #4 = GARAGE #4
 #5 = GARAGE #5
 R.C. = RECYCLING.
 OUT = OUTSIDE
 STATION #1 = OLD

FIRE STATION
 #1 PARK AVE.

R.C.

#3

C.S.

#3

C.S.

C.S.

#2

#5

#3

#3

OUT

OUT

#5

C.S.

#5

#5

OUT

#5

#5

#5

C.S.

#2

#2

#2

?

C.S.

#5

#1

#1

#2

Asset List

2

Administrator: 5/22/2019

0058A	ROTOBEC GRAPLE	HIGHWAY # 2
0058B	POWERTILT QUICK LATCH	HIGHWAY # 2
0059	LANDA PRESSURE WASHER	HIGHWAY # 2
0063	TOYOTA 6,000 LBS FORKLIFT	HIGHWAY # 1
0065	MANITOWOC 12000 LBS LIFT	HIGHWAY # 1
0066	2004 PACE AMERICA CARGO TRAILER	HIGHWAY OUT
0077	2012 John Deere 644K	HIGHWAY # 5
0082	2012 WACKER ROLLER RD27-120	HIGHWAY # 5
0083	2014 SCOTCHMAN IRONWORKER	HIGHWAY # 1
0085	2016 Vermeer BC1500 Chipper	HIGHWAY # 4
0086	2016 John Deere 5075M	HIGHWAY # 3
0089	2017 Kubota SVL75	HIGHWAY # 3
0089A	2017 Blue Diamond Cold Planer	HIGHWAY # 3
0089B	Schulte Multirake SMR-800	HIGHWAY C.S.
0089C	EDGE AUGER DRIVE	HIGHWAY # 3
0089D	Boss 10' box plow	HIGHWAY C.S.
0089E	Lowe grapple G72A	HIGHWAY # 3
0109	2014 FALCON SINGLE AXLE TRAILER	HIGHWAY OUT
0110	2017 TOWMASTER T-12DT	HIGHWAY OUT
0111	2018 Towmaster T-40TA	HIGHWAY OUT
0202	2010 Crown Vic	HIGHWAY OUT
0204	2011 FORD CROWN VIC	HIGHWAY OUT
0407	2009 GMC 5500	HIGHWAY # 4
0408	2007 CHEVY C5500	HIGHWAY # 5
0414	1987 FORD 7000 Flat Bed	HIGHWAY # 5
0416	1988 OSHKOSH P2526 4X4 W/PLOW	HIGHWAY # 5
0418	1995 F350 4 DOOR	HIGHWAY # 4
0420	2012 GMC 3500	HIGHWAY # 4
0421	2012 CHEVY 2500 EXT CAB	HIGHWAY # 4
0422	2013 Chevrolet 3500	HIGHWAY # 4
0423	2013 Chevrolet 2500 ext cab	HIGHWAY # 4
0424	2015 GMC 3500	HIGHWAY # 4
0428	2018 Chevrolet 2500 4wd	HIGHWAY OUT
0431	1978 INT'L 1600 JETTER	HIGHWAY # 2
0431A	1978 FORD BEAN JETTER	HIGHWAY # 2
0437	2004 GMC2500 excab	HIGHWAY # 4
0439	1999 GMC 2500 4X4 W/PLOW	HIGHWAY # 1
0448	2003 320 PETRBILT	HIGHWAY # 2
0448A	VAC/ALL SWEEPER	HIGHWAY # 2
0463	1997 FORD L8000 DUMP W/PLOW	HIGHWAY # 2
0466	2002 INT'L 2654 DUMP W/PLOW	HIGHWAY # 2
0467	2003 INT'L 7400 DUMP W/PLOW	HIGHWAY # 2
0468	2004 INTERNATIONAL 4700	HIGHWAY # 2
0469	2006 INTERNATIONAL 7500	HIGHWAY # 2
0470	2008 INT'L 7500 DUMP W PLOW	HIGHWAY # 2
0471	2009 INT'L 7500 DUMP W PLOW	HIGHWAY # 2

Administrator: 5/22/2019

0472	2011 INT'L 7500 DUMP W PLOW	HIGHWAY #2
0473	2013 INT'L 7400 TANDEM DUMP	HIGHWAY #3
0474	2013 INT'L 7400 DUMP W PLOW	HIGHWAY #2
0475	2015 WESTERN STAR 4700	HIGHWAY #3
0476	2016 WESTERN STAR 4700	HIGHWAY #3
0477	2017 WESTERN STAR 4700 Tandem	HIGHWAY #3
0478	2017 WESTERN STAR 4700	HIGHWAY #3
0479	2018 WESTERN STAR 4700	HIGHWAY OUT
0480	2019 Western star 4700 SF	HIGHWAY #3
0481	2019 Western Star 4700SF	HIGHWAY #3
0755	1980 CHEVY 3500 BOX VAN	HIGHWAY #5

PARKS

0003A	TRACKLESS B3 BLOWER	PARKS #4
0051	2000 JOHN DEERE SKID LOADER	PARKS #4
0064	2005 TRACKLESS MT5T	PARKS #4
0070	John Deere 855	PARKS #4
0071	John Deere 1445	PARKS #4
0073	2010 Trackless	PARKS #4
0074	997 John Deere 72"	PARKS #4
0075	997 John Deere 72"	PARKS #4
0076	997 John Deere 60"	PARKS #4
0078	2013 Kubota ZD326P-60	PARKS #4
0079	2013 Kubota ZD326P-60	PARKS #4
0084	2015 MacLean MV4	PARKS #4
0087	2017 Kubota ZD1211R	PARKS #4
0088	2017 Kubota ZD1211R	PARKS #4
0101	1991 CHILTON TRAILER 6000 LBS	PARKS #4 OUT
0102	1991 HOLDEN 4 TON TANDEM	PARKS OUT
0103	1994 FELLING FT7W TANDEM TRAILER	PARKS OUT
0104	1996 FELLING FT10W TANDEM	PARKS OUT
0105	2000 FT-10LE TANDEM TRAILER	PARKS OUT
0108	2013 18 FT PJ TRAILER	PARKS OUT
0301	2003 F450 FORD	PARKS #4
0302	2006 2500 HD EXT CAB	PARKS #4
0313	2008 GMC CANYON	PARKS #4
0406	2001 GMC 2500 4X4	PARKS #4
0409	1989 CHEVY 3500 DUMP	PARKS #3
0425	2016 DODGE RAM 5500	PARKS #4
0426	2017 Chevrolet 2500 4wd	PARKS #4
0427	2018 Chevrolet 2500 4wd	PARKS #4
0435	2004 CHEVY 2500 HD ext. cab	PARKS #4
0436	2002 CHEVY 2500	PARKS #4
MOWER#8	JOHN DEERE 777 MAX FRAME Z-TRAK	PARKS #4

SEWER

0006	2000 CATERPILLAR XQ225	SEWER #20 STATION 1
0026	CH&E 6" WATER PUMP	SEWER #20

Asset List

4

Administrator: 5/22/2019

0039	1998 WACKER 6" WATER PUMP	SEWER # 2 U
0040	1999 PACE 12' ENCLOSED TRAILER	SEWER Rwy.
0041	1999 HONDA GENERATOR	SEWER # 2 U
0043	Toro Power Max 824OE snowblower	SEWER # 20 Rwy.
0044	1999 WACKER 4" PUMP	SEWER Rwy.
0045	1998 WACKER 4" PUMP	SEWER Rwy.
0046	1998 WACKER 4" PUMP	SEWER Rwy.
0072	1999 7000 lbs Enclosed Trailer	SEWER # 2 U
0080	2013 TAKEUCHI TB153FR	SEWER # 5
0090	2017 Revolver Screener	SEWER Rwy.
0106	2003 12,000 LBS DUMP TRAILER	SEWER Rwy.
0107	2007 14,000 LBS GOOSE NECK TRAILER	SEWER OUT
0550	2017 Chevrolet 3500 4wd	SEWER # 20 OUT
0551	2004 GMC 2500 EX CAB 4X4	SEWER # 2 U
0552	2006 PETERBILT	SEWER # 2 U
0553	2002 3500 GMC VAN	SEWER # 2 U
0554	2006 GMC 3500	SEWER # 2 U
0555	2009 GMC 2500	SEWER # 2 U

SEWER/WATER

0004	2004 CAT 430D BACKHOE LOADER	SEWER/WATER # 2 U
0011A	1992 TRAMAC 125 CONCRETE	SEWER/WATER C.S.
0503	2005 CHEVY EXPRESS VAN	SEWER/WATER # 2 U

WATER

0038	1999 PACE 20' ENCLOSED TRAILER	WATER # 2 U
0042	1999 WACKER GENERATOR	WATER # 2 U
0060	2003 REX VALVE TURNER	WATER # 2 U
0062	10 Foot Trailer	WATER # 2 U
0068	vacuum valve turner	WATER # 2 U
0432	2001 FORD F350 W/UTILITY BOX	WATER # 2 U
0440	2001 GMC 2500 W/VPLOW	WATER # 2 U
0502	2005 GMC 2500 EXT. CAB 4X4	WATER # 2 U
0504	2012 CHEVY 3500	WATER # 2 U
0505	2015 GMC 2500 Sierra Double Cab	WATER OUT
0506	2017 Chevrolet 2500 4wd	WATER # 2 U
0507	2018 Chevrolet 2500 4wd	WATER # 2 U
0508	2019 Chevrolet 2500 4wd	WATER # 2 U
0510	2006 Freightliner Quad Axle	WATER OUT

APPENDIX C

MATERIAL INVENTORY

MATERIAL INVENTORY

MATERIAL	ACTIVITY/USE	QUANTITY STORED	POLLUTANT	LIKELIHOOD OF STORM WATER CONTACT	COMMENTS
Diesel Fuel	Vehicle Fueling		Oil Sheen	High	Spill Absorbants Available.
Diesel Fuel	Storage	2,000 Gallons Below Ground	Oil Sheen	Low	
Motor Oil	Storage	+/- 250 Gallons	Oil Sheen	Low	Stored Inside
Waste Oil	Storage	500 Gallons	Oil Sheen	Low	Stored Inside
Hydraulic Fluid	Storage	+/- 100 Gallons	Oil Sheen	Low	Stored Inside
Radiator Coolant	Storage	+/- 100 Gallons	Oil Sheen	Low	Stored Inside
Other Vehicle Fluids	Storage		Oil Sheen	Low	Stored Inside
Vehicles/Equipment	Washing	Blu Ox - 50 Gallon	Salt, Grease, Oils, Detergent	Low - Building 2	Implemented in 2019
Vehicles/Equipment	Storage		engine oil, hydraulic fluid	Medium- small leaks, drips	repair leaks and use absorbent pads
Fertilizer	Storage			Low	Stored Inside NR151 Compliant
Pesticides	Storage	Mimimal		Low	Store Inside
Scrap Metal	Storage		Debris	High	Cover with Tarp
Dumpsters	Waste Disposal	6 yards	Debris	Low	Covered
Paint	Storage	+/- 50 Gallons	Paint	Low	Stored Inside
Used Tires	Storage	10 to 15		High	Stored Inside
Salt Storage Pile(s)	Storage	+/- 2,000 Tons	Salt	Low	Enclosed

APPENDIX D

SIGNIFICANT SPILLS

LIST OF SIGNIFICANT SPILLS

There have been no significant spills or chronic leaks at the DPW Campus in the past 3 years.

APPENDIX E

SITE SUMMARY POLLUTION SOURCES

APPENDIX E
SITE SUMMARY
POLLUTION SOURCES

ACTIVITY	POLLUTANT	CURRENT PRACTICE	FUTURE PRACTICE
Sand storage for mixing mortar	sand	store outside	store inside in bins

APPENDIX F

SPILL PREVENTION AND RESPONSE

TANKS, FUEL PUMPS, AND HAZARDOUS MATERIALS

The Village of Germantown DPW Campus has two diesel fuel pumps, a waste oil tank, and underground diesel fuel tank, and various hazardous materials. The underground fuel tank is continuously monitored by an electrical monitoring system. The fueling station is inspected often and all emergency shut off points are clearly marked. Minor spills are absorbed with a loose material as they occur. In the event of a substantial spill or a spill of a hazardous material the spill is cordoned off and contained as best as possible. The Germantown Fire Department will be notified immediately of the spill.

WRITTEN SPILL PREVENTION AND RESPONSE PROCEDURE

The Village of Germantown recognizes that spills in the workplace can cause hazards from slips and falls, exposure to spilled materials, and accidental release into the environment. For these reasons the Village uses proper storage, handling, and this spill response plan.

MSDS sheets are posted in specific areas of the DPW campus and employees are aware of these locations. Employees are expected to wear appropriate PPE for the specific spill that may occur. Minimal spills are simply cleaned up by the employee as described by the MSDS sheet. If the spill is substantial or is a volatile substance the spill shall be reported to the appropriate supervisor immediately.

Spills that are minor in nature are commonly cleaned up immediately. Products used to attend to the spill shall be compatible to the material spilled. Oil dry products are commonly used for spills and leaks that are minor in nature. The saturated materials (rags, towels, oil dry, etc.) are brushed into a dustpan and disposed of into a metal garbage can or dumpster. Rags and towels are placed in a double plastic bag and disposed of according to the MSDS.

Hazardous materials that may be spilled or spills that are greater than 2 gallons shall be reported to a Supervisor IMMEDIATELY. These spills shall be contained with absorbent materials on hand (sand, oil dry, etc.). The absorbent material shall be spread from the outside of the spill and work the loose material toward the inside of the spill to reduce splashing or spreading. The spill area shall be cordoned off and protected to prevent further access and potential exposure. If an employee is exposed to a spilled material, use an emergency eye wash station or shower. If the area is enclosed get to a well ventilated area and seek medical attention if necessary. Spills of this size may require the assistance of the Germantown Fire Department. Once the spill is contained the used absorbent material will be vacuum swept with the Village's truck mounted vacuum sweeper and disposed of at a proper land fill site.

In order to prevent spills good storage techniques are used. Materials are kept in a proper container and in a sheltered area. Materials are stored indoors and away from exterior doors and sewer drains. Absorbent covers are placed on top of drums to help absorb minor spills. Containers are properly labeled and checked for leaks periodically. Equipment and dispensing areas are checked and cleaned regularly.

This spill prevention and response plan is a guide for all employees. Good housekeeping and common sense are ALWAYS required when performing any job task. If an employee has a question regarding this or any situation he or she should consult their immediate supervisor.

APPENDIX G

EMPLOYEE TRAINING LOG

EMPLOYEE TRAINING LOG

DATE: _____

TIME: _____

INSTRUCTOR(S): _____

TOPIC(S) COVERED: _____

ATTENDEES:

[illegible]

APPENDIX H

QUARTERLY MONITORING LOG

QUARTERLY MONITORING LOG

DATE: _____

TIME: _____

INSPECTOR: _____

WEATHER CONDITIONS: _____

[illegible]

APPENDIX I

ANNUAL SITE INSPECTION

ANNUAL SITE INSPECTION

DATE: _____ TIME: _____

INSPECTOR: _____

WEATHER CONDITIONS: _____

BMP EVALUATION

--

EVIDENCE OF POLLUTION

--

EQUIPMENT EVALUATION

--

OTHER OBSERVATIONS

--

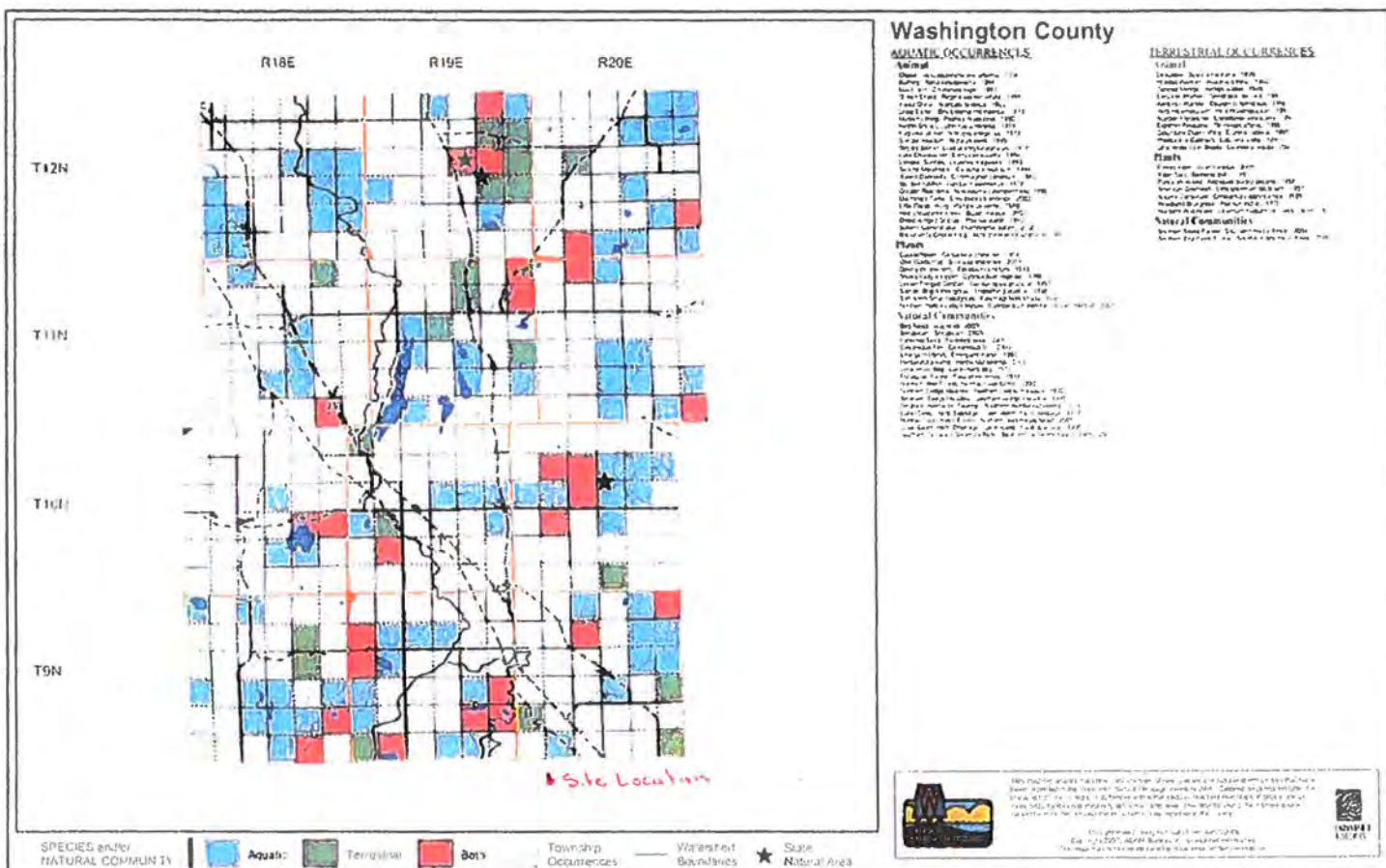
CORRECTIVE ACTIONS TAKEN

--

SIGNATURE OF
INSPECTOR _____

APPENDIX J

ENDANGERED RESOURCES MAP



APPENDIX K

WASH BAY OPERATION

SUMMARY OF WASH BAY EVALUATION & MODIFICATIONS

AT THE

DEPARTMENT OF PUBLIC WORKS FACILITY

Recap of Initial MS4 Permit Test Results which initiated the Notice of Violation (NOV):

Violations were for:

-Detergent = 1.5 mg/L

-Ammonia = 0.8 mg/L

-Phenols = 0.2 mg/L

Existing Conditions at the time of Initial Discharge Testing:

The configuration of the wash bay at the time the initial testing was performed included a detergent siphoned by the pressure washer and a separate foaming degreaser. Village staff attempted to determine the chemical make up of the two washing agents with limited success. The success was limited due to the term "detergent" not having a specific chemical composition.

In the Village's efforts to meet the discharge requirements, staff met with distributors of detergents and degreasers. This was performed in an attempt to continue with a detergent for the washing process and not modifying the discharge configuration. The two washing additives were also bench tested with the MS4 test reactive agents which determined that the degreaser was high in ammonia.

In addition, during the investigation of all components of the wash bay, staff evaluated the entire drain system which included the catch basin and the outfall of the buildings trench drain into the catch basin. Village staff determined that the catch basin piping had been altered by the removal of the 90-degree bend on the catch basin's discharge pipe. *See picture below for Drain Catch Basin with 90 Degree Bend Reinstalled.*



Modification attempts to utilize alternate detergents and no degreaser:

One of the Village's suppliers recommended a soap and degreaser that was advertised to be environmentally friendly. The alternate detergent and degreaser were placed in service to test the effluent at the same test location that recorded the initial high levels of detergent and ammonia. The levels were reduced by as much as 50% but ammonia remained in excess of the discharge limits. See test results below pictures. At this point Village staff did not have any additional materials to investigate. See pictures below showing Wash Bay Alternate Detergent and no Degreaser.



Test Results with alternative detergent

Initial Test: MS4 Test Results: Detergent = 0.5-0.75 mg/L (2 tests) // Ammonia = 0.2-0.2 mg/L (2 tests)

Scheduled Test: MS4 Test Results; Detergent = 0.75 mg/L // Ammonia = 0.4 mg/L

Results remain exceeding suggested limits

Review of Modification Options to Wash Bay to meet Discharge Standards:

Village staff reviewed all remaining alternatives; 1) continue the use of the wash bay without use of detergents and degreasers, 2) continue use of detergent & degreaser and discontinue outfall to roadside ditch with flow redirected to a storage tank or 3) discontinue use of wash bay. Staff's evaluation concluded that it was important to wash the equipment in some manner. The Village has reviewed the three (3) options listed above and has selected No. 2 for future operations. See below for a detailed description of each elected option for final review and consideration.

OPTION NO. 1 (Discontinue the use of detergents & degreasers)

Option No. 1 would utilize washing with clear water utilizing the pressure washer. In addition, with the catch basin reestablished to State Plumbing Code, the corrected piping is now trapping the grease/oils.

The detergents and degreaser materials would be removed from use. To guarantee the discontinued use of detergents and degreasers, the equipment to siphon the detergents and degreaser materials have either been removed or will be removed.

Included in this alternative is the direction to all staff that equipment can ONLY BE WASHED within the building wash area, no washing of equipment outside the building will be tolerated.

In addition, a sign would be made on a reflective white background stating rules for the use of the wash bay. All staff have been instructed on the new rules. The sign will be hung on the wall located by the pressure washing equipment.

OPTION NO. 2 (Discharge to Portable Tank) – Completed July 25, 2019

Overall Description of Storage & Transport System

This option would involve capping the outfall pipe from the interior catch basin (sump pit) and diverting the wash bay flow, by pump, into a trailer mounted tank. The captured wash water would then be transported to a selected area of the Village for discharge into the Village's sanitary sewer system.

This option would continue with the use of detergent and degreaser agents during the washing operation.

In addition, this option would include wash procedure operations requiring that ALL washing be performed within the confines of the area designated as the Wash Bay.

Description of Proposed Collection/Storage System

- 1) The effluent pipe within the internal building #2 catch basin (sump pit) will have the 90-degree bend and reducer removed and a Fernco style cap will be installed. This will discontinue flow to the DPW Campus storm collection system, which outfalls to the roadside ditch.
- 2) An electric pump, sufficient in capacity to handle washing operation, will be installed in the catch basin. Piping will be fabricated so that the pump system will discharge directly into the trailer mounted tank.
- 3) Trailered tank will be parked in a dedicated stall located immediately adjacent to the catch basin. This eliminates the element of winter freezing.
- 4) The tank will be emptied, as necessary, by discharging stored wash water directly into the Village sanitary sewer system via a manhole.
- 5) Two (2) standby 250 gallon poly- tanks will be located adjacent to the trailered tank to accept flow at times the washing operation may exceed the volume capacity of the trailered tank.
- 6) Washing operation will cease at any time the total storage capacity may be exceeded.
- 7) The discharge point for the DPW Building #2 portable wastewater collection system is N116W17230 Main Street.

Trailer Mounted Storage Tank



The picture above shows a trailer mounted 1,300-gallon tank. This is the trailer mounted tank for which the Village received a quote. Other similar tanks would be considered upon receipt of requested quotations.

Pump and Fabricated piping

An electric pump sized to meet the capacity required to handle the wash water flow will be installed into the catch basin. The pressure washer is rated at 4.75 gpm and the Village plans to utilize a 120V pump with float control on/off to manage the redirection of the wash water into the trailered tank. The final design of the piping configuration will be determined once the trailered tank is in place.

Financial Directive

The Village Board of Germantown has approved emergency funds in the amount of \$50,000.00 for the corrective actions required to be compliant with the WIDNR regulations concerning the Department of Public Works Campus illicit discharge to the Division Road Ditch. The proposed corrective actions for Option #2 will be completed within the funds allocated.

Method Selected for Meeting Compliance

Upon evaluation of Options No.1 & 2 and initial review comments from WIDNR staff the Village of Germantown has elected to proceed with Option No. 2 to be compliant with the Village's discharge requirements.

**BUSINESS OF THE PUBLIC WORKS AND HIGHWAY COMMITTEE
GERMANTOWN, WI**

MEETING DATE: September 4, 2019

AGENDA ITEM: New Business

ITEM TITLE: Freistadt Road and Maple Road Intersection

SUBMITTED BY: Eric Nitschke, P.E., Village Engineer

EAN

SUMMARY EXPLANATION:

Concerns from residents and elected officials have been raised regarding the intersection of Freistadt Road and Maple Road. Despite temporary modifications to the intersection in recent years, there continues to be a significant amount of traffic accidents each year. Engineering staff requested a proposal from TADI to analyze the intersection and submit a Highway Safety Improvement Program (HSIP) application.

TADI reviewed multiple options, including a round-a-bout, as part of the application process. Staff are pleased to report that Germantown's application was accepted by WisDOT for funding. The approved project will include a traffic signal with improved street lighting and safety oriented geometric improvements to the intersection. The proposed traffic signals will also have monotube poles enabling the placement of traffic signals over each approach lane. The goal of the project is to substantially reduce the potential for right-angle collisions at the intersection. The estimated project cost, which includes design, is \$1,074,272. The approved Federal and State funds for the project total \$965,945. Germantown's match is estimated to be \$108,327.

Following execution of the SMA, Germantown may begin the process of selecting a consultant to complete the design work. Design is expected to start in 2020 with construction anticipated in either late 2021 or the summer of 2022.

ATTACHMENT: ORDINANCE____ RESOLUTION____ OTHER X

HSIP Application to WisDOT
State/Municipal Agreement (SMA)

RECOMMENDATION:

Staff recommends forwarding approval of the State/Municipal Agreement with WisDOT to the Village Board. Should the Village Board approve the SMA, three original signed copies (in blue ink) must be sent to WisDOT for approval and execution.

COMMITTEE ACTION:

Proper parliamentary procedure to deny a request is to have a motion made in the affirmative and by voting NAY would deny the request if a majority vote.



**STATE/MUNICIPAL AGREEMENT
FOR A STATE- LET HIGHWAY
PROJECT**

Date: June 17, 2019

I.D.: 2712-03-00/70

Road Name: FREISTADT ROAD

Limits: INTERSECTION WITH MAPLE ROAD

County: Washington

Roadway Length: 0.01 Mile

The signatory Village of Germantown, hereinafter called the Municipality, through its undersigned duly authorized officers or officials, hereby requests the State of Wisconsin Department of Transportation, hereinafter called the State, to initiate and effect the highway or street improvement hereinafter described.

The authority for the Municipality to enter into this agreement with the State is provided by Section 86.25(1), (2), and (3) of the Statutes.

NEEDS AND ESTIMATE SUMMARY:

Existing Facility - Describe and give reason for request: Improvement

Proposed Improvement - Nature of work: As determined by project scoping.

Describe non-participating work included in the project and other work necessary to finish the project completely which will be undertaken independently by the municipality: A nominal amount is included to cover items in paragraph 4 (to be adjusted in the final plan).

TABLE 1: SUMMARY OF COSTS

Phase		Total Est. Cost	Federal/State Funds	%	Municipal Funds	%
Preliminary Engineering: Plan Development	1	\$ 159,831	\$ 143,848	90%	\$ 15,983	10%
Construction: Roadway	1	\$ 913,441	\$ 822,097	90%	\$ 91,344	10%
Non-Participating		\$ 1,000	\$ -	0%	\$ 1,000	100%
Total Cost Distribution		\$ 1,074,272	\$ 965,945		\$ 108,327	

1 Federal funding maximum of \$143,848 for Design, and \$822,097 for Construction
Costs in excess of this amount shall be the responsibility of the Municipality.

This request is subject to the terms and conditions that follow (pages 2 – 4) and is made by the undersigned under proper authority to make such request for the designated Municipality and upon signature by the State and delivery to the Municipality shall constitute agreement between the Municipality and the State. No term or provision of neither the State/Municipal Agreement nor any of its attachments may be changed, waived or terminated orally but only by an instrument in writing executed by both parties to the State/Municipal Agreement.

Signed for and in behalf of the Village of Germantown (please sign in blue ink)		
Name	Title	Date
Signed for and in behalf of the State (please sign in blue ink)		
Name	Title SE Region Planning Chief	Date

TERMS AND CONDITIONS:

1. The initiation and accomplishment of the improvement will be subject to the applicable Federal and State regulations.
2. The Municipality shall pay to the State all costs incurred by the State in connection with the improvement which exceed Federal/State financing commitments or are ineligible for Federal/State financing. Local participation shall be limited to the items and percentages set forth in the Summary of Costs table that show Municipal funding participation. In order to guarantee the Municipality's foregoing agreements to pay the State, the Municipality, through its above duly authorized officers or officials, agrees and authorizes the State to set off and withhold the required reimbursement amount as determined by the State from any moneys otherwise due and payable by the State to the Municipality. The costs listed in Table I: Summary of Costs are approximate costs unless otherwise noted. The Municipality will be responsible for actual costs incurred.
3. Funding of each project Phase is subject to inclusion in an approved program and per the State's Facility Development Manual (FDM) standards. Federal aid and/or State transportation fund financing will be limited to participation in the costs of the following items as specified in the Summary of Costs:
 - (a) Design engineering and state review services.
 - (b) Real Estate necessitated for the improvement.
 - (c) Compensable utility adjustment and railroad force work necessitated for the project.
 - (d) The grading, base, pavement, curb and gutter and bridge costs to State standards, excluding the cost of parking areas.
 - (e) Storm sewer mains, culverts, laterals, manholes, inlets, catch basins and connections for surface water drainage of the improvement; including replacement and/or adjustments of existing storm sewer manhole covers and inlet grates as needed.
 - (f) Construction engineering incidental to inspection and supervision of actual construction work, except for inspection, staking and testing of sanitary sewer and water main.
 - (g) Signing and pavement marking necessitated for the safe and efficient flow of traffic, including detour routes.
 - (h) Replacement of existing sidewalks necessitated by construction and construction of new sidewalk at the time of construction. Sidewalk is considered to be new if it's constructed in a location where it has not existed before.
 - (i) Replacement of existing driveways, in kind, necessitated by the project.
 - (j) New installations or alteration resulting from roadway construction of standard State street lighting and traffic signals or devices. Alteration may include salvaging and replacement of existing components.
4. Work necessary to complete the improvement to be financed entirely by the Municipality or other Utility or Facility Owner includes the following items:

- (a) New installations of or alteration of sanitary sewers and connections, water, gas, electric, telephone, telegraph, fire or police alarm facilities, parking meters, and similar utilities.
 - (b) New installation or alteration of signs not necessary for the safe and efficient flow of traffic.
 - (c) Roadway and Bridge width in excess of standards.
 - (d) Construction inspection, staking and material testing and acceptance for construction of sanitary sewer and water main.
 - (e) Coordinate, clean up, and fund any hazardous materials encountered for city utility construction. All hazardous material cleanup work shall be performed in accordance to state and federal regulations.
5. As the work progresses, the Municipality will be billed for work completed which is not chargeable to Federal/State funds. Upon completion of the project, a final audit will be made to determine the final division of costs.
 6. If the Municipality should withdraw the project, it shall reimburse the State for any costs incurred by the State in behalf of the project.
 7. The work will be administered by the State and may include items not eligible for Federal/State participation.
 8. The Municipality shall at its own cost and expense:
 - (a) Maintain all portions of the project that lie within its jurisdiction for such maintenance through statutory requirements, in a manner satisfactory to the State and shall make ample provision for such maintenance each year. This agreement does not remove the current municipal maintenance responsibility.
 - (b) Maintain all items outside the travel lane along the project, to include but not limited to parking lanes, curb and gutter, drainage facilities, sidewalks, multi-use paths, retaining walls, pedestrian refuge islands, landscaping features and amenities funded by community sensitive solutions.
 - (c) Maintain and accept responsibility for the energy, operation, maintenance, repair and replacement of the lighting system.
 - (d) Prohibit angle parking.
 - (e) Regulate parking along the highway. The municipality will file a parking declaration with the state.
 - (f) Use the WisDOT Utility Accommodation Policy unless the Municipality adopts a policy which has equal or more restrictive controls.
 - (g) Provide complete plans, specifications and estimates for sanitary sewer and water main work. The Municipality assumes full responsibility for the design, installation, inspection, testing and operation of the sanitary sewer and water system. This relieves the State and all of its employees from the liability for all suits, actions or claims resulting from the sanitary sewer and water system construction.
 - (h) Maintain all community sensitive solutions and/or enhancement funded items.
 - (i) Coordinate with the state on changes to highway access within the project limits.
 - (j) In cooperation with the state, assist with public relations for the project and announcements to the press and such outlets as would generally alert the affected property owners and the community of the nature, extent, and timing of the project and arrangements for handling traffic within and around the project.
 - (k) Maintain signs and pavement markings not necessary for the safe and efficient movement of traffic (no parking signs, crosswalk pavement markings not at signalized intersections, etc).
 9. Basis for local participation as specified in Surface Transportation Program—(H.S.I.P.) Safety regulations: Participation is based on actual costs incurred, all costs listed in Table I: Summary of Costs are approximate

costs unless otherwise noted.

- (a) Funding for preliminary engineering: Design is funded with 90% Federal funding up to a maximum of \$143,848 when the Municipality agrees to provide the remaining 10% and any funds in excess of the federal funding maximum.
- (b) Funding for construction: Construction is funded with 90% Federal funding up to a maximum of \$822,097 when the Municipality agrees to provide the remaining 10% and any funds in excess of the federal funding maximum.
- (c) Funding for non-participating work including haul roads is funded 100% Municipal.

[END]



HIGHWAY SAFETY IMPROVEMENT PROGRAM (HSIP) PROJECT APPLICATION

Wisconsin Department of Transportation
DT1501 8/2018

GENERAL INSTRUCTIONS

Please read all directions. **Submit completed applications to the appropriate WisDOT Regional HSIP Coordinator.**
Additional information can be found on the WisDOT HSIP website: www.wisconsindot.gov

All shaded areas will be completed by WisDOT staff.

- Box 1** Identify the project limits and/or those areas applicable to your project.
For 'Name of Road/Intersection,' use From-To (South-North or West-East) format for a road segment such as "6th St.-9th St."
If the project is within the boundary of a Metropolitan Planning Organization (MPO), provide the name of the MPO.
Indicate whether the project is located on a connecting highway.
- Box 2** If the project involves an improvement to a roadway segment, provide the requested information.
The segment crash rate equals the number of crashes per 100 million vehicle miles of travel and is calculated by the following formula:

$$\text{Crash Rate} = (\# \text{ of crashes} / \# \text{ of years} \times 100,000,000 / (365 \times \text{AADT} \times \text{project length in miles}))$$

$$\# \text{ of crashes} = \text{Total number of crashes during study period}$$

$$\# \text{ of years} = \text{Number of years in study period}$$

$$\text{AADT} = \text{Annual Average Daily Traffic}$$
- Box 3** If the project involves an improvement to an intersection, provide the requested information.
The intersection crash rate equals the number of crashes per million entering vehicles and is calculated by the following formula:

$$\text{Crash Rate} = (\# \text{ crashes} / \# \text{ yrs.} \times 1,000,000 / (365 \times \text{Entering Vehicle Volume}))$$

$$\text{Entering Vehicle Volume} = \text{Total number of vehicles entering the intersection from all directions}$$
- Box 4** Identify and describe existing safety hazards such as visibility restrictions, curves, hills, intersection problems, bike/pedestrian conflicts, narrow shoulders, rutting, etc. Incorporate relevant crash history and data-supported evidence.
- Box 5** Describe the proposed improvement in as much detail as possible. A detailed description explaining how the project will address the identified hazard(s) is essential for WisDOT review. Include any other important considerations that may be unique to the project or location. In addition, briefly discuss any alternatives considered and why these options are not the preferred alternative.
- Box 6** Provide a summary of the estimated costs and anticipated schedule dates for ALL project elements associated with the project, regardless of whether HSIP funding is being requested. This includes preliminary engineering/design engineering, construction, construction engineering, mobilization, contingencies, utilities, real estate, and all related oversight and delivery costs. Cost estimates should be provided in today's dollars.
- Box 7** For each project element (PE/Design, Real Estate, Construction, Other), indicate whether or not HSIP funding is being requested.
- Box 8** Provide contact information for application sponsor's primary contact person or agency.
- Box 9** Application must be signed by an official able to commit funds and certify as to the answers provided in Box 8. Leave blank for STATE projects.

HIGHWAY SAFETY IMPROVEMENT PROGRAM (HSIP) PROJECT APPLICATION *(continued)*

Wisconsin Department of Transportation DT1501

Required Supporting Materials (RSM): Completed applications require the following (to be submitted to appropriate Region Office in digital or paper form – Region Office will transmit final digital copy to Central Office):

- A. All applications must include:**
- RSM 1A. General sketch of project proposal: *An adequate sketch is the minimum requirement. Preliminary plan layout sheets or study reports should be provided if available. Basic example attached.*
 - RSM 2A. Collision diagram: *Must use most current consecutive 5 years of crash data available. Crash records available from the WisTransPortal Project website (<http://transportal.cee.wisc.edu/services/crash-data>). Agencies can request crash data or WisTransPortal account access through this website. Basic diagram example attached. Not required for projects resulting from statewide crash analyses.*
 - RSM 3A. Crash Reports (MV4000s): *Submit most current consecutive 5 years of crash data available and appropriate crash analysis. Reports should be sent to Region offices. Reports available from the WisTransPortal Project website (<http://transportal.cee.wisc.edu/services/crash-data>). Agencies can request crash reports or WisTransPortal account access through this website. Regions should not submit crash reports to Central Office.*
 - RSM 4A. Site photos
 - RSM 5A. Itemized cost estimate: *Provide with as much detail as possible. For projects on the State Trunk Network (including connecting highways), an itemized cost estimate is needed to determine if signalization and/or intelligent transportation systems components are incidental to the project. See example attached.*
 - RSM 6A. PEF worksheet and results: *Completed by Regional Safety Engineer. Project applications resulting from a statewide systemic safety analysis do not require a PEF.*
- B. If your project is proposing a change in intersection traffic control or a complete intersection reconstruction, your application must also include:**
- RSM 1B. Warrant documentation. *Required for proposals to install new traffic signals. See MUTCD, Part IV, Section C (<http://mutcd.fhwa.dot.gov/pdfs/2009r1r2/part4.pdf>) for additional information. Contact Regional Safety Engineer for example worksheets.*
 - RSM 2B. Completed Traffic Control Signal Approval Request (Form DT1199): *Required for proposals to install new traffic signals on the State Trunk Highway Network, including Connecting Highways and ramp terminals. Contact Regional Safety Engineer for Form DT1199.*
 - RSM 3B. Operational analysis: *Per FDM-11-25-3.2.1 (<http://roadwaystandards.dot.wi.gov/standards/fdm/11-25.pdf>), required for proposals to change the overall intersection traffic control. A capacity analysis should be performed for existing traffic control with forecasted traffic volumes for the design year. At a minimum, perform a capacity analysis for existing traffic control with the most recent traffic volumes for the peak hours. The capacity analysis should be performed using the 2010 Highway Capacity Manual Methodology (e.g. HCS, Synchro). However, if the information necessary for a detailed capacity analysis is not available use any means necessary to demonstrate existing and future capacity concerns, if any. For example, a field survey with pictures during peak hours to demonstrate an existing capacity concerns may be sufficient. Contact the Regional Safety Engineer to discuss alternate options to meet the operational analysis requirement.*
 - RSM 4B. Scoping ICE Memorandum: *As outlined in FDM 11-25-3.2.1 (<http://roadwaystandards.dot.wi.gov/standards/fdm/11-25.pdf>), the scoping ICE Memorandum describes the need for a change in the existing intersection and provides a preliminary review of alternatives. Several pieces of information that are included in the HSIP application materials can be used in the development of the Scoping ICE Memorandum. Contact the Regional Safety Engineer for additional information.*

Optional Support Materials (OSM)

C. If applicable, each application may also include:

- OSM 1C. Local Support/Commitment: *A list of local support received and/or letters of commitment can be used to augment application materials.*

OTHER IMPORTANT NOTES AND CONSIDERATIONS:

- Applications that do not include applicable Required Support Materials will not be accepted.
- This is **NOT** a federal-aid grant program. Project sponsors are responsible for 10% of total project costs, up to the approved project cost. Any costs incurred in excess of the approved project cost will be the responsibility of the project sponsor.
- Local lets are not permitted. All let projects must be let through the state letting process regardless of project sponsor or project location.
- Federal law restricts federal-aid projects from using publicly owned land of a park, recreation area, or wildlife refuge.

HIGHWAY SAFETY IMPROVEMENT PROGRAM (HSIP) PROJECT APPLICATION *(continued)*

Wisconsin Department of Transportation DT1501

Design ID	Tied Project IDs
Related IDs (CONST)	(R/W)

1. PROJECT LOCATION

Name of Road/Intersection Intersection of Freistadt (CTH F) & Maple Road		Highway Number
County Washington	City of Germantown	Town of
Name of the MPO the Project is Represented by Southeastern Wisconsin MPO		
Is this project located on a connecting highway? ☐ Yes ☒ No		

2. SEGMENT INFORMATION

Current Average Daily Traffic N/A	Project Length (miles) N/A	
Crash Rate N/A	Roadway Width N/A	Shoulder Width N/A

3. INTERSECTION INFORMATION

Crash Rate 2.29 per MEV	Entering Vehicle Volume 8,850	Roadway Width Varies
----------------------------	----------------------------------	-------------------------

4. IDENTIFICATION OF HAZARDS

Describe existing hazards such as: visibility restrictions, curves, hills, intersection problems, bike/pedestrian conflicts, narrow shoulders, rutting, etc. The intersection of Freistadt Road and Maple Road has experienced a hazardous, but correctable crash history. Thirty-seven crashes have been observed in the past five years and the intersection has a crash rate of 2.29 crashes per million entering vehicles (MEV).

The most substantial and serious crash pattern at this intersection is right-angle crashes. Twenty-six right-angle crashes were observed and eight of them resulted in B-level injuries. The current operation of the intersection as 2-way stop control (stops on Maple Road approaches) is a contributing factor in these crashes.

Additional factors contributing to these angle crashes include:

- Maple Road drivers misjudging available gaps
- Drivers not seeing oncoming eastbound/westbound Freistadt Road (CTH F) vehicles
- Drivers that ran-the-stop-sign because they did not see it
- Drivers on Maple Road sometimes indicated they had expected traffic on Freistadt Road (CTH F) to stop thinking they had a stop sign.
- High speed of travel on Freistadt Road (40 mph speed limit)

The intersection also experienced patterns of nighttime crashes (two B-level and nine total crashes). The existing street lighting is minimal and only exists in two quadrants of the intersection.

In 2016, Freistadt Road was changed from a four-lane undivided roadway to a 3-lane TWLTL with bicycle lanes. Specifically at the intersection of Freistadt Road and Maple Road, exclusive EB and WB left-turn lanes were provided. The crash patterns of severe right-angle crashes continued after these changes.

HIGHWAY SAFETY IMPROVEMENT PROGRAM (HSIP) PROJECT APPLICATION *(continued)*

Wisconsin Department of Transportation DT1501

5. PROPOSED IMPROVEMENT

Describe the proposed project and how it will address the identified hazards. In addition, briefly discuss any alternatives considered and why these options are not the preferred alternative.

A traffic study and ICE analysis was conducted at this intersection to determine a proposed solution that would safely and efficiently accommodate travel.

The proposed solution is a traffic signal with improved street lighting and safety oriented geometric improvements. The proposed traffic signal would have monotube poles enabling the placement of traffic signals over each approach lane. The signal would also be equipped with vehicle detection, countdown pedestrian timers, pedestrian push buttons, and retro-reflective backplates. Street lighting would be provided in all quadrants of the intersection.

As for geometric improvements, to mitigate the potential for EB/WB left-turn crashes, positively offset left-turn lanes are proposed. An off-set EB right-turn lane is also proposed to enable NB right-turners (a heavy movement) to have better sight lights of approaching EB vehicles on Freistadt Road. A larger radius is proposed for the EB right-turn lane to better accommodate semi-trucks. On the NB approach, striping exclusive lanes are proposed and on the SB approach, a minor widening is proposed to accommodate 200 feet of storage in the outside lane.

Collectively, the proposed improvements are expected to substantially reduce the potential for right-angle collisions at this intersection and are expected to provide safety and efficient operations through year 2028 and likely beyond.

6. TOTAL PROJECT COSTS - Provide ALL project costs in today's dollars for all project elements, regardless of whether HSIP funding will be used

	Prelim. Engineering/ Design (include state review)	Real Estate	Major Construction Items (include Const. Engineering, Mobilization, and Contingencies)	Other Costs	TOTAL
SFY2019					
SFY2020	\$145,544				\$145,544
SFY2021			\$876,709		\$876,709
SFY2022					
SFY2023					
SFY2024					
TOTAL	\$145,544		\$876,709		\$1,022,253

7. HSIP FUNDING REQUESTED? - For each project element, indicate if HSIP funding is being requested.

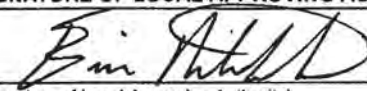
HSIP Funding Requested? (Yes/No) *	Yes		Yes		Yes
--	-----	--	-----	--	-----

* Generally, 90% of the requested safety funding is covered with federal HSIP funds and the remaining 10% is covered by state and/or local funds. The project sponsor is responsible for any project costs exceeding the approved HSIP funding amount.

8. CONTACT INFORMATION

Primary Contact Person (Agency Name) Eric Nitschke	Title Village Engineer
Address N112W17001 Mequon Road	(Area Code) Telephone Number (262) 250-4721
City, State, ZIP Code Germantown, WI 53022	Municipality Germantown

9. SIGNATURE OF LOCAL APPROVING AUTHORITY

X 	February 14, 2019
(Signature of Local Approving Authority)	(Date - m/d/yyyy)

HIGHWAY SAFETY IMPROVEMENT PROGRAM (HSIP) PROJECT APPLICATION *(continued)*

Wisconsin Department of Transportation DT1501

WisDOT INFORMATION *(shaded areas to be completed by WisDOT Regional Staff Only)*

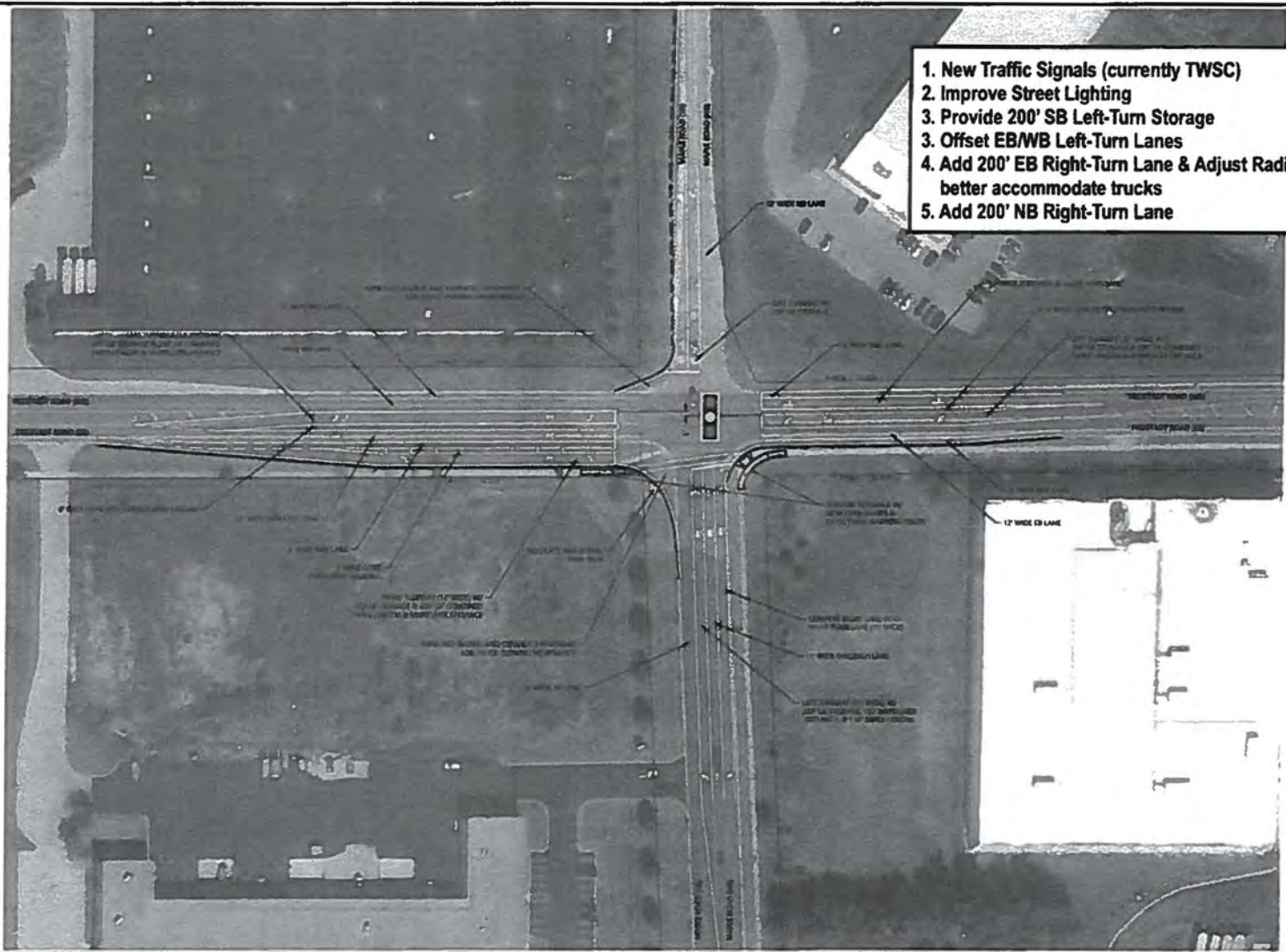
A. Environmental Documentation Type	B. HSIP Work Type
C. Functional Class	D. PEF
E. Is this project location identified in one of the two most recent LOIR/5% Reports? ☐ Yes ☐ No	
F. Which Strategic Highway Safety Plan goal(s) are addressed by this request?	

Region Approval – Project Supervisor	Date – m/d/yyyy
Region Approval – Planning Supervisor	Date – m/d/yyyy

C.O. Decision ☐ Approved ☐ Disapproved	
Approving Authority	Date – m/d/yyyy

RSM 1A

CONCEPTUAL DRAWINGS



NOT TO SCALE

RSM 1A
 CONCEPTUAL DRAWINGS

FREISTADT & MAPLE
 GERMANTOWN, WISCONSIN

RSM 2A

COLLISION DIAGRAMS

INTERSECTION CRASH STATISTICS [Freistadt & Maple]

Total Number of Crashes (3-Year Period)	37
Entering Daily Volume	8,850
Crash Rate per 1 Million Entering Vehicles	2.29

Crash Type	K	A	B	C	POD	TOTAL
Right Angle			8		18	26
Left Turn* (see below)					0	0
Rear End				2	2	2
Sideswipe-Opposite					0	0
Sideswipe-Same					0	0
Head-On					0	0
Hit Object				4	4	4
Run Off Road					0	0
Pedestrian/Bicycle					0	0
Overtake				1	1	1
*EB Left-Turn				1	1	1
*WB Left-Turn				0	0	0
*WB Left-Turn				0	0	0
*WB Left-Turn		1			1	1
Other				2	2	2
Totals	0	1	8	0	28	37

Light Conditions	K	A	B	C	POD	TOTAL
Daytime, Dusk, Dawn		1	6		21	28
Nighttime			2		7	9
Totals	0	1	8	0	28	37

Road Conditions	K	A	B	C	POD	TOTAL
Wet					5	5
Dry, Snow, Ice, Other		1	8		23	32
Totals	0	1	8	0	28	37

LEGEND

- Moving Vehicle
- ←←← Backing Vehicle
- Pedestrian
- ⚙ Bicyclist
- Ⓜ Parked Vehicle
- Ⓢ Traffic Signal
- Ⓢ Stop/Yield Sign
- Ⓢ Tree
- Ⓢ Utility Pole
- Ⓢ Fixed Object
- Ⓢ Non-Fixed Object

NOTE: DEER CRASHES NOT INCLUDED

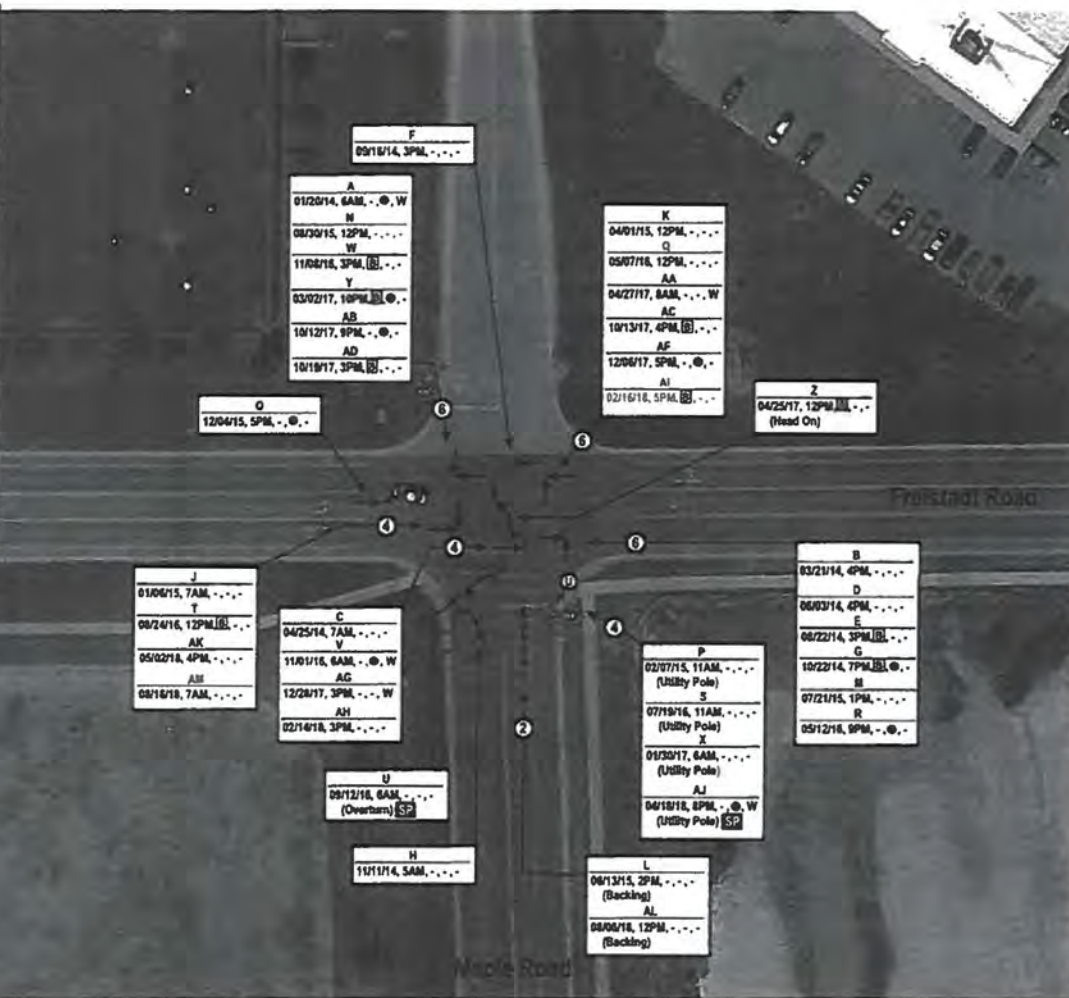
- ↘ Angle (Right Angle)
- ↙ Angle (Left Turn)
- ↗ Angle (Right Turn)
- ↔ Sideswipe-Same
- ↔ Sideswipe-Opposite
- ↔ Head-On
- ↔ Rear-End
- ↔ Out of Control
- ↔ Overtake
- ↔ Overtake

Ⓢ = CRASH FREQUENCY (if > 1)

REFERENCE
ALCOHOL
DRUG INVOLVEMENT
DATE OF CRASH, HOUR,
SEVERITY, DARK/LIGHTED,
ROAD WET (W)

CRASH SEVERITY DEFINITIONS

- Ⓢ = Fatal Crash
- Ⓢ = Incapacitating Injury Crash
- Ⓢ = Non-Incapacitating Injury Crash
- Ⓢ = Possible Injury Crash
- Ⓢ = Property Damage Only Crash



NOT TO SCALE

RSM 2A
COLLISION DIAGRAM

FREISTADT & MAPLE
GERMANTOWN, WISCONSIN

RSM 3A CRASH REPORTS

Link to Document Numbers

[https://tadi.egnyte.com/dl/odS9IXNAQN/Freistadt and Maple HSIP Document Numbers 2-15-19.xlsx](https://tadi.egnyte.com/dl/odS9IXNAQN/Freistadt_and_Maple_HSIP_Document_Numbers_2-15-19.xlsx)

RSM 4A SITE PHOTOS



**Maple Rd NB view looking
EB on Freistadt Rd**



**Maple Rd NB view looking
WB on Freistadt Rd**



**Maple Rd SB view looking
EB on Freistadt Rd**



**Maple Rd SB view looking
WB on Freistadt Rd**



**Freistadt Rd WB view looking at Maple Rd
(2016 - before exclusive lanes striped)**



**Freistadt Rd WB view looking at Maple Rd
(2018 - after exclusive lanes striped)**

Source: Google Earth

**RSM 4A
SITE PHOTOS**

**FREISTADT & MAPLE
GERMANTOWN, WISCONSIN**

RSM 5A

ITEMIZED COST ESTIMATE

PROJECT SUMMARY CONCEPTUAL COST ESTIMATE

Category	Design	Construction	Total
Roadwork	\$ 79,664	\$ 497,899	\$ 577,563
Traffic Signals & Lighting	\$ 65,880	\$ 378,810	\$ 444,690
Totals	\$ 145,544	\$ 876,709	\$ 1,022,253

**RSM 5A
COST ESTIMATE**

**FREISTADT & MAPLE
GERMANTOWN, WISCONSIN**

ROADWORK COST ESTIMATE

ITEM	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
REMOVALS					
1	REMOVING ASPHALTIC PAVEMENT	SY	380	\$10.00	\$3,800
2	REMOVING CONCRETE CURB & GUTTER	LF	1,150	\$5.00	\$5,750
3	REMOVING PAVEMENT MARKINGS	LF	3,350	\$3.00	\$10,050
4	REMOVING PAVEMENT MARKINGS, WORD	EA	8	\$250.00	\$2,000
5	RELOCATE INDUSTRIAL PARK SIGN	EA	1	\$7,500.00	\$7,500
REMOVAL SUBTOTAL COSTS					\$29,100
EARTHWORK					
6	EXCAVATION COMMON	CY	1,660	\$20.00	\$33,200
EARTHWORK SUBTOTAL COSTS					\$33,200
PAVING ITEMS					
7	FULL DEPTH SAWCUT	LF	1,565	\$2.00	\$3,130
8	BASE AGGREGATE DENSE 1 1/4", 10-INCHES	TON	1,225	\$15.00	\$18,375
9	BASE AGGREGATE DENSE 3/4", 5-INCHES	TON	65	\$20.00	\$1,300
10	SELECT CRUSHED MATERIAL 12"	TON	1,400	\$15.00	\$21,000
11	HMA PAVEMENT 5"	TON	525	\$90.00	\$47,250
12	CONCRETE SIDEWALK 4"	SF	885	\$5.00	\$4,425
13	CURB RAMP DETECTABLE WARNING FIELD 2'x2'	EA	7	\$50.00	\$350
14	CONCRETE CORRUGATED MEDIAN	SF	2950	\$20.00	\$59,000
15	CONCRETE CURB & GUTTER, 30-IN	LF	1,005	\$25.00	\$25,125
16	PAVEMENT MARKING, 4-IN	LF	6,950	\$0.50	\$3,475
17	PAVEMENT MARKING, 8-IN	LF	1,600	\$1.00	\$1,600
18	PAVEMENT MARKING STOP LINE, 18-IN	LF	150	\$15.00	\$2,250
19	PAVEMENT MARKING ARROW	EA	20	\$250.00	\$5,000
20	PAVEMENT MARKING WORD	EA	8	\$300.00	\$2,400
PAVING SUBTOTAL COSTS					\$194,680
IMPROVEMENT SUBTOTAL COSTS					\$256,980
MISCELLANEOUS CONSTRUCTION ITEMS					
21	DRAINAGE/STORM SEWER	LS	15 % OF IMPROVEMENTS	N/A	\$38,547
22	TRAFFIC CONTROL/STAGING	LS	15 % OF IMPROVEMENTS	N/A	\$38,547
23	EROSION CONTROL/ RESTORATION	LS	10 % OF IMPROVEMENTS	N/A	\$25,698
24	SIGNING	LS	5 % OF IMPROVEMENTS	N/A	\$12,849
25	UTILITY RELOCATION/ADJUSTMENTS	LS	5 % OF IMPROVEMENTS	N/A	\$12,849
24	MOBILIZATION	LS	5 % OF IMPROVEMENTS	N/A	\$12,849
IMPROVEMENTS AND MISC SUBTOTAL COSTS					\$398,319
26	COST ESTIMATE CONTINGENCIES	LS	10 % OF IMPR. AND MISC	N/A	\$39,832
26	ENGINEERING DESIGN AND STATE DESIGN REVIEW	LS	20 % OF IMPR. AND MISC	N/A	\$79,664
27	CONSTRUCTION ENGINEERING AND OVERSIGHT	LS	15 % OF IMPR. AND MISC	N/A	\$59,748
TOTAL PROJECT COST					\$577,563

**RSM 5A
COST ESTIMATE**

**FREISTADT & MAPLE
GERMANTOWN, WISCONSIN**

TRAFFIC SIGNAL & LIGHTING COST ESTIMATE

Item			Unit	Total
Description	Qty	Unit	Cost	Cost
Controller and cabinet	1	EACH	\$ 25,000	\$ 25,000
Overhead vehicular signal indications and monotube poles NB/SB/EB/WB	4	EACH	\$ 24,000	\$ 96,000
Other new poles and indications including street lights	1	LS	\$ 27,000	\$ 27,000
Reflective backplates	1	LS	\$ 2,500	\$ 2,500
Pedestrian countdown timers	1	LS	\$ 10,000	\$ 10,000
Pedestrian push buttons	1	LS	\$ 6,000	\$ 6,000
Vehicle detection	1	LS	\$ 28,000	\$ 28,000
Wiring, conduit, pull boxes, site restoration, traffic control	1	LS	\$ 80,000	\$ 80,000
Mobilization & traffic control (% of construction items)	10	%		\$ 27,450
Construction contingencies (% of construction items)	10	%		\$ 27,450
Engineering Design and State Design Review (% of all construction, including mobilization, traffic control, and contingencies)	20	%		\$ 65,880
Construction Engineering and Oversight (% of all construction, including mobilization, traffic control, and contingencies)	15	%		\$ 49,410
				\$ 444,690

**RSM 5A
COST ESTIMATE**

**FREISTADT & MAPLE
GERMANTOWN, WISCONSIN**

RSM 6A

PEF WORKSHEET & RESULTS

RSM 1B

WARRANT DOCUMENTATION

Wisconsin Department of Transportation Traffic Signal Warrant Summary Worksheet

70%

The Worksheet(s) attached are provided as an attachment to the Engineering Investigation Study for:

Intersection: Freistadt Road (CTH F) & Maple Road

County: Washington

Village: Germantown

Major Street: Freistadt Road (CTH F)

Critical Approach Speed: 45 mph

Lanes: 1 lane

Minor Street: Maple Road

Critical Approach Speed: 45 mph

Lanes: 1 lane

% Right Turns Included

From North (SB) 0%

From East (WB) 100%

From South (NB) 0%

From West (EB) 100%

In built-up area of isolated community of < 10,000 population? No

Total number of approaches at intersection? 4 or more

If it is a "T" intersection, inflate minor threshold to 150%? No

Manually set volume level?

Analysis based on EXISTING volume data.

Date	Day of the Week	Time (HH:MM)			
		From	AM / PM	To	AM / PM
Year 2018 Existing Traffic**	Yes	6:00	AM	19:00	PM

Warrant Evaluation Summary	Warrant Met:
Warrant 1: Eight - Hour Vehicular Volume	No
Condition A: Minimum Vehicular Volume	No
Condition B: Interruption of Continuous Traffic	No
Condition C: Combination: 80% of A and B	No
Warrant 2: Four-Hour Volume	Yes
Warrant 3: Peak Hour Volume	Yes
Warrant 4: Pedestrian Volume	N/A
Criterion A: Four-Hour	
Criterion B: Peak-Hour	
Warrant 5: School Crossing	N/A
Warrant 6: Coordinated Signal System	N/A
Warrant 7: Crash Experience	Yes
Warrant 8: Roadway Network	N/A
Warrant 9: Intersection Near a Grade Crossing	N/A

Warrant Analysis Conducted By:

Name: Christian R. Sternke, P.E.

Agency: TADI

Date: 1/23/2019

Warrant 1: Eight - Hour Vehicular Volume

70%

Warrant Evaluated? Yes

Warrant Satisfied? No

Manually Set To:

Condition A: Min. Veh. Volume		
Volume Level	70%	56%
Major Rd. Req	350	280
Minor Rd. Req	105	84
Number of Hours	5	9

Satisfied? No

Condition B: Interruption of Continuous Traffic		
Volume Level	70%	56%
Major Rd. Req	525	420
Minor Rd. Req	53	42
Number of Hours	1	5

Satisfied? No

Condition C: Combination of A & B at 56%		
---	--	--

Satisfied? No

6:00 AM		Enter Start Time (Military Time) (HH:MM)			Total
Time Period	From	To	Major Road: Both App. (VPH)	Minor Road: High App. (VPH)	
1	6:00	7:00	335	194	529
2	7:00	8:00	614	209	823
3	8:00	9:00	331	102	433
4	9:00	10:00	251	60	311
5	10:00	11:00	221	52	273
6	11:00	12:00	289	85	374
7	12:00	13:00	314	107	421
8	13:00	14:00	264	106	370
9	14:00	15:00	423	192	615
10	15:00	16:00	500	204	704
11	16:00	17:00	479	237	716
12	17:00	18:00	434	205	639
13	18:00	19:00	258	88	346
14	19:00	20:00	0	0	0
15	20:00	21:00	0	0	0
16	21:00	22:00	0	0	0

Warrant 2: Four-Hour Volume

70%

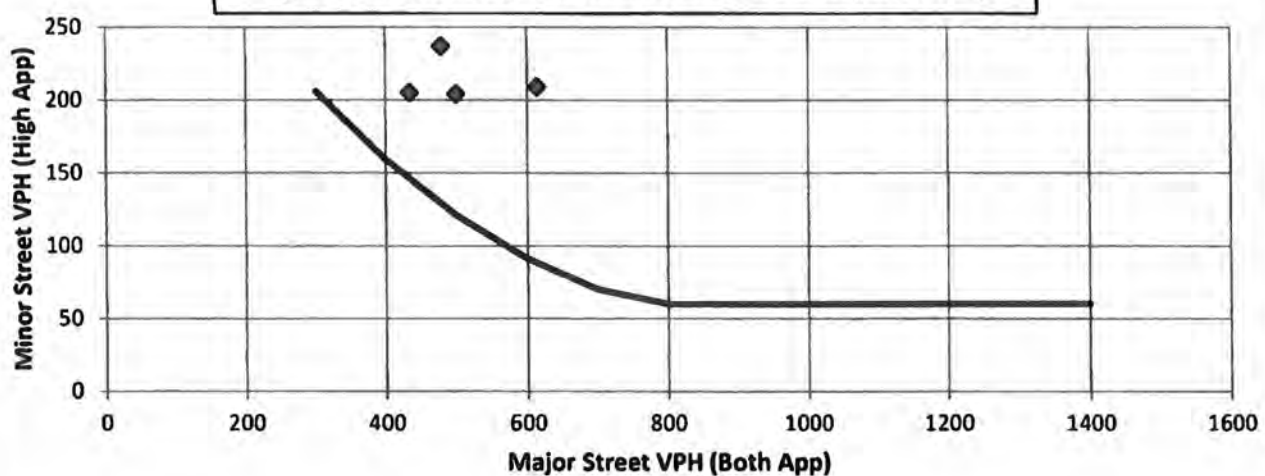
Warrant Evaluated? Yes

Warrant Satisfied? Yes

Manually Set To:

Hour Start	7:00	16:00	15:00	17:00
Major Road Vol.	614	479	500	434
Minor Road Vol.	209	237	204	205

Figure 4C-2 Warrant 2, Four-Hour Vehicular Volume (70% Factor)



Warrant 3: Peak Hour Volume

70%
Warrant Evaluated? Yes
Warrant Satisfied? Yes
Manually Set To:

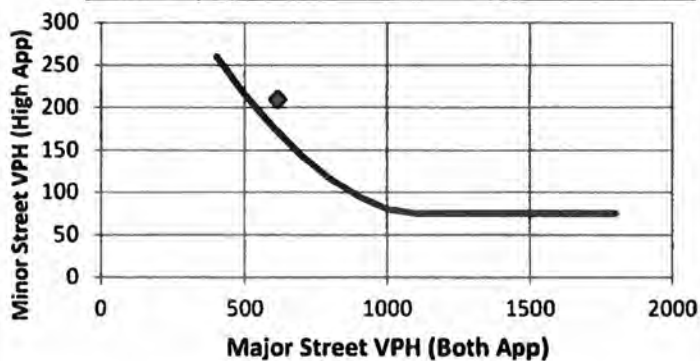
Condition justifying use of warrant:

None

Criteria		Met?
Delay on Minor Approach	4	Yes
Volume on Minor Approach	100	
Total Entering Volume (veh/h)	800	

Manually Set Peak Hour? No

Peak Hour	Major Road Vol. (Both App.)	Minor Road Vol. (High App.)
7:00	614	209

Figure 4C-4 Warrant 3, Peak Hour (70% Factor)


Warrant 4: Pedestrian Volume

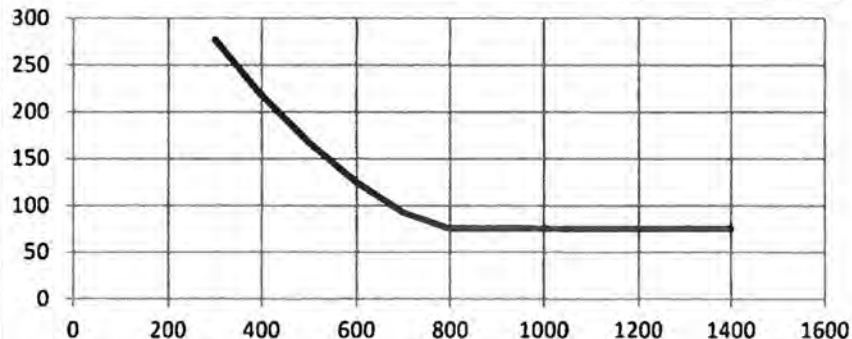
70%
Warrant Evaluated? No
Warrant Satisfied? N/A
Manually Set To:
Criterion A: Four Hour

Hour (Start)	Pedestrian Volume	Major Road Vol.
		0
		0
		0
		0

Manually Set Major Rd Vol?

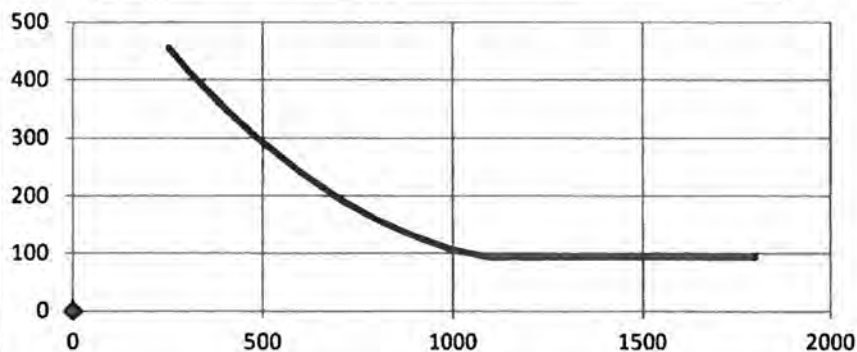
Avg. walk speed less than 3.5 ft/s?

Criterion A Satisfied?

Figure 4C-6 Warrant 4, Pedestrian Four-Hour Volume (70% Factor)

Criterion B: Peak Hour

Peak Hour	Pedestrian Vol.	Major Road Vol.
0:00	0	0

Criterion B Satisfied?

Figure 4C-8 Warrant 4, Pedestrian Peak Hour (70% Factor)


Warrant 5: School Crossing**70%****Warrant Evaluated? No****Warrant Satisfied? N/A****Manually Set To:**

Criteria	Fulfilled?
1 There are a MINIMUM of 20 school children during the highest crossing hour.	
2 There are fewer adequate gaps in the major road traffic stream during the period when the school children are using the crossing than the number of minutes in the same period.	
3 The nearest traffic signal along the major road is located more than 300 ft away. Or, the nearest traffic signal is within 300 ft but the proposed traffic signal will not restrict the progressive movement of traffic.	

Warrant 6: Coordinated Signal System**70%****Warrant Evaluated? No****Warrant Satisfied? N/A****Manually Set To:**

Criteria	Fulfilled?
1 Signal spacing > 1000 ft	
2 On a one-way road or a road that has traffic predominantly in one direction, the adjacent signals are so far apart that they do not provide the necessary degree of vehicle platooning.	
3 On a two-way road, adjacent signals do not provide the necessary degree of platooning and the proposed and the adjacent signals will collectively provide a progressive operation.	

Warrant 7: Crash Experience**70%****Warrant Evaluated? Yes****Warrant Satisfied? Yes****Manually Set To:**

Criteria	Met?	Fulfilled?
1 Adequate trial of other remedial measures has failed to reduce crash frequency. Measures Tried: lane configuration modifications without success reducing crashes		Yes
2 Five or more reported crashes, of types susceptible to correction by signal, have occurred within a 12 month period.	# of crashes per 12 months 9	Yes
3 Warrant 1, Condition A (80%)	Yes	Yes
Warrant 1, Condition B (80%)	No	
Warrant 4, Criterion A (80%)	No	
Warrant 4, Criterion B (80%)	No	

Warrant 8: Roadway Network**70%****Warrant Evaluated? No****Warrant Satisfied? N/A****Manually Set To:**

Criteria	Met?	Fulfilled?
1 Total entering volume of at least 1,000 veh/h during typical weekday peak hour	823	No
Five-year projected volumes that satisfy one or more of Warrants 1, 2, or 3.	No	No
2 Total entering vol. of at least 1,000 veh/h for each of any 5 hrs of non-normal business day (Sat. or Sun.)		
Hour		
Volume		
Characteristics of Major Routes - Select yes if all intersecting routes have characteristic		Fulfilled?
1 Part of the road or highway system that serves as the principal roadway network for through traffic flow		
2 Rural or suburban highway outside of, entering, or traversing a city		
3 Appears as a major route on an official plan		

Warrant 9: Intersection Near a Grade Crossing

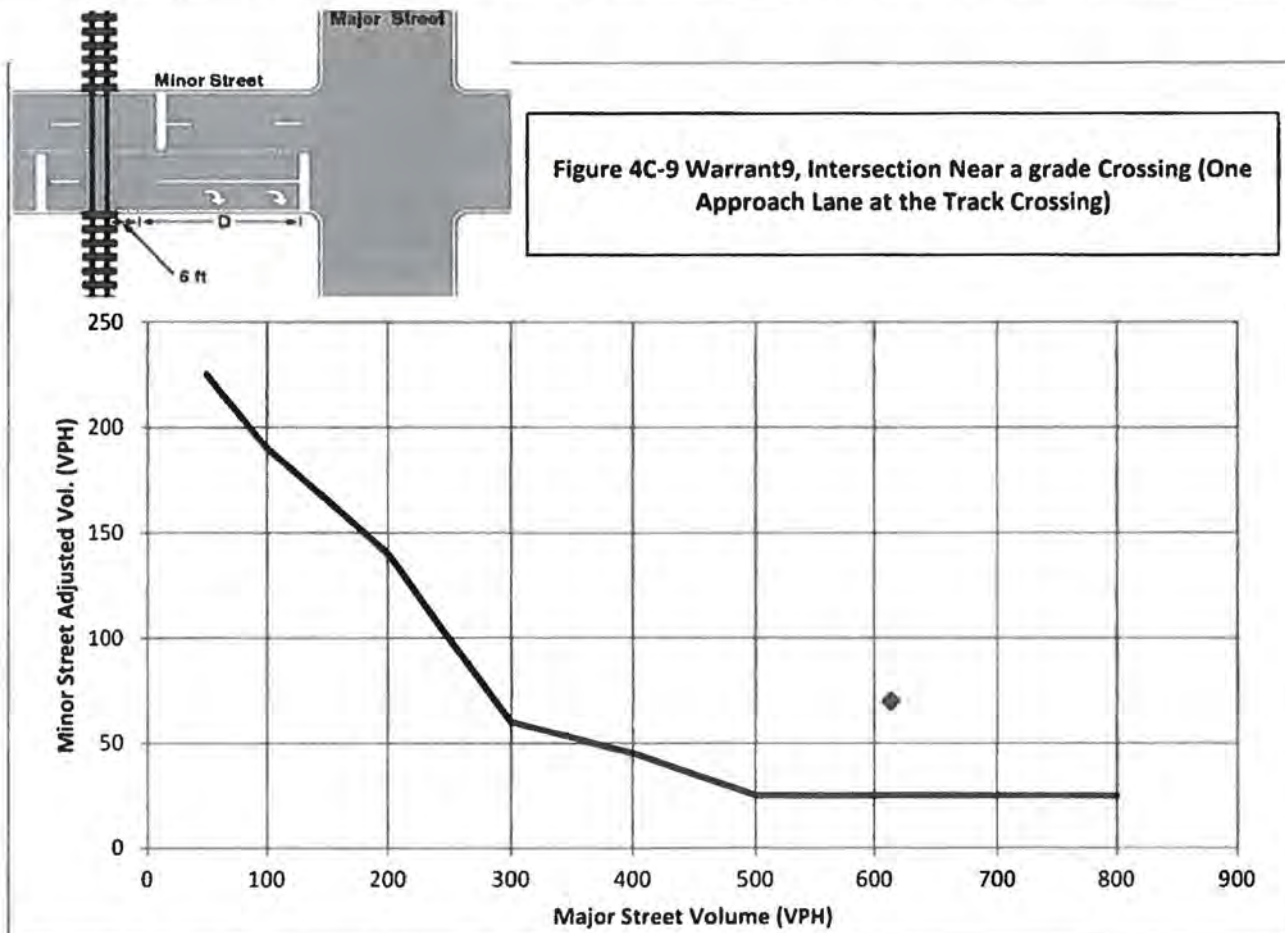
70%

Warrant Evaluated? No

Warrant Satisfied? N/A

Manually Set To:

Adjustment Factors			Manually Set Peak Hour?				
Rail Traffic per Day	% High Occupancy Buses on Minor Road	% Tractor-Trailer Trucks on Minor Road	D	Peak Hour	Major Road Vol.	Minor Road Vol.	Adjusted Minor Vol.
1	0	0% to 2.5%	660	7:00	614	209	70.015



Conclusions/Comments:

**Warrant analysis includes Year 2018 existing traffic.

Based on the warrant analysis, Warrants 2, 3, & 7 are expected to be met.

Updated: 12/6/2017

Hourly Volume Data																						
One Hour Time Period	Start Time	↓ From North (SB)					← From East (WB)					↑ From South (NB)					→ From West (EB)					Total Vehicle Volume
		Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	
AM	6:00	68	177	17	0	262	5	72	128	0	205	28	14	75	0	117	38	86	6	0	130	714
	7:00	62	187	22	0	271	12	116	170	0	298	46	37	46	0	129	96	198	22	0	316	1014
	8:00	23	91	11	0	125	14	89	89	0	192	36	37	46	0	119	31	94	14	0	139	575
	9:00	11	49	2	0	62	12	53	62	0	127	40	37	23	0	100	44	75	5	0	124	413
MD	10:00	17	40	7	0	64	5	54	66	1	126	28	22	30	0	80	27	61	7	0	95	365
	11:00	23	39	11	0	73	11	75	50	0	136	54	43	42	0	139	44	93	16	0	153	501
	12:00	18	52	8	0	78	13	75	65	0	153	56	63	44	0	163	60	81	20	0	161	555
	13:00	18	50	11	0	79	6	85	43	0	134	55	56	50	0	161	55	64	11	0	130	504
PM	14:00	24	72	6	0	102	27	104	57	0	188	103	101	91	0	295	87	116	32	0	235	820
	15:00	18	60	6	0	84	23	122	101	0	246	98	155	49	0	302	75	120	59	0	254	886
	16:00	19	84	10	0	113	27	137	77	0	241	135	187	50	0	372	56	126	56	0	238	964
	17:00	12	34	10	0	56	21	150	78	0	249	97	160	45	0	302	46	106	33	0	185	792
	18:00	10	43	1	0	54	4	96	50	0	150	63	58	30	0	151	40	56	12	0	108	463
	19:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	20:00																					
	21:00																					
Totals		323	978	122	0	1423	180	1228	1036	1	2445	839	970	621	0	2430	699	1276	293	0	2268	8566

Note: Copy volume data and paste into cells using paste special -> values

Note: U-Turns are counted as Left Turns in the Volume Totals

Please Select the Major Road: **E/W**

Major Road Left Turn as Minor Approach? **No**

% Right Turns Included (Default 0%)

From North (SB)	0%
From East (WB)	100%
From South (NB)	0%
From West (EB)	100%

Major Road Volume Totals: East/West				
Right	Thru	Left	T+LT	Total
43	158	134	292	335
108	314	192	506	614
45	183	103	286	331
56	128	67	195	251
32	115	74	189	221
55	168	66	234	289
73	156	85	241	314
61	149	54	203	264
114	220	89	309	423
98	242	160	402	500
83	263	133	396	479
67	256	111	367	434
44	152	62	214	258
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
879	2504	1330	3834	4713

Minor Road Highest Volume: North/South				
Right	Thru	Left	T+LT	Total
0	177	17	194	194
0	187	22	209	209
0	91	11	102	102
0	37	23	60	60
0	22	30	52	52
0	43	42	85	85
0	63	44	107	107
0	56	50	106	106
0	101	91	192	192
0	155	49	204	204
0	187	50	237	237
0	160	45	205	205
0	58	30	88	88
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	1337	504	1841	1841

***																	IN		OUT				IN		OUT			
Start Time	↓				←				↑				→				Intersection Totals	IN	OUT	IN %	OUT %	Notes						
	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn							% AADT IN	% AADT OUT				
6-7am	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	← % Reduction, Sensitivity Test							
7-8am	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0								
8-9am	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0								
9-10am	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0								
10-11am	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0								
11am-12pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0								
12-1pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0								
1-2pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0								
2-3pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0								
3-4pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0								
4-5pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0								
5-6pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0								
6-7pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0								
7-8pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0								
																	IN %		OUT %									
																	OUT %		OUT %									

Wisconsin Department of Transportation Traffic Signal Warrant Summary Worksheet

70%

The Worksheet(s) attached are provided as an attachment to the Engineering Investigation Study for:

Intersection: Freistadt Road (CTH F) & Maple Road

County: Washington

Village: Germantown

Major Street: Freistadt Road (CTH F)

Critical Approach Speed: 45 mph

Lanes: 1 lane

Minor Street: Maple Road

Critical Approach Speed: 45 mph

Lanes: 1 lane

% Right Turns Included

From North (SB) 0%

From East (WB) 100%

From South (NB) 0%

From West (EB) 100%

In built-up area of isolated community of < 10,000 population? No

Total number of approaches at intersection? 4 or more

If it is a "T" intersection, inflate minor threshold to 150%? No

Manually set volume level?

Analysis based on EXISTING volume data.

Date	Day of the Week	Time (HH:MM)			
		From	AM / PM	To	AM / PM
Year 2028 Background Traffic**	Yes	6:00	AM	19:00	PM

Warrant Evaluation Summary	Warrant Met:
Warrant 1: Eight - Hour Vehicular Volume	Yes
Condition A: Minimum Vehicular Volume	Yes
Condition B: Interruption of Continuous Traffic	No
Condition C: Combination: 80% of A and B	No
Warrant 2: Four-Hour Volume	Yes
Warrant 3: Peak Hour Volume	Yes
Warrant 4: Pedestrian Volume	N/A
Criterion A: Four-Hour	
Criterion B: Peak-Hour	
Warrant 5: School Crossing	N/A
Warrant 6: Coordinated Signal System	N/A
Warrant 7: Crash Experience	Yes
Warrant 8: Roadway Network	N/A
Warrant 9: Intersection Near a Grade Crossing	N/A

Warrant Analysis Conducted By:

Name: Christian R. Sternke, P.E.

Agency: TADI

Date: 1/23/2019

Warrant 1: Eight - Hour Vehicular Volume

70%
Warrant Evaluated? Yes
Warrant Satisfied? Yes
Manually Set To:

Condition A :		
Min. Veh. Volume		
Volume Level	70%	56%
Major Rd. Req	350	280
Minor Rd. Req	105	84
Number of Hours	8	11

Satisfied? Yes

Condition B:		
Interruption of Continuous Traffic		
Volume Level	70%	56%
Major Rd. Req	525	420
Minor Rd. Req	53	42
Number of Hours	3	5

Satisfied? No

Condition C:		
Combination of A & B at 56%		

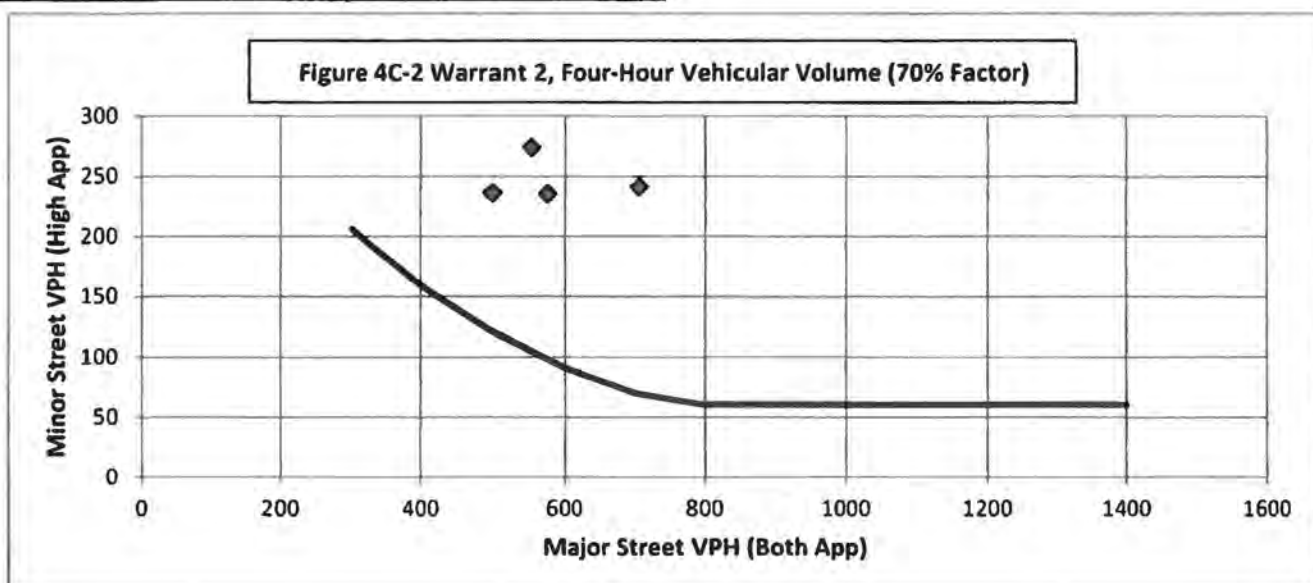
Satisfied? No

6:00 AM		Enter Start Time (Military Time) (HH:MM)			Total
Time Period	From	To	Major Road: Both App. (VPH)	Minor Road: High App. (VPH)	
1	6:00	7:00	387	224	611
2	7:00	8:00	708	241	949
3	8:00	9:00	382	118	500
4	9:00	10:00	289	70	359
5	10:00	11:00	254	60	314
6	11:00	12:00	333	98	431
7	12:00	13:00	361	124	485
8	13:00	14:00	305	123	428
9	14:00	15:00	488	221	709
10	15:00	16:00	576	235	811
11	16:00	17:00	553	274	827
12	17:00	18:00	500	236	736
13	18:00	19:00	299	102	401
14	19:00	20:00	0	0	0
15	20:00	21:00	0	0	0
16	21:00	22:00	0	0	0

Warrant 2: Four-Hour Volume

70%

Hour Start	7:00	16:00	15:00	17:00
Major Road Vol.	708	553	576	500
Minor Road Vol.	241	274	235	236

Warrant Evaluated? Yes
Warrant Satisfied? Yes
Manually Set To:


Warrant 3: Peak Hour Volume

70%
Warrant Evaluated? Yes
Warrant Satisfied? Yes
Manually Set To:

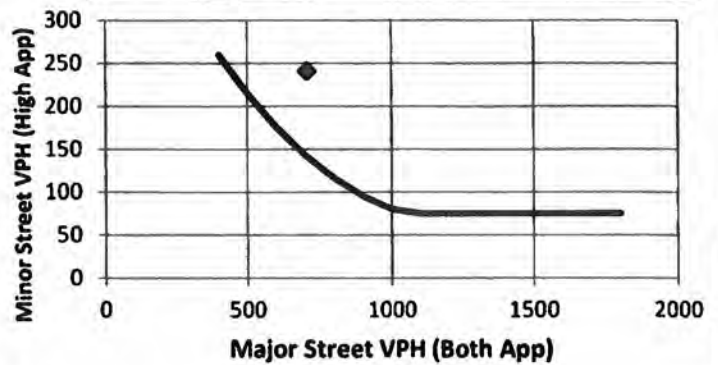
Condition justifying use of warrant:

None

Criteria		Met?
Delay on Minor Approach	4	Yes
Volume on Minor Approach	100	
Total Entering Volume (veh/h)	800	

Manually Set Peak Hour? No

Peak Hour	Major Road Vol. (Both App.)	Minor Road Vol. (High App.)
7:00	708	241

Figure 4C-4 Warrant 3, Peak Hour (70% Factor)


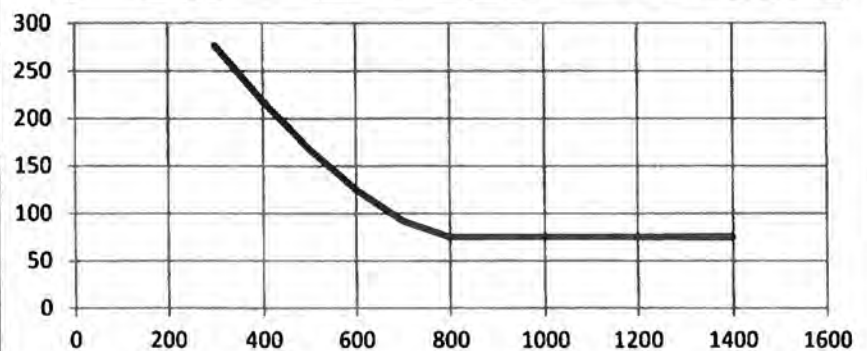
Warrant 4: Pedestrian Volume

70%
Warrant Evaluated? No
Warrant Satisfied? N/A
Manually Set To:
Criterion A: Four Hour

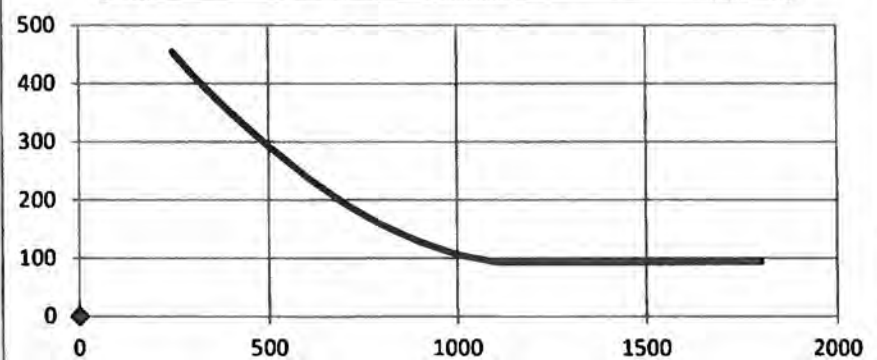
Hour (Start)	Pedestrian Volume	Major Road Vol.
		0
		0
		0
		0

Manually Set Major Rd Vol?

Avg. walk speed less than 3.5 ft/s?

Criterion A Satisfied?
Figure 4C-6 Warrant 4, Pedestrian Four-Hour Volume (70% Factor)

Criterion B: Peak Hour

Peak Hour	Pedestrian Vol.	Major Road Vol.
0:00	0	0

Criterion B Satisfied?
Figure 4C-8 Warrant 4, Pedestrian Peak Hour (70% Factor)


Warrant 5: School Crossing**70%****Warrant Evaluated? No****Warrant Satisfied? N/A****Manually Set To:**

Criteria	Fulfilled?
1 There are a MINIMUM of 20 school children during the highest crossing hour.	
2 There are fewer adequate gaps in the major road traffic stream during the period when the school children are using the crossing than the number of minutes in the same period.	
3 The nearest traffic signal along the major road is located more than 300 ft away. Or, the nearest traffic signal is within 300 ft but the proposed traffic signal will not restrict the progressive movement of traffic.	

Warrant 6: Coordinated Signal System**70%****Warrant Evaluated? No****Warrant Satisfied? N/A****Manually Set To:**

Criteria	Fulfilled?
1 Signal spacing > 1000 ft	
2 On a one-way road or a road that has traffic predominantly in one direction, the adjacent signals are so far apart that they do not provide the necessary degree of vehicle platooning.	
3 On a two-way road, adjacent signals do not provide the necessary degree of platooning and the proposed and the adjacent signals will collectively provide a progressive operation.	

Warrant 7: Crash Experience**70%****Warrant Evaluated? Yes****Warrant Satisfied? Yes****Manually Set To:**

Criteria	Met?	Fulfilled?
1 Adequate trial of other remedial measures has failed to reduce crash frequency. Measures Tried: lane configuration modifications without success reducing crashes		Yes
2 Five or more reported crashes, of types susceptible to correction by signal, have occurred within a 12 month period.	# of crashes per 12 months 9	Yes
3 Warrant 1, Condition A (80%)	Yes	Yes
Warrant 1, Condition B (80%)	No	
Warrant 4, Criterion A (80%)	No	
Warrant 4, Criterion B (80%)	No	

Warrant 8: Roadway Network**70%****Warrant Evaluated? No****Warrant Satisfied? N/A****Manually Set To:**

Criteria	Met?	Fulfilled?
1 Total entering volume of at least 1,000 veh/h during typical weekday peak hour	949	No
Five-year projected volumes that satisfy one or more of Warrants 1, 2, or 3.	No	No
2 Total entering vol. of at least 1,000 veh/h for each of any 5 hrs of non-normal business day (Sat. or Sun.)		
Hour		
Volume		

Characteristics of Major Routes - Select yes if all intersecting routes have characteristic	Fulfilled?
1 Part of the road or highway system that serves as the principal roadway network for through traffic flow	
2 Rural or suburban highway outside of, entering, or traversing a city	
3 Appears as a major route on an official plan	

Warrant 9: Intersection Near a Grade Crossing

70%

Warrant Evaluated? No

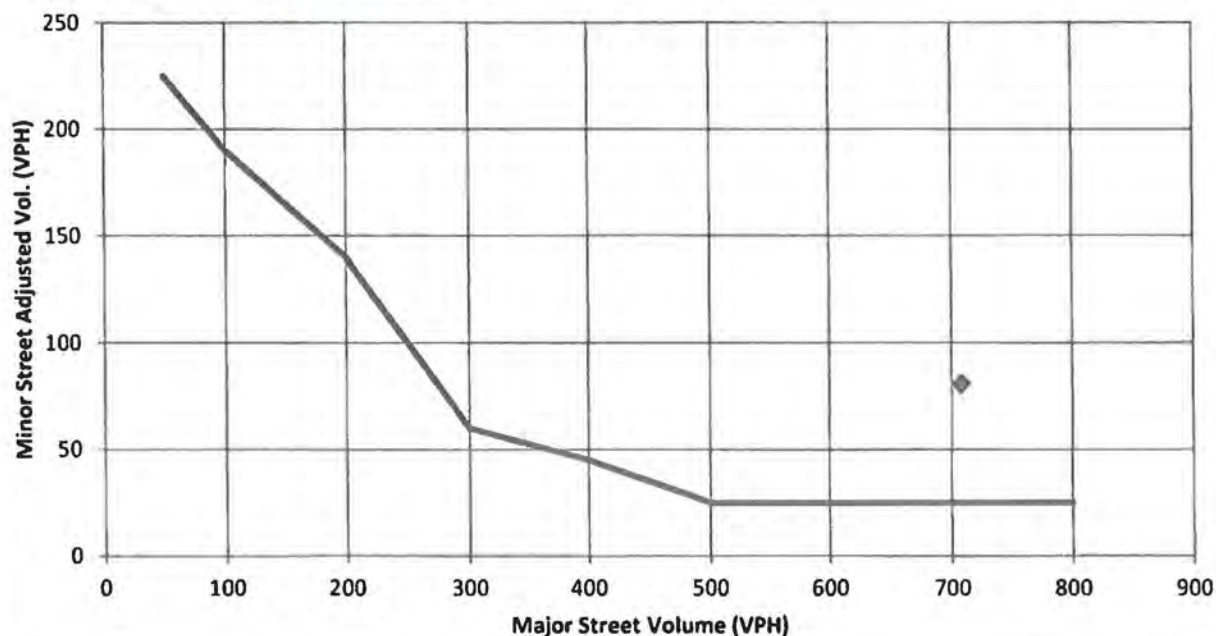
Warrant Satisfied? N/A

Manually Set To:

Adjustment Factors			Manually Set Peak Hour?				
Rail Traffic per Day	% High Occupancy Buses on Minor Road	% Tractor-Trailer Trucks on Minor Road	D	Peak Hour	Major Road Vol.	Minor Road Vol.	Adjusted Minor Vol.
1	0	0% to 2.5%	660	7:00	708	241	80.735



Figure 4C-9 Warrant9, Intersection Near a grade Crossing (One Approach Lane at the Track Crossing)



Conclusions/Comments:

**Warrant analysis includes Year 2028 background traffic.

Based on the warrant analysis, Warrants 1, 2, 3, & 7 are expected to be met.

Updated: 12/6/2017

Hourly Volume Data																						
One Hour Time Period Start Time		↓ From North (SB)					← From East (WB)					↑ From South (NB)					→ From West (EB)					Total Vehicle Volume
		Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	
AM	6:00	78	204	20	0	302	6	83	148	0	237	32	16	86	0	134	44	99	7	0	150	823
	7:00	71	216	25	0	312	14	134	196	0	344	53	43	53	0	149	111	228	25	0	364	1169
	8:00	27	105	13	0	145	16	103	103	0	222	42	43	53	0	138	36	108	16	0	160	665
	9:00	13	56	2	0	71	14	61	71	0	146	46	43	27	0	116	51	86	6	0	143	476
MD	10:00	20	46	8	0	74	6	62	76	1	145	32	25	35	0	92	31	70	8	0	109	420
	11:00	27	45	13	0	85	13	86	58	0	157	62	50	48	0	160	51	107	18	0	176	578
	12:00	21	60	9	0	90	15	86	75	0	176	65	73	51	0	189	69	93	23	0	185	640
	13:00	21	58	13	0	92	7	98	50	0	155	63	65	58	0	186	63	74	13	0	150	583
PM	14:00	28	83	7	0	118	31	120	66	0	217	119	116	105	0	340	100	134	37	0	271	946
	15:00	21	69	7	0	97	27	141	116	0	284	113	179	56	0	348	86	138	68	0	292	1021
	16:00	22	97	12	0	131	31	158	89	0	278	156	216	58	0	430	65	145	65	0	275	1114
	17:00	14	39	12	0	65	24	173	90	0	287	112	184	52	0	348	53	122	38	0	213	913
	18:00	12	50	1	0	63	5	111	58	0	174	73	67	35	0	175	46	65	14	0	125	537
	19:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	20:00																					
	21:00																					
Totals		375	1128	142	0	1645	209	1416	1196	1	2822	968	1120	717	0	2805	806	1469	338	0	2613	9885

Note: Copy volume data and paste into cells using paste special -> values

Note: U-Turns are counted as Left Turns in the Volume Totals

Please Select the Major Road:

Major Road Left Turn as Minor Approach?

% Right Turns Included (Default 0%)

From North (SB)	0%
From East (WB)	100%
From South (NB)	0%
From West (EB)	100%

Major Road Volume Totals: East/West				
Right	Thru	Left	T+LT	Total
50	182	155	337	387
125	362	221	583	708
52	211	119	330	382
65	147	77	224	289
37	132	85	217	254
64	193	76	269	333
84	179	98	277	361
70	172	63	235	305
131	254	103	357	488
113	279	184	463	576
96	303	154	457	553
77	295	128	423	500
51	176	72	248	299
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
1015	2885	1535	4420	5435

Minor Road Highest Volume: North/South				
Right	Thru	Left	T+LT	Total
0	204	20	224	224
0	216	25	241	241
0	105	13	118	118
0	43	27	70	70
0	25	35	60	60
0	50	48	98	98
0	73	51	124	124
0	65	58	123	123
0	116	105	221	221
0	179	56	235	235
0	216	58	274	274
0	184	52	236	236
0	67	35	102	102
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	1543	583	2126	2126

RSM 2B
FORM DT1199 (N/A)

RSM 3B

OPERATIONS ANALYSIS



PROVIDING TRAFFIC ENGINEERING SOLUTIONS

Date: February 8, 2019

Technical Memorandum

To: Eric Nitschke, P.E.
Village Engineer
Village of Germantown
N112W17001 Mequon Road
Germantown, WI 53022

From: John Campbell, P.E.
Christian R. Sternke, P.E.

Subject: Traffic and Safety Intersection Analysis
Freistadt Road at Maple Road
Germantown, Wisconsin

PART A – INTRODUCTION

The Village of Germantown has requested a safety and operational analysis of the Freistadt Road intersection with Maple Road within the Village of Germantown, Wisconsin. The traffic study is being conducted to determine if modifications to the roadway geometry and traffic control would improve the safety and operations of the intersection. It is anticipated that this document will supplement a Highway Safety Improvement Program (HSIP) application for improvements to this intersection – which if accepted in the program, may be eligible for 90 percent Federal Funding.

This technical memorandum has been prepared to analyze the intersection under Year 2018 existing traffic conditions and Year 2028 design year traffic conditions. An aerial map showing the study area intersection is shown in Exhibit 1A. A transportation detail showing existing lane configurations, traffic controls, and posted speed limits is shown in Exhibit 1B.

PART B – CRASH ANALYSIS

Crash Frequency/Severity

A review of the crash records indicated that thirty-seven (37) non-deer crashes occurred at the intersection of Freistadt Road with Maple Road over the past five years (January 2014 through December 2018). The intersection crash rate was calculated to be 2.29 crashes per million entering vehicles (MEV). While there are not statewide average crash statistics available in Wisconsin, a crash rate over 2 crashes per MEV generally indicates a substantial safety issue. Most concerning at this location is the severity of the crashes observed. Eight (8) resulted in Type B injury, and one (1) resulted in Type A injury. The remaining crashes (28) resulted in property damage only. Seventy-six percent (76%) of the crashes were angle crashes and another five percent (5%) of the crashes were rear-end crashes. The majority of the crashes, sixty-eight percent (68%), occurred during the daytime hours. Crash diagrams were prepared for the study area intersection and are included in the Exhibit 2A. A crash statistics summary is also included in the Exhibit 2B.

Crash Patterns Observed

Fourteen (14) of the thirty-seven (37) crashes occurred with northbound Maple Road vehicles and eastbound or westbound Freistadt Road vehicles. Twelve (12) of the thirty-seven (37) angle crashes occurred with southbound Maple Road vehicles and eastbound or westbound Freistadt Road vehicles. Factors leading to these angle crashes include:

- Maple Road drivers misjudging available gaps
- Drivers not seeing oncoming eastbound/westbound Freistadt Road vehicles
- Drivers that ran-the-stop-sign because they did not see it
- Drivers on Maple Road sometimes indicated they had expected traffic on Freistadt Road to stop thinking they had a stop sign.
- The higher speeds of both roadways (40 mph posted speed)

The other crashes involved a combination of additional rear-end crashes, overturn crashes, or vehicles hitting a fixed object (stop sign).

PART C – OPERATIONAL ANALYSIS

The study area intersection was analyzed based on the procedures set forth in the *Highway Capacity Manual, 6th Edition* (HCM) using a Synchro 10 traffic model. Intersection operation is defined by "level of service". Level of Service (LOS) is a quantitative measure that refers to the overall quality of flow at an intersection ranging from very good, represented by LOS 'A', to very poor, represented by LOS 'F'. For the purpose of this study, LOS D has been identified as the acceptable LOS for peak hour operating conditions. It is noted that this threshold is the industry standard for urban areas used by WisDOT and many municipalities. Descriptions of the various levels of service are as follows:

LOS A is the highest level of service that can be achieved. Under this condition, intersection approaches appear quite open, turning movements are easily made, and nearly all drivers find freedom of operation. At signalized and unsignalized intersections, average delays are less than 10 seconds.

LOS B represents stable operation. At signalized intersections, average vehicle delays are 10 to 20 seconds. At unsignalized intersections, average delays are 10 to 15 seconds.

LOS C still represents stable operation, but periodic backups of a few vehicles may develop behind turning vehicles. Most drivers begin to feel restricted, but not objectionably so. At signalized intersections, average vehicle delays are 20 to 35 seconds. At unsignalized intersections, average delays are 15 to 25 seconds.

LOS D represents increasing traffic restrictions as the intersection approaches instability. Delays to approaching vehicles may be substantial during short peaks within the peak period, but periodic clearance of long lines occurs, thus preventing excessive backups. At signalized intersections, average vehicle delays are 35 to 55 seconds. At unsignalized intersections, average delays are 25 to 35 seconds.

LOS E represents the capacity of the intersection. At signalized intersections, average vehicle delays are 55 to 80 seconds. At unsignalized intersections, average delays are 35 to 50 seconds.

LOS F represents jammed conditions where the intersection is over capacity and acceptable gaps for unsignalized intersections in the mainline traffic flow are minimal. At signalized intersections, average vehicle delays exceed 80 seconds. At unsignalized intersections, average delays exceed 50 seconds.

Year 2018 Operations – Existing Geometry & Traffic Control

The weekday morning and weekday afternoon peak hours are expected to drive the improvements necessary to adequately accommodate the overall intersection volumes. A thirteen-hour (6:00 am to 7:00 pm) weekday turning movement count was conducted in December of 2018 at the study area intersection. Based on the turning movement counts, the weekday morning and weekday evening peak hours were identified as being 6:45 to 7:45 am and 4:15 to 5:15 pm, respectively. The existing traffic volumes at the study area intersection are shown in Exhibit 3. The traffic counts used to determine peak hour factors and truck percentages have been included in the appendix of this study.

Table 1 shows the results of the Year 2018 existing weekday morning and weekday evening peak hour operational analysis at the study area intersection. The existing intersection geometry and traffic volumes were used for the analysis.

Table 1
Year 2018 Existing Traffic Peak Hour Operating Conditions
With Existing Geometrics and Traffic Control

Intersection	Peak Hour		Level of Service per Movement by Approach											
			Eastbound			Westbound			Northbound			Southbound		
			LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Existing Geometrics with Existing Two-Way Stop Control	AM	LOS	A	*		A	*		F	B		F	A	
		Queue	0	*		15	*		und.	15		310	10	
	PM	LOS	A	*		A	*		D	C		D	A	
		Queue	5	*		5	*		80	70		45	5	

(--) indicates a movement that is prohibited or does not exist; (*) indicates a freeflow movement.

Queue is maximum of the 50th & 95th percentile queue, measured in feet.

As shown in Table 1, the northbound and southbound shared through/left-turn lanes are currently operating at LOS F conditions in the morning peak hour. All other movements are operating acceptably at LOS D or better conditions in each peak hour.

Design Year 2028 Operations – Existing Geometry & Traffic Control

The turning movement traffic count was forecasted to the Year 2028 using a 1.53-percent linear annual growth rate. This rate was determined based on historical average annual daily traffic (AADT) data within the study area from 1977 to present. The historical AADT data have been included in the appendix of this study.

The Year 2028 background traffic volumes are shown in Exhibit 4.

Table 2 shows the results of the Year 2028 background weekday morning and weekday evening peak hour operational analysis at the study area intersection.

Table 2
Year 2028 Background Traffic Peak Hour Operating Conditions
With Existing Geometrics and Traffic Control

Intersection	Peak Hour		Level of Service per Movement by Approach											
			Eastbound			Westbound			Northbound			Southbound		
			LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Existing Geometrics with Existing Two-Way Stop Control	AM	LOS	A	*		A	*		F	C		F	A	
		Queue	5	*		20	*		und.	20		520	10	
	PM	LOS	A	*		A	*		F	D		F	A	
		Queue	5	*		10	*		155	110		110	5	

(--) indicates a movement that is prohibited or does not exist; (*) indicates a freeflow movement.

Queue is maximum of the 50th & 95th percentile queue, measured in feet.

As shown in Table 2, the northbound and southbound shared through/left-turn lanes are expected to operate at LOS F conditions in both peak hour under Year 2028 background traffic conditions. All other movements are expected to operate acceptably at LOS D or better conditions in each peak hour.

Year 2018 Operations – Alternative Analysis

The following geometric and/or traffic control modifications were evaluated at the study area intersection. Given the higher speeds of the facility and its frequent use by semi-truck traffic, additional geometric modifications that would be expected to improve safety were considered – for example, the addition of an EB right-turn lane and off-set left-turn lanes EB/WB in *Modification 5*.

Modification 1: Reconfigure the northbound approach to include one exclusive left-turn lane, one exclusive through lane, and one exclusive right-turn lane. Keep existing two-way stop control.

Modification 2: Reconfigure the northbound approach to include one shared through/left-turn lane and one exclusive right-turn lane, which fits within the existing footprint of the intersection. Modify traffic control to all-way stop control.

Modification 3: Reconfigure the northbound and eastbound approaches to include one exclusive left-turn lane, one exclusive through lane, and one exclusive right-turn lane. Modify traffic control to all-way stop control.

Modification 4: Reconfigure the northbound and southbound approaches to one exclusive left-turn lane and one shared through/right-turn lane, which fits within the existing footprint of the intersection. Modify traffic control to traffic signal control.

Modification 5: Reconfigure the northbound and eastbound approaches to include one exclusive left-turn lane, one exclusive through lane, and one exclusive right-turn lane and reconfigure the southbound approach to one exclusive left-turn lane and one shared through/right-turn lane. Modify the traffic control to traffic signal control.

Modification 6: Reconfigure the intersection to a single lane roundabout.

Table 3 shows the results of the Year 2018 existing weekday morning and weekday evening peak hour operational analysis at the study area intersection with the modifications implemented. The Year 2018 existing weekday morning and weekday evening peak hour traffic volumes, as shown in Exhibit 3, were used for the analysis.

Table 3
Year 2018 Existing Traffic Peak Hour Operating Conditions
Alternative Analysis with Modified Geometrics and/or Traffic Control

Intersection	Peak Hour		Level of Service per Movement by Approach											
			Eastbound			Westbound			Northbound			Southbound		
			LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
¹ Modified Geometrics with Two-Way Stop Control	AM	LOS	A	*		A	*		F	C	B	F	A	
		Queue	0	*		15	*		und.	15	5	310	10	
	PM	LOS	A	*		A	*		C	D	B	D	A	
		Queue	5	*		5	*		25	115	15	45	5	
² Modified Geometrics with All-Way Stop Control	AM	LOS	B	C		B	B		B	B	B	C	A	
		Queue	5	105		45	30		20	10	75	10		
	PM	LOS	B	B		B	B		C	B	B	B	A	
		Queue	10	45		20	40		75	20	15	5		
³ Modified Geometrics with All-Way Stop Control	AM	LOS	B	C	B	C	B		B	B	B	C	B	
		Queue	5	65	20	50	30		10	10	10	80	15	
	PM	LOS	B	B	B	B	B		B	B	B	B	A	
		Queue	15	30	15	20	45		10	55	25	20	5	
⁴ Modified Geometrics with Traffic Signal Control	AM	LOS	A	A		B	A		B	B	B	B	B	
		Queue	15	135		90	55		30	45	20	140		
	PM	LOS	A	A		A	A		B	B	B	B	B	
		Queue	35	85		45	75		25	125	10	35		
⁵ Modified Geometrics with Traffic Signal Control	AM	LOS	A	A	A	B	A		B	B	B	B	B	
		Queue	15	85	30	85	55		30	20	20	125		
	PM	LOS	A	A	A	A	A		B	B	B	B	B	
		Queue	25	45	20	35	60		25	75	35	10	40	
⁶ Single Lane Roundabout	AM	LOS	A			A			A			A		
		Queue	40			25			10			30		
	PM	LOS	A			A			A			A		
		Queue	20			25			35			10		

(--) indicates a movement that is prohibited or does not exist; (*) indicates a freeflow movement.
Queue is maximum of the 50th & 95th percentile queue, measured in feet.

As shown in Table 3, under two-way stop control, some movements are expected to continue operating at LOS F conditions even with the modification to lane geometry. However, all movements are expected to operate at LOS C or better conditions in both peak hours in each additional alternative analyzed.

Design Year 2028 Operations – Alternative Analysis

The six geometric and/or traffic control modifications analyzed under Year 2018 traffic conditions were also analyzed under Year 2028 traffic conditions.

Table 4 shows the results of the Year 2028 existing weekday morning and weekday evening peak hour operational analysis at the study area intersection with the modifications implemented. The Year 2028 weekday morning and weekday evening peak hour traffic volumes, as shown in Exhibit 4, were used for the analysis.

Freistadt Road at Maple Road Intersection Analysis - Germantown, Wisconsin

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Table 4
Year 2028 Background Traffic Peak Hour Operating Conditions
Alternative Analysis with Modified Geometrics and/or Traffic Control

Intersection	Peak Hour		Level of Service per Movement by Approach											
			Eastbound			Westbound			Northbound			Southbound		
			LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
¹ Modified Geometrics with Two-Way Stop Control	AM	LOS	A	*		A	*		F	D	B	F		A
		Queue	5	*		20	*		und.	20	10	520		10
	PM	LOS	A	*		A	*		D	F	B	F		A
		Queue	5	*		10	*		40	205	20	110		5
² Modified Geometrics with All-Way Stop Control	AM	LOS	B	D	C	B			B	B	B	C		B
		Queue	5	170	65	40			25	10	110	15		
	PM	LOS	B	C	B	B			C	B	B	B		A
		Queue	15	60	25	55			110	30	20	5		
³ Modified Geometrics with All-Way Stop Control	AM	LOS	B	C	B	C			B	B	B	D		B
		Queue	5	90	25	70			15	10	15	125		15
	PM	LOS	B	B	B	B			B	C	B	B		B
		Queue	15	40	15	25			15	75	30	25		5
⁴ Modified Geometrics with Traffic Signal Control	AM	LOS	A	A	B	A			B	B	B	B		B
		Queue	20	170	115	70			40	60	25	195		
	PM	LOS	A	A	A	A			B	B	B	B		B
		Queue	45	110	60	100			30	160	10	45		
⁵ Modified Geometrics with Traffic Signal Control	AM	LOS	A	A	A	B			B	A	A	B		B
		Queue	20	110	40	110			35	25	25	20		160
	PM	LOS	A	A	A	A			B	B	B	B		B
		Queue	35	55	25	45			30	85	40	10		40
⁶ Single Lane Roundabout	AM	LOS		A		A			A			A		
		Queue		50		30			10			40		
	PM	LOS		A		A			A			A		
		Queue		25		30			45			10		

(--) indicates a movement that is prohibited or does not exist; (*) indicates a freeflow movement.

Queue is maximum of the 50th & 95th percentile queue, measured in feet.

As show, under two-way stop control, some movements are expected to continue operating at LOS F conditions even with the modification to lane geometry. However, all movements are expected to operate at LOS D or better conditions in both peak hours in each additional alternative analyzed.

PART D – WARRANT ANALYSIS

All-Way Stop Control Warrants – Year 2018 Volumes

The Federal Highway Administration's *Manual on Uniform Traffic Control Devices (MUTCD)* provides the following guidance for the installation of all-way stop control:

- All-way stop control is used where the volume of traffic on intersecting roads is approximately equal – *Freistadt Road volumes are higher than Maple Road.*
- All-way stop control should be considered if five or more reported crashes within a 12-month period are susceptible to correction by an all-way stop (left-turn and angle

crashes). *This criterion is met. There were nine (9) such crashes within the 12-month period between September 1, 2017 and August 31, 2018.*

- All-way stop control should be considered when for each of the same eight-hours the volumes on the major street approaches (Freistadt Road) is greater than 300 vehicles per hour and the side street approaches (Maple Road) is greater than 200 vehicles per hour. *This criterion is met for 8 of the 13 counted hours (6:00 to 9:00 am, 12:00 to 1:00 pm, and 2:00 to 6:00 pm).*
- All-way stop control may be considered at locations that generate high pedestrian volumes. *This criterion is not met. High pedestrian volumes were not observed.*
- All-way stop control may be considered at locations where a road user cannot see conflicting traffic unless conflicting traffic does not also stop. *This criterion is not met. Sight lines at the intersection were observed to be ample.*
- All-way stop control may be considered where two neighborhood collector streets of similar design/operating characteristics intersect and the installation of all-way stop control would improve operations. *This criterion is not met. Freistadt Road and Maple Road are classified as minor arterials per the Milwaukee urban area Functional Classification map dated 11/09/15.*

Traffic Signal Warrants – Year 2018 Volumes

Note that traffic signal warrants should be viewed as guidelines to help decide whether a traffic signal may be installed. Meeting traffic signal warrants does not translate to a legal requirement for their installation. Completed warrant analysis worksheets are included in the appendix of this study.

A traffic signal warrant analyses was performed at the Freistadt Road intersection with Maple Road as part of this study. Chapter 4C of the 2009 *Manual on Uniform Traffic Control Devices* (MUTCD) outlines the standards for determining the need for traffic signals at a particular location. For a traffic signal to be installed, at least one of the following warrants must be satisfied. The eight signal warrants are listed below:

- Warrant 1, Eight-Hour Vehicular Volume.
- Warrant 2, Four-Hour Vehicular Volume.
- Warrant 3, Peak Hour.
- Warrant 4, Pedestrian Hour.
- Warrant 5, School Crossing.
- Warrant 6, Coordinated Signal Systems.
- Warrant 7, Crash Experience.
- Warrant 8, Roadway Network.

Warrants 1, 2, 3, and 7 have been evaluated for this location. The posted speed limit along Freistadt Road is 40 mph at the Maple Road intersection, so it was analyzed using the 70-percent minimum vehicular volumes per standard practice in WisDOT SE Region for 40 mph roadways. Warrants 1, 2, 3, and 7 are described below:

Warrant 1, Eight Hour Vehicular Volume states that a traffic signal may be considered if one of the following conditions exists for at least eight hours of an average day:

- A. The vehicles per hour given on the major street meet or exceed 500 and the vehicles per hour on the minor street meet or exceed 150; or
- B. The vehicles per hour given on the major street meet or exceed 750 and the vehicles per hour on the minor street meet or exceed 75.

Or if the following two conditions exist for eight hours of an average day:

- A. The vehicles per hour on the major street and minor street meet or exceed 80% of the values stated in A (400 major, 120 minor); and
- B. The vehicles per hour on the major street and minor street meet or exceed 80% of the values stated in B (600 major, 60 minor).

Warrant 2, Four Hour Volume is satisfied if during any four hours of an average day the major street and minor street volumes fall above the 100 percent four-hour curves shown on the graph in the Appendix of this report.

Warrant 3, Peak Hour Volume is satisfied if during any hour of an average day the major street and minor street volumes fall above the 100 percent peak hour curves shown on the graph in the Appendix of this report. Note that this signal warrant is typically applied only in unusual cases, such as office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time.

Warrant 7, Crash Experience states that a traffic signal may be considered if an engineering study finds that all of the following criteria are met:

- A. Adequate trial of alternatives with satisfactory observance and enforcement has failed to reduce the crash frequency; and
- B. Five or more reported crashes, of types susceptible to correction by a traffic control signal, have occurred within a 12-month period, each crash involving personal injury or property damage apparently exceeding the applicable requirements for a reportable crash; and
- C. For each of any 8 hours of an average day, the vehicles per hour (vph) given in both of the 80 percent columns of Warrant 1 Condition A, or the vph in both of the 80 percent columns of Warrant 1 Condition B exists on the major-street and the higher-volume minor-street approach, respectively, to the intersection.

The warrant analysis assumes the intersections to include one-lane approaches eastbound and westbound on Freistadt Road (major street) and a one-lane approaches northbound and southbound along Maple Road (minor street). The one lane designation on Maple Road was utilized since the volume of right-turn movements on the approach is excluded from the approach volume per the MUTCD.

The traffic signal warrant study was conducted using the existing 13-hour turning movement counts collected at the intersection as part of this study, as well as the design year forecasted volumes.

Freistadt Road at Maple Road Intersection Analysis - Germantown, Wisconsin
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February 8, 2019

Based on the warrant analysis, under Year 2018 existing volumes, Warrants 2, 3, and 7 are met at the Freistadt Road intersection with Maple Road. Under design Year 2028 forecasted volumes, Warrants 1, 2, 3, and 7 are expected to be met. Therefore, traffic signals are warranted at this intersection.

PART E – RECOMMENDED MODIFICATIONS

A traffic signal with the geometric modifications (*Modification 5*) described below and shown in Exhibit 5 is recommended at the Freistadt Road intersection with Maple Road:

- Install traffic signal control.
- Provide a positive offset for the EB and WB left-turn lanes.
- Construct an exclusive northbound right-turn lane and modify lane configuration to include one exclusive left-turn lane, one exclusive through lane, and one exclusive right-turn lane.
- Construct an exclusive eastbound right-turn lane – offset to improve sight distance for NB right-turners.
- Modify the southbound lane configuration to include one exclusive left-turn lane and one shared through/right-turn lane. Extend the left-turn lane to provide adequate storage and deceleration distance.

The reason for this recommendation is that *Modification 5* it is expected to provide safety and efficient operations for all users through the design year given the characteristics of the site. Furthermore, *Modification 5* is expected to have a modest overall construction/design cost (approximately one million dollars) compared to a single lane roundabout which could possibly be twice as much. ASWC is not recommended given the high approach speeds and semi-truck usage.

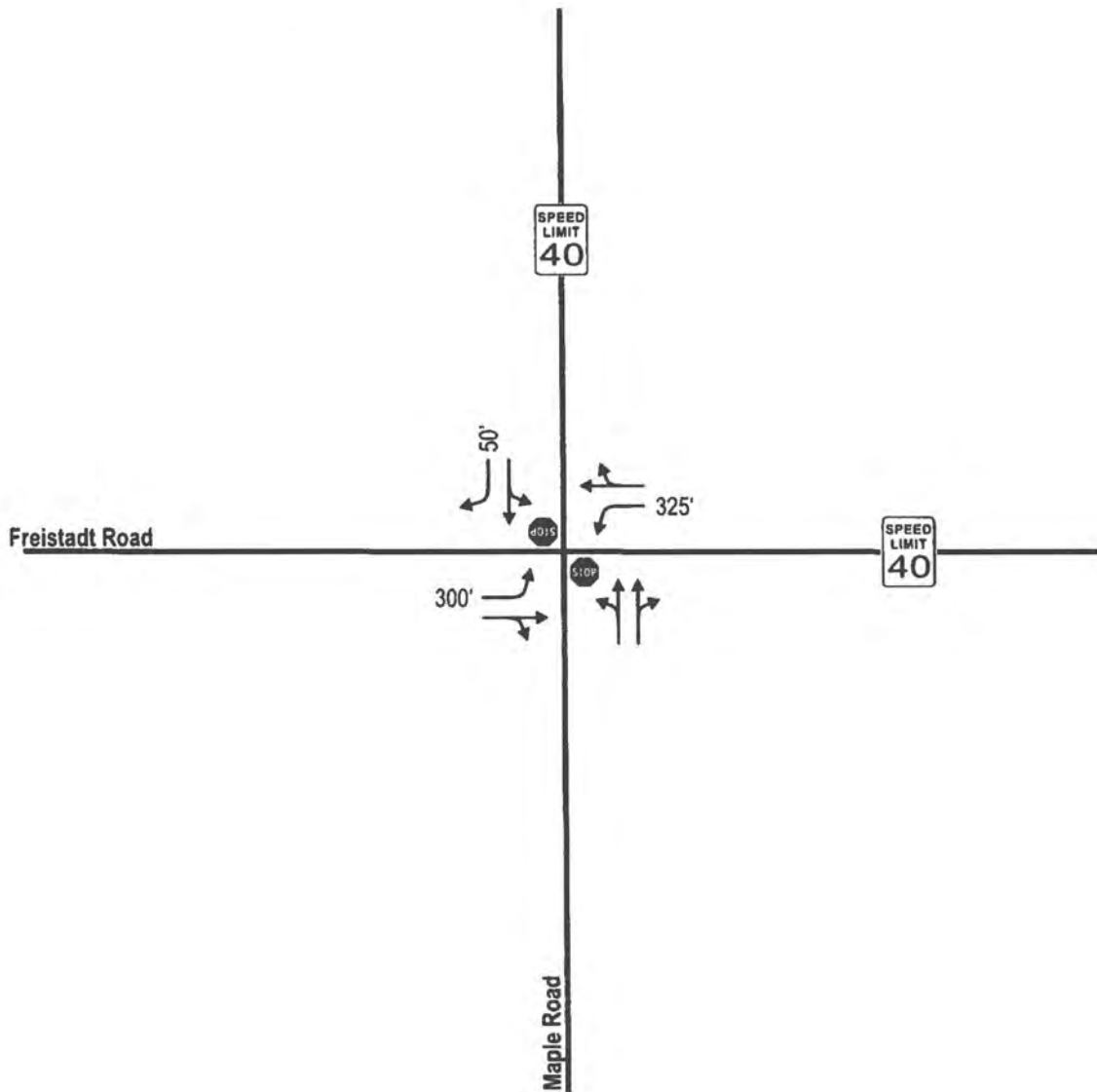
PART F – CONCLUSION

With the implementation of the recommended modifications as listed in this memorandum and shown in Exhibit 5, safe and efficient operations are expected at the study area intersection through the year 2028 traffic volume conditions.



LEGEND

-  Traffic Signal
-  Stop Sign
-  Existing Lane Configuration
-  XX' Existing Storage Length (in Feet)



NOT TO SCALE

CRASH STATISTICS

SPOT LOCATION



LOCATION: Friestadt Rd & Maple Rd
MUNICIPALITY: Germantown
COUNTY: Washington **STATE:** WI
TRAFFIC CONTROL: MINOR STOP CONTROLLED

DATES
FROM: 1/1/2014
TO: 12/31/2018
AADT: 8,850
AREA TYPE: URBAN

DURATION
5 YEARS
0 MONTHS

CRASH FREQUENCY & SEVERITY

YEAR	PD	TYPE C	TYPE B	TYPE A	FATAL	TOTAL
2014	8	0	2	0	0	8
2015	7	0	0	0	0	7
2016	5	0	2	0	0	7
2017	5	0	3	1	0	9
2018	5	0	1	0	0	6
2019						
2020						
TOTAL	28	0	8	1	0	37
PERCENT	75.7%	0.0%	21.6%	2.7%	0.0%	100.0%

CRASH RATES	per MEV
TOTAL	2.29
FATAL	0.00
INJURY	0.58
TYPE A	0.06
TYPE B	0.50
TYPE C	0.00

LIGHT CONDITIONS	PERCENT
DAY	25 67.6%
DARK	12 32.4%
TOTAL	37 100.0%

Note: Dawn, dusk, or street light conditions included in dark total.

DAY AND TIME

DAY	PERCENT	EARLY 2 AM to 5 AM	AM PEAK 5 AM to 10 AM	MIDDAY 10 AM to 2 PM	PM PEAK 2 PM to 5 PM	EVENING 5 PM to 10 PM	LATE 10 PM to 2 AM	Unknown	Total
MONDAY	13.5%	0	3	2	0	0	0	0	5
TUESDAY	27.0%	1	2	3	4	0	0	0	10
WEDNESDAY	18.9%	0	0	2	3	2	0	0	7
THURSDAY	18.9%	0	2	0	2	2	1	0	7
FRIDAY	16.2%	0	1	0	5	0	0	0	6
SATURDAY	2.7%	0	0	1	0	0	0	0	1
SUNDAY	2.7%	0	0	1	0	0	0	0	1
TOTAL		1	8	9	14	4	1	0	37
PERCENT		2.7%	21.6%	24.3%	37.8%	10.8%	2.7%	0.0%	

DRIVER AGES	PERCENT
<25	13 18.8%
25-34	12 17.4%
35-44	9 13.0%
45-54	15 21.7%
55-64	12 17.4%
65-74	4 5.8%
75-84	1 1.4%
85+	0 0.0%
UNKNOWN	3 4.3%
TOTAL	69 100.0%

Note: Statistics based on first and second vehicles in crashes.

VEHICLE TYPES	PERCENT
CAR	50 72.5%
TRUCK	18 26.1%
OTHER/UNK	1 1.4%
TOTAL	69 100.0%

Note: Statistics based on first and second vehicles in crashes.

VEHICLE DAMAGE	PERCENT
OTHER/UNK	3 4.3%
NONE	5 7.2%
VERY MINOR	2 2.9%
MINOR	9 13.0%
MODERATE	15 21.7%
SEVERE	27 39.1%
VERY SEVERE	8 11.6%
TOTAL	69 100.0%

Note: Statistics based on first and second vehicles in crashes.

VEHICLES INVOLVED	PERCENT
SINGLE VEHICLE	13.5%
TWO VEHICLES	81.1%
3 OR MORE VEHICLES	5.4%

SPOT LOCATION CRASH RATE:

2.29 Crashes per Million Entering Vehicles

ROAD CONDITIONS	PERCENT
DRY	31 83.8%
WET	5 13.5%
SNOW	1 2.7%
ICE	0 0.0%
MUD	0 0.0%
OTHER/UNK	0 0.0%
TOTAL	37 100.0%

CRASH TYPE	PERCENT
ANGLE	28 75.7%
REAR-END	2 5.4%
HEAD-ON	0 0.0%
SS-SAME	0 0.0%
SS-OPPOSITE	0 0.0%
PEDESTRIAN	0 0.0%
BICYCLE	0 0.0%
FIXED	4 10.8%
NOT FIXED	0 0.0%
DEER	0 0.0%
OVERTURN	1 2.7%
OTHR/UNK	2 5.4%
TOTAL	37 100.0%

BY SEASON	PERCENT
SPRING	10 27.0%
SUMMER	9 24.3%
FALL	9 24.3%
WINTER	9 24.3%
TOTAL	37 100.0%

Note: Wyo-Dec-Feb, Spr-Mar-May, Sum-June-Aug, Fall-Sept-Nov

PERCENT OF CRASHES

ON HORIZONTAL CURVE	0.0%
ON VERTICAL CURVE	10.8%
AT INTERSECTION	91.9%
ALCOHOL RELATED	2.7%
SPEED RELATED	5.4%



2293; 2/8/19

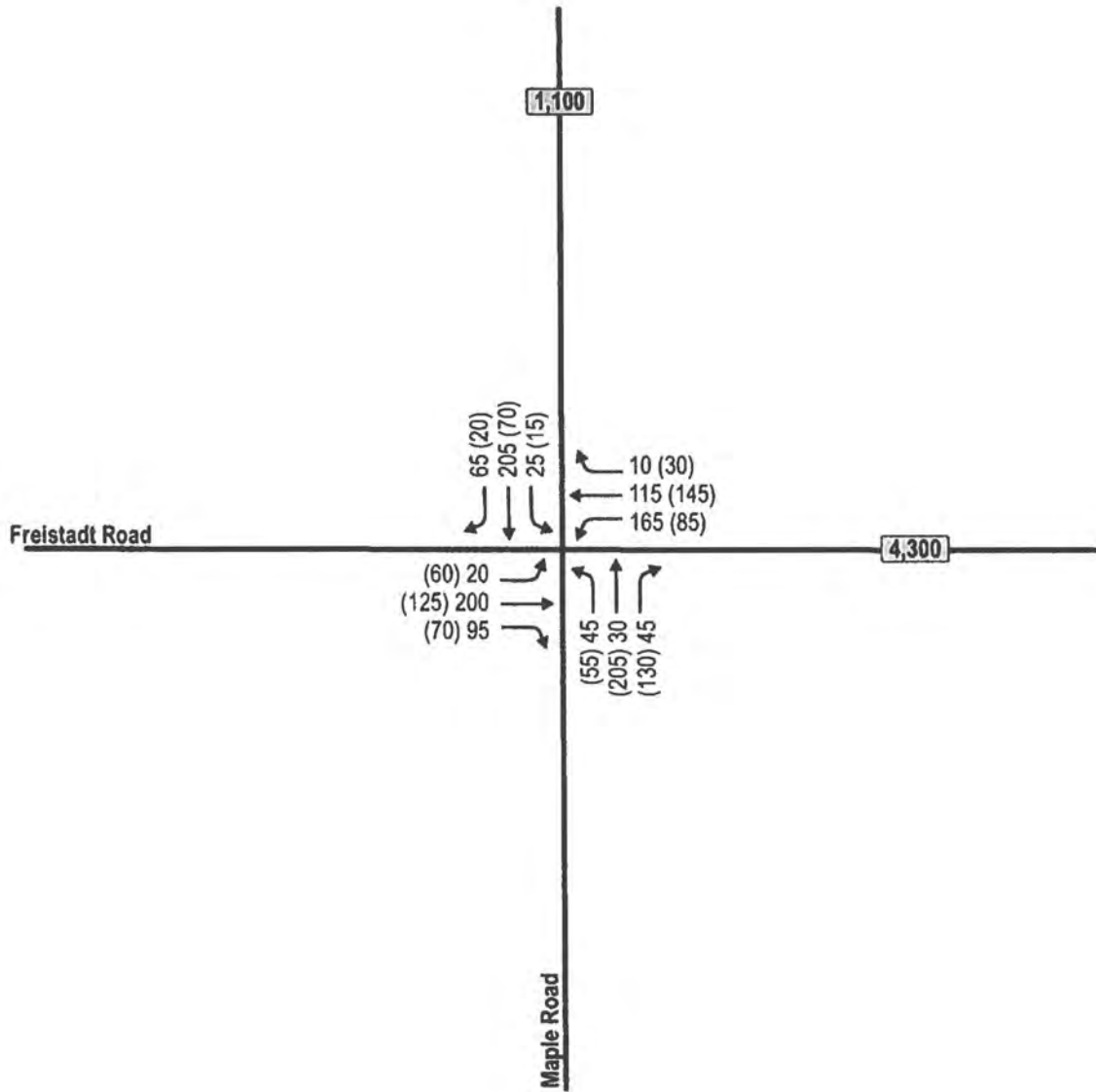


EXHIBIT 2B
CRASH HISTORY (2014-2018)
CRASH STATISTICS

GERMANTOWN, WISCONSIN

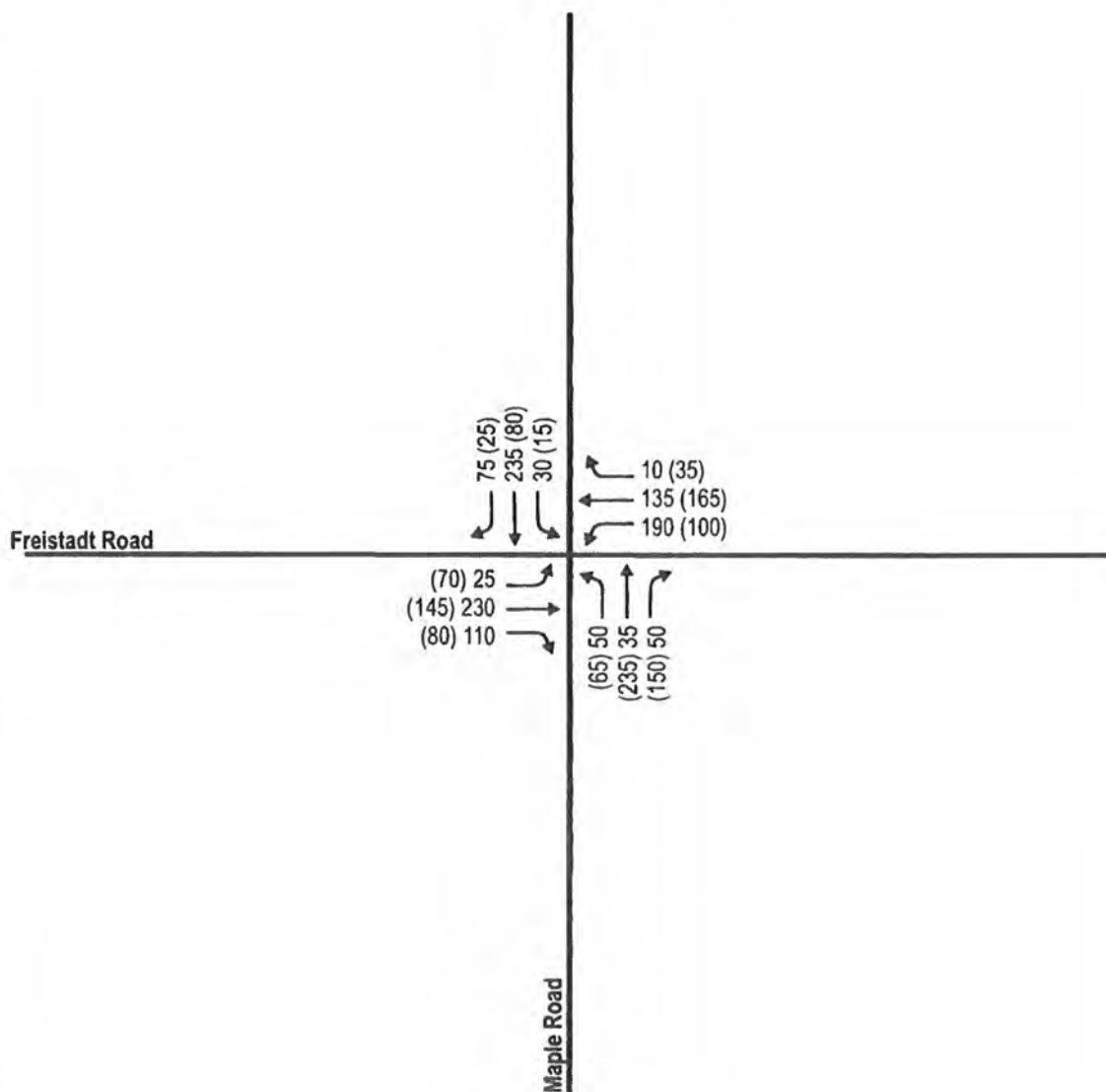
LEGEND

- XX Weekday Morning Peak Hour Traffic (6:45-7:45AM)
 (XX) Weekday Evening Peak Hour Traffic (4:15-5:15PM)
 - Fewer than 2 vehicles per hour
 [X,XXX] 2013 Annual Average Daily Traffic (AADT)



LEGEND

- XX Weekday Morning Peak Hour Traffic (6:45-7:45AM)
 (XX) Weekday Evening Peak Hour Traffic (4:15-5:15PM)
 - Fewer than 2 vehicles per hour

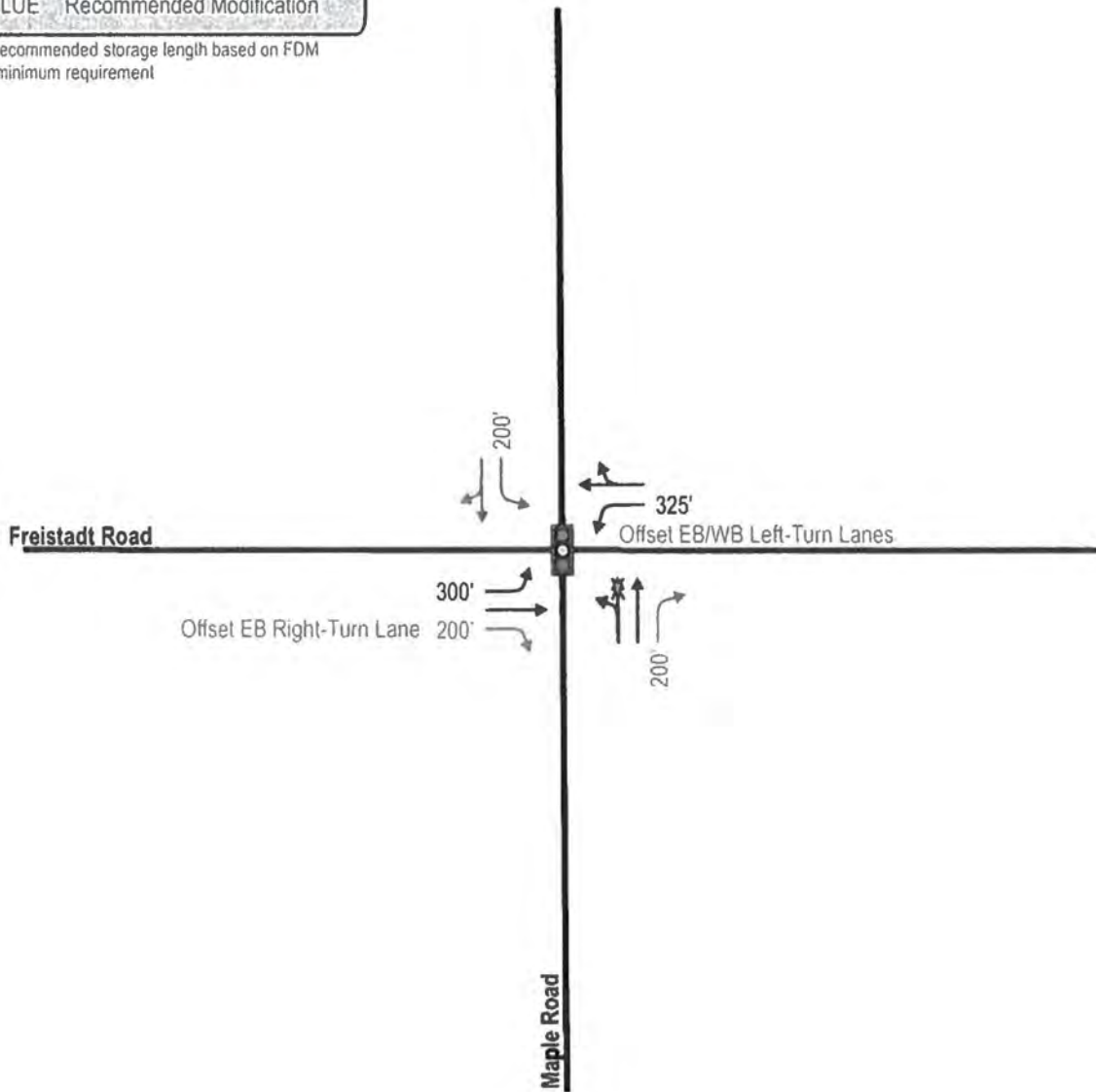


LEGEND

-  Traffic Signal
-  Stop Sign
-  Lane Configuration
-  XX' Storage Length (In Feet)

BLACK Existing Configuration
 BLUE Recommended Modification

*Recommended storage length based on FDM minimum requirement



APPENDIX A

TRAFFIC

APPENDIX A

Existing Traffic Counts

Intersection Traffic Volume Report

Base Information, Observed (13) Hour and Estimated (24) Hour Volume Summaries

Intersection of: **Maple Road and Freistadt Road**

Count Basics	Version 2013.4.1	Page 1 of 13
Start Date:	Wednesday, December 19, 2018	Weekday
Total Number of Hours Counted:	13	Non-Holiday
		Schools in Session
		No Special Events



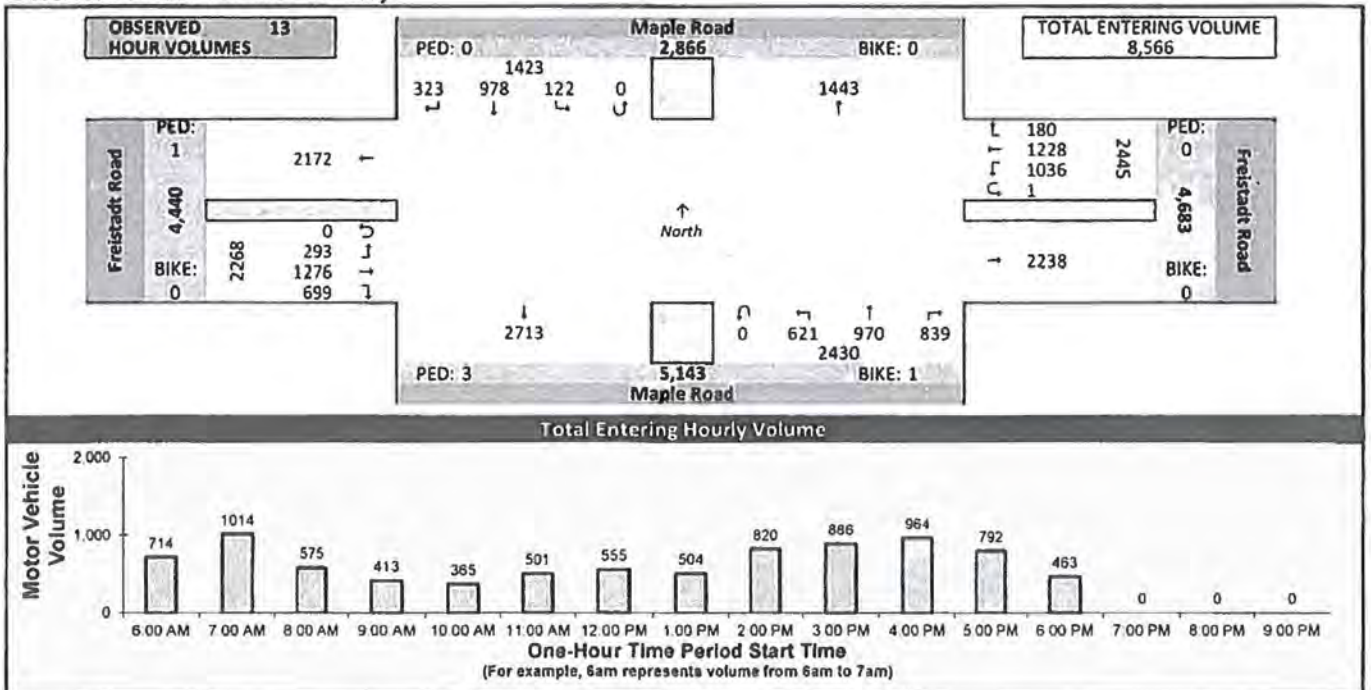
Site Information

Municipality	Village of Germantown
County	Washington
WisDOT Region	SE
Traffic Control	Partial Stop Control
Roadway Names	North Direction
North Leg	Maple Road
East Leg	Freistadt Road
South Leg	Maple Road
West Leg	Freistadt Road
Special Considerations	
Schools in Session	
Holidays	None
Special Events	None
Special Pedestrians Observed	
Pre-school children	None
Elementary school age children	None
Visually Impaired (white cane/helper dog)	None
Elderly/disabled (except wheelchairs)	None
Wheelchairs/electric scooters	None
Other (describe)	None

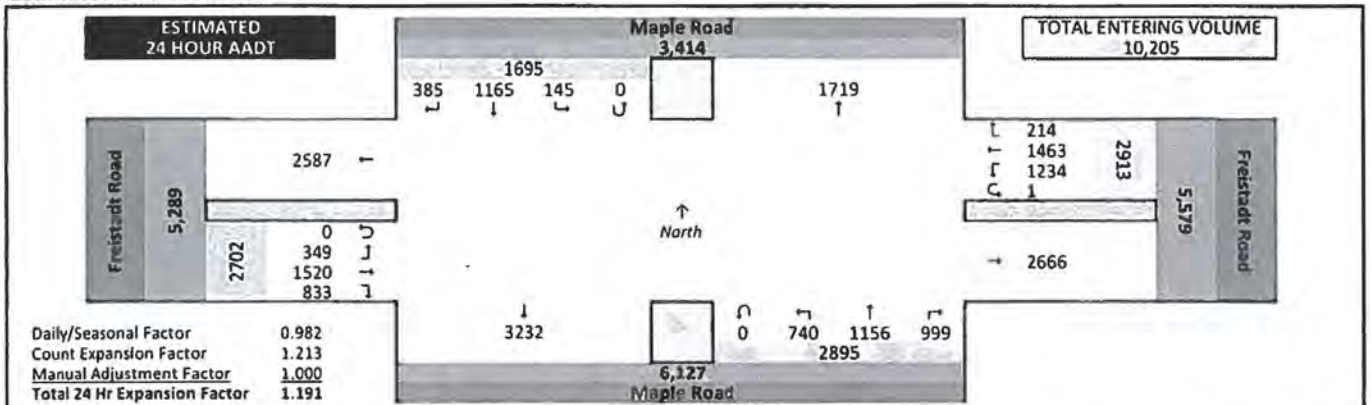
Count Information

Hrs Counted:	6:00 AM-7:00 PM
1st Day of Count	Wednesday, December 19, 2018
Weather	Clear & Dry
AM Peak Period	Wednesday, December 19, 2018
Midday Peak Period	Thursday, December 20, 2018
PM Peak Period	Wednesday, December 19, 2018
Calculated Peak Hours	
AM	6:45-7:45am
MD	12:00-1:00pm
PM	4:15-5:15pm
Peak Hours Selected for Analysis	
AM	6:45-7:45am
MD	12:00-1:00pm
PM	4:15-5:15pm
Daily/Seasonal Adjustment Group	(2) Urban Arterials & Collectors
Count Expansion Group	(2) Urban Arterials & Collectors
Daily/Seasonal Adjustment Factor	0.982
Count Expansion Factor	1.213
Company Name	TAD, Inc.
Manual Adj.	1.000
Observers	AM Peak Period: Jeff Schleif
	Midday Peak Period: JK Bieberitz
	PM Peak Period: Ted Atwell
Comments	2017 DOT Seasonal Factors

Observed 13 Hour Volume Summary



Estimated 24 Hour AADT



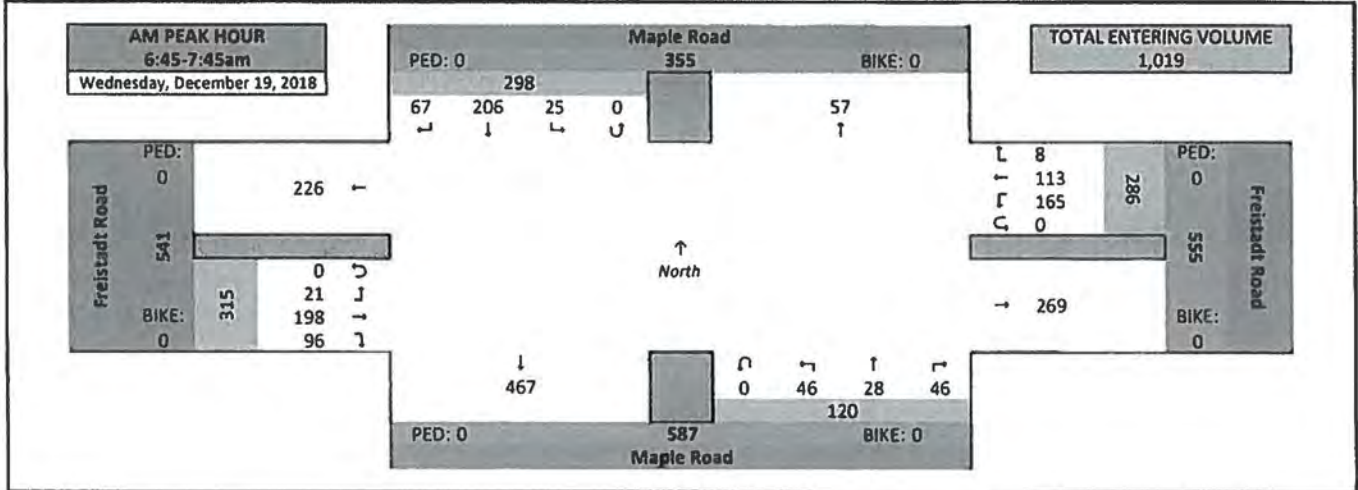
Intersection Traffic Volume Report

Peak Hour Volume Graphical Summary

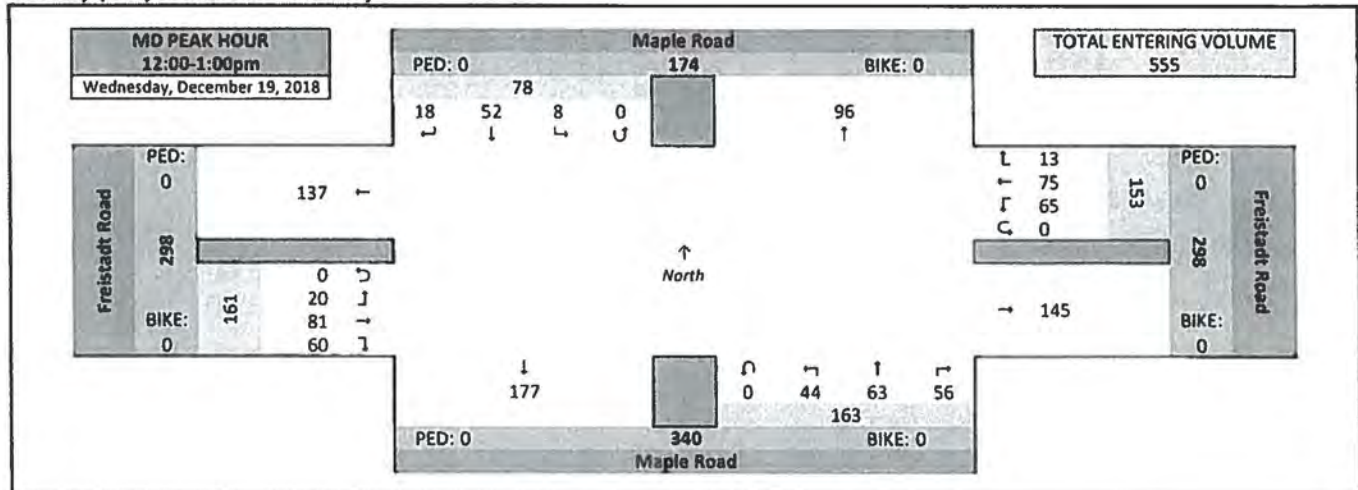
Maple Road and Freistadt Road

AM Peak Hour Summary

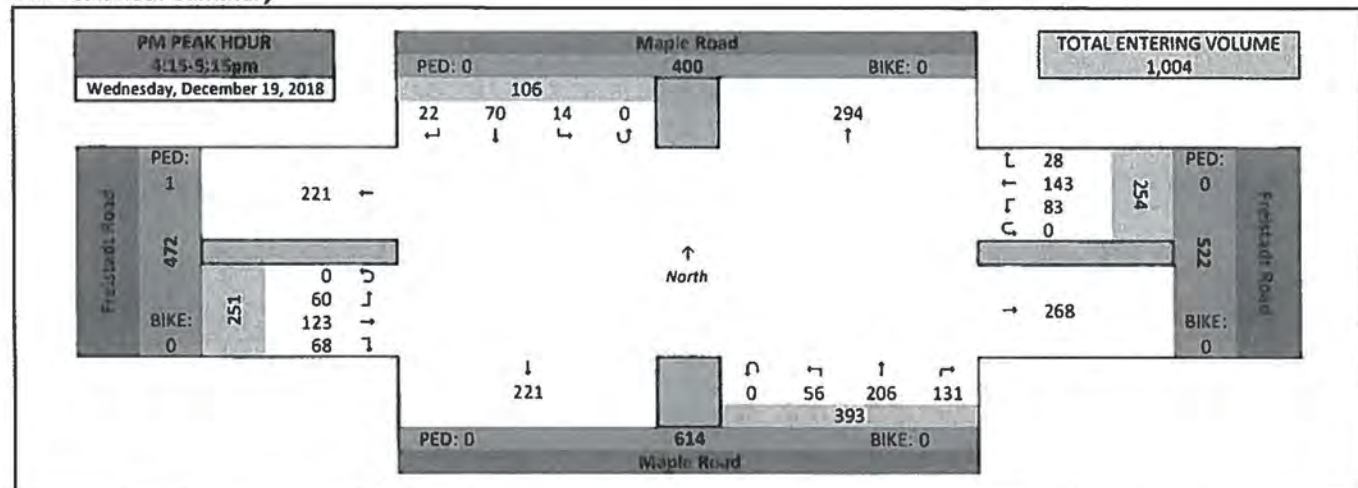
Count Basics				Page 2 of 13
Start Date:	Wednesday, December 19, 2018	Weekday	Schools in Session	
Total Number of Hours Counted:	13	Non-Holiday	No Special Events	



Midday (MD) Peak Hour Summary



PM Peak Hour Summary



Intersection Traffic Volume Report

Peak Hour Volume Summary

Maple Road and Freistadt Road

Peak Hour Volumes, Truck Percentages, and PHFs

Count Basis	Wednesday, December 19, 2018	Weekday	Schools in Session
Start Date	Wednesday, December 19, 2018	Non-Holiday	No Special Events
Total Number of Hours Counted	13		

All Motor Vehicles									

Wednesday, December 19, 2018		↙					↖					↗					↘					Totals
		From North					From East					From South					From West					
AM Peak Hour		Maple Road					Freistadt Road					Maple Road					Freistadt Road					
AM Peak Hour	Start Time	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Totals
	6:45 AM	27	72	8	0	107	1	26	50	0	77	10	5	16	0	31	16	34	2	0	52	267
	7:00 AM	15	39	11	0	65	4	27	34	0	65	14	6	14	0	34	46	74	5	0	125	289
	7:15 AM	15	40	3	0	58	3	28	34	0	65	16	6	8	0	30	19	46	7	0	72	225
	7:30 AM	10	55	3	0	68	0	32	47	0	79	6	11	8	0	25	15	44	7	0	66	238
	Peak Hour Volume	67	206	25	0	298	8	113	165	0	286	46	28	46	0	120	96	198	21	0	315	1019
	Rounded Hourly Volume	65	205	25	0	295	10	115	165	0	290	45	30	45	0	120	95	200	20	0	315	1020
	% Single Unit Trucks	4.5	2.4	0.0	0.0	2.7	0.0	7.1	4.2	0.0	5.2	10.9	14.3	6.5	0.0	10.0	5.2	6.1	4.8	0.0	5.7	5.2
	% Heavy Trucks	0.0	0.0	8.0	0.0	0.7	0.0	3.5	0.6	0.0	1.7	2.2	0.0	0.0	0.0	0.8	1.0	1.0	4.8	0.0	1.3	1.2
	% Trucks (Total)	4.5	2.4	8.0	0.0	3.4	0.0	10.6	4.8	0.0	7.0	13.0	14.3	6.5	0.0	10.8	6.2	7.1	9.5	0.0	7.0	6.4
Peak Hour Factor (PHF)	0.62	0.72	0.57	0.00	0.70	0.50	0.88	0.82	0.00	0.91	0.72	0.64	0.72	0.00	0.88	0.52	0.67	0.75	0.00	0.63	0.88	

Wednesday, December 19, 2018		↙					↖					↗					↘					Totals
		From North					From East					From South					From West					
MD Peak Hour		Maple Road					Freistadt Road					Maple Road					Freistadt Road					
Midday (MD) Peak Hour	Start Time	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Totals
	12:00 PM	4	11	3	0	18	3	16	11	0	30	13	15	8	0	36	19	25	7	0	51	135
	12:15 PM	3	14	0	0	17	4	25	24	0	53	20	13	14	0	47	13	19	7	0	39	156
	12:30 PM	4	13	2	0	19	3	18	16	0	37	10	12	16	0	38	9	21	2	0	32	126
	12:45 PM	7	14	3	0	24	3	16	14	0	33	13	23	6	0	42	19	16	4	0	39	138
	Peak Hour Volume	18	52	8	0	78	13	75	65	0	153	56	63	44	0	163	60	81	20	0	161	555
	Rounded Hourly Volume	20	50	10	0	80	15	75	65	0	155	55	65	45	0	165	60	80	20	0	160	560
% Single Unit Trucks	27.8	13.5	0.0	0.0	15.4	0.0	8.0	12.3	0.0	9.2	14.3	1.6	9.1	0.0	8.0	6.7	4.9	10.0	0.0	6.2	8.8	
% Heavy Trucks	11.1	1.9	0.0	0.0	3.8	15.4	2.7	3.1	0.0	3.9	10.7	3.2	6.8	0.0	6.7	15.0	7.4	5.0	0.0	9.9	6.5	
% Trucks (Total)	38.9	15.4	0.0	0.0	19.2	15.4	10.7	15.4	0.0	13.1	25.0	4.8	15.9	0.0	14.7	21.7	12.3	15.0	0.0	16.1	15.3	
Peak Hour Factor (PHF)	0.64	0.93	0.67	0.00	0.81	0.81	0.75	0.68	0.00	0.72	0.70	0.68	0.69	0.00	0.87	0.79	0.81	0.71	0.00	0.79	0.89	

Wednesday, December 19, 2018		↕					↶					↗					↘						
		From North					From East					From South					From West						
PM Peak Hour	PM Peak Hour	Maple Road					Freistadt Road					Maple Road					Freistadt Road					Totals	
	Start Time	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Totals	
	4:15 PM	5	18	1	0	24	10	39	26	0	75	29	55	13	0	97	12	22	11	0	45	241	
	4:30 PM	7	17	3	0	27	8	32	8	0	48	39	56	15	0	110	16	38	19	0	73	258	
	4:45 PM	4	24	4	0	32	3	30	27	0	60	32	36	13	0	81	17	30	15	0	62	235	
	5:00 PM	6	11	6	0	23	7	42	22	0	71	31	59	15	0	105	23	33	15	0	71	270	
	Peak Hour Volume	22	70	14	0	106	28	143	83	0	254	131	206	56	0	393	68	123	60	0	251	1004	
	Rounded Hourly Volume	20	70	15	0	105	30	145	85	0	260	130	205	55	0	390	70	125	60	0	255	1010	
	% Single Unit Trucks	4.5	0.0	0.0	0.0	0.9	0.0	1.4	0.0	0.0	0.8	0.8	5.3	1.8	0.0	3.3	2.9	2.4	5.0	0.0	3.2	2.4	
	% Heavy Trucks	0.0	1.4	14.3	0.0	2.8	0.0	1.4	3.6	0.0	2.0	0.0	0.0	3.6	0.0	0.5	2.9	0.8	0.0	0.0	1.2	1.3	
	% Trucks (Total)	4.5	1.4	14.3	0.0	3.8	0.0	2.8	3.6	0.0	2.8	0.8	5.3	5.4	0.0	3.8	5.9	3.3	5.0	0.0	4.4	3.7	
	Peak Hour Factor (PHF)	0.79	0.73	0.58	0.00	0.83	0.70	0.85	0.77	0.00	0.85	0.84	0.87	0.93	0.00	0.89	0.74	0.81	0.79	0.00	0.86	0.93	

Peak Hour Pedestrian and Bicyclist Volumes

Pedestrians and Bicyclists		Crossing			Crossing			Crossing			Crossing			Total Ped & Bike Volume
		North Approach			East Approach			South Approach			West Approach			
15-Minute Start Time		Pedestrian	Bicyclist	Total	Pedestrian	Bicyclist	Total	Pedestrian	Bicyclist	Total	Pedestrian	Bicyclist	Total	
AM	6:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
	7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
	7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
	7:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	0	0	0	0	0	0	0	0	0	0	0	0	0
MD	12:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
	12:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
	12:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
	12:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	0	0	0	0	0	0	0	0	0	0	0	0	0
PM	4:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
	4:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
	4:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
	5:00 PM	0	0	0	0	0	0	0	0	0	1	0	1	1
	Total	0	0	0	0	0	0	0	0	0	1	0	1	1

Intersection Traffic Volume Report

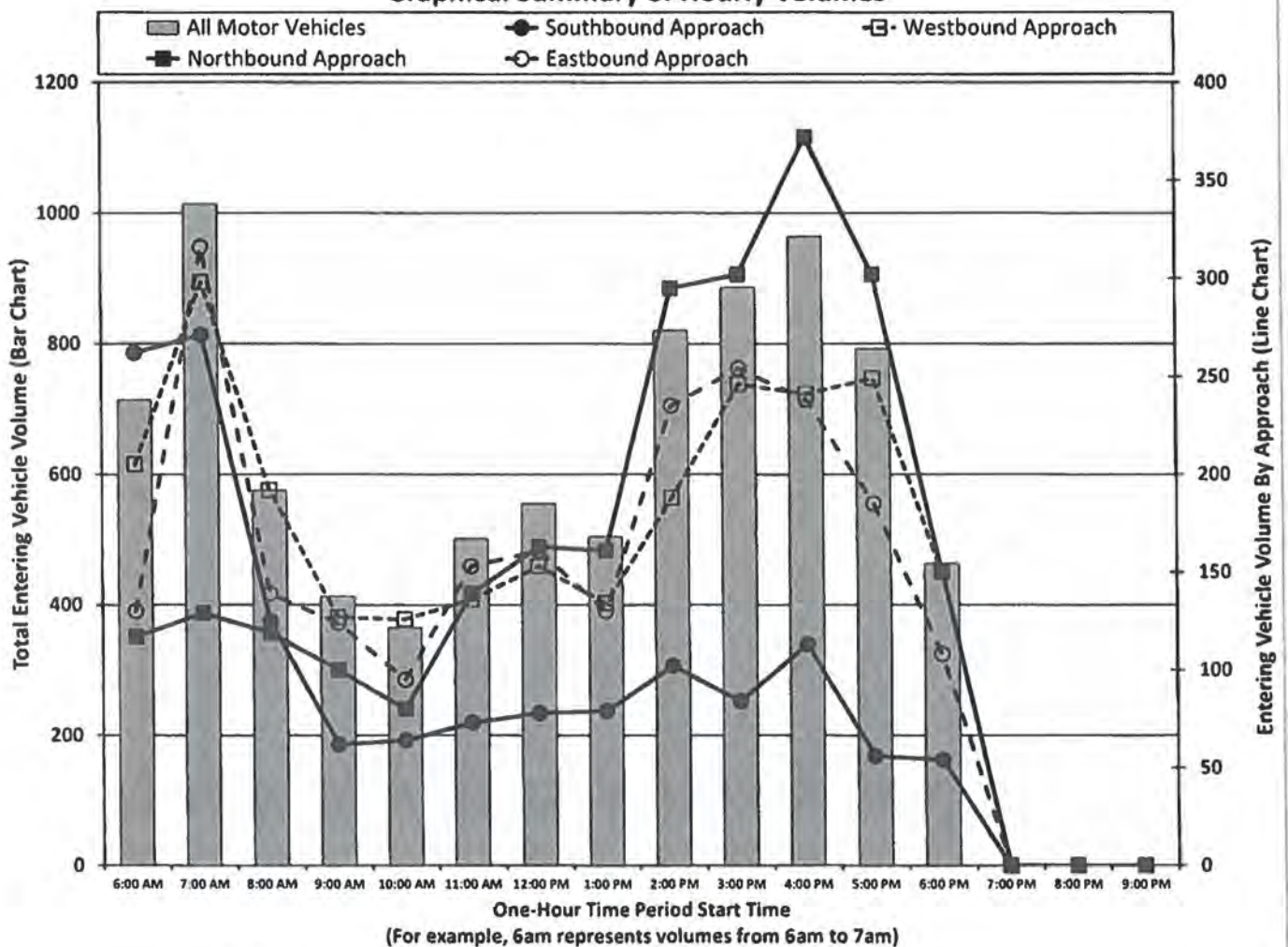
Hourly Volume Summary - Motor Vehicle Data

Maple Road and Freistadt Road

One-Hour Motor Vehicle Data

One-Hour Time Period	Start Time	From North Maple Road					From East Freistadt Road					From South Maple Road					From West Freistadt Road					Total Vehicle Volume	Directional Volume Totals E/W N/S	
		Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total			
AM	6:00 AM	68	177	17	0	262	5	72	128	0	205	28	14	75	0	117	38	86	6	0	130	714	335	379
	7:00 AM	62	187	22	0	271	12	116	170	0	298	46	37	46	0	129	96	198	22	0	316	1014	614	400
	8:00 AM	23	91	11	0	125	14	89	89	0	192	36	37	46	0	119	31	94	14	0	139	575	331	244
	9:00 AM	11	49	2	0	62	12	53	62	0	127	40	37	23	0	100	44	75	5	0	124	413	251	162
MD	10:00 AM	17	40	7	0	64	5	54	66	1	126	28	22	30	0	80	27	61	7	0	95	365	221	144
	11:00 AM	23	39	11	0	73	11	75	50	0	136	54	43	42	0	139	44	93	16	0	153	501	289	212
	12:00 PM	18	52	8	0	78	13	75	65	0	153	56	63	44	0	163	60	81	20	0	161	555	314	241
	1:00 PM	18	50	11	0	79	6	85	43	0	134	55	56	50	0	161	55	64	11	0	130	504	264	240
PM	2:00 PM	24	72	6	0	102	27	104	57	0	188	103	101	91	0	295	87	116	32	0	235	820	423	397
	3:00 PM	18	60	6	0	84	23	122	101	0	246	98	155	49	0	302	75	120	59	0	254	886	500	386
	4:00 PM	19	84	10	0	113	27	137	77	0	241	135	187	50	0	372	56	126	56	0	238	964	479	485
	5:00 PM	12	34	10	0	56	21	150	78	0	249	97	160	45	0	302	46	106	33	0	185	792	434	358
	6:00 PM	10	43	1	0	54	4	96	50	0	150	63	58	30	0	151	40	56	12	0	108	463	258	205
	7:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	8:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	9:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Totals	323	978	122	0	1423	180	1228	1036	1	2445	839	970	621	0	2430	699	1276	293	0	2268	8566	4713	3853

Graphical Summary of Hourly Volumes



Intersection Traffic Volume Report

15-Minute Motor Vehicle Data

Maple Road and Freistadt Road

15-Minute Motor Vehicle Data

Count Basics		Page 5 of 13	
Start Date:	Wednesday, December 19, 2018	Weekday	Schools in Session
Total Number of Hours Counted:	13	Non-Holiday	No Special Events



15-Minute Time Period Start Time	From North					From East					From South					From West					15-Min Totals	Hourly Sum	PHF	
	Maple Road					Freistadt Road					Maple Road					Freistadt Road								
	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total				
AM Peak Period	6:00 AM	5	28	2	0	35	0	10	25	0	35	5	2	6	0	13	4	8	1	0	13	96	714	0.67
	6:15 AM	21	33	3	0	57	2	14	26	0	42	6	3	19	0	28	6	18	2	0	26	153	907	0.78
	6:30 AM	15	44	4	0	63	2	22	27	0	51	7	4	34	0	45	12	26	1	0	39	198	979	0.85
	6:45 AM	27	72	8	0	107	1	26	50	0	77	10	5	16	0	31	16	34	2	0	52	267	1019	0.88
	7:00 AM	15	39	11	0	65	4	27	34	0	65	14	6	14	0	34	46	74	5	0	125	289	1014	0.88
	7:15 AM	15	40	3	0	58	3	28	34	0	65	16	6	8	0	30	19	46	7	0	72	225	885	0.84
	7:30 AM	10	55	3	0	68	0	32	47	0	79	6	11	8	0	25	15	44	7	0	66	238	798	0.76
	7:45 AM	22	53	5	0	80	5	29	55	0	89	10	14	16	0	40	16	34	3	0	53	262	682	0.65
	8:00 AM	10	29	3	0	42	3	24	27	0	54	7	6	10	0	23	11	26	4	0	41	160	575	0.90
	8:15 AM	1	26	3	0	30	2	22	25	0	49	9	7	11	0	27	3	26	3	0	32	138	532	0.86
Midday Peak Period	8:30 AM	4	10	4	0	18	6	23	14	0	43	12	7	13	0	32	6	19	4	0	29	122	490	0.79
	8:45 AM	8	26	1	0	35	3	20	23	0	46	8	17	12	0	37	11	23	3	0	37	155	471	0.76
	9:00 AM	5	12	1	0	18	4	12	18	0	34	16	11	5	0	32	10	21	2	0	33	117	413	0.88
	9:15 AM	4	12	0	0	16	4	14	16	0	34	6	5	6	0	17	12	15	2	0	29	96	404	0.94
	9:30 AM	0	19	1	0	20	2	12	14	0	28	11	11	6	0	28	7	19	1	0	27	103	396	0.92
	9:45 AM	2	6	0	0	8	2	15	14	0	31	7	10	6	0	23	15	20	0	0	35	97	372	0.86
	10:00 AM	5	12	3	0	20	2	17	15	0	34	7	8	12	0	27	6	19	2	0	27	108	365	0.84
	10:15 AM	2	8	3	0	13	1	12	20	1	34	11	2	4	0	17	7	16	1	0	24	88	375	0.79
	10:30 AM	4	8	0	0	12	2	8	13	0	23	3	3	9	0	15	9	16	4	0	29	79	414	0.81
	10:45 AM	6	12	1	0	19	0	17	18	0	35	7	9	5	0	21	5	10	0	0	15	90	463	0.90
PM Peak Period	11:00 AM	7	13	2	0	22	3	21	12	0	36	6	6	14	0	26	7	22	5	0	34	118	501	0.98
	11:15 AM	9	11	5	0	25	3	18	12	0	33	11	11	8	0	30	16	21	2	0	39	127	518	0.96
	11:30 AM	5	7	1	0	13	3	12	14	0	29	16	16	7	0	39	11	31	5	0	47	128	547	0.88
	11:45 AM	2	8	3	0	13	2	24	12	0	38	21	10	13	0	44	10	19	4	0	33	128	545	0.87
	12:00 PM	4	11	3	0	18	3	16	11	0	30	13	15	8	0	36	19	25	7	0	51	135	555	0.89
	12:15 PM	3	14	0	0	17	4	25	24	0	53	20	13	14	0	47	13	19	7	0	39	156	537	0.86
	12:30 PM	4	13	2	0	19	3	18	16	0	37	10	12	16	0	38	9	21	2	0	32	126	494	0.89
	12:45 PM	7	14	3	0	24	3	16	14	0	33	13	23	6	0	42	19	16	4	0	39	138	508	0.91
	1:00 PM	3	17	4	0	24	1	16	10	0	27	10	11	10	0	31	17	16	2	0	35	117	504	0.90
	1:15 PM	1	13	0	0	14	1	18	13	0	32	11	14	13	0	38	13	15	1	0	29	113	548	0.85
	1:30 PM	5	10	6	0	21	2	22	8	0	32	18	20	13	0	51	12	18	6	0	36	140	612	0.86
	1:45 PM	9	10	1	0	20	2	29	12	0	43	16	11	14	0	41	13	15	2	0	30	134	729	0.71
	2:00 PM	7	16	1	0	24	5	25	14	0	44	22	20	10	0	52	16	19	6	0	41	161	820	0.80
	2:15 PM	5	29	1	0	35	5	27	12	0	44	22	16	15	0	53	11	27	7	0	45	177	922	0.88
	2:30 PM	6	10	3	0	19	11	29	17	0	57	33	46	42	0	121	12	34	14	0	60	257	930	0.88
	2:45 PM	6	17	1	0	24	6	23	14	0	43	26	19	24	0	69	48	36	5	0	89	225	929	0.88
	3:00 PM	3	18	2	0	23	6	30	23	0	59	31	47	19	0	97	34	36	14	0	84	263	886	0.84
	3:15 PM	6	12	1	0	19	3	43	21	0	67	16	33	8	0	57	14	16	12	0	42	185	853	0.83
	3:30 PM	1	8	2	0	11	12	26	37	0	75	22	49	14	0	85	19	45	21	0	85	256	909	0.89
	3:45 PM	8	22	1	0	31	2	23	20	0	45	29	26	8	0	63	8	23	12	0	43	182	911	0.88
	4:00 PM	3	25	2	0	30	6	36	16	0	58	35	40	9	0	84	11	36	11	0	58	230	964	0.93
	4:15 PM	5	18	1	0	24	10	39	26	0	75	29	55	13	0	97	12	22	11	0	45	241	1004	0.93
	4:30 PM	7	17	3	0	27	8	32	8	0	48	39	56	15	0	110	16	38	19	0	73	258	950	0.88
	4:45 PM	4	24	4	0	32	3	30	27	0	60	32	36	13	0	81	17	30	15	0	62	235	878	0.81
	5:00 PM	6	11	6	0	23	7	42	22	0	71	31	59	15	0	105	23	33	15	0	71	270	792	0.73
	5:15 PM	2	10	1	0	13	4	40	26	0	70	21	32	7	0	60	8	26	10	0	44	187	675	0.90
	5:30 PM	1	8	2	0	11	4	37	16	0	57	25	40	12	0	77	11	26	4	0	41	186	615	0.83
	5:45 PM	3	5	1	0	9	6	31	14	0	51	20	29	11	0	60	4	21	4	0	29	149	521	0.85
	6:00 PM	3	14	0	0	17	1	36	14	0	51	18	19	9	0	46	18	16	5	0	39	153	463	0.76
	6:15 PM	6	10	0	0	16	3	22	17	0	42	21	16	5	0	42	10	15	2	0	27	127		
6:30 PM	0	10	0	0	10	0	17	11	0	28	14	11	8	0	33	8	11	2	0	21	92			
6:45 PM	1	9	1	0	11	0	21	8	0	29	10	12	8	0	30	4	14	3	0	21	91			
7:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
7:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
7:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
7:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
8:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
8:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
8:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
8:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
9:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
9:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
9:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
9:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Totals	323	978	122	0	1423	180	1228	1036	1	2445	839	970	621	0	2430	699	1276	293	0	2268	8566			

Peak Hour All Vehicle Volume Summary

Hourly Time Period Start Time	From North					From East					From South				
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Intersection Traffic Volume Report

15-Minute Automobile Data

Maple Road and Freistadt Road

15-Minute Automobile Data

Count Baskets				Page 6 of 13	
Start Date:	Wednesday, December 19, 2018	Weekday		Schools in Session	
Total Number of Hours Counted:	13	Non-Holiday		No Special Events	

Automobiles (Cars, Light Trucks, & Motorcycles)

15-Minute Time Period Start Time	From North					From East					From South					From West					15-Min Totals	Hourly Sum	
	Maple Road					Freistadt Road					Maple Road					Freistadt Road							
	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total			
AM Peak Period	6:00 AM	4	27	2	0	33	0	10	22	0	32	5	2	6	0	13	2	8	1	0	11	89	673
	6:15 AM	18	30	3	0	51	2	13	25	0	40	4	2	17	0	23	5	18	1	0	24	138	860
	6:30 AM	14	43	4	0	61	2	22	26	0	50	7	4	34	0	45	10	25	1	0	36	192	929
	6:45 AM	25	70	8	0	103	1	23	50	0	74	8	5	15	0	28	14	33	2	0	49	254	954
	7:00 AM	15	39	10	0	64	4	26	33	0	63	12	5	12	0	29	45	70	5	0	120	276	945
	7:15 AM	15	39	3	0	57	3	26	30	0	59	14	6	8	0	28	17	40	6	0	63	207	812
	7:30 AM	9	53	2	0	64	0	26	44	0	70	6	8	8	0	22	14	41	6	0	61	217	726
	7:45 AM	22	51	4	0	77	4	28	52	0	84	9	12	13	0	34	14	33	3	0	50	245	616
	8:00 AM	7	28	3	0	38	3	22	26	0	51	7	4	10	0	21	8	25	0	0	33	143	500
	8:15 AM	1	24	3	0	28	2	19	24	0	45	8	6	6	0	20	2	23	3	0	28	121	454
Midday Peak Period	8:30 AM	4	8	4	0	16	6	19	13	0	38	10	5	10	0	25	6	18	4	0	28	107	410
	8:45 AM	6	25	1	0	32	2	19	19	0	40	6	13	8	0	27	8	20	2	0	30	129	395
	9:00 AM	4	11	1	0	16	3	11	11	0	25	16	8	4	0	28	9	18	1	0	28	97	355
	9:15 AM	4	11	0	0	15	3	14	12	0	29	2	3	4	0	9	9	14	1	0	24	77	352
	9:30 AM	0	18	1	0	19	2	11	14	0	27	7	10	4	0	21	6	18	1	0	25	92	351
	9:45 AM	2	6	0	0	8	2	12	14	0	28	7	9	5	0	21	14	18	0	0	32	89	325
	10:00 AM	5	12	3	0	20	1	15	14	0	30	7	7	8	0	22	4	17	1	0	22	94	309
	10:15 AM	2	8	3	0	13	1	9	16	1	27	10	2	4	0	16	5	15	0	0	20	76	318
	10:30 AM	4	7	0	0	11	2	6	10	0	18	3	3	8	0	14	5	14	4	0	23	66	352
	10:45 AM	5	10	1	0	16	0	13	15	0	28	5	8	3	0	16	3	10	0	0	13	73	394
PM Peak Period	11:00 AM	6	12	2	0	20	3	20	10	0	33	5	6	8	0	19	6	21	4	0	31	103	433
	11:15 AM	6	10	5	0	21	3	14	10	0	27	9	11	7	0	27	13	20	2	0	35	110	447
	11:30 AM	3	5	1	0	9	3	10	12	0	25	13	15	7	0	35	8	27	4	0	39	108	466
	11:45 AM	2	8	3	0	13	2	20	12	0	34	19	9	9	0	37	8	18	2	0	28	112	464
	12:00 PM	3	11	3	0	17	2	16	10	0	28	8	14	8	0	30	14	21	7	0	42	117	470
	12:15 PM	1	10	0	0	11	3	23	20	0	46	15	13	11	0	39	11	17	5	0	33	129	449
	12:30 PM	3	11	2	0	16	3	14	14	0	31	8	11	12	0	31	7	19	2	0	28	106	416
	12:45 PM	4	12	3	0	19	3	14	11	0	28	11	22	6	0	39	15	14	3	0	32	118	432
	1:00 PM	3	16	3	0	22	1	14	6	0	21	7	11	7	0	25	13	14	1	0	28	96	432
	1:15 PM	1	12	0	0	13	1	16	12	0	29	8	11	10	0	29	11	13	1	0	25	96	465
	1:30 PM	5	9	6	0	20	1	21	8	0	30	16	17	9	0	42	10	15	5	0	30	122	512
	1:45 PM	8	8	1	0	17	2	25	11	0	38	13	11	11	0	35	13	14	1	0	28	118	631
	2:00 PM	2	10	1	0	13	4	22	8	0	34	19	19	10	0	48	11	18	5	0	34	129	720
	2:15 PM	4	15	1	0	20	5	23	8	0	36	20	16	14	0	50	8	25	4	0	37	143	839
	2:30 PM	6	10	2	0	18	10	27	17	0	54	32	42	40	0	114	12	30	13	0	55	241	865
	2:45 PM	6	14	1	0	21	6	21	11	0	38	24	18	23	0	65	48	31	4	0	83	207	866
	3:00 PM	3	18	2	0	23	5	29	20	0	54	27	47	18	0	92	32	34	13	0	79	248	824
	3:15 PM	6	12	1	0	19	3	36	15	0	54	16	32	8	0	56	14	15	11	0	40	169	792
	3:30 PM	1	7	2	0	10	11	24	33	0	68	21	47	13	0	81	19	43	21	0	83	242	851
	3:45 PM	6	22	1	0	29	1	21	18	0	40	24	26	8	0	58	7	23	8	0	38	165	858
	4:00 PM	3	22	1	0	26	6	33	16	0	55	33	39	9	0	81	8	35	11	0	54	216	924
	4:15 PM	4	18	1	0	23	10	39	25	0	74	29	48	12	0	89	11	21	10	0	42	228	967
	4:30 PM	7	17	1	0	25	3	31	8	0	47	39	54	13	0	105	15	37	17	0	69	245	919
	4:45 PM	4	23	4	0	31	3	30	16	0	59	32	36	13	0	81	16	29	15	0	60	231	852
	5:00 PM	6	11	4	0	31	7	39	21	0	67	30	57	15	0	102	22	32	15	0	69	259	763
	5:15 PM	2	9	1	0	12	4	38	24	0	66	20	31	7	0	58	8	26	10	0	44	180	653
	5:30 PM	1	8	2	0	11	4	37	15	0	56	25	40	10	0	75	10	26	4	0	40	182	596
	5:45 PM	3	5	1	0	9	6	31	12	0	49	18	29	8	0	55	4	21	4	0	29	142	504
	6:00 PM	3	14	0	0	17	1	34	14	0	49	17	19	9	0	45	17	16	5	0	38	149	452
	6:15 PM	6	10	0	0	16	3	21	14	0	38	21	16	5	0	42	10	15	2	0	27	123	
6:30 PM	0	10	0	0	10	0	17	11	0	28	14	11	8	0	33	7	10	2	0	19	90		
6:45 PM	1	9	1	0	11	0	21	8	0	29	10	11	8	0	29	4	14	3	0	21	90		
7:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
7:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
7:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
7:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
8:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
8:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
8:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
8:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
9:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
9:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
9:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
9:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Totals	285	908	114	0	1307	167	1125	930	1	2223	756	911	543	0	2210	612	1192	256	0	2060	7800		

Peak Hour Automobile Volume Summary

Hourly Time Period Start Time	From North					From East					From South					From West					Total Hourly Volume
	Maple Road					Freistadt Road					Maple Road					Freistadt Road					
	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	
AM 6:45 AM	64	201	23	0	288	8	101	157	0	266	40	24	43	0	107	90	184	19	0	293	954
MD 12:00 PM	11	44	8	0	63	11	67	55	0	133	42	60	37	0	139	47	71	17	0	135	470
PM 4:15 PM	21	69	12	0	102	28	139	80	0	247	130	195	53	0	378	64	119	57	0	240	969

Intersection Traffic Volume Report

15-Minute Single Unit (SU) Truck & Bus Data

Maple Road and Freistadt Road

15-Minute Single Unit (SU) Truck & Bus Data

Count Basics	Start Date	Wednesday, December 19, 2018	Weekday	Schools in Session
	Total Number of Hours Counted	13	Non-Holiday	No Special Events

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Single Unit (SU) Trucks & Buses



15-Minute Time Period Start Time	From North					From East					From South					From West					15-Min Totals	Hourly Sum	
	Maple Road					Freistadt Road					Maple Road					Freistadt Road							
	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total			
AM Peak Period	6:00 AM	1	0	0	0	1	0	0	2	0	2	0	0	0	0	0	2	0	0	0	2	5	33
	6:15 AM	3	3	0	0	6	0	0	1	0	1	0	1	1	0	2	1	0	1	0	2	11	38
	6:30 AM	1	1	0	0	2	0	0	1	0	1	0	0	0	0	0	2	0	0	0	2	5	43
	6:45 AM	2	2	0	0	4	0	2	0	0	2	2	0	1	0	3	2	1	0	0	3	12	53
	7:00 AM	0	0	0	0	0	0	1	1	0	2	1	1	2	0	4	1	3	0	0	4	10	51
	7:15 AM	0	1	0	0	1	0	0	4	0	4	2	0	0	0	2	2	6	1	0	9	16	56
	7:30 AM	1	2	0	0	3	0	5	2	0	7	0	3	0	0	3	0	2	0	0	2	15	53
	7:45 AM	0	1	0	0	1	1	0	3	0	4	1	2	1	0	4	0	1	0	0	1	10	48
	8:00 AM	3	1	0	0	4	0	2	0	0	2	0	2	0	0	2	2	1	4	0	7	15	58
	8:15 AM	0	2	0	0	2	0	3	1	0	4	1	1	2	0	4	1	2	0	0	3	13	56
	8:30 AM	0	2	0	0	2	0	2	0	0	2	1	2	3	0	6	0	0	0	0	0	10	54
	8:45 AM	2	1	0	0	3	0	0	4	0	4	2	4	2	0	8	2	2	1	0	5	20	51
Midday Peak Period	9:00 AM	0	0	0	0	0	1	0	6	0	7	0	2	0	0	2	1	3	0	0	4	13	36
	9:15 AM	0	1	0	0	1	0	0	4	0	4	1	2	1	0	4	1	1	0	0	2	11	28
	9:30 AM	0	1	0	0	1	0	0	0	0	0	3	1	1	0	5	0	1	0	0	1	7	26
	9:45 AM	0	0	0	0	0	0	1	0	0	1	0	1	1	0	2	0	2	0	0	2	5	26
	10:00 AM	0	0	0	0	0	1	1	1	0	3	0	0	0	0	0	0	1	1	0	2	5	31
	10:15 AM	0	0	0	0	0	0	2	4	0	6	1	0	0	0	1	0	1	1	0	2	9	31
	10:30 AM	0	1	0	0	1	0	0	2	0	2	0	0	1	0	1	1	2	0	0	3	7	33
	10:45 AM	1	1	0	0	2	0	2	3	0	5	2	0	1	0	3	0	0	0	0	0	10	35
	11:00 AM	1	1	0	0	2	0	0	0	0	0	1	0	2	0	3	0	0	0	0	0	5	32
	11:15 AM	3	1	0	0	4	0	2	2	0	4	1	0	0	0	1	2	0	0	0	2	11	35
	11:30 AM	0	1	0	0	1	0	0	2	0	2	2	1	0	0	3	1	2	0	0	3	9	40
	11:45 AM	0	0	0	0	0	0	2	0	0	2	1	1	0	0	2	1	0	2	0	3	7	46
PM Peak Period	12:00 PM	1	0	0	0	1	0	0	1	0	1	2	1	0	0	3	1	2	0	0	3	8	49
	12:15 PM	1	4	0	0	5	0	1	3	0	4	3	0	1	0	4	1	1	1	0	3	16	54
	12:30 PM	1	2	0	0	3	0	4	2	0	6	2	0	3	0	5	0	1	0	0	1	15	45
	12:45 PM	2	1	0	0	3	0	1	2	0	3	1	0	0	0	1	2	0	1	0	3	10	41
	1:00 PM	0	1	0	0	1	0	2	3	0	5	1	0	2	0	3	2	2	0	0	4	13	44
	1:15 PM	0	1	0	0	1	0	1	0	0	1	0	2	2	0	4	0	1	0	0	1	7	53
	1:30 PM	0	1	0	0	1	0	0	0	0	0	1	3	2	0	6	1	2	1	0	4	11	73
	1:45 PM	1	2	0	0	3	0	4	1	0	5	0	0	3	0	3	0	1	1	0	2	13	74
	2:00 PM	4	6	0	0	10	0	2	4	0	6	2	1	0	0	3	2	1	0	0	3	22	75
	2:15 PM	1	14	0	0	15	0	3	3	0	6	0	0	0	0	0	1	2	3	0	6	27	64
	2:30 PM	0	0	0	0	0	0	2	0	0	2	1	3	2	0	6	0	3	1	0	4	12	52
	2:45 PM	0	3	0	0	3	0	2	1	0	3	2	1	0	0	3	0	4	1	0	5	14	51
3:00 PM	0	0	0	0	0	1	1	3	0	5	3	0	1	0	4	0	1	1	0	2	11	51	
3:15 PM	0	0	0	0	0	0	6	6	0	12	0	1	0	0	1	0	1	1	0	2	15	47	
3:30 PM	0	1	0	0	1	1	1	2	0	4	1	2	1	0	4	0	2	0	0	2	11	43	
3:45 PM	2	0	0	0	2	1	2	0	0	3	4	0	0	0	4	1	0	4	0	5	14	39	
4:00 PM	0	2	0	0	2	0	1	0	0	1	1	1	0	0	2	1	1	0	0	2	7	26	
4:15 PM	1	0	0	0	1	0	0	0	0	0	0	7	1	0	8	0	1	1	0	2	11	24	
4:30 PM	0	0	0	0	0	0	1	0	0	1	0	2	0	0	2	1	1	2	0	4	7	18	
4:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	13	
5:00 PM	0	0	0	0	0	0	1	0	0	1	1	2	0	0	3	0	1	0	0	1	5	14	
5:15 PM	0	1	0	0	1	0	1	2	0	3	0	1	0	0	1	0	0	0	0	0	5	10	
5:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0	0	0	0	0	2	7	
5:45 PM	0	0	0	0	0	0	0	1	0	1	1	0	0	0	1	0	0	0	0	0	2	5	
6:00 PM	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	4	
6:15 PM	0	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	2		
6:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
6:45 PM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1		
7:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
7:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
7:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
7:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
8:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
8:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
8:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
8:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
9:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
9:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
9:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
9:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Totals	32	62	0	0	94	6	62	79	0	147	48	52	39	0	139	36	59	29	0	124	504		

Peak Hour Single Unit (SU) Truck & Buses Volume Summary

Peak Hour Single-Ended Volume Data																					
Hourly Time Period	From North					From East					From South					From West					Total Hourly Volume
	Maple Road					Freistadt Road					Maple Road					Freistadt Road					
	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	
AM 6:45 AM	3	5	0	0	8	0	8	7	0	15	5	4	3	0	12	5	12	1	0	18	53
MD 12:00 PM	5	7	0	0	12	0	6	8	0	14	8	1	4	0	13	4	4	2	0	10	49
PM 4:15 PM	1	0	0	0	1	0	2	0	0	2	1	11	1	0	13	2	3	3	0	8	24

Intersection Traffic Volume Report

15-Minute Heavy Vehicle Data

Maple Road and Freistadt Road

15-Minute Heavy Vehicle Data

Count Basics		Page 9 of 13	
Start Date:	Wednesday, December 19, 2018	Weekday	Schools in Session
Total Number of Hours Counted:	13	Non-Holiday	No Special Events

Heavy Vehicles (Single-Unit Trucks, Buses & Semi-Trucks)



15-Minute Time Period Start Time	From North					From East					From South					From West					15-Min Totals	Hourly Sum	
	Maple Road					Freistadt Road					Maple Road					Freistadt Road							
	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total			
AM Peak Period	6:00 AM	1	1	0	0	2	0	0	3	0	3	0	0	0	0	0	2	0	0	0	2	7	41
	6:15 AM	3	3	0	0	6	0	1	1	0	2	2	1	2	0	5	1	0	1	0	2	15	47
	6:30 AM	1	1	0	0	2	0	0	1	0	1	0	0	0	0	0	2	1	0	0	3	6	50
	6:45 AM	2	2	0	0	4	0	3	0	0	3	2	0	1	0	3	2	1	0	0	3	13	65
	7:00 AM	0	0	1	0	1	0	1	1	0	2	2	1	2	0	5	1	4	0	0	5	13	69
	7:15 AM	0	1	0	0	1	0	2	4	0	6	2	0	0	0	2	2	6	1	0	9	18	73
	7:30 AM	1	2	1	0	4	0	6	3	0	9	0	3	0	0	3	1	3	1	0	5	21	72
	7:45 AM	0	2	1	0	3	1	1	3	0	5	1	2	3	0	6	2	1	0	0	3	17	66
	8:00 AM	3	1	0	0	4	0	2	1	0	3	0	2	0	0	2	3	1	4	0	8	17	75
	8:15 AM	0	2	0	0	2	0	3	1	0	4	1	1	5	0	7	1	3	0	0	4	17	78
Midday Peak Period	8:30 AM	0	2	0	0	2	0	4	1	0	5	2	2	3	0	7	0	1	0	0	1	15	80
	8:45 AM	2	1	0	0	3	1	1	4	0	6	2	4	4	0	10	3	3	1	0	7	26	76
	9:00 AM	1	1	0	0	2	1	1	7	0	9	0	3	1	0	4	1	3	1	0	5	20	58
	9:15 AM	0	1	0	0	1	1	0	4	0	5	4	2	2	0	8	3	1	1	0	5	19	52
	9:30 AM	0	1	0	0	1	0	1	0	0	1	4	1	2	0	7	1	1	0	0	2	11	45
	9:45 AM	0	0	0	0	0	0	3	0	0	3	0	1	1	0	2	1	2	0	0	3	8	47
	10:00 AM	0	0	0	0	0	1	2	1	0	4	0	1	4	0	5	2	2	1	0	5	14	56
	10:15 AM	0	0	0	0	0	0	3	4	0	7	1	0	0	0	1	2	1	1	0	4	12	57
	10:30 AM	0	1	0	0	1	0	2	3	0	5	0	0	1	0	1	4	2	0	0	6	13	62
	10:45 AM	1	2	0	0	3	0	4	3	0	7	2	1	2	0	5	2	0	0	0	2	17	69
PM Peak Period	11:00 AM	1	1	0	0	2	0	1	2	0	3	1	0	6	0	7	1	1	1	0	3	15	68
	11:15 AM	3	1	0	0	4	0	4	2	0	6	2	0	1	0	3	3	1	0	0	4	17	71
	11:30 AM	2	2	0	0	4	0	2	2	0	4	3	1	0	0	4	3	4	1	0	8	20	81
	11:45 AM	0	0	0	0	0	0	4	0	0	4	2	1	4	0	7	2	1	2	0	5	16	81
	12:00 PM	1	0	0	0	1	1	0	1	0	2	5	1	0	0	6	5	4	0	0	9	18	85
	12:15 PM	2	4	0	0	6	1	2	4	0	7	5	0	3	0	8	2	2	2	0	6	27	88
	12:30 PM	1	2	0	0	3	0	4	2	0	6	2	1	4	0	7	2	2	0	0	4	20	78
	12:45 PM	3	2	0	0	5	0	2	3	0	5	2	1	0	0	3	4	2	1	0	7	20	76
	1:00 PM	0	1	1	0	2	0	2	4	0	6	3	0	3	0	6	4	2	1	0	7	21	72
	1:15 PM	0	1	0	0	1	0	2	1	0	3	3	3	3	0	9	2	2	0	0	4	17	83
1:30 PM	0	1	0	0	1	1	1	0	0	2	2	3	4	0	9	2	3	1	0	6	18	100	
1:45 PM	1	2	0	0	3	0	4	1	0	5	3	0	3	0	6	0	1	1	0	2	16	98	
2:00 PM	5	6	0	0	11	1	3	6	0	10	3	1	0	0	4	5	1	1	0	7	32	100	
2:15 PM	1	14	0	0	15	0	4	4	0	8	2	0	1	0	3	3	2	3	0	8	34	83	
2:30 PM	0	0	1	0	1	1	2	0	0	3	1	4	2	0	7	0	4	1	0	5	16	65	
2:45 PM	0	3	0	0	3	0	2	3	0	5	2	1	1	0	4	0	5	1	0	6	18	63	
3:00 PM	0	0	0	0	0	1	1	3	0	5	4	0	1	0	5	2	2	1	0	5	15	62	
3:15 PM	0	0	0	0	0	0	7	6	0	13	0	1	0	0	1	0	1	1	0	2	16	61	
3:30 PM	0	1	0	0	1	1	2	4	0	7	1	2	1	0	4	0	2	0	0	2	14	58	
3:45 PM	2	0	0	0	2	1	2	2	0	5	5	0	0	0	5	1	0	4	0	5	17	53	
4:00 PM	0	3	1	0	4	0	3	0	0	3	2	1	0	0	3	3	1	0	0	4	14	40	
4:15 PM	1	0	0	0	1	0	0	1	0	1	0	7	1	0	8	1	1	1	0	3	13	37	
4:30 PM	0	0	0	0	0	0	1	0	0	1	0	2	2	0	4	1	1	2	0	4	9	31	
4:45 PM	0	1	0	0	1	0	0	1	0	1	0	0	0	0	0	1	1	0	0	2	4	26	
5:00 PM	0	0	2	0	2	0	3	1	0	4	1	2	0	0	3	1	1	0	0	2	11	29	
5:15 PM	0	1	0	0	1	0	2	2	0	4	1	1	0	0	2	0	0	0	0	0	7	22	
5:30 PM	0	0	0	0	0	0	0	1	0	1	0	0	2	0	2	1	0	0	0	1	4	19	
5:45 PM	0	0	0	0	0	0	0	2	0	2	2	0	3	0	5	0	0	0	0	0	7	17	
6:00 PM	0	0	0	0	0	0	2	0	0	2	1	0	0	0	1	1	0	0	0	1	4	11	
6:15 PM	0	0	0	0	0	0	1	3	0	4	0	0	0	0	0	0	0	0	0	0	4		
6:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2	2		
6:45 PM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1		
7:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
7:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
7:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
7:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
8:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
8:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
8:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
8:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
9:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
9:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
9:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
9:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Totals	38	70	8	0	116	13	103	106	0	222	83	59	78	0	220	87	84	37	0	208	766		

Peak Hour Heavy Vehicle Volume Summary

Hourly Time Period Start Time	From North					From East					From South					From West					Total Hourly Volume
	Maple Road					Freistadt Road					Maple Road					Freistadt Road					
	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	
AM 6:45 AM	3	5	2	0	10	0	12	8	0	20	6	4	3	0	13	6	14	2	0	22	65
MD 12:00 PM	7	8	0	0	15	2	8	10	0	20	14	3	7	0	24	13	10	3	0	26	85
PM 4:15 PM	1	1	2	0	4	0	4	3	0	7	1	11	3	0	15	4	4	3	0	11	37

Intersection Traffic Volume Report

15-Minute Heavy Vehicle Percentages

Maple Road and Freistadt Road

15-Minute Heavy Vehicle Percentages

Count Basics			Page 10 of 13
Start Date:	Wednesday, December 19, 2018	Weekday	Schools in Session
Total Number of Hours Counted: 13	Non-Holiday	No Special Events	



15-Minute Time Period Start Time	From North					From East					From South					From West					Total Heavy Vehicle Percent	Hourly Heavy Vehicle Percent	
	Maple Road					Freistadt Road					Maple Road					Freistadt Road							
	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total			
AM Peak Period	6:00 AM	20.0	3.6	0.0	0.0	5.7	0.0	0.0	12.0	0.0	8.6	0.0	0.0	0.0	0.0	50.0	0.0	0.0	0.0	15.4	7.3	5.7	
	6:15 AM	14.3	9.1	0.0	0.0	10.5	0.0	7.1	3.8	0.0	4.8	33.3	33.3	10.5	0.0	17.9	16.7	0.0	50.0	0.0	7.7	9.8	
	6:30 AM	6.7	2.3	0.0	0.0	3.2	0.0	0.0	3.7	0.0	2.0	0.0	0.0	0.0	0.0	0.0	16.7	3.8	0.0	0.0	7.7	3.0	
	6:45 AM	7.4	2.8	0.0	0.0	3.7	0.0	11.5	0.0	0.0	3.9	20.0	0.0	6.2	0.0	9.7	12.5	2.9	0.0	0.0	5.8	4.9	
	7:00 AM	0.0	0.0	9.1	0.0	1.5	0.0	3.7	2.9	0.0	3.1	14.1	16.7	14.3	0.0	14.7	2.2	5.4	0.0	0.0	4.0	4.5	
	7:15 AM	0.0	2.5	0.0	0.0	1.7	0.0	7.1	11.8	0.0	9.2	12.5	0.0	0.0	0.0	6.7	10.5	13.0	14.3	0.0	12.5	8.0	
	7:30 AM	10.0	3.6	33.3	0.0	5.9	0.0	18.7	6.4	0.0	11.4	0.0	27.3	0.0	0.0	12.0	6.7	6.8	14.3	0.0	7.6	8.8	
	7:45 AM	0.0	3.8	20.0	0.0	3.7	20.0	3.4	5.5	0.0	5.6	10.0	14.3	18.7	0.0	15.0	12.5	2.9	0.0	0.0	5.7	6.5	
	8:00 AM	30.0	3.4	0.0	0.0	9.5	0.0	8.3	3.7	0.0	5.6	0.0	33.3	0.0	0.0	8.7	27.3	3.8	100.0	0.0	19.5	10.6	
	8:15 AM	0.0	7.7	0.0	0.0	6.7	0.0	13.6	4.0	0.0	8.2	11.1	14.3	45.5	0.0	25.9	33.3	11.5	0.0	0.0	12.5	12.3	
Midday Peak Period	8:30 AM	0.0	20.0	0.0	0.0	11.1	0.0	17.4	7.1	0.0	11.6	16.7	28.6	23.1	0.0	21.9	0.0	5.3	0.0	0.0	3.4	12.3	
	8:45 AM	25.0	3.8	0.0	0.0	8.6	33.3	5.0	17.4	0.0	13.0	25.0	23.5	33.3	0.0	27.0	27.3	13.0	33.3	0.0	18.9	16.8	
	9:00 AM	20.0	8.3	0.0	0.0	11.1	25.0	8.3	38.9	0.0	26.5	0.0	27.3	20.0	0.0	12.5	10.0	14.3	50.0	0.0	15.2	17.1	
	9:15 AM	0.0	8.3	0.0	0.0	6.2	25.0	0.0	25.0	0.0	14.7	66.7	40.0	33.3	0.0	47.1	25.0	6.7	50.0	0.0	17.2	19.8	
	9:30 AM	0.0	5.3	0.0	0.0	5.0	0.0	8.3	0.0	0.0	3.6	36.4	9.1	33.3	0.0	25.0	14.3	5.3	0.0	0.0	7.4	10.7	
	9:45 AM	0.0	0.0	0.0	0.0	0.0	0.0	20.0	0.0	0.0	9.7	0.0	10.0	16.7	0.0	8.7	6.7	10.0	0.0	0.0	8.6	8.2	
	10:00 AM	0.0	0.0	0.0	0.0	0.0	50.0	11.8	6.7	0.0	11.8	0.0	12.5	33.3	0.0	18.5	33.3	10.5	50.0	0.0	18.5	13.0	
	10:15 AM	0.0	0.0	0.0	0.0	0.0	0.0	25.0	20.0	0.0	20.6	9.1	0.0	0.0	0.0	5.9	28.6	6.2	100.0	0.0	16.7	13.6	
	10:30 AM	0.0	12.5	0.0	0.0	8.3	0.0	25.0	23.1	0.0	21.7	0.0	0.0	11.1	0.0	6.7	44.4	12.5	0.0	0.0	20.7	16.5	
	10:45 AM	16.7	16.7	0.0	0.0	15.8	0.0	23.5	16.7	0.0	20.0	28.6	11.1	40.0	0.0	23.8	40.0	0.0	0.0	0.0	13.3	18.9	
PM Peak Period	11:00 AM	14.3	7.7	0.0	0.0	9.1	0.0	4.8	16.7	0.0	8.3	16.7	0.0	42.9	0.0	26.9	14.3	4.5	20.0	0.0	8.8	12.7	
	11:15 AM	33.3	9.1	0.0	0.0	16.0	0.0	22.2	16.7	0.0	18.2	18.2	0.0	12.5	0.0	10.0	18.7	4.8	0.0	0.0	10.3	13.4	
	11:30 AM	40.0	28.6	0.0	0.0	30.8	0.0	16.7	14.3	0.0	13.8	18.7	6.2	0.0	0.0	10.3	27.3	12.9	20.0	0.0	17.0	15.6	
	11:45 AM	0.0	0.0	0.0	0.0	0.0	0.0	16.7	0.0	0.0	10.5	9.5	10.0	30.8	0.0	15.9	20.0	5.3	50.0	0.0	15.2	12.5	
	12:00 PM	25.0	0.0	0.0	0.0	5.6	33.3	0.0	9.1	0.0	6.7	38.5	6.7	0.0	0.0	16.7	26.3	16.0	0.0	0.0	17.6	13.3	
	12:15 PM	66.7	28.6	0.0	0.0	35.3	25.0	8.0	16.7	0.0	13.2	25.0	0.0	21.4	0.0	17.0	15.4	10.5	28.6	0.0	15.4	17.3	
	12:30 PM	25.0	15.4	0.0	0.0	15.8	0.0	22.2	12.5	0.0	16.2	20.0	8.3	25.0	0.0	18.4	22.2	9.5	0.0	0.0	12.5	15.9	
	12:45 PM	42.9	14.3	0.0	0.0	20.8	0.0	12.5	21.4	0.0	15.2	15.4	4.3	0.0	0.0	7.1	21.1	12.5	25.0	0.0	17.9	14.5	
	1:00 PM	0.0	5.9	25.0	0.0	8.3	0.0	12.5	40.0	0.0	22.2	30.0	0.0	30.0	0.0	19.4	23.5	12.5	50.0	0.0	20.0	17.9	
	1:15 PM	0.0	7.7	0.0	0.0	7.1	0.0	11.1	7.7	0.0	9.4	27.3	21.4	23.1	0.0	23.7	15.4	13.3	0.0	0.0	13.8	15.0	
	1:30 PM	0.0	10.0	0.0	0.0	4.8	50.0	4.5	0.0	0.0	6.2	11.1	15.0	30.8	0.0	17.6	16.7	16.7	0.0	0.0	16.7	12.9	
	1:45 PM	11.1	20.0	0.0	0.0	15.0	0.0	13.8	8.3	0.0	11.6	18.7	0.0	21.4	0.0	14.6	0.0	6.7	50.0	0.0	6.7	11.9	
	2:00 PM	71.4	37.5	0.0	0.0	45.8	20.0	12.0	42.9	0.0	22.7	13.6	5.0	0.0	0.0	7.7	31.2	5.3	16.7	0.0	17.1	19.9	
	2:15 PM	20.0	48.3	0.0	0.0	42.9	0.0	14.8	33.3	0.0	18.2	9.1	0.0	6.7	0.0	5.7	27.3	7.4	42.9	0.0	17.8	19.2	
	2:30 PM	0.0	0.0	33.3	0.0	5.3	9.1	6.9	0.0	0.0	5.3	3.0	8.7	4.8	0.0	5.8	0.0	11.8	7.1	0.0	8.3	6.2	
	2:45 PM	0.0	17.6	0.0	0.0	12.5	0.0	8.7	21.4	0.0	11.6	7.7	5.3	4.2	0.0	5.8	0.0	13.9	20.0	0.0	6.7	8.0	
	3:00 PM	0.0	0.0	0.0	0.0	0.0	16.7	3.3	13.0	0.0	8.5	12.9	0.0	5.3	0.0	5.2	5.9	5.6	7.1	0.0	6.0	5.7	
	3:15 PM	0.0	0.0	0.0	0.0	0.0	0.0	16.3	28.6	0.0	19.4	0.0	3.0	0.0	0.0	1.8	0.0	6.2	8.3	0.0	4.8	8.6	
	3:30 PM	0.0	12.5	0.0	0.0	9.1	8.3	7.7	10.8	0.0	9.3	4.5	4.1	7.1	0.0	4.7	0.0	4.4	0.0	0.0	2.4	5.5	
	3:45 PM	25.0	0.0	0.0	0.0	6.5	50.0	8.7	10.0	0.0	11.1	17.2	0.0	0.0	0.0	7.9	12.5	0.0	33.3	0.0	11.6	9.3	
	4:00 PM	0.0	12.0	50.0	0.0	13.3	0.0	8.3	0.0	0.0	5.2	5.7	2.5	0.0	0.0	3.6	27.3	2.8	0.0	0.0	6.9	6.1	
	4:15 PM	20.0	0.0	0.0	0.0	4.7	0.0	0.0	3.8	0.0	1.1	0.0	12.7	7.7	0.0	8.2	8.3	4.5	9.1	0.0	6.7	5.4	
	4:30 PM	0.0	0.0	0.0	0.0	0.0	0.0	3.1	0.0	0.0	2.1	0.0	3.6	13.3	0.0	3.6	6.1	7.6	10.5	0.0	5.5	3.5	
	4:45 PM	0.0	4.2	0.0	0.0	3.1	0.0	0.0	3.7	0.0	1.7	0.0	0.0	0.0	0.0	0.0	5.9	3.8	0.0	0.0	3.7	1.7	
	5:00 PM	0.0	0.0	33.3	0.0	8.7	0.0	7.1	4.5	0.0	5.6	3.2	3.4	0.0	0.0	2.9	4.3	3.0	0.0	0.0	2.8	0.1	
	5:15 PM	0.0	10.0	0.0	0.0	7.7	0.0	5.0	7.7	0.0	5.7	4.8	3.1	0.0	0.0	3.3	0.0	0.0	0.0	0.0	0.0	3.7	3.3
	5:30 PM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.2	0.0	1.8	0.0	0.0	16.7	0.0	2.6	9.1	0.0	0.0	0.0	2.4	2.2	
	5:45 PM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.3	0.0	3.9	10.0	0.0	27.3	0.0	8.3	0.0	0.0	0.0	0.0	0.0	4.7	3.3
	6:00 PM	0.0	0.0	0.0	0.0	0.0	0.0	5.6	0.0	0.0	3.9	5.6	0.0	0.0	0.0	2.2	5.6	0.0	0.0	0.0	2.6	2.6	
	6:15 PM	0.0	0.0	0.0	0.0	0.0	0.0	4.5	17.6	0.0	9.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1	
6:30 PM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.5	9.1	0.0	0.0	9.5	2.2		
6:45 PM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.3	0.0	0.0	3.3	0.0	0.0	0.0	0.0	0.0	1.1		
7:00 PM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
7:15 PM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
7:30 PM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
7:45 PM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
8:00 PM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.													

Intersection Traffic Volume Report

15-Minute Pedestrian and Bicyclist Data

Count Basics				Page 11 of 13
Start Date	Wednesday, December 19, 2018	Weekday	Schools In Session	
Total Number of Hours Counted	13	Non-Holiday	No Special Events	

Maple Road and Freistadt Road

15-Minute Pedestrian and Bicyclist Data



15-Minute Time Period Start Time	Crossing 			Crossing 			Crossing 			Crossing 			15-Min Totals	Hourly Sum	
	North Approach			East Approach			South Approach			West Approach					
	Maple Road			Freistadt Road			Maple Road			Freistadt Road					
	Pedestrian	Bicyclist	Total	Pedestrian	Bicyclist	Total	Pedestrian	Bicyclist	Total	Pedestrian	Bicyclist	Total			
AM Peak Period	6:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	
	6:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	
	6:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	
	6:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	
	7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	
	7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	
	7:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	
	7:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	
	8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	
	8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	
	8:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	
	8:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	
	9:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	
	9:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	
	9:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	
	9:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Midday Peak Period	10:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
		10:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
10:30 AM		0	0	0	0	0	0	0	0	0	0	0	0	0	
10:45 AM		0	0	0	0	0	0	0	0	0	0	0	0	0	
11:00 AM		0	0	0	0	0	0	0	0	0	0	0	0	0	
11:15 AM		0	0	0	0	0	0	0	0	0	0	0	0	0	
11:30 AM		0	0	0	0	0	0	0	0	0	0	0	0	0	
11:45 AM		0	0	0	0	0	0	0	0	0	0	0	0	0	
12:00 PM		0	0	0	0	0	0	0	0	0	0	0	0	0	
12:15 PM		0	0	0	0	0	0	0	0	0	0	0	0	0	
12:30 PM		0	0	0	0	0	0	0	0	0	0	0	0	0	
12:45 PM		0	0	0	0	0	0	0	0	0	0	0	0	0	
1:00 PM		0	0	0	0	0	0	0	0	0	0	0	0	0	
1:15 PM		0	0	0	0	0	0	0	0	0	0	0	0	0	
1:30 PM		0	0	0	0	0	0	0	0	0	0	0	0	0	
1:45 PM		0	0	0	0	0	0	0	0	0	0	0	0	0	
PM Peak Period		2:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
	2:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	1	
	2:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	2	
	2:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	3	
	3:00 PM	0	0	0	0	0	0	1	1	1	0	0	1	4	
	3:15 PM	0	0	0	0	0	0	1	0	1	0	0	0	1	3
	3:30 PM	0	0	0	0	0	0	1	0	1	0	0	0	1	2
	3:45 PM	0	0	0	0	0	0	1	0	1	0	0	0	1	1
	4:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	4:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	4:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	4:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	5:00 PM	0	0	0	0	0	0	0	0	0	1	0	1	1	1
	5:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	5:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	5:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	6:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0		
6:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0		
6:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0		
7:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0		
7:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0		
7:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0		
7:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0		
8:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0		
8:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0		
8:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0		
8:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0		
9:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0		
9:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0		
9:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0		
9:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0		
Totals	0	0	0	0	0	0	3	1	4	1	0	1	5		

Special Pedestrians

Pedestrian Type	None	1 or 2	A Few	Several	Many	Unknown
Pre-school Children	x					
Elementary School Age Children	x					
Visually Impaired (white cane/helper dog)	x					
Elderly/Disabled (except wheelchairs)	x					
Wheelchairs/Electric Scooters	x					
Other (None)	x					

Intersection Traffic Volume Report

15-Minute Adult & Children Count (Manual Entry)

Count Basics			Page 12 of 13
Start Date	Wednesday, December 19, 2018	Weekday	Schools in Session
Total Number of Hours Counted: 13		Non-Holiday	No Special Events

Maple Road and Freistadt Road



15-Minute Adult & Children Pedestrian Data

15-Minute Time Period Start Time	Crossing  North Approach			Crossing  East Approach			Crossing  South Approach			Crossing  West Approach			15-Min Totals	Hourly Sum
	Maple Road			Freistadt Road			Maple Road			Freistadt Road				
	Adults	Children	Total	Adults	Children	Total	Adults	Children	Total	Adults	Children	Total		
AM Peak Period	6:00 AM	0		0	0		0	0		0	0		0	0
	6:15 AM	0		0	0		0	0		0	0		0	0
	6:30 AM	0		0	0		0	0		0	0		0	0
	6:45 AM	0		0	0		0	0		0	0		0	0
	7:00 AM	0		0	0		0	0		0	0		0	0
	7:15 AM	0		0	0		0	0		0	0		0	0
	7:30 AM	0		0	0		0	0		0	0		0	0
	7:45 AM	0		0	0		0	0		0	0		0	0
	8:00 AM	0		0	0		0	0		0	0		0	0
	8:15 AM	0		0	0		0	0		0	0		0	0
Midday Peak Period	8:30 AM	0		0	0		0	0		0	0		0	0
	8:45 AM	0		0	0		0	0		0	0		0	0
	9:00 AM	0		0	0		0	0		0	0		0	0
	9:15 AM	0		0	0		0	0		0	0		0	0
	9:30 AM	0		0	0		0	0		0	0		0	0
	9:45 AM	0		0	0		0	0		0	0		0	0
	10:00 AM	0		0	0		0	0		0	0		0	0
	10:15 AM	0		0	0		0	0		0	0		0	0
	10:30 AM	0		0	0		0	0		0	0		0	0
	10:45 AM	0		0	0		0	0		0	0		0	0
PM Peak Period	11:00 AM	0		0	0		0	0		0	0		0	0
	11:15 AM	0		0	0		0	0		0	0		0	0
	11:30 AM	0		0	0		0	0		0	0		0	0
	11:45 AM	0		0	0		0	0		0	0		0	0
	12:00 PM	0		0	0		0	0		0	0		0	0
	12:15 PM	0		0	0		0	0		0	0		0	0
	12:30 PM	0		0	0		0	0		0	0		0	0
	12:45 PM	0		0	0		0	0		0	0		0	0
	1:00 PM	0		0	0		0	0		0	0		0	0
	1:15 PM	0		0	0		0	0		0	0		0	0
PM Peak Period	1:30 PM	0		0	0		0	0		0	0		0	0
	1:45 PM	0		0	0		0	0		0	0		0	0
	2:00 PM	0		0	0		0	0		0	0		0	0
	2:15 PM	0		0	0		0	0		0	0		0	0
	2:30 PM	0		0	0		0	0		0	0		0	1
	2:45 PM	0		0	0		0	0		0	0		0	2
	3:00 PM	0		0	0		0	0		0	0		0	3
	3:15 PM	0		0	0		1	0		1	0		0	3
	3:30 PM	0		0	0		1	0		1	0		0	2
	3:45 PM	0		0	0		1	0		1	0		0	1
4:00 PM	0		0	0		0	0		0	0		0	0	
PM Peak Period	4:15 PM	0		0	0		0	0		0	0		0	1
	4:30 PM	0		0	0		0	0		0	0		0	1
	4:45 PM	0		0	0		0	0		0	0		0	1
	5:00 PM	0		0	0		0	0		0	1		1	1
	5:15 PM	0		0	0		0	0		0	0		0	0
	5:30 PM	0		0	0		0	0		0	0		0	0
	5:45 PM	0		0	0		0	0		0	0		0	0
	6:00 PM	0		0	0		0	0		0	0		0	0
	6:15 PM	0		0	0		0	0		0	0		0	0
	6:30 PM	0		0	0		0	0		0	0		0	0
6:45 PM	0		0	0		0	0		0	0		0	0	
PM Peak Period	7:00 PM	0		0	0		0	0		0	0		0	0
	7:15 PM	0		0	0		0	0		0	0		0	0
	7:30 PM	0		0	0		0	0		0	0		0	0
	7:45 PM	0		0	0		0	0		0	0		0	0
	8:00 PM	0		0	0		0	0		0	0		0	0
	8:15 PM	0		0	0		0	0		0	0		0	0
	8:30 PM	0		0	0		0	0		0	0		0	0
	8:45 PM	0		0	0		0	0		0	0		0	0
	9:00 PM	0		0	0		0	0		0	0		0	0
	9:15 PM	0		0	0		0	0		0	0		0	0
9:30 PM	0		0	0		0	0		0	0		0	0	
9:45 PM	0		0	0		0	0		0	0		0	0	
Totals	0	0	0	0	0	0	3	0	3	1	0	1	4	

Intersection Traffic Volume Report

Count Basics				Page 13 of 13	
Start Date		Wednesday, December 19, 2018		Weekday	
Total Number of Hours Counted:		13		Non-Holiday	
				No Special Events	

15-Minute Bicycle Turning Movement Count (Manual Entry)**Maple Road and Freistadt Road**

15-Minute Bicycle Data

Bicyclists



15-Minute Time Period Start Time		From North					From East					From South					From West					15-Min Totals	Hourly Sum
		Maple Road					Freistadt Road					Maple Road					Freistadt Road						
		Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total		
AM Peak Period	6:00 AM					0					0					0					0	0	
	6:15 AM					0					0					0					0	0	
	6:30 AM					0					0					0					0	0	
	6:45 AM					0					0					0					0	0	
	7:00 AM					0					0					0					0	0	
	7:15 AM					0					0					0					0	0	
	7:30 AM					0					0					0					0	0	
	7:45 AM					0					0					0					0	0	
	8:00 AM					0					0					0					0	0	
	8:15 AM					0					0					0					0	0	
Midday Peak Period	8:30 AM					0					0					0					0	0	
	8:45 AM					0					0					0					0	0	
	9:00 AM					0					0					0					0	0	
	9:15 AM					0					0					0					0	0	
	9:30 AM					0					0					0					0	0	
	9:45 AM					0					0					0					0	0	
	10:00 AM					0					0					0					0	0	
	10:15 AM					0					0					0					0	0	
	10:30 AM					0					0					0					0	0	
	10:45 AM					0					0					0					0	0	
PM Peak Period	11:00 AM					0					0					0					0	0	
	11:15 AM					0					0					0					0	0	
	11:30 AM					0					0					0					0	0	
	11:45 AM					0					0					0					0	0	
	12:00 PM					0					0					0					0	0	
	12:15 PM					0					0					0					0	0	
	12:30 PM					0					0					0					0	0	
	12:45 PM					0					0					0					0	0	
	1:00 PM					0					0					0					0	0	
	1:15 PM					0					0					0					0	0	
PM Peak Period	1:30 PM					0					0					0					0	0	
	1:45 PM					0					0					0					0	0	
	2:00 PM					0					0					0					0	0	
	2:15 PM					0					0					0					0	0	
	2:30 PM					0					0					0					0	0	
	2:45 PM					0					0					0					0	0	
	3:00 PM					0					0					0					0	0	
	3:15 PM					0					0					0					0	0	
	3:30 PM					0					0					0					0	0	
	3:45 PM					0					0					0					0	0	
4:00 PM					0					0					0					0	0		
PM Peak Period	4:15 PM					0					0					0					0	0	
	4:30 PM					0					0					0					0	0	
	4:45 PM					0					0					0					0	0	
	5:00 PM					0					0					0					0	0	
	5:15 PM					0					0					0					0	0	
	5:30 PM					0					0					0					0	0	
	5:45 PM					0					0					0					0	0	
	6:00 PM					0					0					0					0	0	
	6:15 PM					0					0					0					0	0	
	6:30 PM					0					0					0					0	0	
6:45 PM					0					0					0					0	0		
7:00 PM					0					0					0					0	0		
7:15 PM					0					0					0					0	0		
7:30 PM					0					0					0					0	0		
7:45 PM					0					0					0					0	0		
8:00 PM					0					0					0					0	0		
8:15 PM					0					0					0					0	0		
8:30 PM					0					0					0					0	0		
8:45 PM					0					0					0					0	0		
9:00 PM					0					0					0					0	0		
9:15 PM					0					0					0					0	0		
9:30 PM					0					0					0					0	0		
9:45 PM					0					0					0					0	0		
Totals		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Peak Hour Bicycle Turning Movement Volume Summary

[illegible]

APPENDIX A

Historical AADT Volumes

Germantown Historical ADTs

	Data for Graphs			
	660415	660840	660747	660420
1977				1,060
1983	1,200		2,800	
1986	1,180			1,530
1989	1,570		4,830	1,800
1992	1,890	2,450	8,260	1,820
1995	2,420	2,250	7,300	2,070
1998	2,100	2,400	7,300	2,300
2001	2,500	2,700	8,200	2,700
2004	2,000	3,100	8,200	3,000
2007	1,800	3,100	7,500	
2010	1,800	4,300	7,000	3,500
2013	1,100	4,300	9,600	
2016			8,400	3,900
2018	2,000	4,700	9,600	4,000
2028	2,000	5,700	10,900	4,800
i	0.00%	2.13%	1.35%	2.00%
				i _{avg} 1.37%

2018 _{TOTAL}	20,300	
2028 _{TOTAL}	23,400	
	1.53%	i

USE 1.53% GROWTH RATE IN ANALYSIS

APPENDIX B

YEAR 2018 EXISTING TRAFFIC PEAK HOUR ANALYSIS OUTPUTS

Lanes, Volumes, Timings
100: Maple Rd & Freistadt Rd (CTH F)

2018 Exist AM.syn
01/02/2019

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↰	↰	↰	↰	↰	↰	↰	↰	↰	↰	↰
Traffic Volume (vph)	20	200	95	165	115	10	45	30	45	25	205	65
Future Volume (vph)	20	200	95	165	115	10	45	30	45	25	205	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300		0	325		0	0		0	0		50
Storage Lanes	1		0	1		0	0		0	0		1
Taper Length (ft)	75			75			75			75		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	1.00	1.00	1.00
Frt		0.952			0.988			0.944				0.850
Flt Protected	0.950			0.950				0.982			0.995	
Satd. Flow (prot)	1687	1690	0	1687	1754	0	0	3015	0	0	1835	1568
Flt Permitted	0.950			0.950				0.982			0.995	
Satd. Flow (perm)	1687	1690	0	1687	1754	0	0	3015	0	0	1835	1568
Link Speed (mph)		40			40			40			40	
Link Distance (ft)		1000			1000			1000			1000	
Travel Time (s)		17.0			17.0			17.0			17.0	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Heavy Vehicles (%)	7%	7%	7%	7%	7%	7%	11%	11%	11%	3%	3%	3%
Adj. Flow (vph)	23	227	108	188	131	11	51	34	51	28	233	74
Shared Lane Traffic (%)												
Lane Group Flow (vph)	23	335	0	188	142	0	0	136	0	0	261	74
Sign Control		Free			Free			Stop			Stop	

Intersection Summary

Area Type: Other
Control Type: Unsignalized

HCM 6th TWSC
100: Maple Rd & Freistadt Rd (CTH F)

2018 Exist AM.syn
01/02/2019

Intersection

Int Delay, s/veh 36.4

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↰	↰	↰	↰	↰	↰	↰	↰	↰	↰	↰
Traffic Vol, veh/h	20	200	95	165	115	10	45	30	45	25	205	65
Future Vol, veh/h	20	200	95	165	115	10	45	30	45	25	205	65
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	300			325								50
Vel in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	88	88	88	88	88	88	88	88	88	88	88	88
Heavy Vehicles, %	7	7	7	7	7	7	11	11	11	3	3	3
Minor Flow	23	227	108	188	131	11	51	34	51	28	233	74

	Major1	Major2	Minor1	Minor2
Conflicting Flow All	142	0	0	335
Stage 1	-	-	-	327
Stage 2	-	-	-	666
Critical Hdwy	4.17	-	4.17	-
Critical Hdwy Stg 1	-	-	-	6.21
Critical Hdwy Stg 2	-	-	-	6.21
Follow-up Hdwy	2.263	-	2.263	-
Platoon blocked, %	1411	-	1197	-
Stage 1	-	-	-	667
Stage 2	-	-	-	434
Platoon blocked, %	1411	-	1197	-
Mov Cap-1 Maneuver	1411	-	1197	-
Mov Cap-2 Maneuver	-	-	-	241
Stage 1	-	-	-	658
Stage 2	-	-	-	162

	EB	WB	NB	SB
HCM Control Delay, s	0.5	4.9		120.4
HCM LOS				F

	WBL	NBL	EBL	EBT	EBR	WBL	WBT	WBR	SBL	SBT	SBR
Capacity (veh/h)	-	487	1411	-	-	1197	-	-	227	909	-
HCM Lane V/C Ratio	-	0.14	0.016	-	-	0.157	-	-	1.151	0.081	-
HCM Control Delay (s)	-	13.6	7.6	-	-	8.6	-	-	151.8	9.3	-
HCM Lane LOS	-	B	A	-	-	A	-	-	F	A	-
HCM 95th %ile Q (veh)	-	0.5	0	-	-	0.6	-	-	12.3	0.3	-

Notes

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

Lanes, Volumes, Timings
100: Maple Rd & Freistadt Rd (CTH F)

2018 Exist PM.syn
01/02/2019

	1	2	3	4	5	6	7	8	9	10	11	12
Lane Configurations	1	2	3	4	5	6	7	8	9	10	11	12
Traffic Vol. veh/h	60	125	70	85	145	30	55	205	130	15	70	20
Future Volume (vph)	60	125	70	85	145	30	55	205	130	15	70	20
Peak Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300		0	325		0	0		0	0		50
Storage Lanes	1		0	1		0	0		0	0		1
Taper Length (ft)	75			75			75			75		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	1.00	1.00	1.00	1.00
Fit		0.946			0.974			0.950				0.850
Flt Protected	0.950			0.950				0.993			0.991	
Satd. Flow (prot)	1736	1728	0	1752	1797	0	0	3275	0	0	1810	1553
Flt Permitted	0.950			0.950				0.993			0.991	
Satd. Flow (perm)	1736	1728	0	1752	1797	0	0	3275	0	0	1810	1553
Link Speed (mph)		40			40			40			40	
Link Distance (ft)		1000			1000			1000			1000	
Travel Time (s)		17.0			17.0			17.0			17.0	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles (%)	4%	4%	4%	3%	3%	3%	4%	4%	4%	4%	4%	4%
Adj. Flow (vph)	65	134	75	91	156	32	59	220	140	16	75	22
Shared Lane Traffic (%)												
Lane Group Flow (vph)	65	209	0	91	188	0	0	419	0	0	91	22
Sign Control		Free			Free			Stop			Stop	
Area Type:	Other											
Control Type:	Unsignalized											

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HCM 6th TWSC
100: Maple Rd & Freistadt Rd (CTH F)

2018 Exist PM.syn
01/02/2019

Int Delay, s/veh	13											
Lane Configurations	1	2	3	4	5	6	7	8	9	10	11	12
Traffic Vol. veh/h	60	125	70	85	145	30	55	205	130	15	70	20
Future Vol. veh/h	60	125	70	85	145	30	55	205	130	15	70	20
Conflicting Peds. #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized			None		None			None			None	
Storage Length	300			325								50
Vehicle in Median Storage		0			0			0				0
Grade, %		0			0			0				0
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	4	4	4	3	3	3	4	4	4	4	4	4
Minor Flow	65	134	75	91	156	32	59	220	140	16	75	22
Conflicting Flow All	188	0	0	209	0	0	705	672	172	836	693	172
Stage 1							302	302		354	354	
Stage 2							403	370		482	339	
Critical Hdwy	4.14			4.13			7.14	6.54	6.24	7.14	6.54	6.24
Critical Hdwy Sig 1							6.14	5.54		6.14	5.54	
Critical Hdwy Sig 2							6.14	5.54		6.14	5.54	
Follow-up Hdwy	2.236			2.227			3.536	4.036	3.336	3.536	4.036	3.336
For Cap 1 Maneuver	1374			1356			349	375	856	284	354	866
Stage 1							703	661		659	627	
Stage 2							620	617		562	636	
Platoon blocked, %												
Minor Cap 1 Maneuver	1374			1356			257	333	866	103	324	866
Minor Cap 2 Maneuver							257	333		103	324	
Stage 1							670	630		628	585	
Stage 2							491	576		292	606	
HCM Control Delay, s	7.8			2.6			23.8			25.8		
HCM LOS							C			D		
Capacity (veh/h)	302	508	1374				1356			235	866	
HCM Lane V/C Ratio	0.561	0.492	0.047				0.067			0.389	0.025	
HCM Control Delay (s)	31.1	18.8	2.7				7.8			29.7	9.3	
HCM Lane LOS	D	C	A				A			D	A	
HCM 95th %ile Q (veh)	3.2	2.7	0.1				0.2			1.7	0.1	

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Lanes, Volumes, Timings
100: Maple Rd & Freistadt Rd (CTH F)

2018 Exist AM - MOD 1.syn
02/07/2019

	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Lane Group	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	20	200	95	165	115	10	45	30	45	25	205	65
Future Volume (vph)	20	200	95	165	115	10	45	30	45	25	205	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300		0	325		0	0		0	0		50
Storage Lanes	1		0	1		0	1		1	0		1
Taper Length (ft)	75			75			75			75		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fit		0.952			0.988				0.850			0.850
Fit Protected	0.950			0.950			0.950				0.995	
Satd. Flow (prot)	1687	1690	0	1687	1754	0	1626	1712	1455	0	1835	1568
Fit Permitted	0.950			0.950			0.950				0.995	
Satd. Flow (perm)	1687	1690	0	1687	1754	0	1626	1712	1455	0	1835	1568
Link Speed (mph)		40			40			40			40	
Link Distance (ft)		1000			1000			1000			1000	
Travel Time (s)		17.0			17.0			17.0			17.0	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Heavy Vehicles (%)	7%	7%	7%	7%	7%	7%	11%	11%	11%	3%	3%	3%
Adj. Flow (vph)	23	227	108	188	131	11	51	34	51	28	233	74
Shared Lane Traffic (%)												
Lane Group Flow (vph)	23	335	0	188	142	0	51	34	51	0	261	74
Sign Control	Free			Free			Stop			Stop		

Intersection Summary
Area Type: Other
Control Type: Unsignalized

HCM 6th TWSC
100: Maple Rd & Freistadt Rd (CTH F)

2018 Exist AM - MOD 1.syn
02/07/2019

Section	
Ini Delay, s/veh	36.4
Movement	EB EB EB WB WB WB NB NB NB SB SB SB
Lane Configurations	↔ ↔ ↔ ↔ ↔ ↔ ↔ ↔ ↔ ↔ ↔ ↔
Traffic Vol, veh/h	20 200 95 165 115 10 45 30 45 25 205 65
Future Vol, veh/h	20 200 95 165 115 10 45 30 45 25 205 65
Conflicting Peds, #/h	0 0 0 0 0 0 0 0 0 0 0 0
Sign Control	Free Free Free Free Free Free Stop Stop Stop Stop Stop Stop
RT Channelized	None None None None None None None None
Storage Length	300 325 0 0 0 0 0 0 0 0 0 0
Veh in Median Storage, #	0 0 0 0 0 0 0 0 0 0 0 0
Grade, %	0 0 0 0 0 0 0 0 0 0 0 0
Peak Hour Factor	0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88
Heavy Vehicles, %	7 7 7 7 7 7 11 11 11 3 3 3
Minor Flow	23 227 108 188 131 11 51 34 51 28 233 74

Major/Minor	Major1	Major2	Major1	Major2
Conflicting Flow All	142	0	0	335
Stage 1	327	327	513	513
Stage 2	666	518	370	381
Critical Hdwy	4.17	4.17	7.21	6.61
Critical Hdwy Stg 1	6.21	5.61	6.13	5.53
Critical Hdwy Stg 2	6.21	5.61	6.13	5.53
Follow up Hdwy	2.263	2.263	3.599	4.099
Platoon blocked, %	1411	1197	216	290
Stage 1	667	632	542	534
Stage 2	434	519	648	612
Platoon blocked, %				
Mov Cap 1 Maneuver	1411	1197	241	737
Mov Cap 2 Maneuver			241	192
Stage 1			656	622
Stage 2			162	438

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.5	4.9		120.4
HCM LOS				F

Minor Lane Major Lane	North Major Lane	East Major Lane	West Major Lane	South Major Lane
Capacity (veh/h)	241	737	1411	1197
HCM Lane V/C Ratio	0.141	0.069	0.016	0.157
HCM Control Delay (s)	22.4	10.2	1.6	8.6
HCM Lane LOS	C	B	A	A
HCM 85th %ile Q (veh)	0.5	0.2	0	0.6

Notes
- Volume exceeds capacity - Delay exceeds 300s - Computation Not Defined - All major volume in platoon

Lanes, Volumes, Timings
100: Maple Rd & Freistadt Rd (CTH F)

2018 Exist PM - MOD 1.syn
02/07/2019

	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB
Lane Configurations	1	1	1	1	1	1	1	1	1	1	1	1
Traffic Volume (vph)	150	125	70	85	145	30	55	205	130	15	70	20
Future Volume (vph)	60	125	70	85	145	30	55	205	130	15	70	20
Real Flow (vph)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300		0	325		0	0		0	0		50
Storage Lanes	1		0	1		0	1		1	0		1
Taper Length (ft)	75			75			75			75		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fit		0.946			0.974			0.850				0.850
Fit Protected	0.950			0.950			0.950			0.991		
Satd. Flow (prot)	1736	1728	0	1752	1797	0	1736	1827	1553	0	1810	1553
Fit Permitted	0.950			0.950			0.950			0.991		
Satd. Flow (perm)	1736	1728	0	1752	1797	0	1736	1827	1553	0	1810	1553
Link Speed (mph)		40			40			40			40	
Link Distance (ft)		1000			1000			1000			1000	
Travel Time (s)		17.0			17.0			17.0			17.0	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles (%)	4%	4%	4%	3%	3%	3%	4%	4%	4%	4%	4%	4%
Adj. Flow (vph)	65	134	75	91	156	32	59	220	140	16	75	22
Shared Lane Traffic (%)												
Lane Group Flow (vph)	65	209	0	91	188	0	59	220	140	0	91	22
Sign Control		Free			Free			Stop			Stop	
Control Type: Unsignalized												

2018 Exist PM - MOD 1.syn
TADI

Synchro 10 Report

HCM 6th TWSC
100: Maple Rd & Freistadt Rd (CTH F)

2018 Exist PM - MOD 1.syn
02/07/2019

Int Delay, s/veh	13.4											
Lane Configurations	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB
Traffic Vol. veh/h	150	125	70	85	145	30	55	205	130	15	70	20
Future Vol. veh/h	60	125	70	85	145	30	55	205	130	15	70	20
Conflicting Peds. #/h	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized			None		None			None			None	
Storage Length	300			325			0		0			50
Vehicle in Median Storage, #		0			0			0				0
Grade, %		0			0			0				0
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	4	4	4	3	3	3	4	4	4	4	4	4
Minor Flow	65	134	75	91	156	32	59	220	140	16	75	22
Conflicting Flow All	188	0	0	209	0	0	705	672	172	836	693	172
Stage 1	-	-	-	-	-	-	382	389	-	354	354	-
Stage 2	-	-	-	-	-	-	403	370	-	482	339	-
Critical Hdwy	4.14			4.13			7.14	6.54	6.24	7.14	6.54	6.24
Critical Hdwy Stg 1	-	-	-	-	-	-	6.14	5.54	-	6.14	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.14	5.54	-	6.14	5.54	-
Follow-up Hdwy	2.236			2.227			3.536	4.036	3.336	3.536	4.036	3.336
Post Cap-1 Maneuver	1374			1356			249	375	866	284	364	866
Stage 1	-	-	-	-	-	-	703	661	-	659	627	-
Stage 2	-	-	-	-	-	-	620	617	-	582	636	-
Platoon blocked, %												
Minor Cap-1 Maneuver	1374			1356			257	333	866	103	324	866
Minor Cap-2 Maneuver	-	-	-	-	-	-	257	333	-	103	324	-
Stage 1	-	-	-	-	-	-	670	630	-	628	585	-
Stage 2	-	-	-	-	-	-	491	576	-	292	606	-
HCM Control Delay, s	17.8			25			24.8			25.8		
HCM LOS				C			C			D		
Capacity (veh/h)	257	333	866	1374			1356			235	866	
HCM Lane V/C Ratio	0.23	0.662	0.161	0.047			0.067			0.389	0.025	
HCM Control Delay (s)	23.1	34.6	10	1.7			7.8			29.7	9.3	
HCM Lane LOS	C	D	B	A			A			D	A	
HCM 95th-ile Q (veh)	0.9	4.5	0.5	0.1			0.2			1.7	0.1	

2018 Exist PM - MOD 1.syn
TADI

Synchro 10 Report

Lanes, Volumes, Timings
100 Maple Rd & Freistadt Rd (CTH F)

2018 Exist AM - AWSC - MOD 2.syn
02/07/2019

Lane Group	EBL	EBT	ELB	WBL	WBT	WSL	WSL	NBL	NBT	SBL	SBL	SBL
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	20	200	95	165	115	10	45	30	45	25	205	65
Future Volume (vph)	20	200	95	165	115	10	45	30	45	25	205	65
Peak Hour Factor	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300		0	325		0	0		0	0		50
Storage Lanes	1		0	1		0	0		1	0		1
Taper Length (ft)	75			75			75			75		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.952			0.988				0.850			0.850
Flt Protected	0.950			0.950				0.971			0.995	
Satd. Flow (prot)	1687	1690	0	1687	1754	0	0	1662	1455	0	1835	1568
Flt Permitted	0.950			0.950				0.971			0.995	
Satd. Flow (perm)	1687	1690	0	1687	1754	0	0	1662	1455	0	1835	1568
Link Speed (mph)	40			40				40			40	
Link Distance (ft)	1000			1000				1000			1000	
Travel Time (s)	17.0			17.0				17.0			17.0	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Heavy Vehicles (%)	7%	7%	7%	7%	7%	7%	7%	11%	11%	3%	3%	3%
Adj. Flow (vph)	23	227	108	188	131	11	51	34	51	28	233	74
Shared Lane Traffic (%)												
Lane Group Flow (vph)	23	335	0	188	142	0	0	85	51	0	261	74
Sign Control	Stop			Stop				Stop			Stop	

Intersection Summary

Area Type: Other
Control Type: Unsignalized

HCM 6th AWSC
100 Maple Rd & Freistadt Rd (CTH F)

2018 Exist AM - AWSC - MOD 2.syn
02/07/2019

Plan Section

Intersection Delay, s/veh 15.6
Intersection LOS C

Movements

Lane Group	EBL	EBT	ELB	WBL	WBT	WSL	WSL	NBL	NBT	SBL	SBL	SBL
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Vol. veh/h	20	200	95	165	115	10	45	30	45	25	205	65
Future Vol. veh/h	20	200	95	165	115	10	45	30	45	25	205	65
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Heavy Vehicles, %	7	7	7	7	7	7	7	11	11	3	3	3
Minor Flow	23	227	108	188	131	11	51	34	51	28	233	74
Number of Lanes	1	1	0	1	1	0	0	1	1	0	1	1

Approach

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	2	2	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	2	2	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	2	2	2
HCM Control Delay	19	13.6	11.7	15.6
HCM LOS	C	B	B	C

Lane

Lane	NBL	NBT	WBL	WBT	WSL	WSL	SBL	SBL
Vol Left, %	60%	0%	100%	0%	100%	0%	11%	0%
Vol Thru, %	40%	0%	0%	68%	0%	92%	89%	0%
Vol Right, %	0%	100%	0%	32%	0%	8%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	75	45	20	295	165	125	230	65
LT Vol	45	0	20	0	165	0	75	0
Through Vol	30	0	0	200	0	115	205	0
RT Vol	0	45	0	95	0	10	0	65
Lane Flow Rate	85	51	23	335	188	142	261	74
Geometry Grp	7	7	7	7	7	7	7	7
Degree of Util (X)	0.188	0.098	0.047	0.618	0.387	0.271	0.515	0.13
Departure Headway (Hd)	7.948	6.92	7.38	6.64	7.433	6.865	7.096	6.325
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	452	517	486	543	486	524	510	567
Service Time	5.691	4.664	5.114	4.374	5.17	4.602	4.832	4.061
HCM Lane V/C Ratio	0.188	0.098	0.047	0.617	0.387	0.271	0.512	0.131
HCM Control Delay	12.5	10.4	10.5	19.6	14.8	12.1	17.2	10
HCM Lane LOS	B	B	B	C	B	B	C	A
HCM 95thile Q	0.7	0.3	0.1	4.2	1.8	1.1	2.9	0.4

Lanes, Volumes, Timings
100: Maple Rd & Freistadt Rd (CTH F)

2018 Exist PM - AWSC - MOD 2.syn
02/07/2019

	EB	EB	EB	EB	EB	EB	EB	EB	EB	EB	EB	EB
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	60	125	70	85	145	30	55	205	130	15	70	20
Future Volume (vph)	60	125	70	85	145	30	55	205	130	15	70	20
Peak Hour Factor	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300	0	325	0	0	0	0	0	0	0	50	0
Storage Lanes	1	0	1	0	0	0	0	1	0	0	1	0
Taper Length (ft)	75	0	75	0	0	0	0	75	0	0	75	0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fit	0.946	0	0.974	0	0	0	0	0.850	0	0	0.850	0
Fit Protected	0.950	0	0.950	0	0	0	0	0.990	0	0	0.991	0
Satd. Flow (prot)	1736	1728	0	1752	1797	0	0	1809	1553	0	1810	1553
Fit Permitted	0.950	0	0.950	0	0	0	0	0.990	0	0	0.991	0
Satd. Flow (perm)	1736	1728	0	1752	1797	0	0	1809	1553	0	1810	1553
Link Speed (mph)	40	40	40	40	40	40	40	40	40	40	40	40
Link Distance (ft)	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Travel Time (s)	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles (%)	4%	4%	4%	3%	3%	3%	4%	4%	4%	4%	4%	4%
Adj. Flow (vph)	65	134	75	91	156	32	59	220	140	16	75	22
Shared Lane Traffic (%)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	65	209	0	91	188	0	0	279	140	0	91	22
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop

Area Type: Other
Control Type: Unsignalized

HCM 6th AWSC
100: Maple Rd & Freistadt Rd (CTH F)

2018 Exist PM - AWSC - MOD 2.syn
02/07/2019

Intersection Delay, s/veh	12.9
Intersection LOS	B

	EB	EB	EB	EB	EB	EB	EB	EB	EB	EB	EB	EB
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Vol, veh/h	60	125	70	85	145	30	55	205	130	15	70	20
Future Vol, veh/h	60	125	70	85	145	30	55	205	130	15	70	20
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles, %	4	4	4	3	3	3	4	4	4	4	4	4
Adj. Flow	65	134	75	91	156	32	59	220	140	16	75	22
Number of Lanes	1	1	0	1	1	0	0	1	1	0	1	1

Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	2	2	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	2	2	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	2	2	2
HCM Control Delay	12.5	12.2	14.1	11
HCM LOS	B	B	B	B

	EB	EB	EB	EB	EB	EB	EB	EB	EB	EB	EB	EB
Vol Left, %	21%	0%	100%	0%	100%	0%	18%	0%	0%	0%	0%	0%
Vol Thru, %	79%	0%	0%	64%	0%	83%	82%	0%	0%	0%	0%	0%
Vol Right, %	0%	100%	0%	36%	0%	17%	0%	100%	0%	0%	0%	0%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	260	130	60	195	85	175	85	20	0	0	0	0
LT Vol	55	0	60	0	85	0	15	0	0	0	0	0
Through Vol	205	0	0	125	0	145	70	0	0	0	0	0
RT Vol	0	130	0	70	0	30	0	20	0	0	0	0
Lane Flow Rate	280	140	65	210	91	188	91	22	0	0	0	0
Geometry Grp	7	7	7	7	7	7	7	7	7	7	7	7
Degree of Util (X)	0.509	0.223	0.128	0.372	0.181	0.339	0.179	0.037	0	0	0	0
Departure Headway (Hd)	6.552	5.734	7.146	6.381	7.115	5.494	7.061	6.250	0	0	0	0
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	548	623	499	560	502	551	505	568	0	0	0	0
Service Time	4.319	3.5	4.922	4.157	4.889	4.258	4.854	4.048	0	0	0	0
HCM Lane V/C Ratio	0.511	0.225	0.13	0.375	0.18	0.341	0.18	0.039	0	0	0	0
HCM Control Delay	16	10.2	11	12.9	11.5	12.6	11.4	9.3	0	0	0	0
HCM Lane LOS	C	B	B	B	B	B	B	A	0	0	0	0
HCM 95thile Q	2.9	0.8	0.4	1.7	0.7	1.5	0.6	0.1	0	0	0	0

Lanes, Volumes, Timings
100: Maple Rd & Freistadt Rd (CTH F)

2018 Exist AM - AWSC - MOD 3.syn
02/07/2019

Lane Group	EBL	EBT	FLR	WBL	WBT	WBR	WBL	FLR	FLR	FLR	FLR	FLR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	20	200	95	165	115	10	45	30	45	25	205	65
Future Volume (vph)	20	200	95	165	115	10	45	30	45	25	205	65
Peak Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300		100	325		0	0		100	0		50
Storage Lanes	1		1			0	1		1	0		1
Taper Length (ft)	75			75			75			75		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850		0.988				0.850			0.850
Flt Protected	0.950			0.950			0.950				0.950	
Satd. Flow (prot)	1687	1776	1509	1687	1754	0	1626	1712	1455	0	1835	1568
Flt Permitted	0.950			0.950			0.950				0.950	
Satd. Flow (perm)	1687	1776	1509	1687	1754	0	1626	1712	1455	0	1835	1568
Link Speed (mph)	40			40			40				40	
Link Distance (ft)	1000			1000			1000				1000	
Travel Time (s)	17.0			17.0			17.0				17.0	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Heavy Vehicles (%)	7%	7%	7%	7%	7%	7%	11%	11%	11%	3%	3%	3%
Adj. Flow (vph)	23	227	108	188	131	11	51	34	51	28	233	74
Shared Lane Traffic (vph)												
Lane Group Flow (vph)	23	227	108	188	142	0	51	34	51	0	261	74
Sign Control	Stop			Stop			Stop				Stop	

Area Type: Other

Control Type: Unsignalized

HCM 6th AWSC
100: Maple Rd & Freistadt Rd (CTH F)

2018 Exist AM - AWSC - MOD 3.syn
02/07/2019

Intersection	
Intersection Delay, s/veh	15.1
Intersection LOS	C

Movement	EBL	EBT	EBR	FLR	FLR	FLR	FLR	FLR	FLR	FLR	FLR	FLR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Vol, veh/h	20	200	95	165	115	10	45	30	45	25	205	65
Future Vol, veh/h	20	200	95	165	115	10	45	30	45	25	205	65
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Heavy Vehicles, %	7	7	7	7	7	7	11	11	11	3	3	3
Adj. Flow	23	227	108	188	131	11	51	34	51	28	233	74
Number of Lanes	1	1	1	1	1	0	1	1	1	0	1	1

Approach	EB	FL	WB
Opposing Approach	WB	EB	SB
Opposing Lanes	2	3	2
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	2	3	2
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	3	2	2
HCM Control of Delay	14.7	14.9	11.9
HCM LOS	B	B	C

Lane	WBL	WBL	WBL	WBL	WBL	WBL	WBL	WBL	WBL	WBL	WBL	WBL
Vol Left, %	100%	0%	0%	100%	0%	0%	100%	0%	11%	0%		
Vol Thru, %	0%	100%	0%	0%	100%	0%	0%	92%	89%	0%		
Vol Right, %	0%	0%	100%	0%	0%	100%	0%	8%	0%	100%		
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop		
Traffic Vol by Lane	45	30	45	20	200	95	165	125	230	65		
LT Vol	45	0	0	20	0	0	165	0	25	0		
Through Vol	0	30	0	0	200	0	0	115	205	0		
RT Vol	0	0	45	0	0	95	0	10	0	65		
Lane Flow Rate	51	34	51	23	227	108	188	142	261	74		
Geometry Gap	8	8	8	8	8	8	8	8	8	8		
Degree of Util (X)	0.124	0.078	0.106	0.05	0.47	0.202	0.413	0.291	0.543	0.138		
Departure Headway (Hd)	8.711	8.199	7.484	7.947	7.439	6.728	7.928	7.365	7.478	6.713		
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
Cap	411	436	478	450	484	532	454	487	481	533		
Service Time	6.473	5.962	5.246	5.699	5.191	4.48	5.681	5.117	5.228	4.462		
HCM Lane V/C Ratio	0.124	0.078	0.107	0.051	0.469	0.203	0.414	0.292	0.543	0.139		
HCM Control of Delay	12.7	11.7	11.1	11.1	16.7	11.2	16.2	13.1	18.8	10.5		
HCM Lane LOS	B	B	B	B	C	B	C	B	C	B		
HCM 95th tile Q	0.4	0.3	0.4	0.2	2.5	0.7	2	1.2	3.2	0.5		

Lanes, Volumes, Timings
100: Maple Rd & Freistadt Rd (CTH F)

2018 Exist PM - AWSC - MOD 3.syn
02/07/2019

	1	2	3	4	5	6	7	8	9	10	11	12
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	60	125	70	85	145	30	55	205	130	15	70	20
Future Volume (vph)	60	125	70	85	145	30	55	205	130	15	70	20
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Storage Length (ft)	300		100	325		0	0		100	0		50
Storage Lanes	1		1	1		0	1		1	0		1
Taper Length (ft)	75			75		75			75			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ft		0.850		0.974				0.850				0.850
Flt Protected	0.950			0.950		0.950			0.950			0.950
Satd. Flow (prot)	1736	1827	1553	1752	1797	0	1736	1827	1553	0	1810	1553
Flt Permitted	0.950			0.950		0.950			0.950			0.950
Satd. Flow (perm)	1736	1827	1553	1752	1797	0	1736	1827	1553	0	1810	1553
Link Speed (mph)	40			40		40			40			40
Link Distance (ft)	1000			1000		1000			1000			1000
Travel Time (s)	17.0			17.0		17.0			17.0			17.0
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles (%)	4%	4%	4%	3%	3%	3%	4%	4%	4%	4%	4%	4%
Adj. Flow (vph)	65	134	75	91	156	32	59	220	140	16	75	22
Shared Lane Traffic (%)												
Lane Group Flow (vph)	65	134	75	91	188	0	59	220	140	0	91	22
Sign Control	Stop			Stop		Stop			Stop			Stop

Area Type: Other
Control Type: Unsignalized

HCM 6th AWSC
100: Maple Rd & Freistadt Rd (CTH F)

2018 Exist PM - AWSC - MOD 3.syn
02/07/2019

Intersection Delay, s/veh	12.5
Intersection LOS	B

	1	2	3	4	5	6	7	8	9	10	11	12
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Vol. (veh/h)	60	125	70	85	145	30	55	205	130	15	70	20
Future Vol. (veh/h)	60	125	70	85	145	30	55	205	130	15	70	20
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles, %	4	4	4	3	3	3	4	4	4	4	4	4
Minor Flow	65	134	75	91	156	32	59	220	140	16	75	22
Number of Lanes	1	1	1	1	1	0	1	1	1	0	1	1

	1	2	3	4	5	6	7	8	9	10	11	12
Opposing Approach	WB			EB			SB			NB		
Opposing Lanes	2			3			2			3		
Conflicting Approach Left	SB			NB			EB			WB		
Conflicting Lanes Left	2			3			3			2		
Conflicting Approach Right	NB			SB			WB			EB		
Conflicting Lanes Right	3			2			2			3		
HCM Control Delay	11.7			13.2			12.8			11.8		
HCM LOS	B			B			B			B		

	1	2	3	4	5	6	7	8	9	10	11	12
Vol Left, %	100%	0%	0%	100%	0%	0%	100%	0%	0%	18%	0%	0%
Vol Thru, %	0%	100%	0%	0%	100%	0%	0%	100%	0%	83%	82%	0%
Vol Right, %	0%	0%	100%	0%	0%	100%	0%	0%	17%	0%	100%	0%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	55	205	130	60	125	70	85	175	85	20		
LT Vol	55	0	0	60	0	0	85	0	15	0		
Through Vol	0	205	0	0	125	0	0	145	70	0		
RT Vol	0	0	130	0	0	70	0	30	0	20		
Lane Flow Rate	59	220	140	65	134	75	91	188	91	22		
Geometry Gap	8	8	8	8	8	8	8	8	8	8		
Degree of Util (X)	0.121	0.422	0.24	0.138	0.268	0.135	0.193	0.365	0.195	0.041		
Departure Headway (Hd)	7.396	6.897	6.183	7.681	7.175	6.465	7.614	6.986	7.676	6.876		
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
Cap	487	525	503	467	501	555	473	517	468	521		
Service Time	5.111	4.605	3.897	5.42	4.913	4.203	5.331	4.704	5.419	4.618		
HCM Lane V/C Ratio	0.121	0.419	0.24	0.139	0.267	0.135	0.192	0.364	0.194	0.042		
HCM Control Delay	11.1	14.6	10.8	11.7	12.5	10.2	12.1	13.7	12.3	9.9		
HCM Lane LOS	B	B	B	B	B	B	B	B	B	A		
HCM 95thile Q	0.4	2.1	0.9	0.5	1.1	0.5	0.7	1.7	0.7	0.1		

Lanes, Volumes, Timings

2018 Exist AM - Signal - MOD 4.syn

100: Maple Rd & Freistadt Rd (CTH F)

02/07/2019

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	→	→	→	→	→	→	→	→	→	→	→	→
Traffic Volume (vph)	20	200	95	165	115	10	45	30	45	25	205	65
Future Volume (vph)	20	200	95	165	115	10	45	30	45	25	205	65
Peak Flow (vph)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300		0	325		0	0		0	0	50	
Storage Lanes	1		0	1		0	1		0	1	0	
Taper Length (ft)	75			75			75			75		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fit		0.952			0.988			0.910			0.964	
Fit Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1687	1690	0	1687	1754	0	1626	1558	0	1752	1778	0
Fit Permitted	0.666			0.559			0.570			0.702		
Satd. Flow (perm)	1183	1690	0	993	1754	0	976	1558	0	1295	1778	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)	40			40			40			40		
Link Distance (ft)	1000			1000			1000			1000		
Travel Time (s)	17.0			17.0			17.0			17.0		
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Heavy Vehicles (%)	7%	7%	7%	7%	7%	7%	11%	11%	11%	3%	3%	3%
Adj. Flow (vph)	23	227	108	188	131	11	51	34	51	28	233	74
Shared Lane Traffic (%)												
Lane Group Flow (vph)	23	335	0	188	142	0	51	85	0	28	307	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	2			6			4			8		
Permitted Phases	2	2		6	6		4	4		8	8	
Detector Phase	2	2		6	6		4	4		8	8	
Switch Phase												
Minimum Initial (s)	15.0	15.0		15.0	15.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	21.0	21.0		21.0	21.0		16.0	16.0		16.0	16.0	
Total Split (s)	40.0	40.0		40.0	40.0		30.0	30.0		30.0	30.0	
Total Split (%)	57.1%	57.1%		57.1%	57.1%		42.9%	42.9%		42.9%	42.9%	
Maximum Green (s)	34.0	34.0		34.0	34.0		24.0	24.0		24.0	24.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Lead/Lag												
Lead Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	Min	Min		Min	Min		None	None		None	None	
v/c Ratio	0.05	0.49		0.47	0.20		0.17	0.18		0.07	0.57	
Control Delay	9.1	12.9		14.7	9.8		13.2	12.6		11.8	17.5	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	9.1	12.9		14.7	9.8		13.2	12.6		11.8	17.5	
90th %ile Green (s)	26.1	26.1		26.1	26.1		21.0	21.0		21.0	21.0	
90th %ile Term Code	Hold	Hold		Gap	Gap		Hold	Hold		Gap	Gap	
90th %ile Green (s)	16.9	16.9		16.9	16.9		14.3	14.3		14.3	14.3	
90th %ile Term Code	Hold	Hold		Gap	Gap		Hold	Hold		Gap	Gap	

2018 Exist AM - Signal - MOD 4.syn
TADI

Synchro 10 Report

Lanes, Volumes, Timings

2018 Exist AM - Signal - MOD 4.syn

100: Maple Rd & Freistadt Rd (CTH F)

02/07/2019

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
50th %ile Green (s)	15.0	15.0		15.0	15.0		11.6	11.6		11.6	11.6	
50th %ile Term Code	Min	Min		Min	Min		Hold	Hold		Gap	Gap	
90th %ile Green (s)	15.0	15.0		15.0	15.0		10.1	10.1		10.1	10.1	
90th %ile Term Code	Min	Min		Min	Min		Hold	Hold		Gap	Gap	
10th %ile Green (s)	15.0	15.0		15.0	15.0		10.0	10.0		10.0	10.0	
10th %ile Term Code	Min	Min		Min	Min		Hold	Hold		Min	Min	
Queue Length 50th (ft)	3	51		28	19		8	13		4	54	
Queue Length 95th (ft)	15	134		89	57		32	45		20	142	
Internal Link Dist (ft)		920			920			920			920	
Turn Bay Length (ft)	300			325								
Base Capacity (vph)	965	1378		810	1430		562	896		745	1023	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.02	0.24		0.23	0.10		0.09	0.09		0.04	0.30	

Intersection Summary

Area Type: Other

Cycle Length: 70

Actuated Cycle Length: 43

Natural Cycle: 40

Control Type: Actuated-Uncoordinated

90th %ile Actuated Cycle: 59.1

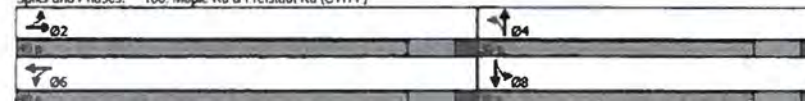
70th %ile Actuated Cycle: 43.2

50th %ile Actuated Cycle: 38.6

10th %ile Actuated Cycle: 37.1

10th %ile Actuated Cycle: 37

Splices and Phases: 100: Maple Rd & Freistadt Rd (CTH F)

2018 Exist AM - Signal - MOD 4.syn
TADI

Synchro 10 Report

HCM 6th Signalized Intersection Summary
100: Maple Rd & Freistadt Rd (CTH F)

2018 Exist AM - Signal - MOD 4.syn
02/07/2019

	FSL	FTL	EBL	EBL	EBL	EBL	EBL	EBL	EBL	EBL	EBL	EBL
Lane Configurations	FSL	FTL	EBL	EBL	EBL	EBL	EBL	EBL	EBL	EBL	EBL	EBL
Traffic Volume (veh/h)	20	200	95	165	115	10	45	30	45	25	205	85
Future Volume (veh/h)	20	200	95	165	115	10	45	30	45	25	205	85
Initial Q (Qb) veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj (A _{pbi})	1.00	1.00	1.00	1.00	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	No	No	No	No	No	No	No	No
Adj Sat Flow, veh/h	1796	1796	1796	1796	1796	1796	1737	1737	1737	1856	1856	1856
Adj Flow Rate, veh/h	23	227	108	188	131	11	51	34	51	28	233	74
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Percent Heavy Veh. %	7	7	7	7	7	7	11	11	11	3	3	3
Cap, veh/h	623	472	224	460	670	56	307	167	251	487	360	114
Arrive On Green	0.41	0.41	0.41	0.41	0.41	0.41	0.27	0.27	0.27	0.27	0.27	0.27
Sat Flow, veh/h	1197	1150	547	1004	1634	137	986	627	941	1302	1350	628
Grp Volume(v), veh/h	23	0	335	188	0	142	51	0	85	28	0	307
Grp Sat Flow(s), veh/h	1197	0	1888	1004	0	1772	996	0	1568	1302	0	1778
Q Serve(q, s)	0.5	0.0	5.4	6.3	0.0	1.9	1.8	0.0	1.6	0.6	0.0	5.7
Cycle Q Clear(q, c), s	2.4	0.0	5.4	11.7	0.0	1.9	7.5	0.0	1.6	2.2	0.0	5.7
Prop In Lane	1.00	0.32	1.00	0.08	1.00	0.60	1.00	0.60	1.00	0.24	0.24	0.24
Lane Grp Cap(c), veh/h	623	0	696	460	0	726	307	0	419	487	0	478
V/C Ratio(X)	0.04	0.00	0.48	0.41	0.00	0.20	0.17	0.00	0.20	0.06	0.00	0.65
Kvail Cap(c), veh/h	1228	0	1553	967	0	1621	685	0	1013	980	0	1149
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(f)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	7.8	0.0	8.1	12.3	0.0	7.0	15.4	0.0	10.6	11.4	0.0	12.1
Inc Delay (d2), s/veh	0.0	0.0	0.5	0.6	0.0	0.1	0.3	0.0	0.2	0.0	0.0	1.3
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Red Back(Q/50%) veh/h	0.1	0.0	1.3	1.1	0.0	0.5	0.3	0.0	0.4	0.1	0.0	1.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	7.8	0.0	8.6	12.9	0.0	7.2	15.6	0.0	10.8	11.5	0.0	12.3
LnGrp LOS	A	A	A	B	A	A	B	A	B	B	A	B
Approach Vol, veh/h	358			330			136			335		
Approach Delay, s/veh	8.5			10.4			12.6			13.4		
Approach LOS	A			B			B			B		
Phase 1 (G+Y+R), s	21.2			15.9			21.2			15.9		
Change Period (Y+R), s	6.0			6.0			6.0			6.0		
Max Green Setting (Gmax), s	34.0			24.0			34.0			24.0		
Max Q Clear Time (q, c+1), s	7.4			9.5			13.7			7.7		
Green Ext Time (p, c), s	2.1			0.5			1.6			1.6		
HCM 6th Ctrl Delay				11.0								
HCM 6th LOS				B								

Lanes, Volumes, Timings
100: Maple Rd & Freistadt Rd (CTH F)

2018 Exist PM - Signal - MOD 4 syn
02/01/2019

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	ESL	EST	ESR	SEL	SET	SEB
Lane Configurations	↰	↱	↲	↰	↱	↲	↰	↱	↲	↰	↱	↲
Traffic Volume (vph)	60	125	70	85	145	30	55	205	130	15	70	20
Future Volume (vph)	60	125	70	85	145	30	55	205	130	15	70	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300		0	325		0	0		0	0		50
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (ft)	75			75			75			75		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.946			0.974			0.942			0.966	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1736	1728	0	1752	1797	0	1736	1721	0	1736	1765	0
Flt Permitted	0.639			0.627			0.694			0.516		
Satd. Flow (perm)	1167	1728	0	1157	1797	0	1268	1721	0	943	1765	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)	40			40			40			40		
Link Distance (ft)	1000			1000			1000			1000		
Travel Time (s)	17.0			17.0			17.0			17.0		
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles (%)	4%	4%	4%	3%	3%	3%	4%	4%	4%	4%	4%	4%
Adj. Flow (vph)	65	134	75	91	156	32	59	220	140	16	75	22
Shared Lane Traffic (%)												
Lane Group Flow (vph)	65	209	0	91	188	0	59	360	0	16	97	0
Plan Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	2			6			4			8		
Detector Phase	2	2		6	6		4	4		8	8	
Switch Phase												
Minimum Initial (s)	15.0	15.0		15.0	15.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	21.0	21.0		21.0	21.0		16.0	16.0		16.0	16.0	
Total Split (s)	40.0	40.0		40.0	40.0		30.0	30.0		30.0	30.0	
Total Split (%)	57.1%	57.1%		57.1%	57.1%		42.9%	42.9%		42.9%	42.9%	
Maximum Green (s)	34.0	34.0		34.0	34.0		24.0	24.0		24.0	24.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Lead/Lag												
Lead Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	Min	Min		Min	Min		None	None		None	None	
Wt Ratio	0.15	0.33		0.21	0.28		0.14	0.62		0.05	0.16	
Control Delay	11.2	12.2		11.9	11.7		9.8	16.5		8.9	9.8	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	11.2	12.2		11.9	11.7		9.8	16.5		8.9	9.8	
90th %ile Green (s)	15.0	15.0		15.0	15.0		19.7	19.7		19.7	19.7	
90th %ile Term Code	Min	Min		Min	Min		Gap	Gap		Hold	Hold	
10th %ile Green (s)	15.0	15.0		15.0	15.0		15.3	15.3		15.3	15.3	
70th %ile Term Code	Min	Min		Min	Min		Gap	Gap		Hold	Hold	

2018 Exist PM - Signal - MOD 4 syn
TADI

Synchro 10 Report

Lanes, Volumes, Timings
100: Maple Rd & Freistadt Rd (CTH F)

2018 Exist PM - Signal - MOD 4 syn
02/01/2019

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	ESL	EST	ESR	SEL	SET	SEB
50th %ile Green (s)	15.0	15.0		15.0	15.0		13.3	13.3		13.3	13.3	
50th %ile Term Code	Min	Min		Min	Min		Gap	Gap		Hold	Hold	
90th %ile Green (s)	15.0	15.0		15.0	15.0		11.4	11.4		11.4	11.4	
30th %ile Term Code	Min	Min		Min	Min		Gap	Gap		Hold	Hold	
10th %ile Green (s)	15.0	15.0		15.0	15.0		10.0	10.0		10.0	10.0	
10th %ile Term Code	Min	Min		Min	Min		Min	Min		Hold	Hold	
Queue Length 50th (ft)	9	32		13	28		9	66		2	15	
Queue Length 95th (ft)	34	86		45	77		25	125		11	36	
Internal Link Delay (s)		920			920			920			920	
Turn Bay Length (ft)	300			325								
Base Capacity (vph)	975	1444		967	1502		748	1015		556	1041	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced vlt Ratio	0.07	0.14		0.09	0.13		0.08	0.35		0.03	0.09	

Intersection Summary

Area Type: Other

Cycle Length: 70

Actuated Cycle Length: 40.9

Natural Cycle: 40

Control Type: Actuated Uncoordinated

90th %ile Actuated Cycle: 46.7

70th %ile Actuated Cycle: 42.3

50th %ile Actuated Cycle: 40.3

30th %ile Actuated Cycle: 38.4

10th %ile Actuated Cycle: 37

Splits and Phases: 100: Maple Rd & Freistadt Rd (CTH F)



2018 Exist PM - Signal - MOD 4 syn
TADI

Synchro 10 Report

HCM 6th Signalized Intersection Summary
100: Maple Rd & Freistadt Rd (CTH F)

2018 Exist PM - Signal - MOD 4 syn
02/07/2019

	←	→	↙	↘	↖	↗	↙	↘	↖	↗	↙	↘	↖	↗
Lane Configurations	↙	↘	↖	↗	↙	↘	↖	↗	↙	↘	↖	↗	↙	↘
Traffic Volume (veh/h)	60	125	70	85	145	30	55	205	130	15	70	20		
Future Volume (veh/h)	60	125	70	85	145	30	55	205	130	15	70	20		
Initial Q (Q ₀), veh	0	0	0	0	0	0	0	0	0	0	0	0		
Ped Bike Adj (A _{pb}), %	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	1.00	1.00
Work Zone On Approach	No		No		No		No		No		No		No	
Adj Sat Flow, veh/h	1841	1841	1841	1856	1856	1841	1841	1841	1841	1841	1841	1841	1841	1841
Adj Flow Rate, veh/h	65	134	75	91	156	32	59	220	140	16	75	22		
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	4	4	4	3	3	3	4	4	4	4	4	4	4	4
Cap, veh/h	569	1137	244	550	588	121	508	306	195	293	398	111		
Arrive On Green	0.39	0.39	0.39	0.39	0.39	0.39	0.29	0.29	0.29	0.29	0.29	0.29		
Sat Flow, veh/h	1175	1109	620	1183	1494	306	1278	1051	659	1005	1367	401		
Grp Volume(s), veh/h	65	0	209	91	0	188	59	0	360	16	0	97		
Grp Sat Flow(s), veh/h	1175	0	1729	1183	0	1800	1278	0	1720	1005	0	1768		
Q Serve(s), s	1.5	0.0	3.2	2.2	0.0	2.7	1.4	0.0	7.1	0.6	0.0	1.6		
Cycle Q Clear(s), s	4.2	0.0	3.2	5.4	0.0	2.7	2.9	0.0	7.1	7.7	0.0	1.6		
Prop In Lane	1.00		0.36	1.00		0.17	1.00		0.39	1.00		0.23		
Lane Grp Cap(s), veh/h	569	0	681	550	0	709	508	0	501	293	0	518		
VIC Ratio(X)	0.11	0.00	0.31	0.17	0.00	0.27	0.12	0.00	0.72	0.05	0.00	0.19		
Avail Cap(s), veh/h	1156	0	1543	1131	0	1607	942	0	1084	634	0	1114		
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(f)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00		
Uniform Delay (d), s/veh	9.2	0.0	8.0	9.8	0.0	7.8	11.2	0.0	12.1	15.6	0.0	10.1		
Inc Delay (d ₂), s/veh	0.1	0.0	0.3	0.1	0.0	0.2	0.1	0.0	2.6	0.1	0.0	0.2		
Initial Q Delay (d ₃), 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		
Red Back Of (50%), veh/s	0.3	0.0	0.8	0.4	0.0	0.7	0.3	0.0	2.2	0.1	0.0	0.3		
Unsig. Movement Delay, s/veh														
LnGrp Delay(d), s/veh	9.3	0.0	8.2	10.0	0.0	8.0	11.3	0.0	14.1	15.6	0.0	10.3		
LnGrp LOS	A	A	A	A	A	A	B	A	B	B	A	B		
Approach Vol, veh/h		274			279			419				113		
Approach Delay, s/veh		8.5			8.6			13.7				11.1		
Approach LOS		A			A			B				B		
Phs Duration (G+Y+R), s		21.0		17.1		21.0		17.1						
Change Period (Y+R), s		6.0		6.0		6.0		6.0						
Max Green Setting (G _{max}), s		34.0		24.0		34.0		24.0						
Max Q Clear Time (q _{c+1}), s		6.2		9.1		7.4		9.7						
Green Ext Time (p _c), s		1.4		2.0		1.3		0.4						
HCM 6th Ctrl Delay				10.8										
HCM 6th LOS				B										

Lanes, Volumes, Timings
100: Maple Rd & Freistadt Rd (CTH F)

2018 Exist AM - Signal - MOD 5.syn
02/01/2019

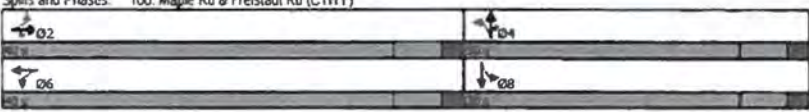
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	←	↑	→	←	↑	→	←	↑	→	←	↑	→
Traffic Volume (vph)	20	200	95	165	115	10	45	30	45	25	205	65
Future Volume (vph)	20	200	95	165	115	10	45	30	45	25	205	65
Real Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300		100	325					100			50
Storage Lanes	1		1	1			1		1		1	0
Taper Length (ft)	75			75			75			75		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Friction			0.850			0.988			0.850			0.964
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1687	1776	1509	1687	1754	0	1626	1712	1455	1752	1778	0
Flt Permitted	0.950			0.617			0.523			0.735		
Satd. Flow (perm)	1183	1776	1509	1096	1754	0	981	1712	1455	1356	1778	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)	40			40			40			40		
Link Distance (ft)	1000			1000			1000			1000		
Travel Time (s)	17.0			17.0			17.0			17.0		
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Growth Factor	100%	100%	62%	100%	100%	100%	100%	100%	62%	100%	100%	100%
Heavy Vehicles (%)	7%	7%	7%	7%	7%	7%	11%	11%	11%	3%	3%	3%
Adj. Flow (vph)	23	227	67	188	131	11	51	34	32	28	233	74
Shared Lane Traffic (%)												
Lane Group Flow (vphpl)	23	227	67	188	142	0	51	34	32	28	307	0
Turn Type	Perm	NA	Perm	Perm	NA	Perm	NA	Perm	Perm	NA	NA	NA
Protected Phases		2			6			4		8		
Permitted Phases	2		2	6			4		4	8		
Detector Phase	2	2	2	6	6		4	4	4	8	8	
Switch Phase												
Minimum Initial (s)	15.0	15.0	15.0	15.0	15.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	21.0	21.0	21.0	21.0	21.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
Total Split (s)	40.0	40.0	40.0	40.0	40.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
Total Split (%)	57.1%	57.1%	57.1%	57.1%	57.1%	42.9%	42.9%	42.9%	42.9%	42.9%	42.9%	42.9%
Maximum Green (s)	34.0	34.0	34.0	34.0	34.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag												
Lead/Lag Optimize?												
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	Min	Min	Min	Min	Min	None	None	None	None	None	None	None
v/c Ratio	0.05	0.32	0.11	0.43	0.20	0.17	0.06	0.07	0.07	0.07	0.56	0.56
Control Delay	9.2	10.9	9.4	13.8	10.0	12.2	10.6	10.7	10.8	16.5	16.5	16.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	9.2	10.9	9.4	13.8	10.0	12.2	10.6	10.7	10.8	16.5	16.5	16.5
90th %ile Green (s)	21.8	21.8	21.8	21.8	21.8	19.5	19.5	19.5	19.5	19.5	19.5	19.5
90th %ile Term Code	Hold	Hold	Hold	Cap	Cap	Hold	Hold	Hold	Cap	Cap	Cap	Cap
70th %ile Green (s)	15.0	15.0	15.0	15.0	15.0	13.6	13.6	13.6	13.6	13.6	13.6	13.6

2018 Exist AM - Signal - MOD 5.syn
TADI

Synchro 10 Report

Lanes, Volumes, Timings
100: Maple Rd & Freistadt Rd (CTH F)

2018 Exist AM - Signal - MOD 5.syn
02/01/2019

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
70th %ile Term Code	Min	Min	Min	Min	Min		Hold	Hold	Hold	Gap	Gap	Gap
50th %ile Green (s)	15.0	15.0	15.0	15.0	15.0		11.6	11.6	11.6	11.6	11.6	11.6
50th %ile Term Code	Min	Min	Min	Min	Min		Hold	Hold	Hold	Gap	Gap	Gap
30th %ile Green (s)	15.0	15.0	15.0	15.0	15.0		10.1	10.1	10.1	10.1	10.1	10.1
30th %ile Term Code	Min	Min	Min	Min	Min		Hold	Hold	Hold	Gap	Gap	Gap
10th %ile Green (s)	15.0	15.0	15.0	15.0	15.0		10.0	10.0	10.0	10.0	10.0	10.0
10th %ile Term Code	Min	Min	Min	Min	Min		Hold	Hold	Hold	Min	Min	Min
Queue Length 50th (ft)	3	32	9	28	19		8	5	5	4	54	54
Queue Length 95th (ft)	15	85	31	83	56		29	20	20	18	127	127
Internal Link Dist (ft)		920			920			920			920	
Turn Bay Length (ft)	300		100	325					100			
Base Capacity (vph)	991	1488	1264	918	1470		580	1013	861	802	1052	1052
Starvation Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Reduced v/c Ratio	0.02	0.15	0.05	0.20	0.10		0.09	0.03	0.04	0.03	0.29	0.29
Intersection Summary												
Area Type:	Other											
Cycle Length:	70											
Actuated Cycle Length:	41.3											
Natural Cycle:	40											
Control Type:	Actuated Uncoordinated											
90th %ile Actuated Cycle:	53.3											
70th %ile Actuated Cycle:	40.6											
50th %ile Actuated Cycle:	38.6											
30th %ile Actuated Cycle:	37.1											
10th %ile Actuated Cycle:	37											
Splits and Phases: 100: Maple Rd & Freistadt Rd (CTH F)												
												

2018 Exist AM - Signal - MOD 5.syn
TADI

Synchro 10 Report

HCM 6th Signalized Intersection Summary
100: Maple Rd & Freistadt Rd (CTH F)

2018 Exist AM - Signal - MOD 5 syn
02/07/2019

	EB	EB	EB	EB	EB	WB	WB	WB	WB	SB	SB	SB
Lane Configurations	↩	↩	↩	↩	↩	↩	↩	↩	↩	↩	↩	↩
Traffic Volume (veh/h)	20	200	95	165	115	10	45	30	45	25	205	65
Future Volume (veh/h)	20	200	95	165	115	10	45	30	45	25	205	65
Initial Q (Q ₀) veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped. Bk Adj (A _{pb1})	1.00	1.00	1.00	1.00	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	No	No	No	No	No	No	No	No
Adj Sat Flow, veh/h	1796	1796	1796	1796	1796	1796	1737	1737	1737	1856	1856	1856
Adj Flow Rate, veh/h	23	227	67	188	131	11	51	34	32	28	233	74
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Percent Heavy Veh. %	7	7	7	7	7	7	11	11	11	3	3	3
Cap, veh/h	620	730	619	529	664	56	310	466	395	531	362	119
Arrive On Green	0.41	0.41	0.41	0.41	0.41	0.41	0.27	0.27	0.27	0.27	0.27	0.27
Sat Flow, veh/h	1197	1796	1522	1042	1634	137	996	1737	1472	1325	1350	429
Grp Volume(v), veh/h	23	227	67	188	0	142	51	34	32	28	0	307
Grp Sat Flow(s), veh/h	1197	1796	1522	1042	0	1772	996	1737	1472	1325	0	1778
Q Serve(q, s), s	0.5	3.2	1.0	5.5	0.0	1.9	1.8	0.5	0.6	0.6	0.0	5.6
Cycle Q Clear(q, c), s	2.4	3.2	1.0	8.7	0.0	1.9	7.4	0.5	0.5	1.7	0.0	5.6
Prop In Lane	1.00	1.00	1.00	1.00	0.08	1.00	1.00	1.00	1.00	1.00	0.24	0.24
Lane Grp Cap(c), veh/h	620	730	619	529	0	720	310	466	395	531	0	471
V/C Ratio(X)	0.04	0.31	0.11	0.36	0.00	0.20	0.16	0.07	0.08	0.05	0.00	0.64
Avail Cap(c _a), veh/h	1236	1655	1403	1066	0	1632	891	1130	957	1037	0	1157
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(f)	1.00	1.00	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	7.8	7.4	6.8	10.4	0.0	7.1	15.2	10.1	10.1	10.5	0.0	11.9
Inc Delay (d ₂), s/veh	0.0	0.2	0.1	0.4	0.0	0.1	0.2	0.1	0.1	0.0	0.0	1.3
Initial Q Delay(d ₃), 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
Red Back Q (Q ₀ 50%), veh/h	0.1	0.8	0.2	0.9	0.0	0.4	0.3	0.2	0.1	0.1	0.0	1.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	7.9	7.7	6.9	10.8	0.0	7.2	15.5	10.1	10.2	10.5	0.0	13.4
LnGrp LOS	A	A	A	B	A	A	B	B	B	B	A	B
Approach Vol, veh/h	317	330	330	330	330	330	330	330	330	330	330	330
Approach Delay, s/veh	7.5	9.2	12.5	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2
Approach LOS	A	A	B	B	B	B	B	B	B	B	B	B
Phase Duration (G+Y+R), s	21.0	15.9	21.0	15.9	21.0	15.9	21.0	15.9	21.0	15.9	21.0	15.9
Change Period (Y+R), s	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Max Green Setting (G _{max}), s	34.0	24.0	34.0	24.0	34.0	24.0	34.0	24.0	34.0	24.0	34.0	24.0
Max Q Clear Time (q _c +1), s	5.2	9.4	10.7	7.6	5.2	9.4	10.7	7.6	5.2	9.4	10.7	7.6
Green Ext Time (g _c), s	1.5	0.3	1.5	1.5	1.5	0.3	1.5	1.5	1.5	0.3	1.5	1.5
HCM 6th Ctrl Delay	10.3											
HCM 6th LOS	B											

Lanes, Volumes, Timings

2018 Exist PM - Signal - MOD 5.syn

100: Maple Rd & Freistadt Rd (CTH F)

02/07/2019

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	←	↑	→	←	↑	→	←	↑	→	←	↑	→
Traffic Volume (vph)	60	125	70	85	145	30	55	205	130	15	70	20
Future Volume (vph)	60	125	70	85	145	30	55	205	130	15	70	20
Peak Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300		100	325		0	0		100	0		50
Storage Lanes	1		1	1		0	1		1	1		0
Taper Length (ft)	75			75			75			75		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Friction			0.850		0.974				0.850		0.966	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1736	1827	1553	1752	1797	0	1736	1827	1553	1736	1765	0
Flt Permitted	0.639			0.671			0.694			0.621		
Satd. Flow (perm)	1167	1827	1553	1238	1797	0	1268	1827	1553	1135	1765	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)	40			40			40			40		
Link Distance (ft)	1000			1000			1000			1000		
Travel Time (s)	17.0			17.0			17.0			17.0		
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Growth Factor	100%	100%	62%	100%	100%	100%	100%	62%	100%	100%	100%	100%
Heavy Vehicles (%)	4%	4%	4%	4%	3%	3%	4%	4%	4%	4%	4%	4%
Adj. Flow (vph)	65	134	47	91	156	32	59	220	87	16	75	22
Shared Lane Traffic (%)												
Lane Group Flow (vph)	65	134	47	91	188	0	59	220	87	16	97	0
Turn Type	Perm	NA	Perm	Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases	2		2	6			4		4	8		
Permitted Phases	2		2	6			4		4	8		
Detector Phase	2	2	2	6	6		4	4	4	8	8	
Switch Phase												
Minimum Initial (s)	15.0	15.0	15.0	15.0	15.0		10.0	10.0	10.0	10.0	10.0	
Minimum Split (s)	21.0	21.0	21.0	21.0	21.0		16.0	16.0	16.0	16.0	16.0	
Initial Split (s)	40.0	40.0	40.0	40.0	40.0		30.0	30.0	30.0	30.0	30.0	
Total Split (%)	57.1%	57.1%	57.1%	57.1%	57.1%		42.9%	42.9%	42.9%	42.9%	42.9%	
Maximum Green (s)	34.0	34.0	34.0	34.0	34.0		24.0	24.0	24.0	24.0	24.0	
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0	6.0	6.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Recall Mode	Min	Min	Min	Min	Min		None	None	None	None	None	
v/c Ratio	0.14	0.18	0.07	0.18	0.26		0.17	0.43	0.20	0.05	0.20	
Control Delay	8.8	8.7	8.1	9.1	9.3		11.3	14.0	11.4	10.0	11.2	
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Delay	8.8	8.7	8.1	9.1	9.3		11.3	14.0	11.4	10.0	11.2	
90th %ile Green (s)	15.0	15.0	15.0	15.0	15.0		13.6	13.6	13.6	13.6	13.6	
90th %ile Term Code	Min	Min	Min	Min	Min		Gap	Gap	Gap	Hold	Hold	
70th %ile Green (s)	15.0	15.0	15.0	15.0	15.0		10.7	10.7	10.7	10.7	10.7	

2018 Exist PM - Signal - MOD 5.syn
TADI

Synchro 10 Report

Lanes, Volumes, Timings

2018 Exist PM - Signal - MOD 5.syn

100: Maple Rd & Freistadt Rd (CTH F)

02/07/2019

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
70th %ile Term Code	Min	Min	Min	Min	Min		Gap	Gap	Gap	Hold	Hold	
50th %ile Green (s)	15.0	15.0	15.0	15.0	15.0		10.0	10.0	10.0	10.0	10.0	
60th %ile Term Code	Min	Min	Min	Min	Min		Min	Min	Min	Min	Min	
30th %ile Green (s)	15.0	15.0	15.0	15.0	15.0		10.0	10.0	10.0	10.0	10.0	
30th %ile Term Code	Min	Min	Min	Min	Min		Min	Min	Min	Hold	Hold	
10th %ile Green (s)	19.6	19.6	19.6	19.6	19.6		10.0	10.0	10.0	10.0	10.0	
10th %ile Term Code	Dwell	Dwell	Dwell	Dwell	Dwell		Min	Min	Min	Hold	Hold	
Queue Length 50th (ft)	8	16	5	11	23		9	36	13	2	15	
Queue Length 95th (ft)	27	45	21	36	61		27	76	35	11	38	
Internal Link Dist (ft)							920			920		
Turn Bay Length (ft)	300			100	325					100		
Base Capacity (vph)	1025	1605	1365	1087	1579		786	1133	963	704	1094	
Starvation Cap Reductn	0	0	0	0	0		0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0		0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0		0	0	0	0	0	
Reduced v/c Ratio	0.06	0.08	0.03	0.08	0.12		0.08	0.19	0.09	0.02	0.09	

Intersection Summary

Area Type: Other

Cycle Length: 70

Actuated Cycle Length: 38.8

Natural Cycle: 40

Control Type: Actuated Uncoordinated

90th %ile Actuated Cycle: 40.6

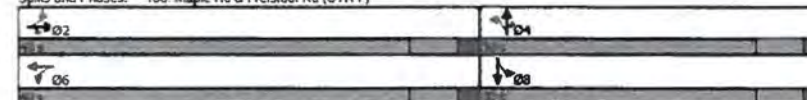
70th %ile Actuated Cycle: 37.7

50th %ile Actuated Cycle: 37

30th %ile Actuated Cycle: 37

10th %ile Actuated Cycle: 41.6

Splits and Phases: 100: Maple Rd & Freistadt Rd (CTH F)

2018 Exist PM - Signal - MOD 5.syn
TADI

Synchro 10 Report

HCM 6th Signalized Intersection Summary
100: Maple Rd & Freistadt Rd (CTH F)

2018 Exist PM - Signal - MOD 5 syn
02/07/2019

	W	W	W	W	W	W	W	W	W	W	W	W	W
Lane Configurations	W	W	W	W	W	W	W	W	W	W	W	W	W
Traffic Volume (veh/h)	60	125	70	85	145	30	55	205	130	15	70	20	20
Future Volume (veh/h)	60	125	70	85	145	30	55	205	130	15	70	20	20
Initial Q (veh)	0	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	1.00
Work Zone On Approach	No		No		No		No		No		No		No
Adj Sat Flow (veh/h)	1841	1841	1841	1856	1856	1841	1841	1841	1841	1841	1841	1841	1841
Adj Flow Rate (veh/h)	65	134	47	91	156	32	59	220	87	16	75	22	22
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh. %	4	4	4	3	3	3	3	4	4	4	4	4	4
Cap (veh/h)	591	748	634	624	607	124	484	495	419	374	358	108	108
Arrive On Green	0.41	0.41	0.41	0.41	0.41	0.41	0.27	0.27	0.27	0.27	0.27	0.27	0.27
Sat Flow (veh/h)	1176	1841	1560	1194	1494	306	1278	1841	1560	1055	1367	401	401
Grp Volume (veh/h)	65	134	47	91	0	188	59	220	87	16	0	97	97
Grp Sat Flow (veh/h)	1176	1841	1560	1194	0	1800	1278	1841	1560	1055	0	1769	1769
Q Serve (g, s)	1.4	1.7	0.7	2.0	0.0	2.6	1.4	3.7	1.6	0.5	0.0	1.6	1.6
Cycle Q Clear (g, c, s)	4.0	1.7	0.7	3.7	0.0	2.6	2.3	3.7	1.6	4.1	0.0	1.6	1.6
Prop In Lane	1.00		1.00	1.00		0.17	1.00		1.00	1.00		0.23	
Lane Grp Cap (veh/h)	591	748	634	624	0	731	484	495	419	374	0	479	479
V/C Ratio (X)	0.11	0.18	0.07	0.15	0.00	0.26	0.12	0.44	0.21	0.04	0.00	0.20	0.20
Avail Cap (veh/h)	1197	1695	1436	1238	0	1658	971	1196	1014	776	0	1149	1149
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	1.00
Upstream Filter (t)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	8.6	7.0	6.7	8.2	0.0	7.3	11.6	11.2	10.5	12.9	0.0	10.4	10.4
Inc Delay (d2), s/veh	0.1	0.1	0.0	0.1	0.0	0.2	0.1	0.6	0.2	0.0	0.0	0.2	0.2
Initial Q Delay (d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Side Back (d4) (s/veh)	0.2	0.4	0.1	0.3	0.0	0.6	0.3	1.1	0.4	0.1	0.0	0.5	0.5
Unsig. Movement Delay, s/veh													
LnGrp Delay (d), s/veh	8.7	7.1	6.8	8.3	0.0	7.5	11.7	11.8	10.7	13.0	0.0	10.7	10.7
LnGrp LOS	A	A	A	A	A	A	B	B	B	B	A	B	B
Approach Vol (veh/h)	246			279			366				113		
Approach Delay, s/veh	7.5			7.7			11.5				11.0		
Approach LOS	A			A			B				B		
Phs Duration (G+Y+R), s	21.0			15.9			21.0				15.9		
Change Period (Y+R), s	6.0			6.0			6.0				6.0		
Max Green Setting (G _{max}), s	34.0			24.0			34.0				24.0		
Max Q Clear Time (g, c+1), s	6.0			5.7			5.7				6.1		
Green Ext Time (g, c), s	1.1			1.5			1.3				0.4		
HCM 6th Ctrl Delay				9.1									
HCM 6th LOS				A									

HCS7 Roundabouts Report

General Information				Site Information			
Analyst	Christian Sternke			Intersection	Freistadt Road (CTH F) & Maple Road		
Agency or Co.	TADI			E/W Street Name	Freistadt Road (CTH F)		
Date Performed	1/4/2019			N/S Street Name	Maple Road		
Analysis Year	2018			Analysis Time Period (hrs)	0.25		
Time Analyzed	AM Peak			Peak Hour Factor	0.88		
Project Description				Jurisdiction	Village of Germantown		

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0
Lane Assignment	LTR				LTR				LTR				LTR			
Volume (V), veh/h	5	20	200	95	5	165	115	10	5	45	30	45	5	25	205	65
Percent Heavy Vehicles, %	7	7	7	7	7	7	7	7	11	11	11	11	3	3	3	3
Flow Rate (v_{pc}), pc/h	6	24	243	116	6	201	140	12	6	57	38	57	6	29	240	76
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1				1				1			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)		4.2000			4.2000			4.2000			4.2000	
Follow-Up Headway (s)		2.0000			2.0000			2.0000			2.0000	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h		389			359			158			351	
Entry Volume veh/h		364			336			142			341	
Circulating Flow (v_c), pc/h		488			137			314			416	
Exiting Flow (v_e), pc/h		335			279			80			563	
Capacity (c_{pc}), pc/h		1167			1594			1362			1244	
Capacity (c), veh/h		1090			1489			1227			1207	
v/c Ratio (x)		0.33			0.23			0.12			0.28	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		6.6			4.2			3.9			5.6	
Lane LOS		A			A			A			A	
95% Queue, veh		1.5			0.9			0.4			1.2	
Approach Delay, s/veh		6.6			4.2			3.9			5.6	
Approach LOS		A			A			A			A	
Intersection Delay, s/veh LOS	5.3						A					

HCS7 Roundabouts Report

General Information

Analyst	Christian Sterneke	Intersection	Freistadt Road (CTH F) & Maple Road
Agency or Co.	TADI	E/W Street Name	Freistadt Road (CTH F)
Date Performed	1/4/2019	N/S Street Name	Maple Road
Analysis Year	2018	Analysis Time Period (hrs)	0.25
Time Analyzed	PM Peak	Peak Hour Factor	0.93
Project Description		Jurisdiction	Village of Germantown

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0
Lane Assignment			LTR				LTR				LTR				LTR	
Volume (V), veh/h	5	60	125	70	5	85	145	30	5	55	205	130	5	15	70	20
Percent Heavy Vehicles, %	4	4	4	4	3	3	3	3	4	4	4	4	4	4	4	4
Flow Rate (v_{adj}), pc/h	6	67	140	78	6	94	161	33	6	62	229	145	6	17	78	22
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1				1				1			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)		4.2000			4.2000			4.2000			4.2000	
Follow-Up Headway (s)		2.0000			2.0000			2.0000			2.0000	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h		291			294			442			123	
Entry Volume veh/h		280			285			425			118	
Circulating Flow (v_c), pc/h		207			376			242			335	
Exiting Flow (v_{ex}), pc/h		308			251			335			256	
Capacity (C_{adj}), pc/h		1497			1289			1452			1336	
Capacity (c), veh/h		1440			1251			1396			1285	
v/c Ratio (x)		0.19			0.23			0.30			0.09	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		4.1			4.9			5.2			3.5	
Lane LOS		A			A			A			A	
95% Queue, veh		0.7			0.9			1.3			0.3	
Approach Delay, s/veh		4.1			4.9			5.2			3.5	
Approach LOS		A			A			A			A	
Intersection Delay, s/veh LOS	4.7						A					

APPENDIX C

YEAR 2028 BACKGROUND TRAFFIC PEAK HOUR ANALYSIS OUTPUTS

Lanes, Volumes, Timings
100: Maple Rd & Freistadt Rd (CTH F)

2028 Back AM.syn
01/02/2019

Lane Group	EB	EB	EB	WB	WB	WB	WB	WB	WB	WB	WB	WB
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	25	230	110	190	135	10	50	35	50	30	235	75
Future Volume (vph)	25	230	110	190	135	10	50	35	50	30	235	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300	0	325	0	0	0	0	0	0	0	50	0
Storage Lanes	1	0	1	0	0	0	0	0	0	0	1	0
Taper Length (ft)	75	0	75	0	0	0	0	0	0	0	75	0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	1.00	1.00	1.00
Flt	0.951	0.951	0.951	0.951	0.951	0.951	0.951	0.951	0.951	0.951	0.951	0.951
Flt Protected	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950
Satd. Flow (prot)	1687	1689	0	1687	1758	0	0	3015	0	0	1834	1568
Flt Permitted	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950
Satd. Flow (perm)	1687	1689	0	1687	1758	0	0	3015	0	0	1834	1568
Link Speed (mph)	40	40	40	40	40	40	40	40	40	40	40	40
Link Distance (ft)	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Travel Time (s)	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Heavy Vehicles (%)	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%
Adj. Flow (vph)	28	261	125	216	153	11	57	40	57	34	267	85
Shared Lane Traffic (%)	28	386	0	216	164	0	0	154	0	0	301	85
Lane Group Flow (vph)	28	386	0	216	164	0	0	154	0	0	301	85
Sign Control	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop	Stop

Intersection Summary

Area Type: Other
Control Type: Unsignalized

HCM 6th TWSC
100: Maple Rd & Freistadt Rd (CTH F)

2028 Back AM.syn
01/02/2019

Intersection												
Int Delay, s/veh	86.9											
Movement	EB	EB	EB	WB	WB	WB	WB	WB	WB	WB	WB	WB
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Vol, veh/h	25	230	110	190	135	10	50	35	50	30	235	75
Future Vol, veh/h	25	230	110	190	135	10	50	35	50	30	235	75
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	-	-	-	-	-	-	-	-	-	-
Storage Length	300	0	325	0	0	0	0	0	0	0	50	0
Wht in Median Storage, #	0	0	0	0	0	0	0	0	0	0	0	0
Grade, %	0	0	0	0	0	0	0	0	0	0	0	0
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Heavy Vehicles, %	7	7	7	7	7	7	7	7	7	7	7	7
Mini Flow	28	261	125	216	153	11	57	40	57	34	267	85

Intersection	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6	Stage 7	Stage 8	Stage 9	Stage 10	Stage 11	Stage 12
Conflicting Flow All	164	0	0	386	0	0	1147	976	324	1019	1033	159
Stage 1	-	-	-	-	-	-	380	380	-	591	591	-
Stage 2	-	-	-	-	-	-	767	596	-	428	442	-
Critical Hdwy	4.17	-	-	4.17	-	-	7.21	6.61	6.31	7.73	6.53	6.23
Critical Hdwy Stg 1	-	-	-	-	-	-	6.21	5.61	-	6.13	5.53	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.21	5.61	-	6.13	5.53	-
Follow-up Hdwy	2.263	-	-	2.263	-	-	3.599	4.099	3.399	3.527	4.027	3.327
Plat Cap-1 Maneuver	1385	-	-	1146	-	-	169	242	697	214	232	884
Stage 1	-	-	-	-	-	-	624	598	-	492	493	-
Stage 2	-	-	-	-	-	-	381	478	-	603	575	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1385	-	-	1146	-	-	193	697	140	185	884	-
Mov Cap-2 Maneuver	-	-	-	-	-	-	193	-	140	-	185	-
Stage 1	-	-	-	-	-	-	612	586	-	482	400	-
Stage 2	-	-	-	-	-	-	93	388	-	506	564	-

Intersection	EB	WB	WB	WB
HCM Control Delay, s	0.5	5	-	294.8
HCM LOS	-	-	-	F

Intersection	EB	WB	WB	WB
Capacity (veh/h)	-	416	1385	-
HCM Lane V/C Ratio	-	0.184	0.021	-
HCM Control Delay (s)	-	15.6	7.7	-
HCM Lane LOS	-	C	A	-
HCM 95th %ile D (veh)	-	0.7	0.1	-

Volume exceeds capacity: Delay exceeds 300s: Computation Not Defined: All major volume in platoon

Lanes, Volumes, Timings
100: Maple Rd & Freistadt Rd (CTH F)

2028 Back PM.syn
01/02/2019

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↰	↰	↰	↰	↰	↰	↰	↰	↰	↰	↰
Traffic Volume (vph)	70	145	80	100	165	35	65	235	150	15	80	25
Future Volume (vph)	70	145	80	100	165	35	65	235	150	15	80	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300		0	325		0	0		0	0		50
Storage Lanes	1		0	1		0	0		0	0		1
Taper Length (ft)	75			75			75			75		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	1.00	1.00	1.00
Frt		0.947			0.973			0.950				0.850
Flt Protected	0.950			0.950				0.993			0.992	
Satd. Flow (prot)	1736	1730	0	1752	1795	0	0	3275	0	0	1812	1553
Flt Permitted	0.950			0.950				0.993			0.992	
Satd. Flow (perm)	1736	1730	0	1752	1795	0	0	3275	0	0	1812	1553
Link Speed (mph)		40			40			40			40	
Link Distance (ft)		1000			1000			1000			1000	
Travel Time (s)		17.0			17.0			17.0			17.0	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles (%)	4%	4%	4%	3%	3%	3%	4%	4%	4%	4%	4%	4%
Adj. Flow (vph)	75	156	86	108	177	38	70	253	161	16	86	27
Shared Lane Traffic (%)												
Lane Group Flow (vph)	75	242	0	108	215	0	0	484	0	0	102	27
Sign Control	Free			Free			Stop			Stop		

Intersection Summary

Area Type: Other
Control Type: Unsignalized

HCM 6th TWSC
100: Maple Rd & Freistadt Rd (CTH F)

2028 Back PM.syn
01/02/2019

Intersection												
Int Delay, s/veh	23.9											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↰	↰	↰	↰	↰	↰	↰	↰	↰	↰	↰
Traffic Vol. veh/h	70	145	80	100	165	35	65	235	150	15	80	25
Future Vol. veh/h	70	145	80	100	165	35	65	235	150	15	80	25
Conflicting Peds. #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	300			325								50
Vel in Median Storage, ft	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	4	4	4	3	3	3	4	4	4	4	4	4
Minor Flow	75	156	86	108	177	38	70	253	161	16	86	27

Major/Minor	Major1	Major2	Minor1	Minor2
Conflicting Flow All	215	0	0	242
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Critical Hdwy	4.14	-	4.13	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-
Follow-up Hdwy	2.236	-	2.227	-
Pot Cap-1 Maneuver	1343	-	1319	-
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Platoon blocked, %	-	-	-	-
Mov Cap-1 Maneuver	1343	-	1319	-
Mov Cap-2 Maneuver	-	-	-	-
Stage 1	-	-	-	-
Stage 2	-	-	-	-

Approach	EB	WB	NS	SB
HCM Control Delay, s	1.9	2.7	40.9	67.4
HCM LOS	E	E	F	F

Minor Lane/Minor	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	242	448	1343	-	-	1319	-	-	138	840
HCM Lane V/C Ratio	0.811	0.642	0.056	-	-	0.082	-	-	0.74	0.032
HCM Control Delay (s)	62.4	28.3	7.8	-	-	8	-	-	82.7	9.4
HCM Lane LOS	F	D	A	-	-	A	-	-	F	A
HCM 95th %ile D (veh)	6.2	4.4	0.2	-	-	0.3	-	-	4.3	0.1

Lanes, Volumes, Timings
100: Maple Rd & Freistadt Rd (CTH F)

2028 Back AM - MOD 1 syn
02/07/2019

	EB	EBT	EBR	WB	WBT	WBR	NB	NBT	NBR	SB	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	25	230	110	190	135	10	50	35	50	30	235	75
Future Volume (vph)	25	230	110	190	135	10	50	35	50	30	235	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300	0	325	0	0	0	0	0	0	0	50	0
Storage Lanes	1	0	1	0	0	0	1	0	1	0	1	0
Taper Length (ft)	75	0	75	0	0	0	75	0	75	0	75	0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.951	0.951	0.951	0.951	0.951	0.951	0.951	0.951	0.951	0.951	0.951	0.951
Flt Protected	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950
Satd. Flow (prot)	1687	1689	0	1687	1758	0	1626	1712	1455	0	1834	1568
Flt Permitted	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950
Satd. Flow (perm)	1687	1689	0	1687	1758	0	1626	1712	1455	0	1834	1568
Link Speed (mph)	40	40	40	40	40	40	40	40	40	40	40	40
Link Distance (ft)	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Travel Time (s)	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Heavy Vehicles (%)	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%
Adj. Flow (vph)	28	261	125	216	153	11	57	40	57	34	267	85
Shared Lane Traffic (%)	28	386	0	216	164	0	57	40	57	0	301	85
Lane Group Flow (vph)	28	386	0	216	164	0	57	40	57	0	301	85
Sign Control	Free	Free	Free	Free	Free	Free	Free	Free	Free	Free	Free	Free
Area Type:	Other											
Control Type:	Unsignalized											

HCM 6th TWSC
100: Maple Rd & Freistadt Rd (CTH F)

2028 Back AM - MOD 1.syn
02/07/2019

Int Delay, s/veh	86.9											
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Vol, veh/h	25	230	110	190	135	10	50	35	50	30	235	75
Future Vol, veh/h	25	230	110	190	135	10	50	35	50	30	235	75
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	300	-	-	325	-	-	0	-	0	-	-	50
Wht in Median Storage, #	-	0	-	-	0	-	0	-	0	-	0	-
Grade, %	-	0	-	-	0	-	0	-	0	-	0	-
Peak Hour Factor	88	88	88	88	88	88	88	88	88	88	88	88
Heavy Vehicles, %	7	7	7	7	7	7	11	11	11	3	3	3
Minor Flow	28	261	125	216	153	11	57	40	57	34	267	85
Conflicting Flow All	164	0	0	386	0	0	1147	976	324	1019	1033	159
Stage 1	-	-	-	-	-	-	380	380	-	591	591	-
Stage 2	-	-	-	-	-	-	767	596	-	428	442	-
Critical Hdwy	4.17	-	-	4.17	-	-	7.21	6.61	6.31	7.13	6.53	6.23
Critical Hdwy Stg 1	-	-	-	-	-	-	6.21	5.61	-	6.13	5.53	-
Critical Hdwy Stg 2	-	-	-	-	-	-	8.21	5.61	-	6.13	5.53	-
Follow-up Hdwy	2.263	-	-	2.263	-	-	3.599	4.099	3.399	3.527	4.027	3.327
Plat Cap-1 Maneuver	1385	-	-	1146	-	-	169	242	697	214	232	884
Stage 1	-	-	-	-	-	-	624	598	-	492	493	-
Stage 2	-	-	-	-	-	-	381	478	-	603	575	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1385	-	-	1146	-	-	193	697	140	185	884	-
Mov Cap-2 Maneuver	-	-	-	-	-	-	193	-	140	-	185	-
Stage 1	-	-	-	-	-	-	612	596	-	482	496	-
Stage 2	-	-	-	-	-	-	93	388	-	506	564	-
HCM Control Delay, s	0.5	-	-	5	-	-	-	-	-	-	294.8	-
HCM LOS	-	-	-	-	-	-	-	-	-	-	F	-
Capacity (veh/h)	-	193	697	1385	-	-	1146	-	-	179	884	-
HCM Lane V/C Ratio	-	0.206	0.082	0.021	-	-	0.188	-	-	1.682	0.096	-
HCM Control Delay (s)	-	28.4	10.6	7.7	-	-	8.9	-	-	375.8	9.5	-
HCM Lane LOS	-	D	B	A	-	-	A	-	-	F	A	-
HCM 95th Pct Delay (s)	-	0.7	0.3	0.1	-	-	0.7	-	-	20.7	0.3	-
Notes	- Volume exceeds capacity \$ Delay exceeds 300s + Computation Not Defined * All major volume in platoon											

Lanes, Volumes, Timings
100: Maple Rd & Freistadt Rd (CTH F)

2028 Back PM - MOD 1 syn
02/07/2019

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	70	145	80	100	165	35	65	235	150	15	80	25
Future Volume (vph)	70	145	80	100	165	35	65	235	150	15	80	25
Peak Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300		0	325		0		0	0		0	50
Storage Lanes	1		0	1		0		1	0		0	1
Taper Length (ft)	75			75				75				75
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.947			0.973				0.850				0.850
Flt Protected	0.950			0.950				0.950				0.992
Satd Flow (prot)	1736	1730	0	1752	1795	0	1736	1827	1553	0	1812	1553
Flt Permitted	0.950			0.850				0.950				0.992
Satd Flow (perm)	1736	1730	0	1752	1795	0	1736	1827	1553	0	1812	1553
Link Speed (mph)	40			40				40				40
Link Distance (ft)	1000			1000				1000				1000
Travel Time (s)	17.0			17.0				17.0				17.0
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles (%)	4%	4%	4%	3%	3%	3%	4%	4%	4%	4%	4%	4%
Adj. Flow (vph)	75	156	86	108	177	38	70	253	161	16	86	27
Shared Lane Traffic (%)												
Lane Group Flow (vph)	75	242	0	108	215	0	70	253	161	0	102	27
Sign Control	Free			Free			Stop				Stop	

Intersection Summary

Area Type: Other
Control Type: Unsignalized

HCM 6th TWSC
100: Maple Rd & Freistadt Rd (CTH F)

2028 Back PM - MOD 1 syn
02/07/2019

Intersection

Int Delay, s/veh 25.6

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Vol. veh/h	70	145	80	100	165	35	65	235	150	15	80	25
Future Vol. veh/h	70	145	80	100	165	35	65	235	150	15	80	25
Conflicting Peds. #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	300			325			0		0		0	50
Veh in Median Storage	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	4	4	4	3	3	3	4	4	4	4	4	4
Adj. Flow	75	156	86	108	177	38	70	253	161	16	86	27

Major Minor	Major1	Major2	Minor1	Minor2
Conflicting Flow All	215	0	242	0
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Critical Hdwy	4.14	-	4.13	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-
Follow-up Hdwy	2.236	-	2.227	-
Plat Cap-1 Maneuver	1343	-	1319	-
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Platoon blocked, %	-	-	-	-
Plat Cap-1 Maneuver	1343	-	1319	-
Plat Cap-2 Maneuver	-	-	-	-
Stage 1	-	-	-	-
Stage 2	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	19	27	45.2	67.4
HCM LOS	E	E	F	F

Minor Lane/Major Mvmt	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Capacity (veh/h)	193	281	837	1343	-	-	1319	-	-	138	240	840
HCM Lane V/C Ratio	0.362	0.899	0.193	0.056	-	-	0.082	-	-	0.74	0.032	0.032
HCM Control Delay (s)	33.9	70.6	10.3	7.8	-	-	8	-	-	82.7	9.4	9.4
HCM Lane LOS	D	F	B	A	-	-	A	-	-	F	A	A
HCM 95th %ile Q (veh)	1.5	8.1	0.7	0.2	-	-	0.3	-	-	4.3	0.1	0.1

Lanes, Volumes, Timings
100: Maple Rd & Freistadt Rd (CTH F)

2028 Back AM - AWSC - MOD 2.syn
02/07/2019

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	←	→	→	←	→	→	←	→	→	←	→	→
Traffic Volume (vph)	25	230	110	190	135	10	50	35	50	30	235	75
Future Volume (vph)	25	230	110	190	135	10	50	35	50	30	235	75
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Storage Length (ft)	300	0	325	0	0	0	0	0	0	0	50	50
Storage Lanes	1	0	1	0	0	0	1	0	1	0	1	1
Taper Length (ft)	75		75				75		75			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fit		0.951			0.990			0.850			0.850	
Fit Protected	0.950		0.950			0.971			0.994			
Satd. Flow (prot)	1687	1689	0	1687	1758	0	0	1662	1455	0	1834	1568
Fit Permitted	0.950		0.950			0.971			0.994			
Satd. Flow (perm)	1687	1689	0	1687	1758	0	0	1662	1455	0	1834	1568
Link Speed (mph)	40		40			40			40			
Link Distance (ft)	1000		1000			1000			1000			
Travel Time (s)	17.0		17.0			17.0			17.0			
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Heavy Vehicles (%)	7%	7%	7%	7%	7%	7%	11%	11%	11%	3%	3%	3%
Adj. Flow (vph)	28	261	125	216	153	11	57	40	57	34	267	85
Shared Lane Traffic (%)												
Lane Group Flow (vph)	28	386	0	216	164	0	0	97	57	0	301	85
Sign Control	Stop		Stop			Stop			Stop		Stop	

Intersection Summary

Area Type: Other
Control Type: Unsignalized

HCM 6th AWSC
100: Maple Rd & Freistadt Rd (CTH F)

2028 Back AM - AWSC - MOD 2.syn
02/07/2019

Intersection	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection Delay, s/veh	20.8											
Intersection LOS	C											
Lane Configurations	←	→	→	←	→	→	←	→	→	←	→	→
Traffic Vol. veh/h	25	230	110	190	135	10	50	35	50	30	235	75
Future Vol. veh/h	25	230	110	190	135	10	50	35	50	30	235	75
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Heavy Vehicles, %	7	7	7	7	7	7	11	11	11	3	3	3
Adj. Flow	28	261	125	216	153	11	57	40	57	34	267	85
Number of Lanes	1	1	0	1	1	0	0	1	1	0	1	1
Opposing Approach	WB		EB		SB		NB		EB		WB	
Opposing Lanes	2		2		2		2		2		2	
Conflicting Approach Left	SB		NB		EB		WB		EB		WB	
Conflicting Lanes Left	2		2		2		2		2		2	
Conflicting Approach Right	NB		SB		WB		EB		EB		WB	
Conflicting Lanes Right	2		2		2		2		2		2	
HCM Control Delay	28.5		16.2		13		20.3					
HCM LOS	D		C		B		C					

Lane	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol Left, %	59%	0%	100%	0%	100%	0%	11%	0%				
Vol Thru, %	41%	0%	0%	88%	0%	83%	89%	0%				
Vol Right, %	0%	100%	0%	32%	0%	7%	0%	100%				
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop				
Traffic Vol by Lane	85	50	25	340	190	145	265	75				
LT Vol	50	0	25	0	190	0	30	0				
Through Vol	35	0	0	230	0	135	235	0				
RT Vol	0	50	0	110	0	10	0	75				
Lane Flow Rate	97	57	28	386	216	165	301	85				
Geometry Grp	7	7	7	7	7	7	7	7				
Degree of Utl (X)	0.231	0.12	0.062	0.767	0.479	0.34	0.637	0.162				
Departure Headway (Hd)	8.62	7.592	7.891	7.147	7.994	7.431	7.517	8.84				
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes				
Cap	415	470	453	506	449	483	473	523				
Service Time	6.399	5.369	5.651	4.906	5.76	5.197	5.378	4.6				
HCM Lane V/C Ratio	0.234	0.121	0.062	0.763	0.481	0.342	0.636	0.163				
HCM Control Delay	14	11.4	11.2	29.8	17.9	14	22.9	10.9				
HCM Lane LOS	B	B	B	D	C	B	C	B				
HCM 95th-ile Q	0.9	0.4	0.2	6.7	2.5	1.5	4.4	0.6				

Lanes, Volumes, Timings
100: Maple Rd & Freistadt Rd (CTH F)

2028 Back PM - AWSC - MOD 2.syn
02/07/2019

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱	↲	↰	↱	↲	↰	↱	↲	↰	↱	↲
Traffic Volume (vph)	70	145	80	100	165	35	65	235	150	15	80	25
Future Volume (vph)	70	145	80	100	165	35	65	235	150	15	80	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300		0	325		0	0		0	0		50
Storage Lanes	1		0	1		0	0		1	0		1
Taper Length (ft)	75			75			75			75		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.947			0.973			0.850			0.850	
Flt Protected	0.950			0.950			0.985			0.992		
Satd. Flow (prot)	1736	1730	0	1752	1795	0	0	1807	1553	0	1812	1553
Flt Permitted	0.950			0.950			0.985			0.992		
Satd. Flow (perm)	1736	1730	0	1752	1795	0	0	1807	1553	0	1812	1553
Link Speed (mph)		40			40			40			40	
Link Distance (ft)		1000			1000			1000			1000	
Travel Time (s)		17.0			17.0			17.0			17.0	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles (%)	4%	4%	4%	3%	3%	3%	4%	4%	4%	4%	4%	4%
Adj. Flow (vph)	75	156	86	108	177	38	70	253	161	16	86	27
Shared Lane Traffic (%)												
Lane Group Flow (vph)	75	242	0	108	215	0	0	323	161	0	102	27
Sign Control		Stop			Stop			Stop			Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

HCM 6th AWSC
100: Maple Rd & Freistadt Rd (CTH F)

2028 Back PM - AWSC - MOD 2.syn
02/07/2019

Intersection

Intersection Delay, s/veh

15.4

Intersection LOS

C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱	↲	↰	↱	↲	↰	↱	↲	↰	↱	↲
Traffic Vol, veh/h	70	145	80	100	165	35	65	235	150	15	80	25
Future Vol, veh/h	70	145	80	100	165	35	65	235	150	15	80	25
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles, %	4	4	4	3	3	3	4	4	4	4	4	4
Min. Flow	75	156	86	108	177	38	70	253	161	16	86	27
Number of Lanes	1	1	0	1	1	0	0	1	1	0	1	1

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	2	2	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	2	2	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	2	2	2
HCM Control Delay	14.6	14	17.8	12.1
HCM LOS	B	B	C	B

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1	WBLn2	SBLn1	SBLn2
Vol Left, %	22%	0%	100%	0%	100%	0%	16%	0%
Vol Thru, %	78%	0%	0%	84%	0%	82%	84%	0%
Vol Right, %	0%	100%	0%	36%	0%	17%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	300	150	70	225	100	200	95	25
LT Vol	65	0	70	0	100	0	15	0
Through Vol	235	0	0	145	0	165	80	0
RT Vol	0	150	0	80	0	35	0	25
Lane Flow Rate	323	161	75	242	108	215	102	27
Geometry Grp	7	7	7	7	7	7	7	7
Degree of Util (X)	0.629	0.279	0.16	0.464	0.228	0.419	0.218	0.051
Departure Headway (Hd)	7.018	6.227	7.674	6.908	7.844	7.007	7.692	6.881
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	516	581	488	523	470	514	457	519
Service Time	4.751	3.927	5.414	4.648	5.384	4.747	5.438	4.636
HCM Lane V/C Ratio	0.626	0.277	0.16	0.463	0.23	0.418	0.218	0.052
HCM Control Delay	21	11.3	11.9	15.5	12.6	14.7	12.6	10
HCM Lane LOS	C	B	B	C	B	B	B	A
HCM 95th-Pe Q	4.3	1.1	0.6	2.4	0.9	2.1	0.8	0.2

Lanes, Volumes, Timings
100: Maple Rd & Freistadt Rd (CTH F)

2028 Back AM - AWSC - MOD 3 syn
02/07/2019

	EBL	EB	EBR	WBL	WB	WBR	NBL	NB	NBR	SBL	SB	SBR
Lane Configurations	↔	↑	↔	↔	↑	↔	↔	↑	↔	↔	↑	↔
Traffic Volume (vph)	25	230	110	190	135	10	50	35	50	30	235	75
Future Volume (vph)	25	230	110	190	135	10	50	35	50	30	235	75
Real Flow (vph)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300		100	325		0	0		100	0		50
Storage Lanes	1		1	1		0	1		1	0		1
Taper Length (ft)	75			75			75			75		
Lane Use Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ft			0.850			0.990			0.850			0.850
Fl Protected	0.950			0.950			0.950				0.950	
Satd. Flow (prot)	1687	1776	1509	1687	1758	0	1626	1712	1455	0	1834	1568
Fl Permitted	0.950			0.950			0.950				0.950	
Satd. Flow (perm)	1687	1776	1509	1687	1758	0	1626	1712	1455	0	1834	1568
Link Speed (mph)		40			40			40			40	
Link Distance (ft)		1000			1000			1000			1000	
Travel Time (s)		17.0			17.0			17.0			17.0	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Heavy Vehicles (%)	7%	7%	7%	7%	7%	7%	11%	11%	11%	3%	3%	3%
Adj. Flow (vph)	28	261	125	216	153	11	57	40	57	34	267	85
Shared Lane Traffic (%)												
Lane Group Flow (vph)	28	261	125	216	164	0	57	40	57	0	301	85
Sign Control		Stop			Stop			Stop			Stop	

Area Type: Other
Control Type: Unsignalized

HCM 6th AWSC
100: Maple Rd & Freistadt Rd (CTH F)

2028 Back AM - AWSC - MOD 3 syn
02/07/2019

	EBL	EB	EBR	WBL	WB	WBR	NBL	NB	NBR	SBL	SB	SBR
Intersection Delay, s/veh	18.9											
Intersection LOS	C											
Lane Configurations	↔	↑	↔	↔	↑	↔	↔	↑	↔	↔	↑	↔
Traffic Vol, veh/h	25	230	110	190	135	10	50	35	50	30	235	75
Future Vol, veh/h	25	230	110	190	135	10	50	35	50	30	235	75
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Heavy Vehicles, %	7	7	7	7	7	7	11	11	11	3	3	3
Minor Flow	28	261	125	216	153	11	57	40	57	34	267	85
Number of Lanes	1	1	1	1	1	0	1	1	1	0	1	1
Opposing Approach	WB			EB			SB			NB		
Opposing Lanes	2			3			2			3		
Conflicting Approach Left	SB			NB			EB			WB		
Conflicting Lanes Left	2			3			2			3		
Conflicting Approach Right	NB			SB			WB			EB		
Conflicting Lanes Right	3			2			2			3		
HCM Control Delay	18.2			18			13.1			22.9		
HCM LOS	C			C			B			C		

	EBL	EB	EBR	WBL	WB	WBR	NBL	NB	NBR	SBL	SB	SBR
Vol Left, %	100%	0%	0%	100%	0%	0%	100%	0%	11%	0%		
Vol Thru, %	0%	100%	0%	0%	100%	0%	0%	100%	93%	0%		
Vol Right, %	0%	0%	100%	0%	0%	100%	0%	7%	0%	100%		
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop		
Traffic Vol by Lane	50	35	50	25	230	110	190	145	265	75		
LT Vol	50	0	0	25	0	0	190	0	30	0		
Through Vol	0	35	0	0	230	0	0	135	235	0		
RT Vol	0	0	50	0	0	110	0	10	0	75		
Lane Flow Rate	57	40	57	28	261	125	216	165	301	85		
Geometry Grp	B	B	B	B	B	B	B	B	B	B		
Degree of Util (X)	0.151	0.1	0.132	0.067	0.584	0.254	0.512	0.365	0.674	0.172		
Departure Headway (Hd)	9.503	9.068	8.347	8.551	8.041	7.376	8.532	7.973	8.056	7.285		
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
Cap	377	398	432	417	447	488	421	448	448	490		
Service Time	7.283	6.768	6.047	6.343	5.832	5.117	6.322	5.763	5.842	5.07		
HCM Lane V/C Ratio	0.151	0.101	0.132	0.087	0.584	0.254	0.512	0.365	0.674	0.172		
HCM Control Delay	14	12.8	12.3	12	21.6	12.6	20	15.3	26.1	11.6		
HCM Lane LOS	B	B	B	B	C	B	C	C	C	B		
HCM 95th-ile Q	0.5	0.3	0.5	0.2	3.6	1	2.8	1.6	4.9	0.6		

Lanes, Volumes, Timings
100: Maple Rd & Freistadt Rd (CTH F)

2028 Back PM - AWSC - MOD 3 syn
02/07/2019

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰	↑	↱	↰	↑	↱	↰	↑	↱
Traffic Volume (vph)	70	145	80	100	165	35	65	235	150	15	80	25
Future Volume (vph)	70	145	80	100	165	35	65	235	150	15	80	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300		100	325		0	0		100	0		50
Storage Lanes	1		1	1		0	1		1	0		1
Taper Length (ft)	75			75			75			75		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850		0.973				0.850				0.850
Flt Protected	0.950			0.950			0.950			0.992		
Satd. Flow (prot)	1736	1827	1553	1752	1795	0	1736	1827	1553	0	1812	1553
Flt Permitted	0.950			0.950			0.950			0.992		
Satd. Flow (perm)	1736	1827	1553	1752	1795	0	1736	1827	1553	0	1812	1553
Link Speed (mph)		40			40			40			40	
Link Distance (ft)		1000			1000			1000			1000	
Travel Time (s)		17.0			17.0			17.0			17.0	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles (%)	4%	4%	4%	3%	3%	3%	4%	4%	4%	4%	4%	4%
Adj. Flow (vph)	75	156	86	108	177	38	70	253	161	16	86	27
Shared Lane Traffic (%)												
Lane Group Flow (vph)	75	156	86	108	215	0	70	253	161	0	102	27
Sign Control	Stop			Stop			Stop			Stop		

Intersection Summary

Area Type: Other
Control Type: Unsignalized

HCM 6th AWSC
100: Maple Rd & Freistadt Rd (CTH F)

2028 Back PM - AWSC - MOD 3 syn
02/07/2019

Intersection

Intersection Delay, s/veh 14.4
Intersection LOS B

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰	↑	↱	↰	↑	↱	↰	↑	↱
Traffic Vol, veh/h	70	145	80	100	165	35	65	235	150	15	80	25
Future Vol, veh/h	70	145	80	100	165	35	65	235	150	15	80	25
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles, %	4	4	4	3	3	3	4	4	4	4	4	4
Minor Flow	75	156	86	108	177	38	70	253	161	16	86	27
Number of Lanes	1	1	1	1	1	0	1	1	1	0	1	1

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	3	2	3
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	3	3	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	3	2	2	3
HCM Control Delay	13.1	15.2	15	13
HCM LOS	B	C	B	B

Lane	NBL	NBL2	NBL3	EBL	EBL2	EBL3	WBL	WBL2	WBL3	SBL	SBL2	SBL3
Vol Left, %	100%	0%	0%	100%	0%	0%	100%	0%	0%	16%	0%	0%
Vol Thru, %	0%	100%	0%	0%	100%	0%	0%	82%	84%	0%	0%	0%
Vol Right, %	0%	0%	100%	0%	0%	100%	0%	17%	0%	0%	100%	0%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	65	235	150	70	145	80	100	200	95	25		
LT Vol	65	0	0	70	0	0	100	0	15	0		
Through Vol	0	235	0	0	145	0	0	165	80	0		
RT Vol	0	0	150	0	0	80	0	35	0	25		
Lane Flow Rate	70	253	161	75	156	86	108	215	102	27		
Geometry Gap	B	B	B	B	B	B	B	B	B	B		
Degree of Util (X)	0.152	0.515	0.297	0.172	0.334	0.167	0.242	0.446	0.235	0.056		
Departure Headway (Hd)	7.852	7.344	6.634	8.212	7.703	6.981	8.108	7.474	8.261	7.497		
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
Cap	456	490	540	437	468	513	443	482	432	477		
Service Time	5.601	5.093	4.383	5.964	5.455	4.742	5.859	5.227	6.053	5.258		
HCM Lane V/C Ratio	0.154	0.516	0.298	0.172	0.335	0.168	0.244	0.448	0.236	0.057		
HCM Control Delay	12	17.7	12.2	12.7	14.3	11.1	13.4	16.1	13.6	10.7		
HCM Lane LOS	B	C	B	B	B	B	B	C	B	B		
HCM 95th-ile Q	0.5	2.9	1.2	0.6	1.5	0.6	0.9	2.3	0.9	0.2		

Lanes, Volumes, Timings
100: Maple Rd & Freistadt Rd (CTH F)

2028 Back AM - Signal - MOD 4.syn
02/07/2019

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	25	230	110	190	135	10	50	35	50	30	235
Future Volume (vph)	25	230	110	190	135	10	50	35	50	30	235
Ideal Flow (vph/s)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300		0	325		0	0		0	0	50
Storage Lanes	1		0	1		0	1		0	1	0
Taper Length (ft)	75			75			75			75	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.951			0.990			0.912			0.964
Flt Protected	0.950			0.950			0.950			0.950	
Satd. Flow (prot)	1687	1689	0	1687	1758	0	1626	1561	0	1752	1778
Flt Permitted	0.653			0.458			0.484			0.664	
Satd. Flow (perm)	1160	1689	0	884	1758	0	828	1561	0	1280	1778
Right Turn on Red			No			No			No		No
Satd. Flow (RTOR)											
Link Speed (mph)	40			40			40			40	
Link Distance (ft)	1000			1000			1000			1000	
Travel Time (s)	17.0			17.0			17.0			17.0	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Heavy Vehicles (%)	7%	7%	7%	7%	7%	7%	11%	11%	11%	3%	3%
Adj. Flow (vph)	28	261	125	216	153	11	57	40	57	34	267
Shared Lane Traffic (%)											
Lane Group Flow (vph)	28	386	0	216	164	0	57	97	0	34	352
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA
Protected Phases	2			6			4			8	
Permitted Phases	2			6			4			8	
Detector Phase	2	2		6	6		4	4		8	8
Switch Phase											
Minimum Initial (s)	15.0	15.0		15.0	15.0		10.0	10.0		10.0	10.0
Minimum Split (s)	21.0	21.0		21.0	21.0		16.0	16.0		16.0	16.0
Total Split (s)	40.0	40.0		40.0	40.0		30.0	30.0		30.0	30.0
Total Split (%)	57.1%	57.1%		57.1%	57.1%		42.9%	42.9%		42.9%	42.9%
Maximum Green (s)	34.0	34.0		34.0	34.0		24.0	24.0		24.0	24.0
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0
Lead/Lag											
Lead-Lag Optimize?											
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0
Recall Mode	Min	Min		Min	Min		None	None		None	None
Wt Ratio	0.06	0.54		0.58	0.22		0.22	0.20		0.09	0.63
Control Delay	9.4	14.1		18.6	10.3		16.2	14.5		13.9	20.9
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0
Total Delay	9.4	14.1		18.6	10.3		16.2	14.5		13.9	20.9
90th %ile Green (s)	34.0	34.0		34.0	34.0		24.0	24.0		24.0	24.0
90th %ile Term Code	Hold	Hold		Max	Max		Hold	Hold		Max	Max
90th %ile Green (s)	22.2	22.2		22.2	22.2		17.4	17.4		17.4	17.4
70th %ile Term Code	Hold	Hold		Gap	Gap		Hold	Hold		Gap	Gap

2028 Back AM - Signal - MOD 4.syn
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Synchro 10 Report

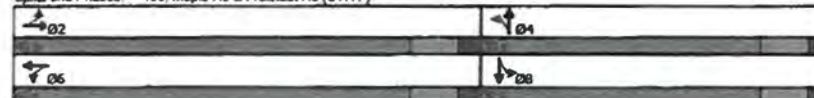
Lanes, Volumes, Timings
100: Maple Rd & Freistadt Rd (CTH F)

2028 Back AM - Signal - MOD 4.syn
02/07/2019

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBR
60th %ile Green (s)	16.5	16.5		16.5	16.5		13.7	13.7		13.7	13.7
50th %ile Term Code	Hold	Hold		Gap	Gap		Hold	Hold		Gap	Gap
50th %ile Green (s)	15.0	15.0		15.0	15.0		11.0	11.0		11.0	11.0
30th %ile Term Code	Min	Min		Min	Min		Hold	Hold		Gap	Gap
10th %ile Green (s)	15.0	15.0		15.0	15.0		10.0	10.0		10.0	10.0
10th %ile Term Code	Min	Min		Min	Min		Hold	Hold		Min	Min
Queue Length 50th (ft)	4	68		39	25		10	15		6	69
Queue Length 95th (ft)	18	168		116	69		42	59		27	195
Internal Link Dist (ft)		920			920			920			920
Turn Bay Length (ft)	300			325							
Base Capacity (vph)	873	1271		665	1323		439	829		680	944
Starvation Cap Reductn	0	0		0	0		0	0		0	0
Spillback Cap Reductn	0	0		0	0		0	0		0	0
Storage Cap Reductn	0	0		0	0		0	0		0	0
Reduced v/c Ratio	0.03	0.30		0.32	0.12		0.13	0.12		0.05	0.37

Area Type:	Other
Cycle Length: 70	
Actuated Cycle Length: 47.8	
Natural Cycle: 45	
Control Type: Actuated-Uncoordinated	
90th %ile Actuated Cycle: 70	
70th %ile Actuated Cycle: 51.6	
50th %ile Actuated Cycle: 42.2	
30th %ile Actuated Cycle: 38	
10th %ile Actuated Cycle: 37	

Splits and Phases: 100: Maple Rd & Freistadt Rd (CTH F)



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Synchro 10 Report

HCM 6th Signalized Intersection Summary
100: Maple Rd & Freistadt Rd (CTH F)

2028 Back AM - Signal - MOD 4 syn
02/07/2019

	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	WB	WB
	↖	→	↗	↖	↗	↖	→	↗	↖	↗	↖	↗
Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	WB	WB
Lane Configurations	2	2	2	2	2	2	2	2	2	2	2	2
Initial Volume (veh/h)	25	230	110	190	135	10	50	35	50	30	235	75
Future Volume (veh/h)	25	230	110	190	135	10	50	35	50	30	235	75
Initial Q (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	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	No	No	No	No	No	No	No	No
Adj Sat Flow (veh/h)	1796	1796	1796	1796	1796	1796	1737	1737	1737	1856	1856	1856
Adj Flow Rate (veh/h)	28	261	125	216	153	11	57	40	57	34	267	85
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Percent Heavy Veh. %	7	7	7	7	7	7	11	11	11	3	3	3
Cap (veh/h)	620	517	247	434	746	54	264	188	265	467	387	123
Arrive On Green	0.45	0.45	0.45	0.45	0.45	0.45	0.29	0.29	0.29	0.29	0.29	0.29
Sat Flow (veh/h)	1173	1148	550	958	1656	119	956	648	923	1288	1349	429
Grp Volume (v) (veh/h)	28	0	386	216	0	164	57	0	97	34	0	352
Grp Sat Flow (s) (veh/h)	1173	0	1697	958	0	1775	956	0	1971	1288	0	1778
Q Serve (s) (s)	0.7	0.0	7.4	9.5	0.0	2.6	2.6	0.0	2.1	0.9	0.0	8.0
Cycle Q Clear (s) (s)	3.2	0.0	7.4	18.9	0.0	2.8	10.5	0.0	2.1	3.1	0.0	8.0
Prop In Lane	1.00	0.32	1.00	0.07	1.00	0.07	1.00	0.59	1.00	0.24	0.00	0.00
Lane Grp Cap (s) (veh/h)	620	0	764	434	0	799	264	0	451	467	0	519
V/C Ratio(X)	0.05	0.00	0.51	0.50	0.00	0.21	0.22	0.00	0.22	0.07	0.00	0.69
Avail Cap (c) (veh/h)	965	0	1263	716	0	1321	492	0	825	774	0	934
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	0.00	1.00	0.00	1.00	0.00	1.00	0.00	1.00	0.00
Uniform Delay (d) (s/veh)	8.6	0.0	8.9	14.9	0.0	7.6	19.2	0.0	12.4	13.5	0.0	14.5
Incr Delay (d2) (s/veh)	0.0	0.0	0.5	0.9	0.0	0.1	0.4	0.0	0.2	0.1	0.0	1.7
Initial Q Delay (d3) (s/veh)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Size Back Delay (50%) (veh/h)	0.1	0.0	1.9	1.7	0.0	0.7	0.5	0.0	0.6	0.2	0.0	2.1
Unsig. Movement Delay (s/veh)												
LnGrp Delay (d) (s/veh)	8.6	0.0	9.5	15.8	0.0	7.7	19.6	0.0	12.6	13.6	0.0	16.1
LnGrp LOS	A	A	A	B	A	A	B	A	B	B	A	B
Approach Vol (veh/h)	414			380				154			386	
Approach Delay (s/veh)	9.4			12.3				15.2			15.9	
Approach LOS	A			B				B			B	
Phase - Assigned Phs	2			4				5			5	
Phs Duration (G+Y+Rc) (s)	26.6			19.1				26.6			19.1	
Change Period (Y+Rc) (s)	6.0			6.0				6.0			6.0	
Max Green Setting (Gmax) (s)	34.0			24.0				34.0			24.0	
Max Q Clear Time (g_c+I) (s)	9.4			12.6				10.0			12.6	
Green Ext Time (g_cj) (s)	2.4			0.5				1.8			0.5	
Intersection Summary												
HCM 6th Ctrl Delay				12.8								
HCM 6th LOS				B								

Lanes, Volumes, Timings
100: Maple Rd & Freistadt Rd (CTH F)

2028 Back PM - Signal - MOD 4.syn
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Lane Group	EB	EBT	EBR	WB	WBT	WBR	NS	NSL	NSR	SB	SBT	SBR
Lane Configurations	TH	TH	TH	TH	TH	TH	TH	TH	TH	TH	TH	TH
Traffic Volume (vph)	70	145	80	100	165	35	65	235	150	15	80	25
Future Volume (vph)	70	145	80	100	165	35	65	235	150	15	80	25
Peak Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300		0	325		0	0		0	0		50
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (ft)	75			75			75			75		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.947			0.973			0.942			0.964	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1736	1730	0	1752	1795	0	1736	1721	0	1736	1761	0
Flt Permitted	0.824			0.808			0.884			0.445		
Satd. Flow (perm)	1140	1730	0	1122	1795	0	1250	1721	0	813	1761	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)	40			40			40			40		
Link Distance (ft)	1000			1000			1000			1000		
Travel Time (s)	17.0			17.0			17.0			17.0		
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles (%)	4%	4%	4%	3%	3%	3%	4%	4%	4%	4%	4%	4%
Adj. Flow (vph)	75	156	86	108	177	38	70	253	161	16	86	27
Shared Lane Traffic (%)												
Lane Group Flow (vph)	75	242	0	108	215	0	70	414	0	16	113	0
Form Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	2	2		6	6		4	4		8	8	
Permitted Phases	2	2		6	6		4	4		8	8	
Detector Phase	2	2		6	6		4	4		8	8	
Switch Phase												
Minimum Initial (s)	15.0	15.0		15.0	15.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	21.0	21.0		21.0	21.0		16.0	16.0		16.0	16.0	
Total Split (s)	40.0	40.0		40.0	40.0		30.0	30.0		30.0	30.0	
Total Split (%)	57.1%	57.1%		57.1%	57.1%		42.9%	42.9%		42.9%	42.9%	
Maximum Green (s)	34.0	34.0		34.0	34.0		24.0	24.0		24.0	24.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	Min	Min		Min	Min		None	None		None	None	
Acc Ratio	0.18	0.33		0.27	0.33		0.16	0.87		0.05	0.18	
Control Delay	12.8	14.1		13.9	13.4		9.9	17.4		9.0	9.8	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	12.8	14.1		13.9	13.4		9.9	17.4		9.0	9.8	
90th %ile Green (s)	17.5	17.5		17.5	17.5		24.0	24.0		24.0	24.0	
90th %ile Term Code	Gap	Gap		Hold	Hold		Max	Max		Hold	Hold	
90th %ile Green (s)	15.0	15.0		15.0	15.0		18.4	18.4		18.4	18.4	
70th %ile Term Code	Min	Min		Min	Min		Gap	Gap		Hold	Hold	

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Lanes, Volumes, Timings
100: Maple Rd & Freistadt Rd (CTH F)

2028 Back PM - Signal - MOD 4.syn
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Lane Group	EB	EBT	EBR	WB	WBT	WBR	NS	NSL	NSR	SB	SBT	SBR
50th %ile Green (s)	15.0	15.0		15.0	15.0		14.9	14.9		14.9	14.9	
50th %ile Term Code	Min	Min		Min	Min		Gap	Gap		Hold	Hold	
90th %ile Green (s)	15.0	15.0		15.0	15.0		12.8	12.8		12.8	12.8	
30th %ile Term Code	Min	Min		Min	Min		Gap	Gap		Hold	Hold	
10th %ile Green (s)	15.0	15.0		15.0	15.0		10.1	10.1		10.1	10.1	
10th %ile Term Code	Min	Min		Min	Min		Gap	Gap		Hold	Hold	
Queue Length 50th (ft)	12	41		17	35		11	80		2	18	
Queue Length 95th (ft)	43	111		58	98		31	159		11	43	
Internal Link Dist (ft)		920			920			920			920	
Turn Bay Length (ft)	300			325								
Base Capacity (vph)	904	1372		898	1424		699	963		455	985	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.08	0.18		0.12	0.15		0.10	0.43		0.04	0.11	

Area Type:	Other
Cycle Length: 70	
Actuated Cycle Length: 43.5	
Natural Cycle: 40	
Control Type: Actuated-Uncoordinated	
90th %ile Actuated Cycle: 53.5	
70th %ile Actuated Cycle: 45.4	
50th %ile Actuated Cycle: 41.9	
30th %ile Actuated Cycle: 39.8	
10th %ile Actuated Cycle: 37.1	

Splits and Phases: 100: Maple Rd & Freistadt Rd (CTH F)



2028 Back PM - Signal - MOD 4.syn
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Synchro 10 Report

HCM 6th Signalized Intersection Summary
100: Maple Rd & Freistadt Rd (CTH F)

2028 Back PM - Signal - MOD 4.syn
02/07/2019

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBR	SBR
Lane Configurations	↰	↱	↰	↰	↱	↰	↰	↱	↰	↱	↰	↱
Traffic Volume (veh/h)	70	145	80	100	185	35	65	235	150	15	80	25
Future Volume (veh/h)	70	145	80	100	185	35	65	235	150	15	80	25
Initial Q (Q ₀), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj (A _{PB} T)	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		No		No	
Adj Sat Flow, veh/h/s	1841	1841	1841	1841	1841	1841	1841	1841	1841	1841	1841	1841
Adj Flow Rate, veh/h	75	156	86	108	177	38	70	253	161	16	86	27
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	4	4	4	3	3	3	4	4	4	4	4	4
Cap, veh/h	516	420	232	492	568	120	528	336	215	283	432	138
Arrive On Green	0.38	0.38	0.38	0.38	0.38	0.38	0.32	0.32	0.32	0.32	0.32	0.32
Sat Flow, veh/h	1148	1115	615	1129	1480	318	1259	1051	669	957	1343	422
Grp Volume (v), veh/h	75	0	242	108	0	215	70	0	414	16	0	113
Grp Sat Flow (s), veh/h/s	1148	0	1730	1129	0	1798	1259	0	1720	957	0	1766
Q Serve (g, s), s	2.0	0.0	4.0	3.1	0.0	3.4	1.7	0.0	8.6	0.6	0.0	1.8
Cycle Q Clear (g, c), s	5.3	0.0	4.0	7.1	0.0	3.4	3.5	0.0	8.6	9.2	0.0	1.8
Prop In Lane	1.00		0.36	1.00		0.18	1.00		0.39	1.00		0.24
Lane Grp Cap (c), veh/h	516	0	652	492	0	678	528	0	553	283	0	568
V/C Ratio (X)	0.15	0.00	0.37	0.22	0.00	0.32	0.13	0.00	0.75	0.06	0.00	0.20
Avail Cap (c, a), veh/h	1064	0	1478	1031	0	1536	882	0	1037	552	0	1064
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 (f)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	10.7	0.0	9.0	11.6	0.0	8.8	11.1	0.0	12.1	16.2	0.0	9.8
Incr Delay (d ₂), s/veh	0.1	0.0	0.4	0.2	0.0	0.3	0.1	0.0	2.1	0.1	0.0	0.2
Initial Q Delay (d ₃), 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
Queue Back (Q _B 50%), veh/h	6.4	0.0	1.1	0.8	0.0	0.9	0.4	0.0	2.6	0.1	0.0	0.3
Unsig. Movement Delay, s/veh												
LnGrp Delay (d), s/veh	10.8	0.0	9.3	11.8	0.0	9.0	11.2	0.0	14.1	16.2	0.0	10.0
LnGrp LOS	B	A	A	B	A	A	B	A	B	B	A	A
Approach Vol, veh/h	317			323			484			129		
Approach Delay, s/veh	9.7			10.0			13.7			10.7		
Approach LOS	A			A			B			B		
Timer Assigned Phs	1			4			6			8		
Phs Duration (G+Y+Rc), s	21.0			18.3			21.0			18.8		
Change Period (Y+Rc), s	6.0			6.0			6.0			6.0		
Max Green Setting (G _{max}), s	34.0			24.0			34.0			24.0		
Max Q Clear Time (g _c +1), s	7.3			10.6			9.1			11.2		
Green Ext Time (g _e), s	1.7			2.3			1.6			0.4		
Intersection Summary												
HCM 6th Ctrl Delay				11.4								
HCM 6th LOS				B								

Lanes, Volumes, Timings
100: Maple Rd & Freistadt Rd (CTH F)

2028 Back AM - Signal - MOD 5 syn
02/07/2019

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBR	SBR
Lane Configurations	↰	↱	↰	↰	↱	↰	↰	↱	↰	↱	↰	↰
Traffic Volume (vph)	25	230	110	190	135	10	90	35	50	30	235	75
Future Volume (vph)	25	230	110	190	135	10	90	35	50	30	235	75
Local Flow (vph)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300		100	325		0	0		100	0		50
Storage Lanes	1		1	1		0	1		1	1		0
Taper Length (ft)	75			75			75			75		
Link Util Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850		0.990				0.850		0.964	
Fit Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1687	1776	1509	1687	1758	0	1626	1712	1455	1752	1778	0
Fit Permitted	0.653			0.598			0.505			0.731		
Satd. Flow (perm)	1160	1776	1509	1062	1758	0	864	1712	1455	1348	1778	0
Right Turn on Red			No		No		No		No		No	No
Satd. Flow (RTOR)												
Link Speed (mph)	40			40			40			40		
Link Distance (ft)	1000			1000			1000			1000		
Travel Time (s)	17.0			17.0			17.0			17.0		
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Green Factor	100%	100%	62%	100%	100%	100%	100%	100%	62%	100%	100%	100%
Heavy Vehicles (%)	7%	7%	7%	7%	7%	7%	11%	11%	11%	3%	3%	3%
Adj. Flow (vph)	28	251	78	216	153	11	57	40	35	34	297	85
Shared Lane Traffic (%)												
Lane Group Flow (vph)	28	251	78	216	154	0	57	40	35	34	352	0
Turn Type	Perm	NA	Perm	Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases	2	2		6			4		4	8		
Permitted Phases	2	2	2	6	6		4	4	4	8	8	
Detector Phase	2	2	2	6	6		4	4	4	8	8	
Switch Phase												
Minimum Initial (s)	15.0	15.0	15.0	15.0	15.0		10.0	10.0	10.0	10.0	10.0	
Minimum Split (s)	21.0	21.0	21.0	21.0	21.0		16.0	16.0	16.0	16.0	16.0	
Total Split (s)	40.0	40.0	40.0	40.0	40.0		30.0	30.0	30.0	30.0	30.0	
Total Split (%)	57.1%	57.1%	57.1%	57.1%	57.1%		42.9%	42.9%	42.9%	42.9%	42.9%	
Maximum Green (s)	34.0	34.0	34.0	34.0	34.0		24.0	24.0	24.0	24.0	24.0	
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0	6.0	6.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Recall Mode	Min	Min	Min	Min	Min		None	None	None	None	None	
v/c Ratio	0.06	0.37	0.13	0.51	0.24		0.21	0.07	0.07	0.08	0.61	
Control Delay	10.0	12.1	10.2	16.3	10.8		13.5	11.2	11.3	11.4	18.2	
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Delay	10.0	12.1	10.2	16.3	10.8		13.5	11.2	11.3	11.4	18.2	
90th %ile Green (s)	25.6	25.6	25.6	25.6	25.6		23.2	23.2	23.2	23.2	23.2	
80th %ile Term Code	Hold	Hold	Hold	Gap	Gap		Hold	Hold	Hold	Gap	Gap	
70th %ile Green (s)	17.5	17.5	17.5	17.5	17.5		15.8	15.8	15.8	15.8	15.8	

2028 Back AM - Signal - MOD 5 syn
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Synchro 10 Report

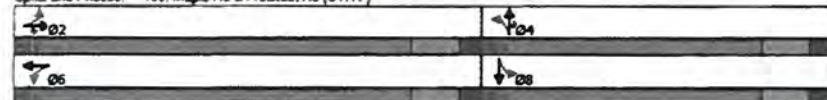
Lanes, Volumes, Timings
100: Maple Rd & Freistadt Rd (CTH F)

2028 Back AM - Signal - MOD 5 syn
02/07/2019

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBR	SBR
70th %ile Term Code	Hold	Hold	Hold	Gap	Gap		Hold	Hold	Hold	Gap	Gap	
50th %ile Green (s)	15.0	15.0	15.0	15.0	15.0		12.8	12.8	12.8	12.8	12.8	
50th %ile Term Code	Min	Min	Min	Min	Min		Hold	Hold	Hold	Gap	Gap	
30th %ile Green (s)	15.0	15.0	15.0	15.0	15.0		11.0	11.0	11.0	11.0	11.0	
30th %ile Term Code	Min	Min	Min	Min	Min		Hold	Hold	Hold	Gap	Gap	
10th %ile Green (s)	15.0	15.0	15.0	15.0	15.0		10.0	10.0	10.0	10.0	10.0	
10th %ile Term Code	Min	Min	Min	Min	Min		Hold	Hold	Hold	Min	Min	
Queue Length 50th (ft)	4	40	11	36	24		9	6	5	5	64	
Queue Length 95th (ft)	18	108	38	108	69		35	25	23	22	181	
Internal Link Dist (ft)			920						920			
Turn Bay Length (ft)	300			100	325					100		
Base Capacity (vph)	922	1413	1200	844	1398		485	961	816	757	998	
Starvation Cap Reductn	0	0	0	0	0		0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0		0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0		0	0	0	0	0	
Reduced v/c Ratio	0.03	0.18	0.07	0.26	0.12		0.12	0.04	0.04	0.04	0.35	

Area Type:	Other
Cycle Length:	70
Actuated Cycle Length:	44.2
Natural Cycle:	40
Control Type:	Actuated-Uncoordinated
90th %ile Actuated Cycle:	60.8
70th %ile Actuated Cycle:	45.3
50th %ile Actuated Cycle:	39.8
30th %ile Actuated Cycle:	38
10th %ile Actuated Cycle:	37

Splits and Phases: 100: Maple Rd & Freistadt Rd (CTH F)



2028 Back AM - Signal - MOD 5 syn
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Synchro 10 Report

HCM 6th Signalized Intersection Summary
100: Maple Rd & Freistadt Rd (CTH F)

2028 Back AM - Signal - MOD 5.syn
02/07/2019

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBR	SBR
Lane Configurations	↰	↑	↱	↰	↑	↱	↰	↑	↱	↰	↑	↱
Traffic Volume (veh/h)	25	230	110	190	135	10	50	35	50	30	235	75
Future Volume (veh/h)	25	230	110	190	135	10	50	35	50	30	235	75
Initial Q (Cb), 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		No		No	
Adj Sat Flow, veh/h	1796	1796	1796	1796	1796	1737	1737	1737	1737	1856	1856	1856
Adj Flow Rate, veh/h	28	261	78	216	153	11	57	40	35	34	267	85
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Percent Heavy Veh, %	7	7	7	7	7	11	11	11	11	3	3	3
Cap, veh/h	580	713	604	481	657	47	299	507	429	548	293	125
Arrive On Green	0.40	0.40	0.40	0.40	0.40	0.29	0.29	0.29	0.29	0.29	0.29	0.29
Sat Flow, veh/h	1173	1796	1522	1000	1656	119	956	1737	1472	1314	1349	429
Grp Volume(v), veh/h	28	261	78	216	0	164	57	40	35	34	0	352
Grp Sat Flow(s), veh/h	1173	1796	1522	1000	0	1775	956	1737	1472	1314	0	1778
Q Serve(g_s), s	0.6	3.9	1.3	7.5	0.0	2.4	2.2	0.6	0.7	0.7	0.0	6.7
Cycle Q Clear(g_c), s	3.0	3.9	1.3	11.4	0.0	2.4	8.9	0.6	0.7	1.4	0.0	6.7
Prop In Lane	1.00		1.00	1.00		0.07	1.00		1.00	1.00		0.24
Lane Grp Cap(C), veh/h	580	713	604	481	0	704	299	507	429	548	0	519
V/C Ratio(X)	0.05	0.37	0.13	0.45	0.00	0.23	0.19	0.08	0.08	0.06	0.00	0.68
Avail Cap(c_a), veh/h	1151	1586	1344	968	0	1567	616	1083	918	984	0	1168
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	8.7	8.2	7.4	12.2	0.0	7.7	16.0	9.9	9.9	10.4	0.0	12.0
Incir Delay (d2), s/veh	0.0	0.3	0.1	0.7	0.0	0.2	0.3	0.1	0.1	0.0	0.0	1.8
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
Wt Back Q Delay 50%, s/veh	0.1	1.0	0.3	1.2	0.0	0.6	0.4	0.2	0.2	0.2	0.0	2.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	8.7	8.5	7.5	12.9	0.0	7.9	16.3	10.0	10.0	10.4	0.0	13.8
LnGrp LOS	A	A	A	B	A	A	B	A	A	B	A	B
Approach Vol, veh/h	367			380			132			386		
Approach Delay, s/veh	8.3			10.7			12.7			13.3		
Approach LOS	A			B			B			B		
Timer Assigned Phs	2			4			6			8		
Phs Duration (G+Y+Rc), s	21.3			17.2			21.3			17.2		
Change Period (Y+Rc), s	6.0			6.0			6.0			6.0		
Max Green Setting (Gmax), s	34.0			24.0			34.0			24.0		
Max Q Clear Time (g_c+I), s	5.9			10.9			13.4			8.7		
Green Ext Time (g_e), s	1.8			0.4			1.8			1.8		
Intersection Summary												
HCM 6th Ctrl Delay				11.0								
HCM 6th LOS				B								

Lanes, Volumes, Timings

100: Maple Rd & Freistadt Rd (CTH F)

2028 Back PM - Signal - MOD 5.syn

02/07/2019

	EB	EBT	EBR	WB	WBT	WBR	NB	NBT	NBR	SB	SBT	SBR
Lane Configurations	↖	↖	↖	↖	↖	↖	↖	↖	↖	↖	↖	↖
Traffic Volume (vph)	70	145	80	100	165	35	65	235	150	15	80	25
Future Volume (vph)	70	145	80	100	165	35	65	235	150	15	80	25
Real Flow (vphs)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300		100	325		0	0		100	0		50
Storage Lanes	1		1	1		0	0		1	1		0
Taper Length (ft)	75			75			75			75		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850		0.973				0.850		0.964	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1736	1827	1553	1752	1795	0	1736	1827	1553	1736	1761	0
Flt Permitted	0.624			0.658			0.684			0.602		
Satd. Flow (perm)	1140	1827	1553	1214	1795	0	1250	1827	1553	1100	1761	0
Right Turn on Red	No			No		No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)	40			40			40			40		
Link Distance (ft)	1000			1000			1000			1000		
Travel Time (s)	17.0			17.0			17.0			17.0		
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Growth Factor	100%	100%	82%	100%	100%	100%	100%	100%	62%	100%	100%	100%
Heavy Vehicles (%)	4%	4%	4%	3%	3%	3%	4%	4%	4%	4%	4%	4%
Adj. Flow (vph)	75	156	53	108	177	38	70	253	100	16	86	27
Shared Lane Traffic (%)												
Lane Group Flow (vph)	75	156	53	108	215	0	70	253	100	16	113	0
Turn Type	Perm	NA	Perm	Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases	2	2		6			4	4		8		
Permitted Phases	2	2	2	6	6		4	4	4	8	8	
Detector Phase	2	2	2	6	6		4	4	4	8	8	
Switch Phase												
Minimum Initial (s)	15.0	15.0	15.0	15.0	15.0		10.0	10.0	10.0	10.0	10.0	
Minimum Split (s)	21.0	21.0	21.0	21.0	21.0		20.0	20.0	20.0	20.0	20.0	
Total Split (s)	40.0	40.0	40.0	40.0	40.0		30.0	30.0	30.0	30.0	30.0	
Total Split (%)	57.1%	57.1%	57.1%	57.1%	57.1%		42.9%	42.9%	42.9%	42.9%	42.9%	
Maximum Green (s)	34.0	34.0	34.0	34.0	34.0		24.0	24.0	24.0	24.0	24.0	
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0	6.0	6.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Recall Mode	Min	Min	Min	Min	Min		None	None	None	None	None	
v/c Ratio	0.17	0.22	0.09	0.23	0.31		0.19	0.46	0.21	0.05	0.21	
Control Delay	9.9	9.7	8.9	10.4	10.4		11.1	13.9	11.1	9.6	11.0	
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Delay	9.9	9.7	8.9	10.4	10.4		11.1	13.9	11.1	9.6	11.0	
90th %ile Green (s)	15.0	15.0	15.0	15.0	15.0		15.9	15.9	15.9	15.9	15.9	
90th %ile Term Code	Min	Min	Min	Min	Min		Gap	Gap	Gap	Hold	Hold	
70th %ile Green (s)	15.0	15.0	15.0	15.0	15.0		12.5	12.5	12.5	12.5	12.5	

2028 Back PM - Signal - MOD 5.syn

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Synchro 10 Report

Lanes, Volumes, Timings

100: Maple Rd & Freistadt Rd (CTH F)

2028 Back PM - Signal - MOD 5.syn

02/07/2019

	EB	EBT	EBR	WB	WBT	WBR	NB	NBT	NBR	SB	SBT	SBR
70th %ile Term Code	Min	Min	Min	Min	Min		Gap	Gap	Gap	Hold	Hold	
50th %ile Green (s)	15.0	15.0	15.0	15.0	15.0		10.2	10.2	10.2	10.2	10.2	
90th %ile Term Code	Min	Min	Min	Min	Min		Gap	Gap	Gap	Hold	Hold	
30th %ile Green (s)	15.0	15.0	15.0	15.0	15.0		10.0	10.0	10.0	10.0	10.0	
50th %ile Term Code	Min	Min	Min	Min	Min		Min	Min	Min	Hold	Hold	
10th %ile Green (s)	15.0	15.0	15.0	15.0	15.0		10.0	10.0	10.0	10.0	10.0	
10th %ile Term Code	Min	Min	Min	Min	Min		Min	Min	Min	Hold	Hold	
Queue Length 50th (ft)	9	19	6	13	28		11	43	16	2	18	
Queue Length 95th (ft)	34	57	25	45	76		30	86	39	11	42	
Internal Link Dist (ft)			920						920			920
Turn Bay Length (ft)	300		100	325					100			
Base Capacity (vph)	1004	1609	1368	1069	1581		777	1136	965	684	1095	
Starvation Cap Reductn	0	0	0	0	0		0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0		0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0		0	0	0	0	0	
Reduced v/c Ratio	0.07	0.10	0.04	0.10	0.14		0.09	0.22	0.10	0.02	0.10	

Map Summary

Area Type: Other

Cycle Length: 70

Actuated Cycle Length: 38.7

Natural Cycle: 45

Control Type: Actuated-Uncoordinated

90th %ile Actuated Cycle: 42.9

70th %ile Actuated Cycle: 39.5

50th %ile Actuated Cycle: 37.2

30th %ile Actuated Cycle: 37

10th %ile Actuated Cycle: 37

Split and Phases: 100: Maple Rd & Freistadt Rd (CTH F)

EB	EBT	EBR	WB	WBT	WBR	NB	NBT	NBR	SB	SBT	SBR
EB	EBT	EBR	WB	WBT	WBR	NB	NBT	NBR	SB	SBT	SBR
EB	EBT	EBR	WB	WBT	WBR	NB	NBT	NBR	SB	SBT	SBR
EB	EBT	EBR	WB	WBT	WBR	NB	NBT	NBR	SB	SBT	SBR

2028 Back PM - Signal - MOD 5.syn

TADI

Synchro 10 Report

HCM 6th Signalized Intersection Summary
100: Maple Rd & Freistadt Rd (CTH F)

2028 Back PM - Signal - MOD 5.syn
02/07/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↵	↑	↵	↵	↵	↵	↵	↑	↵	↵	↵	↵
Traffic Volume (veh/h)	70	145	80	100	165	35	65	235	150	15	80	25
Future Volume (veh/h)	70	145	80	100	165	35	65	235	150	15	80	25
Initial Q (Q ₀) 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)	1841	1841	1841	1856	1856	1856	1841	1841	1841	1841	1841	1841
Adj Flow Rate, veh/h	75	156	53	108	177	38	70	253	100	16	86	27
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh. %	4	4	4	3	3	3	4	4	4	4	4	4
Cap. veh/h	568	747	633	603	601	129	471	496	421	350	362	114
Arrive On Green	0.41	0.41	0.41	0.41	0.41	0.41	0.27	0.27	0.27	0.27	0.27	0.27
Sat Flow, veh/h	1148	1841	1560	1163	1480	318	1259	1841	1560	1012	1343	422
Grp Volume(v), veh/h	75	156	53	108	0	215	70	253	100	16	0	113
Grp Sat Flow(s), veh/h	1148	1841	1560	1163	0	1798	1259	1841	1560	1012	0	1763
Q Serve(g, s), s	1.7	2.0	0.8	2.5	0.0	3.0	1.7	4.3	1.8	0.5	0.0	1.8
Cycle Q Clearance (c), s	4.7	2.0	0.8	4.5	0.0	3.0	3.5	4.3	1.8	4.8	0.0	1.8
Prop In Lane	1.00		1.00	1.00		0.18	1.00		1.00	1.00		0.24
Line Grp Cap(c), veh/h	568	747	633	603	0	730	471	496	421	350	0	476
V/C Ratio(X)	0.13	0.21	0.08	0.18	0.00	0.29	0.15	0.51	0.24	0.05	0.00	0.24
Avail Cap (c, a), veh/h	1158	1693	1435	1201	0	1654	950	1195	1013	734	0	1148
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	9.0	7.1	6.8	8.6	0.0	7.4	11.9	11.4	10.5	13.5	0.0	10.5
Incrl Delay (d ₂), s/veh	0.1	0.1	0.1	0.1	0.0	0.2	0.1	0.8	0.3	0.1	0.0	0.3
Initial Q Delay(d ₃), 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
Rele Back (Q ₀ 50%) veh/h	0.1	0.5	0.2	0.4	0.0	0.7	0.4	1.3	0.5	0.1	0.0	0.9
Unsig. Movement Delay, s/veh												
Ln Grp Delay (d), s/veh	9.1	7.3	6.8	8.7	0.0	7.6	12.1	12.2	10.8	13.5	0.0	10.8
Ln Grp LOS	A	A	A	A	A	A	B	B	B	B	A	B
Approach Vol, veh/h	284			323			423			129		
Approach Delay, s/veh	7.7			8.0			11.9			11.1		
Approach LOS	A			A			B			B		
Timer - Acquired Phs	2			4			8			B		
Phs Duration (G+Y+Rc), s	21.0			16.0			21.0			16.0		
Change Period (Y+Rc), s	6.0			6.0			6.0			6.0		
Max Green Setting (G _{max}), s	34.0			24.0			34.0			24.0		
Max Q Clear Time (g, c+1), s	6.7			6.3			6.5			6.8		
Green Ext Time (p, c), s	1.3			1.8			1.6			0.5		
Intersection Summary												
HCM 6th Ctrl Delay	9.7											
HCM 6th LOS	A											

HCS7 Roundabouts Report

General Information				Site Information			
Analyst	Christian Sternke			Intersection	Freistadt Road (CTH F) & Maple Road		
Agency or Co.	TADI			E/W Street Name	Freistadt Road (CTH F)		
Date Performed	1/4/2019			N/S Street Name	Maple Road		
Analysis Year	2028			Analysis Time Period (hrs)	0.25		
Time Analyzed	AM Peak			Peak Hour Factor	0.88		
Project Description				Jurisdiction	Village of Germantown		

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0
Lane Assignment	LTR				LTR				LTR				LTR			
Volume (V), veh/h	5	25	230	110	5	190	135	10	5	50	30	50	5	30	235	75
Percent Heavy Vehicles, %	7	7	7	7	7	7	7	7	11	11	11	11	3	3	3	3
Flow Rate (v_{fcs}), pc/h	6	30	280	134	6	231	164	12	6	63	38	63	6	35	275	88
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1				1				1			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)		4.2000			4.2000			4.2000			4.2000	
Follow-Up Headway (s)		2.0000			2.0000			2.0000			2.0000	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h		450			413			170			404	
Entry Volume veh/h		421			386			153			392	
Circulating Flow (v_c), pc/h		559			149			363			476	
Exiting Flow (v_{ex}), pc/h		384			321			86			646	
Capacity (c_{pc}), pc/h		1095			1577			1304			1179	
Capacity (c), veh/h		1024			1474			1174			1145	
v/c Ratio (x)		0.41			0.26			0.13			0.34	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		8.0			4.6			4.2			6.5	
Lane LOS		A			A			A			A	
95% Queue, veh		2.0			1.1			0.4			1.5	
Approach Delay, s/veh		8.0			4.6			4.2			6.5	
Approach LOS		A			A			A			A	
Intersection Delay, s/veh LOS	6.2						A					

HCS7 Roundabouts Report

General Information				Site Information			
Analyst	Christian Sternke			Intersection	Freistadt Road (CTH F) & Maple Road		
Agency or Co.	TADI			E/W Street Name	Freistadt Road (CTH F)		
Date Performed	1/4/2019			N/S Street Name	Maple Road		
Analysis Year	2028			Analysis Time Period (hrs)	0.25		
Time Analyzed	PM Peak			Peak Hour Factor	0.93		
Project Description				Jurisdiction	Village of Germantown		

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0
Lane Assignment	LTR				LTR				LTR				LTR			
Volume (V), veh/h	5	70	145	80	5	100	165	35	5	65	235	150	5	15	80	25
Percent Heavy Vehicles, %	4	4	4	4	3	3	3	3	4	4	4	4	4	4	4	4
Flow Rate (v_{adj}), pc/h	6	78	162	89	6	111	183	39	6	73	263	168	6	17	89	28
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1				1				1			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)		4.2000			4.2000			4.2000			4.2000	
Follow-Up Headway (s)		2.0000			2.0000			2.0000			2.0000	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h		335			339			510			140	
Entry Volume veh/h		322			329			490			135	
Circulating Flow (v_c), pc/h		235			432			275			385	
Exiting Flow (v_{ex}), pc/h		353			290			386			295	
Capacity (C_{pvt}), pc/h		1461			1226			1410			1278	
Capacity (c), veh/h		1404			1190			1355			1229	
v/c Ratio (x)		0.23			0.28			0.36			0.11	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		4.5			5.6			6.0			3.8	
Lane LOS		A			A			A			A	
95% Queue, veh		0.9			1.1			1.7			0.4	
Approach Delay, s/veh		4.5			5.6			6.0			3.8	
Approach LOS		A			A			A			A	
Intersection Delay, s/veh LOS	5.3						A					

APPENDIX D

WARRANT ANALYSIS FOR INTERSECTION CONTROL

APPENDIX D

All-Way Stop Control Warrant Analysis (Year 2018 Existing)

ASWC Warrant Criteria

MUTCD Yes

WisDOT Yes

A, B, V,

1, 2, 3, 5

MUTCD

Met? Criteria

Yes A. Is a signal justified? Yes

Yes B. # of crashes in a 12 month period that can be corrected by multi-way stop control: 9

Yes C. Minimum Volumes

1. Major road approach volume (total of both) at least 300 vph for min 8 hours?

2. Combined ped, bike, and veh volume on minor approach (total of both) at least 200 units per hour for the same 8 hours as criteria C-1?

3. If the 85th percentile speed on the major road exceeds 40 mph, may use 70% of the values in C-1 and C-2

Major Street 85th percentile mph:

Time Period	From	To	Major Road: Both App.	Minor Road: Both App. (VPH)	C-1	C-2	Both Met?	D (80%)		Both Met?
1	6:00	7:00	335	379	Yes	Yes	Yes	No	No	No
2	7:00	8:00	614	400	Yes	Yes	Yes	No	No	No
3	8:00	9:00	331	244	Yes	Yes	Yes	No	No	No
4	9:00	10:00	251	162	No	No	No	No	No	No
5	10:00	11:00	221	144	No	No	No	No	No	No
6	11:00	12:00	289	212	No	Yes	No	No	No	No
7	12:00	13:00	314	241	Yes	Yes	Yes	No	No	No
8	13:00	14:00	264	240	No	Yes	No	No	No	No
9	14:00	15:00	423	397	Yes	Yes	Yes	No	No	No
10	15:00	16:00	500	386	Yes	Yes	Yes	No	No	No
11	16:00	17:00	479	485	Yes	Yes	Yes	No	No	No
12	17:00	18:00	434	358	Yes	Yes	Yes	No	No	No
13	18:00	19:00	258	205	No	Yes	No	No	No	No
14	19:00	20:00								
15	20:00	21:00								
16	21:00	22:00								

No D. Use when previous criteria have not been met:

If 80% minimum values of Criteria B, C-1, and C-2 (C-3 excluded) are satisfied, warrant is met.

WisDOT

Met? Criteria

Yes

1 **Functional Highway Classification**

Approach	Classification
1: (SB)	Minor Arterial
2: (WB)	Minor Arterial
3: (NB)	Minor Arterial
4: (EB)	Minor Arterial

Yes

2 **Average Daily Traffic**

Approach	AADT
Minor 1	3414
Minor 2	6127
Major 1	5289
Major 2	5579

Yes

3 **Crash History**

of crashes in a 12 month period that can be corrected by multi-way stop control:
Expected to significantly reduce the overall severity of future crashes?

9

Yes

4 **Alternatives**

Refer to TGM 13-26-5 Section D.

Yes

5 **Mobility Impact**

Will the high-volume "through" street experience significant delays for the benefit of reducing delays for a low-volume side street?

No

6 **Right Turn Inclusion**

Refer to WisDOT TSDM 2-3-2

APPENDIX D

Signal Warrant Analysis **(Year 2018 Existing)**

Wisconsin Department of Transportation Traffic Signal Warrant Summary Worksheet

70%

The Worksheet(s) attached are provided as an attachment to the Engineering Investigation Study for:

Intersection: Freistadt Road (CTH F) & Maple Road

County: Washington

Village: Germantown

Major Street: Freistadt Road (CTH F)

Critical Approach Speed: 45 mph

Lanes: 1 lane

Minor Street: Maple Road

Critical Approach Speed: 45 mph

Lanes: 1 lane

% Right Turns Included

From North (SB) 0%

From East (WB) 100%

From South (NB) 0%

From West (EB) 100%

In built-up area of isolated community of < 10,000 population? No

Total number of approaches at intersection? 4 or more

If it is a "T" intersection, inflate minor threshold to 150%? No

Manually set volume level?

Analysis based on **EXISTING** volume data.

Date	Day of the Week	Time (HH:MM)			
		From	AM / PM	To	AM / PM
Year 2018 Existing Traffic**	Yes	6:00	AM	19:00	PM

Warrant Evaluation Summary	Warrant Met:
Warrant 1: Eight - Hour Vehicular Volume	No
Condition A: Minimum Vehicular Volume	No
Condition B: Interruption of Continuous Traffic	No
Condition C: Combination: 80% of A and B	No
Warrant 2: Four-Hour Volume	Yes
Warrant 3: Peak Hour Volume	Yes
Warrant 4: Pedestrian Volume	N/A
Criterion A: Four-Hour	
Criterion B: Peak-Hour	
Warrant 5: School Crossing	N/A
Warrant 6: Coordinated Signal System	N/A
Warrant 7: Crash Experience	Yes
Warrant 8: Roadway Network	N/A
Warrant 9: Intersection Near a Grade Crossing	N/A

Warrant Analysis Conducted By:

Name: Christian R. Sternke, P.E.

Agency: TADI

Date: 1/23/2019

Warrant 1: Eight - Hour Vehicular Volume**70%****Warrant Evaluated? Yes****Warrant Satisfied? No****Manually Set To:**

Condition A:		
Min. Veh. Volume		
Volume Level	70%	56%
Major Rd. Req	350	280
Minor Rd. Req	105	84
Number of Hours	5	9

Satisfied? No

Condition B:		
Interruption of Continuous Traffic		
Volume Level	70%	56%
Major Rd. Req	525	420
Minor Rd. Req	53	42
Number of Hours	1	5

Satisfied? No

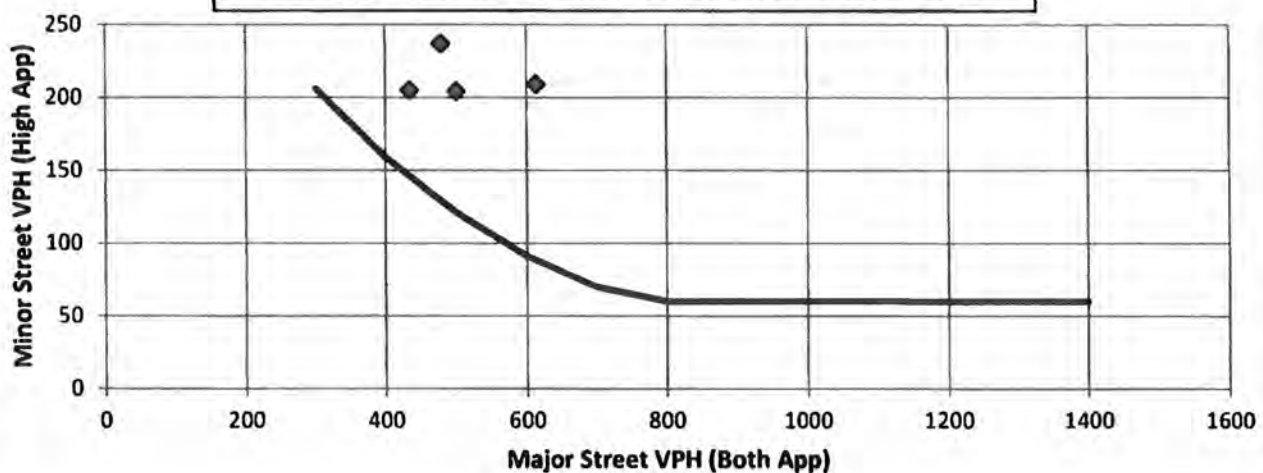
Condition C:		
Combination of A & B at 56%		

Satisfied? No

6:00 AM		Enter Start Time (Military Time) (HH:MM)			Total
Time Period	From	To	Major Road: Both App. (VPH)	Minor Road: High App. (VPH)	
1	6:00	7:00	335	194	529
2	7:00	8:00	614	209	823
3	8:00	9:00	331	102	433
4	9:00	10:00	251	60	311
5	10:00	11:00	221	52	273
6	11:00	12:00	289	85	374
7	12:00	13:00	314	107	421
8	13:00	14:00	264	106	370
9	14:00	15:00	423	192	615
10	15:00	16:00	500	204	704
11	16:00	17:00	479	237	716
12	17:00	18:00	434	205	639
13	18:00	19:00	258	88	346
14	19:00	20:00	0	0	0
15	20:00	21:00	0	0	0
16	21:00	22:00	0	0	0

Warrant 2: Four-Hour Volume**70%****Warrant Evaluated? Yes****Warrant Satisfied? Yes****Manually Set To:**

Hour Start	7:00	16:00	15:00	17:00
Major Road Vol.	614	479	500	434
Minor Road Vol.	209	237	204	205

Figure 4C-2 Warrant 2, Four-Hour Vehicular Volume (70% Factor)

Warrant 3: Peak Hour Volume

70%
Warrant Evaluated? Yes
Warrant Satisfied? Yes
Manually Set To:

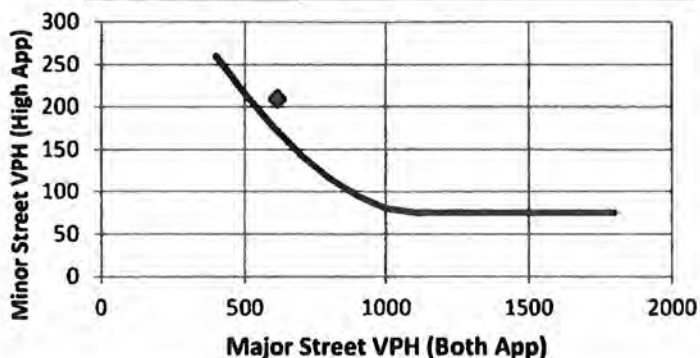
Condition justifying use of warrant:

None

Criteria		Met?
Delay on Minor Approach	4	Yes
Volume on Minor Approach	100	
Total Entering Volume (veh/h)	800	

Manually Set Peak Hour? No

Peak Hour	Major Road Vol. (Both App.)	Minor Road Vol. (High App.)
7:00	614	209

Figure 4C-4 Warrant 3, Peak Hour (70% Factor)


Warrant 4: Pedestrian Volume

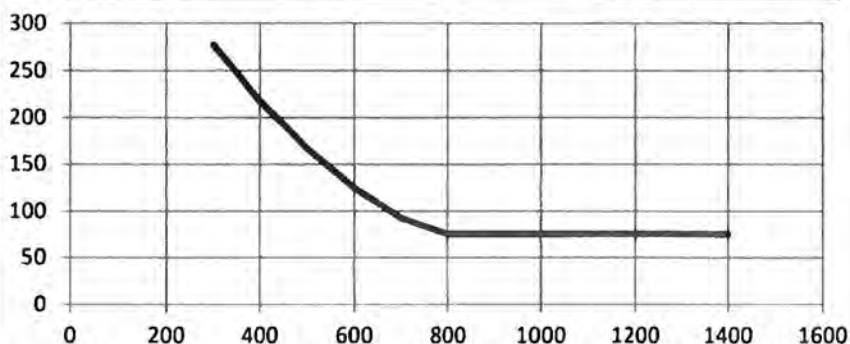
70%
Warrant Evaluated? No
Warrant Satisfied? N/A
Manually Set To:
Criterion A: Four Hour

Hour (Start)	Pedestrian Volume	Major Road Vol.
		0
		0
		0
		0

Manually Set Major Rd Vol?

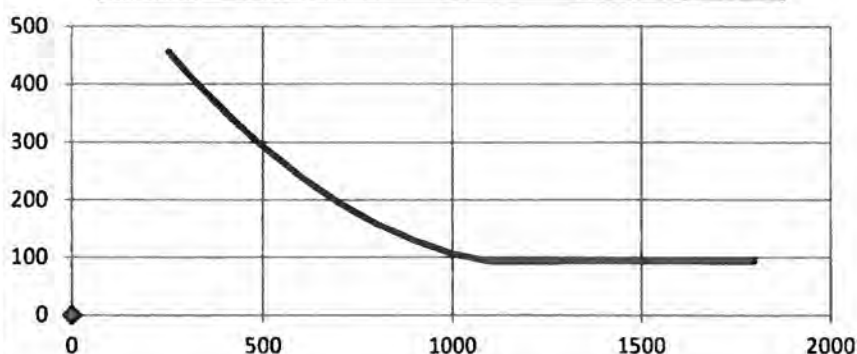
Avg. walk speed less than 3.5 ft/s?

Criterion A Satisfied?

Figure 4C-6 Warrant 4, Pedestrian Four-Hour Volume (70% Factor)

Criterion B: Peak Hour

Peak Hour	Pedestrian Vol.	Major Road Vol.
0:00	0	0

Criterion B Satisfied?

Figure 4C-8 Warrant 4, Pedestrian Peak Hour (70% Factor)


Warrant 5: School Crossing**70%**

Warrant Evaluated? No

Warrant Satisfied? N/A

Manually Set To:

Criteria

Fulfilled?

1	There are a MINIMUM of 20 school children during the highest crossing hour.	
2	There are fewer adequate gaps in the major road traffic stream during the period when the school children are using the crossing than the number of minutes in the same period.	
3	The nearest traffic signal along the major road is located more than 300 ft away. Or, the nearest traffic signal is within 300 ft but the proposed traffic signal will not restrict the progressive movement of traffic.	

Warrant 6: Coordinated Signal System**70%**

Warrant Evaluated? No

Warrant Satisfied? N/A

Manually Set To:

Criteria

Fulfilled?

1	Signal spacing > 1000 ft	
2	On a one-way road or a road that has traffic predominantly in one direction, the adjacent signals are so far apart that they do not provide the necessary degree of vehicle platooning.	
3	On a two-way road, adjacent signals do not provide the necessary degree of platooning and the proposed and the adjacent signals will collectively provide a progressive operation.	

Warrant 7: Crash Experience**70%**

Warrant Evaluated? Yes

Warrant Satisfied? Yes

Manually Set To:

Criteria

Met?

Fulfilled?

1	Adequate trial of other remedial measures has failed to reduce crash frequency.					Yes
	Measures Tried: lane configuration modifications without success reducing crashes					
2	Five or more reported crashes, of types susceptible to correction by signal, have occurred within a 12 month period.	# of crashes per 12 months				Yes
		9				
3	Warrant 1, Condition A (80%)		Yes			Yes
	Warrant 1, Condition B (80%)		No			
	Warrant 4, Criterion A (80%)		No			
	Warrant 4, Criterion B (80%)		No			

Warrant 8: Roadway Network**70%**

Warrant Evaluated? No

Warrant Satisfied? N/A

Manually Set To:

Criteria

Met?

Fulfilled?

1	Total entering volume of at least 1,000 veh/h during typical weekday peak hour		823	No		No
	Five-year projected volumes that satisfy one or more of Warrants 1, 2, or 3.			No		
2	Total entering vol. of at least 1,000 veh/h for each of any 5 hrs of non-normal business day (Sat. or Sun.)					
	Hour					
	Volume					

Characteristics of Major Routes - Select yes if all intersecting routes have characteristic

Fulfilled?

1	Part of the road or highway system that serves as the principal roadway network for through traffic flow	
2	Rural or suburban highway outside of, entering, or traversing a city	
3	Appears as a major route on an official plan	

Warrant 9: Intersection Near a Grade Crossing

70%

Warrant Evaluated? No

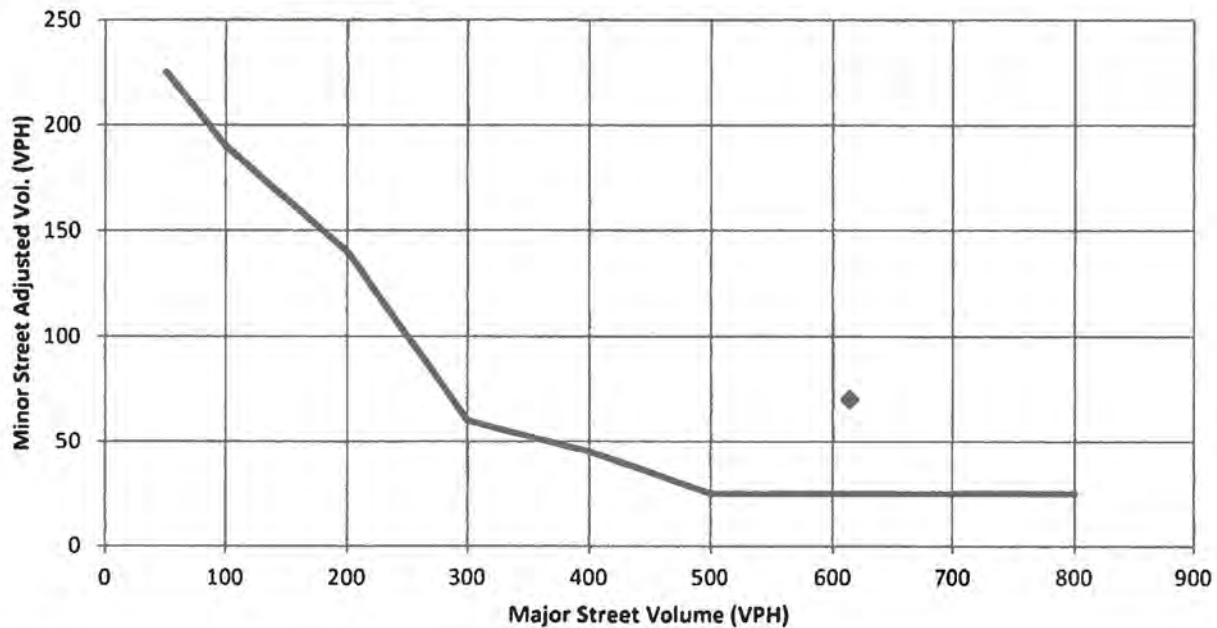
Warrant Satisfied? N/A

Manually Set To:

Adjustment Factors			Manually Set Peak Hour?				
Rail Traffic per Day	% High Occupancy Buses on Minor Road	% Tractor-Trailer Trucks on Minor Road	D	Peak Hour	Major Road Vol.	Minor Road Vol.	Adjusted Minor Vol.
1	0	0% to 2.5%	660	7:00	614	209	70.015



Figure 4C-9 Warrant9, Intersection Near a grade Crossing (One Approach Lane at the Track Crossing)



Conclusions/Comments:

**Warrant analysis includes Year 2018 existing traffic.

Based on the warrant analysis, Warrants 2, 3, & 7 are expected to be met.

Updated: 12/6/2017

Hourly Volume Data																					
One Hour Time Period		From North (SB)					From East (WB)					From South (NB)					From West (EB)				
Start Time		Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total
AM	6:00	68	177	17	0	262	5	72	128	0	205	28	14	75	0	117	38	86	6	0	130
	7:00	62	187	22	0	271	12	116	170	0	298	46	37	46	0	129	96	198	22	0	316
	8:00	23	91	11	0	125	14	89	89	0	192	36	37	46	0	119	31	94	14	0	139
	9:00	11	49	2	0	62	12	53	62	0	127	40	37	23	0	100	44	75	5	0	124
MD	10:00	17	40	7	0	64	5	54	66	1	126	28	22	30	0	80	27	61	7	0	95
	11:00	23	39	11	0	73	11	75	50	0	136	54	43	42	0	139	44	93	16	0	153
	12:00	18	52	8	0	78	13	75	65	0	153	56	63	44	0	163	60	81	20	0	161
	13:00	18	50	11	0	79	6	85	43	0	134	55	56	50	0	161	55	64	11	0	130
PM	14:00	24	72	6	0	102	27	104	57	0	188	103	101	91	0	295	87	116	32	0	235
	15:00	18	60	6	0	84	23	122	101	0	246	98	155	49	0	302	75	120	59	0	254
	16:00	19	84	10	0	113	27	137	77	0	241	135	187	50	0	372	56	126	56	0	238
	17:00	12	34	10	0	56	21	150	78	0	249	97	160	45	0	302	46	106	33	0	185
	18:00	10	43	1	0	54	4	96	50	0	150	63	58	30	0	151	40	56	12	0	108
	19:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	20:00																				
	21:00																				
Totals		323	978	122	0	1423	180	1228	1036	1	2445	839	970	621	0	2430	699	1276	293	0	2268

Note: Copy volume data and paste into cells using paste special -> values

Note: U-Turns are counted as Left Turns in the Volume Totals

Please Select the Major Road:

Major Road Left Turn as Minor Approach?

% Right Turns Included (Default 0%)

From North (SB)	0%
From East (WB)	100%
From South (NB)	0%
From West (EB)	100%

Major Road Volume Totals: East/West				
Right	Thru	Left	T+LT	Total
43	158	134	292	335
108	314	192	506	614
45	183	103	286	331
56	128	67	195	251
32	115	74	189	221
55	168	66	234	289
73	156	85	241	314
61	149	54	203	264
114	220	89	309	423
98	242	160	402	500
83	263	133	396	479
67	256	111	367	434
44	152	62	214	258
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
879	2504	1330	3834	4713

Minor Road Highest Volume: North/South				
Right	Thru	Left	T+LT	Total
0	177	17	194	194
0	187	22	209	209
0	91	11	102	102
0	37	23	60	60
0	22	30	52	52
0	43	42	85	85
0	63	44	107	107
0	56	50	106	106
0	101	91	192	192
0	155	49	204	204
0	187	50	237	237
0	160	45	205	205
0	58	30	88	88
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	1337	504	1841	1841

[illegible]

Year 2028 Background Traffic																		
Start Time	↙				←				↑				→				Intersection Totals	Notes
	Maple Road				Freestadt Road (CTH F)				Maple Road				Freestadt Road (CTH F)					
	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn		
6-7am	78	204	20	0	6	83	148	0	32	16	86	0	44	99	7	0	823	
7-8am	71	216	25	0	14	134	196	0	53	43	53	0	111	228	25	0	1169	
8-9am	27	105	13	0	16	103	103	0	42	43	53	0	38	108	16	0	865	
9-10am	13	56	7	0	14	61	71	0	46	43	27	0	51	85	6	0	476	
10-11am	20	46	8	0	6	62	76	1	32	25	35	0	31	70	8	0	420	
11am-12pm	27	45	13	0	13	86	58	0	62	50	48	0	51	107	18	0	578	
12-1pm	21	60	9	0	15	86	75	0	65	73	51	0	69	93	23	0	640	
1-2pm	21	58	13	0	7	98	50	0	63	65	58	0	63	74	13	0	583	
2-3pm	28	83	7	0	31	120	66	0	119	116	105	0	100	134	37	0	946	
3-4pm	21	68	7	0	27	113	116	0	113	119	56	0	86	138	58	0	1021	
4-5pm	22	97	12	0	31	158	89	0	156	215	58	0	65	145	65	0	1114	
5-6pm	14	39	12	0	24	173	90	0	112	184	52	0	53	122	38	0	913	
6-7pm	12	50	1	0	5	111	58	0	73	67	35	0	46	85	14	0	537	
7-8pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Growth Rates	1.530%	1.530%	1.530%	1.530%	1.530%	1.530%	1.530%	1.530%	1.530%	1.530%	1.530%	1.530%	1.530%	1.530%	1.530%	1.530%	Growth rate calculated based on historical AADT data from 1977 to present	

Start Time	↓				←				↑				→				Intersection Totals	IN	OUT	IN	OUT	Notes
	Maple Road				Frestadt Road (CTHF)				Maple Road				Frestadt Road (CTHF)									
	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn						
6-7am	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
7-8am	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
8-9am	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
9-10am	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
10-11am	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
11am-12pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
12-1pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
1-2pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
2-3pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
3-4pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
4-5pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
5-6pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
6-7pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
7-8pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
8-9pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
9-10pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
10-11pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
11-12pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
12-1pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
1-2pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
2-3pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
3-4pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
4-5pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
5-6pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
6-7pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
7-8pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
8-9pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
9-10pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
10-11pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
11-12pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
12-1pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
1-2pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
2-3pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
3-4pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
4-5pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
5-6pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
6-7pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
7-8pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
8-9pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
9-10pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
10-11pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
11-12pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
12-1pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
1-2pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
2-3pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
3-4pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
4-5pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
5-6pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
6-7pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
7-8pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
8-9pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
9-10pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
10-11pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
11-12pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
12-1pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
1-2pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
2-3pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
3-4pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
4-5pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
5-6pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
6-7pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
7-8pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
8-9pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
9-10pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
10-11pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
11-12pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
12-1pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
1-2pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
2-3pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
3-4pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
4-5pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
5-6pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
6-7pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
7-8pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
8-9pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
9-10pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
10-11pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
11-12pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
12-1pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
1-2pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
2-3pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
3-4pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
4-5pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
5-6pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
6-7pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
7-8pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
8-9pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
9-10pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
10-11pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
11-12pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
12-1pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
1-2pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
2-3pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
3-4pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
4-5pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
5-6pm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
6-7pm	0	0	0	0	0																	

APPENDIX D

Signal Warrant Analysis (Year 2028 Background)

Wisconsin Department of Transportation Traffic Signal Warrant Summary Worksheet

70%

The Worksheet(s) attached are provided as an attachment to the Engineering Investigation Study for:

Intersection: Freistadt Road (CTH F) & Maple Road
County: Washington
Village: Germantown

Major Street: Freistadt Road (CTH F)
Critical Approach Speed: 45 mph
Lanes: 1 lane

Minor Street: Maple Road
Critical Approach Speed: 45 mph
Lanes: 1 lane

% Right Turns Included
From North (SB) 0%
From East (WB) 100%
From South (NB) 0%
From West (EB) 100%

In built-up area of isolated community of < 10,000 population? No
Total number of approaches at intersection? 4 or more
If it is a "T" intersection, inflate minor threshold to 150%? No
Manually set volume level?

Analysis based on **EXISTING** volume data.

Date	Day of the Week	Time (HH:MM)			
		From	AM / PM	To	AM / PM
Year 2028 Background Traffic**	Yes	6:00	AM	19:00	PM

Warrant Evaluation Summary	Warrant Met:
Warrant 1: Eight - Hour Vehicular Volume	Yes
Condition A: Minimum Vehicular Volume	Yes
Condition B: Interruption of Continuous Traffic	No
Condition C: Combination: 80% of A and B	No
Warrant 2: Four-Hour Volume	Yes
Warrant 3: Peak Hour Volume	Yes
Warrant 4: Pedestrian Volume	N/A
Criterion A: Four-Hour	
Criterion B: Peak-Hour	
Warrant 5: School Crossing	N/A
Warrant 6: Coordinated Signal System	N/A
Warrant 7: Crash Experience	Yes
Warrant 8: Roadway Network	N/A
Warrant 9: Intersection Near a Grade Crossing	N/A

Warrant Analysis Conducted By:

Name: Christian R. Sternke, P.E.
Agency: TADI
Date: 1/23/2019

Warrant 1: Eight - Hour Vehicular Volume

70%

Warrant Evaluated? Yes

Warrant Satisfied? Yes

Manually Set To:

Condition A : Min. Veh. Volume		
Volume Level	70%	56%
Major Rd. Req	350	280
Minor Rd. Req	105	84
Number of Hours	8	11

Satisfied? Yes

Condition B: Interruption of Continuous Traffic		
Volume Level	70%	56%
Major Rd. Req	525	420
Minor Rd. Req	53	42
Number of Hours	3	5

Satisfied? No

Condition C: Combination of A & B at 56%		
---	--	--

Satisfied? No

6:00 AM		Enter Start Time (Military Time) (HH:MM)			Total
Time Period	From	To	Major Road: Both App. (VPH)	Minor Road: High App. (VPH)	
1	6:00	7:00	387	224	611
2	7:00	8:00	708	241	949
3	8:00	9:00	382	118	500
4	9:00	10:00	289	70	359
5	10:00	11:00	254	60	314
6	11:00	12:00	333	98	431
7	12:00	13:00	361	124	485
8	13:00	14:00	305	123	428
9	14:00	15:00	488	221	709
10	15:00	16:00	576	235	811
11	16:00	17:00	553	274	827
12	17:00	18:00	500	236	736
13	18:00	19:00	299	102	401
14	19:00	20:00	0	0	0
15	20:00	21:00	0	0	0
16	21:00	22:00	0	0	0

Warrant 2: Four-Hour Volume

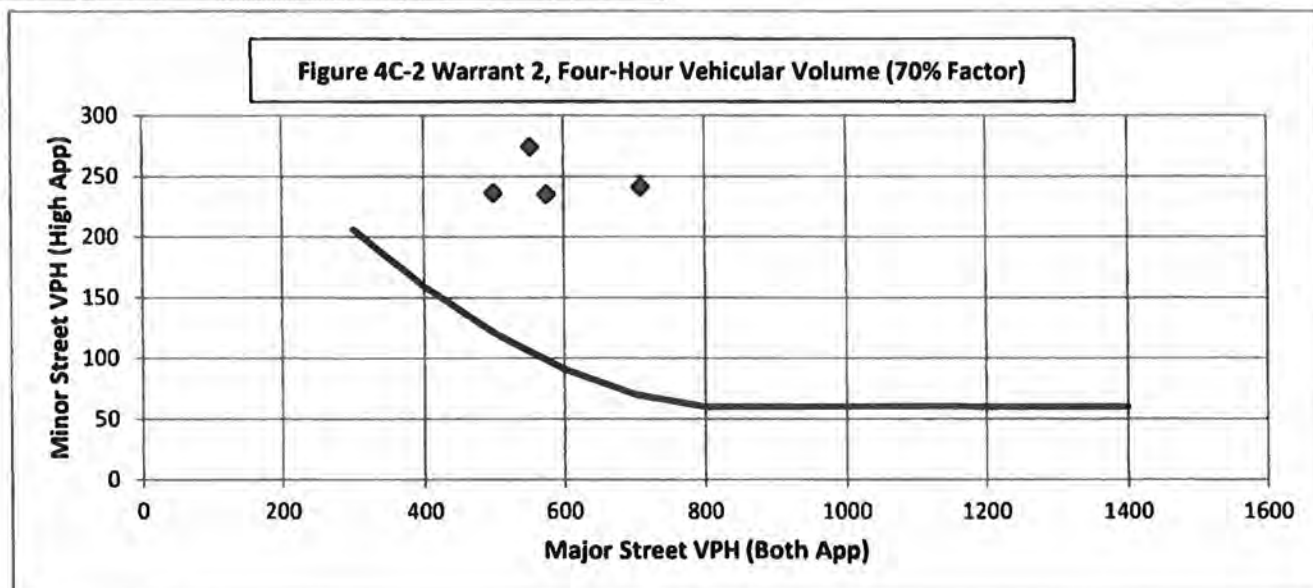
70%

Warrant Evaluated? Yes

Warrant Satisfied? Yes

Manually Set To:

Hour Start	7:00	16:00	15:00	17:00
Major Road Vol.	708	553	576	500
Minor Road Vol.	241	274	235	236



Warrant 3: Peak Hour Volume

70%
Warrant Evaluated? Yes
Warrant Satisfied? Yes
Manually Set To:

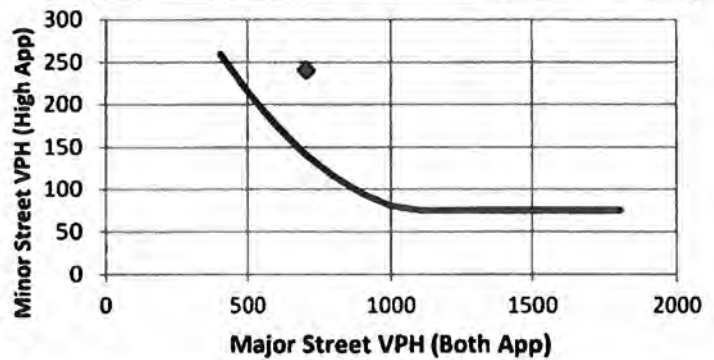
Condition justifying use of warrant:

None

Criteria		Met?
Delay on Minor Approach	4	Yes
Volume on Minor Approach	100	
Total Entering Volume (veh/h)	800	

Manually Set Peak Hour? No

Peak Hour	Major Road Vol. (Both App.)	Minor Road Vol. (High App.)
7:00	708	241

Figure 4C-4 Warrant 3, Peak Hour (70% Factor)


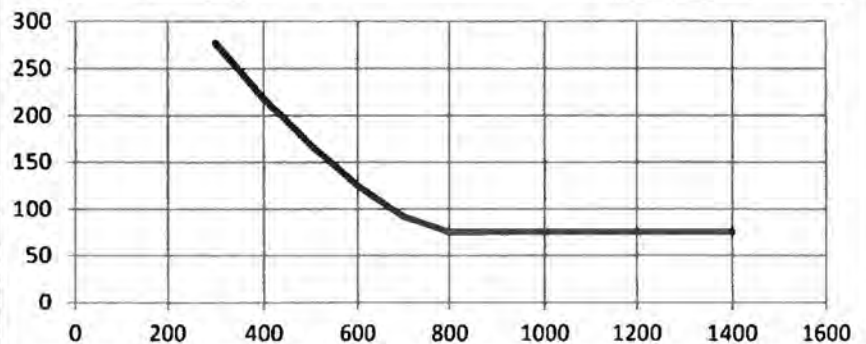
Warrant 4: Pedestrian Volume

70%
Warrant Evaluated? No
Warrant Satisfied? N/A
Manually Set To:
Criterion A: Four Hour

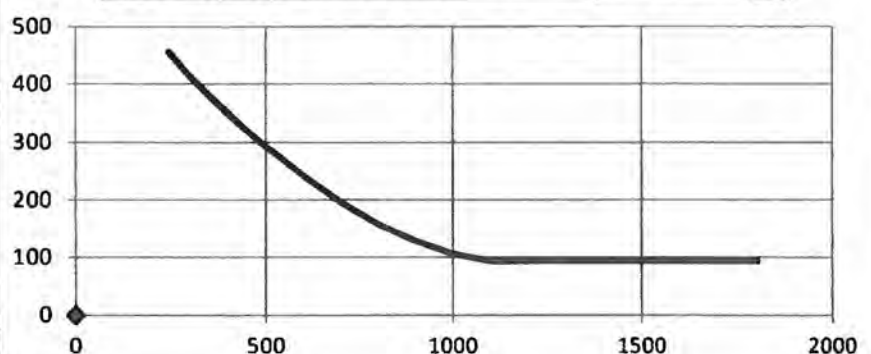
Hour (Start)	Pedestrian Volume	Major Road Vol.
		0
		0
		0
		0

Manually Set Major Rd Vol?

Avg. walk speed less than 3.5 ft/s?

Criterion A Satisfied?
Figure 4C-6 Warrant 4, Pedestrian Four-Hour Volume (70% Factor)

Criterion B: Peak Hour

Peak Hour	Pedestrian Vol.	Major Road Vol.
0:00	0	0

Criterion B Satisfied?
Figure 4C-8 Warrant 4, Pedestrian Peak Hour (70% Factor)


Warrant 5: School Crossing**70%**

Warrant Evaluated? No

Warrant Satisfied? N/A

Manually Set To:

Criteria	Fulfilled?
1 There are a MINIMUM of 20 school children during the highest crossing hour.	
2 There are fewer adequate gaps in the major road traffic stream during the period when the school children are using the crossing than the number of minutes in the same period.	
3 The nearest traffic signal along the major road is located more than 300 ft away. Or, the nearest traffic signal is within 300 ft but the proposed traffic signal will not restrict the progressive movement of traffic.	

Warrant 6: Coordinated Signal System**70%**

Warrant Evaluated? No

Warrant Satisfied? N/A

Manually Set To:

Criteria	Fulfilled?
1 Signal spacing > 1000 ft	
2 On a one-way road or a road that has traffic predominantly in one direction, the adjacent signals are so far apart that they do not provide the necessary degree of vehicle platooning.	
3 On a two-way road, adjacent signals do not provide the necessary degree of platooning and the proposed and the adjacent signals will collectively provide a progressive operation.	

Warrant 7: Crash Experience**70%**

Warrant Evaluated? Yes

Warrant Satisfied? Yes

Manually Set To:

Criteria	Met?	Fulfilled?
1 Adequate trial of other remedial measures has failed to reduce crash frequency. Measures Tried: lane configuration modifications without success reducing crashes		Yes
2 Five or more reported crashes, of types susceptible to correction by signal, have occurred within a 12 month period.	# of crashes per 12 months 9	Yes
3 Warrant 1, Condition A (80%)	Yes	Yes
Warrant 1, Condition B (80%)	No	
Warrant 4, Criterion A (80%)	No	
Warrant 4, Criterion B (80%)	No	

Warrant 8: Roadway Network**70%**

Warrant Evaluated? No

Warrant Satisfied? N/A

Manually Set To:

Criteria	Met?	Fulfilled?
1 Total entering volume of at least 1,000 veh/h during typical weekday peak hour	949	No
Five-year projected volumes that satisfy one or more of Warrants 1, 2, or 3.		No
2 Total entering vol. of at least 1,000 veh/h for each of any 5 hrs of non-normal business day (Sat. or Sun.)		
Hour		
Volume		

Characteristics of Major Routes - Select yes if all intersecting routes have characteristic**Fulfilled?**

1	Part of the road or highway system that serves as the principal roadway network for through traffic flow	
2	Rural or suburban highway outside of, entering, or traversing a city	
3	Appears as a major route on an official plan	

Warrant 9: Intersection Near a Grade Crossing

70%

Warrant Evaluated? No

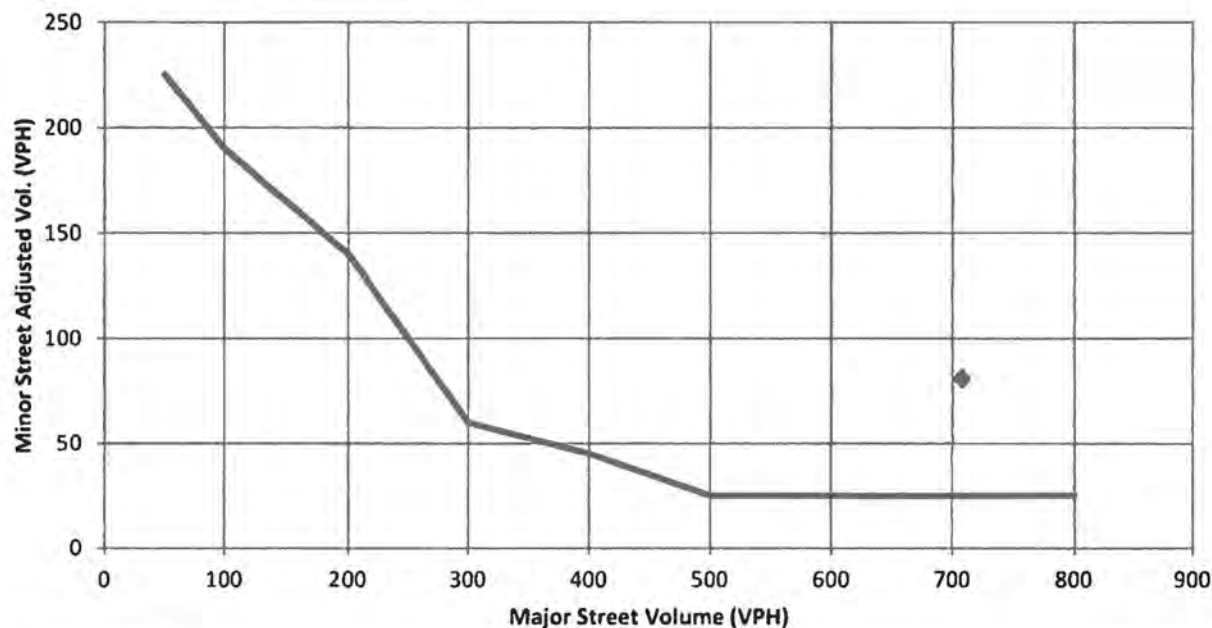
Warrant Satisfied? N/A

Manually Set To:

Adjustment Factors			Manually Set Peak Hour?				
Rail Traffic per Day	% High Occupancy Buses on Minor Road	% Tractor-Trailer Trucks on Minor Road	D	Peak Hour	Major Road Vol.	Minor Road Vol.	Adjusted Minor Vol.
1	0	0% to 2.5%	660	7:00	708	241	80.735



Figure 4C-9 Warrant9, Intersection Near a grade Crossing (One Approach Lane at the Track Crossing)



Conclusions/Comments:

**Warrant analysis includes Year 2028 background traffic.

Based on the warrant analysis, Warrants 1, 2, 3, & 7 are expected to be met.

Updated: 12/6/2017

Hourly Volume Data																						
One Hour Time Period Start Time		↓ From North (SB)					← From East (WB)					↑ From South (NB)					→ From West (EB)					Total Vehicle Volume
		Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	
AM	6:00	78	204	20	0	302	6	83	148	0	237	32	16	86	0	134	44	99	7	0	150	823
	7:00	71	216	25	0	312	14	134	196	0	344	53	43	53	0	149	111	228	25	0	364	1169
	8:00	27	105	13	0	145	16	103	103	0	222	42	43	53	0	138	36	108	16	0	160	665
	9:00	13	56	2	0	71	14	61	71	0	146	46	43	27	0	116	51	86	6	0	143	476
MD	10:00	20	46	8	0	74	6	62	76	1	145	32	25	35	0	92	31	70	8	0	109	420
	11:00	27	45	13	0	85	13	86	58	0	157	62	50	48	0	160	51	107	18	0	176	578
	12:00	21	60	9	0	90	15	86	75	0	176	65	73	51	0	189	69	93	23	0	185	640
	13:00	21	58	13	0	92	7	98	50	0	155	63	65	58	0	186	63	74	13	0	150	583
PM	14:00	28	83	7	0	118	31	120	66	0	217	119	116	105	0	340	100	134	37	0	271	946
	15:00	21	69	7	0	97	27	141	116	0	284	113	179	56	0	348	86	138	68	0	292	1021
	16:00	22	97	12	0	131	31	158	89	0	278	156	216	58	0	430	65	145	65	0	275	1114
	17:00	14	39	12	0	65	24	173	90	0	287	112	184	52	0	348	53	122	38	0	213	913
	18:00	12	50	1	0	63	5	111	58	0	174	73	67	35	0	175	46	65	14	0	125	537
	19:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	20:00																					
	21:00																					
Totals		375	1128	142	0	1645	209	1416	1196	1	2822	968	1120	717	0	2805	806	1469	338	0	2613	9885

Note: Copy volume data and paste into cells using paste special -> values

Note: U-Turns are counted as Left Turns in the Volume Totals

Please Select the Major Road:

Major Road Left Turn as Minor Approach?

% Right Turns Included (Default 0%)

From North (SB)	0%
From East (WB)	100%
From South (NB)	0%
From West (EB)	100%

Major Road Volume Totals: East/West				
Right	Thru	Left	T+LT	Total
50	182	155	337	387
125	362	221	583	708
52	211	119	330	382
65	147	77	224	289
37	132	85	217	254
64	193	76	269	333
84	179	98	277	361
70	172	63	235	305
131	254	103	357	488
113	279	184	463	576
96	303	154	457	553
77	295	128	423	500
51	176	72	248	299
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
1015	2885	1535	4420	5435

Minor Road Highest Volume: North/South				
Right	Thru	Left	T+LT	Total
0	204	20	224	224
0	216	25	241	241
0	105	13	118	118
0	43	27	70	70
0	25	35	60	60
0	50	48	98	98
0	73	51	124	124
0	65	58	123	123
0	116	105	221	221
0	179	56	235	235
0	216	58	274	274
0	184	52	236	236
0	67	35	102	102
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	1543	583	2126	2126

RSM 4A

SCOPING ICE MEMORANDUM



PHASE I: ICE MEMORANDUM

BUREAU OF TRAFFIC OPERATIONS

To: DOT ICE Review
From: John Campbell, P.E.
Christian R. Sternke, P.E.
Date: 2/8/2019
RE: Freistadt Road & Maple Road
Germantown, Wisconsin
Highway Safety Improvement Program (HSIP)

Project Description:

The Village of Germantown has requested a safety and operational analysis of the Freistadt Road intersection with Maple Road within the Village of Germantown, Wisconsin. The traffic study is being conducted to determine if modifications to the roadway geometry and traffic control would improve the safety and operations of the intersection. This ICE report has been prepared to analyze the intersection under Year 2028 design year traffic conditions.

Alternatives:

All-Way Stop Control: Reconfigure the northbound and eastbound approaches to include one exclusive left-turn lane, one exclusive through lane, and one exclusive right-turn lane.

Traffic Signal Control: Reconfigure the northbound and eastbound approaches to include one exclusive left-turn lane, one exclusive through lane, and one exclusive right-turn lane and reconfigure the southbound approach to one exclusive left-turn lane and one shared through/right-turn lane.

Roundabout Control: Reconfigure the intersection to a single lane roundabout.

Safety Considerations:

A review of the crash records indicated that thirty-seven (37) non-deer crashes occurred at the intersection of Freistadt Road with Maple Road over the past five years (January 2014 through December 2018). The intersection crash rate was calculated to be 2.29 crashes per million entering vehicles (MEV). While there are not statewide average crash statistics available in Wisconsin, a crash rate over 2 crashes per MEV generally indicates a substantial safety issue. Most concerning at this location is the severity of the crashes observed. Eight (8) resulted in Type B injury, and one (1) resulted in Type A injury. The remaining crashes (28) resulted in property damage only. Seventy-six percent (76%) of the crashes were angle crashes and another five percent (5%) of the crashes were rear-end crashes. The majority of the crashes, sixty-eight percent (68%), occurred during the daytime hours.

Fourteen (14) of the thirty-seven (37) angle crashes occurred with northbound Maple Road vehicles and eastbound or westbound Freistadt Road vehicles. Twelve (12) of the thirty-seven (37) angle crashes occurred with southbound Maple Road vehicles and eastbound or westbound Freistadt Road vehicles.

Factors leading to these angle crashes include:

- Maple Road drivers misjudging available gaps
- Drivers not seeing oncoming eastbound/westbound Freistadt Road vehicles
- Drivers that ran the stop sign because they did not see it



PHASE I: ICE MEMORANDUM

- Drivers on Maple Road sometimes indicated they had expected traffic on Freistadt Road to stop thinking they had a stop sign.

The other crashes involved a combination of additional rear-end crashes, overturn crashes, or vehicles hitting a fixed object (stop sign).

Operational Analysis:

The Freistadt Road intersection with Maple Road currently operates with unacceptable movements during the morning peak hour under Year 2018 existing traffic volumes and unacceptable movements during both peak hours under Year 2028 background traffic volumes. Movements are expected to remain operating unacceptably even with modified geometrics if the intersection remains under two-way stop control.

All-way stop control and traffic signal warrant analyses were therefore completed for the intersection. Under the Year 2018 existing traffic volumes, all-way stop control warrants are met and traffic signal warrants 2, 3, and 7 are met. Additionally, under Year 2028 background traffic volumes, traffic signal warrant 1 is also expected to be met. Therefore, all-way stop control, modern roundabout control, and traffic signal control can be considered at this intersection.

Under all-way stop control, all traffic movements at the intersection are expected to operate acceptably during the weekday morning and evening peak hours with Year 2028 background traffic volumes.

Under traffic signal control, all traffic movements at the intersection are expected to operate acceptably during the weekday morning and evening peak hours with Year 2028 background traffic volumes.

Under single-lane roundabout control, all traffic movements at the intersection are expected to operate acceptably during the weekday morning and evening peak hours with Year 2028 background traffic volumes.

Feasibility of Alternatives:

All three traffic control options are feasible options that have unique pros and cons. The table below lists the potential benefits and potential concerns for each alternative:

Alternative	Potential Benefits	Potential Concerns
All-Way Stop Control ~\$500,000 with geometric improvements	Can be very safe Requires minimal ROW and sight distance Inexpensive to install and maintain	Operationally inefficient under most conditions Not ideal for high approach speeds (Both Maple and Freistadt are posted 40 mph) Higher vehicle emissions due to required stopping The volume of semi-traffic at this intersection is expected to make AWSC operations challenging for drivers



PHASE I: ICE MEMORANDUM

BUREAU OF TRAFFIC OPERATIONS

		More approach lanes are needed compared to a single lane roundabout.
Traffic Signal ~\$1,000,000 with geometric improvements	Expected to result in a substantial reduction of angle crashes. Less expensive than a roundabout. Flexibility can be achieved via timing adjustments Pedestrians are assigned crossing times rather than having to find gaps	Rear-end crashes and red-light running crashes are possible. More expensive than AWSC. Would require more maintenance than other alternatives. More approach lanes are needed compared to a single lane roundabout.
Roundabout ~\$1.5-\$2.0 million	Geometry and lower speed reduce the potential for severe right-angle crashes Lower vehicle emissions as a result of limited stopping and idling Allows for convenient U-turn movement Pedestrians face traffic from only one direction at a time and have shorter crosswalks	Rear-end and sideswipe crashes are possible. The most expensive alternative. Future capacity expansion could be more challenging. All vehicles are required to slow down from free-flow speeds Accommodation of larger vehicles, including OSOW, can be challenging but may be addressed with unique design considerations

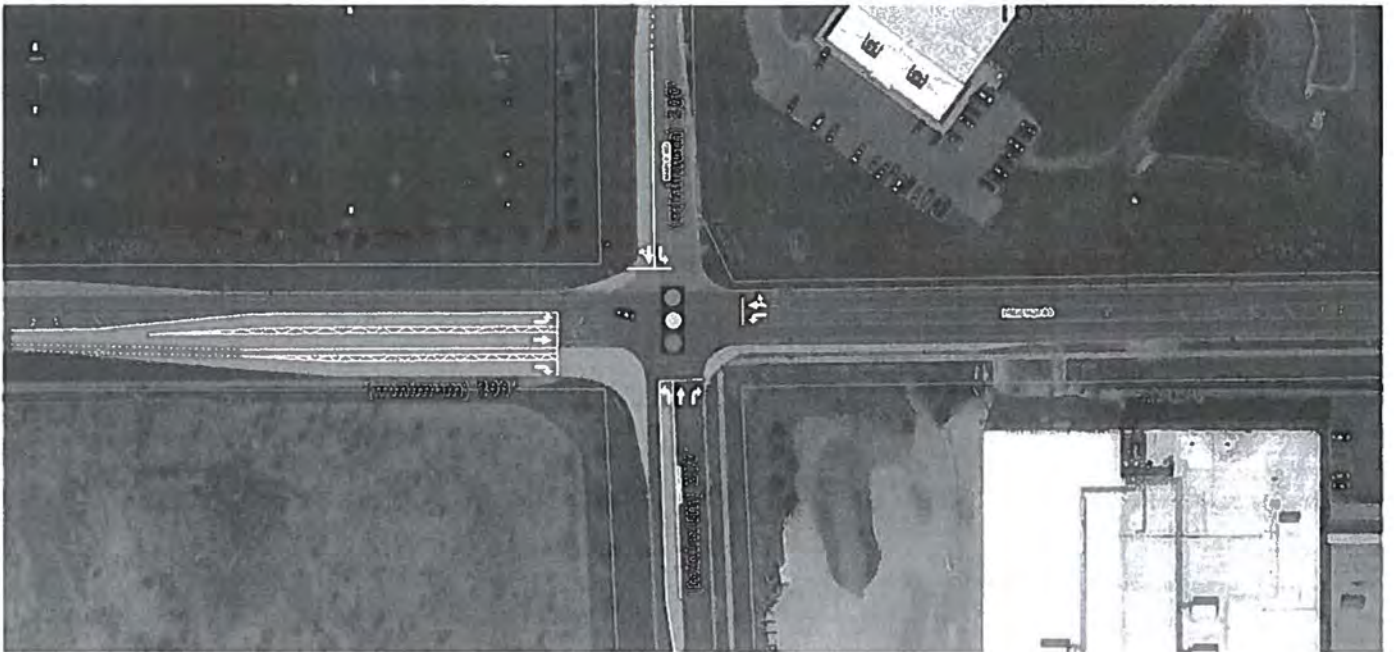
Conclusion:

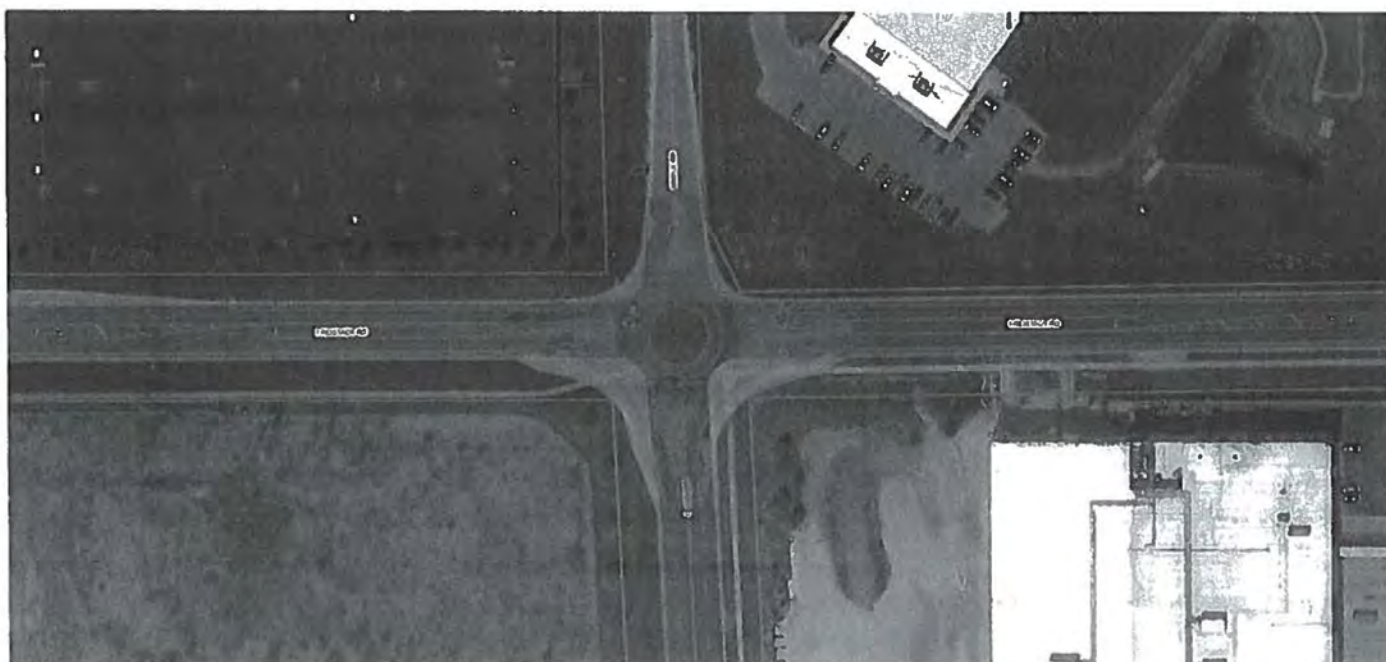
The information provided in this memorandum is expected to assist in the selection of a geometric and operational solution for the intersection of Freistadt Road and Maple Road which currently fails operationally with two-way stop control and has observed a substantial pattern of severe right-angle crashes.

Attachments:

- ROW Constraints







**BUSINESS OF THE PUBLIC WORKS AND HIGHWAY COMMITTEE
GERMANTOWN, WI**

MEETING DATE: September 4, 2019

AGENDA ITEM: New Business

ITEM TITLE: Discussion and possible action regarding the proposed 2020 Road Capital Improvement Plan

SUBMITTED BY: Eric Nitschke, P.E., Village Engineer

EN

SUMMARY EXPLANATION:

A 10-year Roadway Capital Improvement Plan was created in December of 2018 in order to better define immediate and long-term roadway needs in Germantown. The overall goal continues to be to increase efficiency and effectiveness of the road program. To that end, staff is requesting formal approval to move forward with the following areas for the 2020 Road Program.

- The remaining portion of the Old Farm Subdivision which includes Old Farm Road, Harvest Lane, Pheasant Run, Deer Crossing, Bridle Path, Surrey Drive, and Prairie Way.
- Esquire Estates which would include Western Avenue, Kings Way, Kings Court, Esquire Court, Queens Court, and portions of Hawthorne Drive.
- Start with the process of obtaining easements and Right-of-Way along Lovers Lane and Century Lane between Division Road and STH 145.

An update will be provided to the Public Works Committee in the November/December timeframe once soil borings, plans, and specifications have been completed. Following that update, it is anticipated the project will go out for bid in January of 2020.

ATTACHMENT: ORDINANCE____ RESOLUTION____ OTHER X

Proposed 2020 Road Program Work Map

RECOMMENDATION:

Staff recommends approval of the proposed areas of road rehabilitation for 2020. Further approvals will be necessary once the project is in the bidding phase early in 2020.

COMMITTEE ACTION:

Proper parliamentary procedure to deny a request is to have a motion made in the affirmative and by voting NAY would deny the request if a majority vote.

**BUSINESS OF THE PUBLIC WORKS & HIGHWAYS COMMITTEE
GERMANTOWN, WI**

MEETING DATE: September 4, 2019

AGENDA ITEM: New Business

ITEM TITLE: Drainage Ditch & Culvert Replacement

SUBMITTED BY: Lawrence W Ratayczak, P.E., Director of Public Works

SUMMARY EXPLANATION:

At the request of the Chairwoman of the Public Works and Highway Committee staff brings forward the topic of Drainage Ditches & Culvert Replacement. This topic generally revolves around the replacement of driveway culverts and the responsible party and when the Village performs drainage ditch maintenance.

First, regarding the responsibility for the replacement and associated cost to replace private driveway culverts. Pursuant to Section 8.03 (Driveways and Culverts) it is the responsibility of the property owner of a private driveway culvert to bear the cost of replacement. Section 8.03(c) (Existing Culverts); "The Director of Public Works may also require the owner of an abutting property to remove, or cause to be removed or replaced with adequate facilities, any culverts or drain pipes which do not conform to the requirements as provided herein when, in his judgement, it is necessary to do so, either for the orderly construction, maintenance or repair of any such highway, street or alley or in providing for a proper drainage system thereon".

Drainage Ditch Regrading and Culvert Replacement; Staff has, over the past several years, discontinued the regrading of roadside drainage ditches with funds from the Annual Road Improvement Projects. The Funds for the Road Improvement project are borrowed and therefore more correctly focused for the improvement of roads in the Village. Staff continues to investigate drainage issues and has in the past incorporated driveway culvert replacement if the regrading of the ditch to correct the drainage issue requires the replacement of the existing private culvert due to change in size, location or depth. In other words, if the culvert required removal to perform the drainage work then the Village has replaced private culverts.

In order for the Village to better evaluate and address the drainage issues existing in the Village staff has started to accumulate a list of drainage issues within the Village. The list is comprised of drainage issues noticed by Village employees and resident complaints. These drainage issues are reviewed for severity and whether they fall into the next years paving program. If involved in the paving program the drainage issue will be addressed by funds other than the Road Improvement project funds. Some drainage issues are larger or more intricate and require survey, plans and engineering to be completed. This may postpone an individual road improvement until the drainage issue is resolved.

In reviewing Section 8.03 staff recommends updating to current materials and to add clarity.

ATTACHMENT: ORDINANCE____ RESOLUTION____ OTHER XX

--Section 8.03 of the Municipal Code

RECOMMENDATION:

Staff recommends the Public Works & Highway Committee direct staff to review and make changes to Section 8.03 of the Municipal Code and to bring a revised version back to Committee in six months for review and approval.

COMMITTEE ACTION:

Proper parliamentary procedure to deny a request is to have a motion made in the affirmative and by voting NAY would deny the request if a majority vote.

8.03 - DRIVEWAYS AND CULVERTS.

- (1) **PERMIT REQUIRED.** (Am. Ord. #14-05) No person shall construct a driveway or install or replace a culvert without first obtaining a permit from the Director of Public Works. All driveway permits for new construction shall be obtained prior to the issuance of the building permit. Fee for driveway permit shall be \$50.00 for Zoning Districts A-1, A-2, Rs-1, Rs-2, Rs-3, Rs-4, Rs-5, Rs-6 and Rs-7. Fee for driveway permit shall be \$100.00 for Zoning Districts Rd-2, Rm-1, Rm-2, Rm-3, EH, MHP, I, PD, B-1, B-2, B-3, B-4, B-5, M-1, M-2, M-3 and M-4.
- (2) **CONSTRUCTION OF DRIVEWAYS REGULATED.** The location and size of all proposed driveways shall comply with all applicable provisions of this Code.
- (3) **CONSTRUCTION OF CULVERTS REGULATED.**
 - (a) Size and Location. (Am. Ord. #14-05) All culverts, drain pipes and other similar conduits placed on, in or along the highways, streets or alleys of the Village, either under private driveways leading from the public highways to private property or otherwise, shall be of sufficient size and constructed in such manner and of such materials as to provide means for the flow of water naturally accumulating or flowing along the ditches on such highways, streets or alleys. Such culvert or drain pipe shall not be less than 12 inches in diameter, and shall be of sufficient length to prevent injury to persons or property in the use of the highways and the entrance to and exit from the highways over and across such culverts, provided no culvert shall be less than 20 feet nor more than 40 feet in length. The Director of Public Works or designee shall determine the size of the culvert required in excess of the minimum herein described. Any culvert hereafter installed in the Village shall have metal apron end sections placed thereon. Such panels shall be the type designated by the Director of Public Works, or designee, and shall be placed in conjunction with the culvert installation.
 - (b) Conditions For Building. No permit for the lot or parcel shall be issued by the Director of Public Works until he is satisfied that the culvert has been placed, that sufficient gravel has been placed thereon to afford ingress and egress, that the concrete end panels are in place and notice has been given of the charges to be levied for services and materials furnished to properly install such culvert. Payment for installation of the culvert shall be made before or at the time of issuance of the building permit.

- (c) Existing Culverts. The Director of Public Works may investigate, approve or disapprove the various existing culverts or other drain pipes placed in the highways, streets or alleys in the Village. The Director Inspector may require concrete end panels to be placed on existing culvert installations where he determines it to be in the best interest of the Village and the abutting property owners. The Director may also require the owner of an abutting property to remove, or cause to be removed or replaced with adequate facilities, any culverts or drain pipes which do not conform to the requirements as provided herein when, in his judgment, it is necessary to do so, either for the orderly construction, maintenance or repair of any such highway, street or alley or in providing for a proper drainage system thereon.
- (4) **CONSTRUCTION OF CURB CUTS FOR DRIVEWAYS REGULATED.** (Cr. Ord. #26-03) A curb cut for a driveway entrance may be made only by removing and reconstructing the entire curb and gutter section or by sawcutting the existing curb using a "profile curb cut" with the curb head removed by using a machine type concrete saw specifically designed for this type of work. Driveway surfaces shall connect with the street pavement and sidewalk (if applicable) in a neat, workmanlike manner.

**BUSINESS OF THE PUBLIC WORKS AND HIGHWAY COMMITTEE
GERMANTOWN, WI**

MEETING DATE: September 4, 2019

AGENDA ITEM: New Business

ITEM TITLE: Germantown Development Handbook

SUBMITTED BY: Eric Nitschke, P.E., Village Engineer 

SUMMARY EXPLANATION:

In 2018 efforts began to update the engineering and development specifications utilized by Germantown staff in the Water Utility, Sewer Utility, Engineering, and Planning Departments. The updated requirements are meant to assist Germantown staff, developers, contractors, and consulting engineers provide high quality, consistent designs and specifications for public and private projects within Germantown. A draft Development Handbook has been developed and is currently under internal review.

It is village staff's intent to make the Public Works Committee aware of the efforts currently underway, so as to keep an open line of communication during the process of updating Germantown's specifications. It is anticipated that ordinance changes will be required once the revised Development Handbook is brought before the Public Works Committee and Village Board for review and approval.

ATTACHMENT: ORDINANCE____ RESOLUTION____ OTHER X

Draft Development Handbook

RECOMMENDATION:

No recommendation at this time.

COMMITTEE ACTION:

Proper parliamentary procedure to deny a request is to have a motion made in the affirmative and by voting NAY would deny the request if a majority vote.

DEVELOPMENT HANDBOOK

VILLAGE OF GERMANTOWN INFRASTRUCTURE STANDARDS

Adopted by Public Works & Highway Committee (PWHC) as "Developer's Handbook" 9-25-2018

Prepared for:

**President Dean Wolter,
Public Works & Highway Committee
Village of Germantown**

By:

**Lawrence Ratayczak, P.E.
Public Works Director
September 28th, 2018**

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3	Typical Cul-De-Sac Detail
4	Typical Acceleration/Deceleration Lane
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1. CONSTRUCTION PLAN REQUIREMENTS

1.1 GENERAL

1.1.1 Plans submitted for approval shall be on "D" size paper, 24-inches x 36-inches. The only exception is the master grading plan. The master grading plan shall not exceed a size of 30-inches x 36-inches and shall show the entire development if possible. If additional sheets are required match lines shall be used.

1.1.2 Plans shall be drawn to a recognized Engineering scale, i.e.: 1" = 40' or 1" = 50' horizontal and 1" = 4', 1" = 5' vertical.

1.1.3 Plans shall use local datum (NVGD 1929 datum) in establishing benchmarks and elevations.

1.1.4 Title blocks are required on each plan page and shall include:

- "Drawn By"
- "Designed By"
- "Checked By"
- "Date"
- "Scale"
- "Revised"
- "Project Name"
- "Location of Project"
- "Type of Plan"
- "Sheet Number"

1.1.5 Stationing shall be at 100-foot intervals from South to North or West to East and shall be indicated on plan and profiles. Every 100-foot station shall be noted.

1.1.6 All plans shall be signed, dated, and stamped by a registered Professional Engineer in the State of Wisconsin, according to the Wisconsin Administrative Code Chapter A-E 2. The design Engineer shall bear the responsibility for the coordination of submitting all development plans for review. Any plans that are submitted without a professional seal will be immediately rejected.

1.1.7 A cover sheet is required for the plan set. The cover sheet shall include a 1" = 200' scale drawing of the project area that shows the locations of the proposed utility improvements. Plan sheets shall be indexed on this 200 scale system plan.

1.1.8 Each cover sheet shall show the locations, elevations, and descriptions of the project benchmarks as established by the project surveyor. The cover sheet shall also show a location map with township, range, and section labeled.

1.1.9 Profile view shall be located below the plan view on plan/profile drawings and the two views should be in alignment vertically.

1.1.10 Each plan sheet shall show a north arrow. North direction shall be to the top or to the right of the sheet and indicated by a north arrow.

1.1.11 A legend shall be included in the plan set to designate line types.

1.1.12 Four (4) sets of all preliminary plans shall be submitted for initial review and corrections. Plans and support documents (i.e. stormwater management report, maintenance agreement, etc.) requiring state approval from MMSD and DNR, shall be processed through the Village. After Village review and approval, the documents will be sent to the appropriate state agencies by the Village Engineer.

1.1.13 Two full size and two half size sets of approved complete construction plans which meet all the requirements shall be submitted to the Village at least three working days prior to the preconstruction meeting. Failure to submit plans within the required time frame will result in the cancellation of the preconstruction meeting. These construction plans shall include but not be limited to the following:

- Sanitary Sewer Plans
- Water main and Pump house Plans
- Storm Sewer/Sump Pump Collection System Plans
- Roadway Plans
- Master Grading/Drainage Plans

1.2 Plan Review

1.2.1 Detail Sheet

1.2.1.1 A minimum of three working days shall be required for approval of any revisions or changes to previously approved plans. The approval shall be in writing from the Village Engineer. No construction, related to these proposed revisions or changes shall proceed prior to the approval of such revisions.

1.2.1.2 Preliminary proposed and existing grading plans (with plan view of preliminary sanitary sewer) shall be reviewed prior to all other preliminary construction plans being submitted. Complete detail on detention/retention objectives should be shown.

1.2.1.3 Digger's Hotline number of 1-800-242-8511 shall be noted on the plan set.

1.2.1.4 All requirements of the Village of Germantown Municipal Code, the DNR, and MMSD shall be met.

1.2.1.5 A construction estimate including materials, quantities, and cost will be included with the plans for water, sanitary, roadway, storm water, and grading.

1.2.1.6 A copy of the approved plans shall be submitted to the Village on CD in AutoCAD v2004.

1.2.2 Plan View

1.2.2.1 Lot, block, street, property, $\frac{1}{4}$ section, and easement line shall be shown.

1.2.2.2 Lot and block numbers, subdivision name, and existing physical features shall be shown.

1.2.2.3 Lot or property frontage, street width and easement dimensions shall be indicated.

1.2.2.4 Street names shall be shown.

1.2.2.5 Street centerline shall be indicated.

1.2.2.6 Match lines shall be shown.

1.2.3 Profile View

1.2.3.1 Elevations shall be based on the Village of Germantown datum (USGS) and given to the nearest 0.01 of a foot. Benchmarks used shall be indicated on the plans.

1.2.3.2 Conversion factor to Milwaukee Metropolitan Sewerage District datum shall be shown on the plans. (-580.61')

1.2.4 Signage Plan

1.2.4.1 Sign types, locations, and regulations to be listed and clearly stated.

1.3 Master Grading and Drainage Plans

1.3.1 General

1.3.1.1 Scale of the plans shall be 1" = 100' for the master plan and 1" = 40' for the individual plan sheets.

1.3.1.2 A note shall be prominently placed on each sheet of the Master Grading Plan indicating "The Village of Germantown shall not approve any yard grade change in excess of 0.25 feet."

1.3.2 Plan View shall show the following:

1.3.2.1 Subdivision boundary lines and all lot lines.

1.3.2.2 Adjoining and inclusive roadways and their names.

1.3.2.3 Contour lines at 2-foot intervals. These contour lines shall extend at least 100 feet into adjacent parcels. Contours shall show all offsite drainage that is tributary to the site. Existing contour lines shall be dashed while proposed contour lines shall be solid, with the 10-foot increments in boldface.

1.3.2.4 Existing and proposed culvert locations, invert elevations, sizes, and materials on and within 200 feet of the proposed development.

1.3.2.5 Existing and proposed storm sewer locations, invert elevations, sizes, and materials on and within 200 feet of the proposed development, including catch basins, manholes, and inlets.

1.3.2.6 Location of existing trees.

1.3.2.7 Location of proposed topsoil stockpile.

1.3.2.8 Typical building pad locations and finished floor elevation for each lot, which incorporate setbacks and offsets and show finished yard grade, and exposure grade, if applicable, elevations to the nearest tenth of a foot. If it is desirable to maintain post grading/pre-building construction yard grades low, to not exceed 1.5 feet, it shall be noted prominently on plan.

1.3.2.9 Proposed elevations at all property corners.

1.3.2.10 Show all high points and low points with an elevation.

1.3.2.11 Notes required to properly sequence the construction activities (i.e. erosion and grading which must be done ahead of other operations on site to manage storm water runoff).

1.3.2.12 Specific details on all retention/detention basins, ponds, overflows, etc.

1.3.2.13 Obstructions within the project limits including but not limited to: trees, landscaping, fences, structures, light poles, etc.

1.3.2.14 Finished street centerline elevations shall be indicated at 100-foot stations, all intersections, cul-de-sacs, and other changes in slope. At vertical curves, elevations must be shown at P.V.C.,

P.O.C., P.V.T. and at 25 foot intervals for curves 100 feet long or less. For vertical curves over 100 feet long, elevations at 50-foot intervals along the V.C., plus the P.O.C. and P.V.I.

1.3.2.15 Channel or swale flow-line elevations shall be indicated every 100 feet within public land or easement.

1.3.2.16 Arrows indicating path and direction of sheet flow shall be shown for each proposed lot.

1.3.2.17 Mapped wetland boundaries and 100-year floodplain shall be delineated along with setbacks.

1.3.2.18 Overflow discharge and overland flow path.

1.3.2.19 After finished grading is accomplished, a grading record drawing shall be created and submitted to verify conformance with the approved grading plan. The drawing shall consist of the following:

- A. Use approved grading plan as the base sheet. Denote "record drawing" in bold letters at the top and specify the firm doing the record. Cross out the name of the design firm if different than the firm doing record drawings. Drawings should denote a Record Drawing (As-Built) Date.
- B. Spot elevations in the center of all lot building pads to the nearest tenth of a foot.
- C. Spot elevations at all property corners to the nearest tenth of a foot.
- D. Crossroad culvert invert elevations to the nearest hundredth of a foot.
- E. Flowline ditch elevations at every even station to the nearest tenth of a foot.
- F. Berm elevations to the nearest tenth of a foot.
- G. Spot elevations at all high and low points to the nearest tenth of a foot.
- H. Verify topo lines as directed by the Village Engineer.
- I. Field inlet grate elevations.

1.4 Erosion Control Plan

1.4.1 General

1.4.2 Plans shall conform to Chapter 17 Zoning Code, Section 17.44 Erosion Control of the Municipal Code.

1.4.3 Plans shall conform to The Wisconsin Stormwater Manual and the Wisconsin Construction Site Best Management Practice Handbook.

1.4.4 In certain instances it is accepted to combine the grading and drainage plan with the erosion control plan, as long as all required items are discernible.

1.4.5 Plan View shall show the following:

1.4.5.1 Site boundaries and adjacent lands.

1.4.5.2 Vegetative cover and soil type.

1.4.5.3 The limits of any areas which need special stabilization techniques.

1.4.5.4 Mapped wetland boundaries, 100-year floodplain, and watercourses shall be delineated along with setbacks.

1.4.5.5 Location and dimensions of storm water drainage systems and natural drainage patterns on and immediately adjacent to the site for 200 feet.

1.4.5.6 Locations and dimensions of existing; utilities, structures, roads, highways, paving, lot lines and outlots.

1.4.6 Proposed conditions of the site shall include:

1.4.6.1 Locations and dimensions of all proposed land disturbing activities, including finished topography.

1.4.6.2 Location and dimensions of all temporary soil and dirt stockpiles with erosion control method.

1.4.6.3 Location and dimensions of all construction site sediment and erosion control measures necessary. From the WI Construction Site Handbook, best management practices include the following categories: diverting flow, managing overland flow, trapping sediment in channelized flow, establishing permanent drainageways, protecting inlet trapping sediment during site dewatering, preventing tracking, and others. Construction details should be shown on the plan.

1.4.6.4 Location, dimensions and description of all channels, pipes, structures, basins or reservoirs, or other conveyances proposed to carry runoff to the nearest adequate outlet, including applicable design assumptions and computations. The application, design discharge rate, in cubic feet per second, for each structure, pipe, channel, or conveyance. Design flow velocity for channels and outlets shall be indicated.

1.4.6.5 Areas to be sodded or seeded and mulched or otherwise, stabilized with vegetation, describing type of final vegetative cover. Type and quality of mulch and method of anchoring shall be indicated, as well as seeding mixtures, rates, lime and fertilizer application rate for temporary or permanent seeding.

1.4.6.6 Schedule of anticipated starting and completion date of each land disturbing and land developing activity including the installation of construction site control measures.

1.4.6.7 Provisions for maintenance of the construction site control measures during construction.

1.5 Storm Water Management Plan

1.5.1 General

1.5.1.1 MMSD Rules and Regulations Chapter 13, must be followed for developments that involve an increase of one-half acre or more of impervious surface.

1.5.1.2 DNR Chapters NR 151 and NR 216 must be followed for construction sites with 1 acre or more of land disturbance.

1.5.1.3 The Village's Storm Water Management Guidelines must be followed for developments with > 3,000 SF of land disturbance.

1.5.2 Plan View

1.5.2.1 Highlight drainage basins and specify acres of each basin for existing and proposed conditions. Show contours to determine accuracy of basin.

1.5.2.2 Show time of concentration paths including lengths and slopes.

1.5.2.3 Indicate soil groups and curve numbers.

1.5.2.4 Show detention basin volumes, HWL, overflow location and elevation. Indicate basins with a title to be referenced by details and in the report.

1.5.2.5 Provide detail of basin discharge structure, size, and materials, showing the 2-yr and 100-yr elevations and restrictions.

1.5.2.6 Existing and proposed contours in pond area at one foot contour interval.

1.5.2.7 Flood routing for runoff greater than design capacity.

1.5.2.8 Flood stage elevation of 100 year 24 hour storm event.

1.5.2.9 Accompanying the plan shall be a signed and sealed Detailed Report including a narrative, design assumptions, conclusions, calculations, and recommendations.

1.6 Storm Sewer Plans

1.6.1 Plan View

1.6.1.1 Right-of-way and its width.

1.6.1.2 Lot lines, lot and block numbers and frontages.

1.6.1.3 Name of each roadway and any intersecting roadways in which the storm sewer will be located.

1.6.1.4 Edge of pavement or face and back of curb and sidewalk.

1.6.1.5 All easement limits and widths, including existing and proposed, permanent and temporary.

1.6.1.6 All proposed and existing sanitary sewer and laterals (existing-dashed, proposed-solid).

1.6.1.7 All proposed and existing water main and laterals (existing-dashed, proposed-solid).

1.6.1.8 Proposed size and diameter of manholes, catch basins, inlets, and junction boxes.

1.6.1.9 Inlets at intersections shall be located at the end of the curb and gutter radius.

1.6.1.10 Dimensions showing offset from right-of-way and roadway centerline to the storm sewer. Typically, the storm sewer should be located 10 feet south or west of roadway centerline.

1.6.1.11 Length and diameter of storm sewer between structures, center-center of manholes and other structures shall be dimensioned.

1.6.1.12 Material and size of any existing storm sewer to be tied into.

1.6.1.13 Details of outfall or ditch inlet protection requirements such as rip-rap, end sections or headwalls as needed.

1.6.1.14 Additional details shall include typical manholes, catch basins, inlets, etc.

1.6.1.15 Location of sump pump collection system and construction elevations and details.

1.6.1.16 All obstructions/appurtenances located within the project limits, including, but not limited to: trees, signs, utilities, fences, light poles, structures, etc.

1.6.1.17 A note shall be included that states storm sewer construction shall be according to Standard Specifications for Sewer and Water construction in Wisconsin and Village of Germantown Construction Standards and Specifications, all as latest edition.

1.6.2 Profile view

1.6.2.1 Existing and proposed surface profiles over the storm sewer.

1.6.2.2 The proposed size and diameter of manholes, catch basins, inlets, culverts, and junction boxes.

1.6.2.3 Distances, slope, size, and material of storm sewer shall be labeled between structures.

1.6.2.4 Rim and invert elevations at structures.

1.6.2.5 Invert of storm sewer pipe if different than structure invert elevation.

1.6.2.6 Material and size of any existing storm sewer to be tied into.

1.6.2.7 Sanitary sewer (dashed).

1.6.2.8 Water main (dashed).

1.6.2.9 Backfill material to be used shall be labeled.

1.7 Sanitary Sewer and Water Main Plans

1.7.1 General

1.7.1.1 Sanitary sewer and water main may be shown on the same sheet and bound in one set.

1.7.1.2 Plans shall state that construction shall be according to Standard Specifications for Sewer and Water Construction in Wisconsin, and the Construction Standards and Specifications of the Village of Germantown.

1.7.2 Plan View

1.7.2.1 Right-of-way and its width.

1.7.2.2 Lot lines, lot and block numbers and frontages.

1.7.2.3 Edge of pavement or face and back of curb and sidewalk where applicable.

1.7.2.4 All easement limits and widths; easements shall be a minimum of 20 feet wide.

1.7.2.5 Proposed water main pipe diameter, hydrant, valve and lateral locations. (existing-dashed, proposed-solid).

1.7.2.6 Existing water facilities on, or adjacent to, the development. This shall include material and size of any existing water main.

1.7.2.7 Proposed sanitary sewer manholes, pipe slopes and center-to-center distances between manholes, pipe diameter, laterals, and rim and invert elevations. (existing-dashed, proposed-solid).

1.7.2.8 Existing sanitary facilities on, or adjacent to, the development. This shall include material and size of any existing sewer.

1.7.2.9 Sanitary sewers shall generally be located at the centerline of the street. Water mains shall be located 10 feet to the north or east of centerline of the street.

1.7.2.10 Dimensions showing offset from right-of-way to the sewer line and water line. Dimensions shall also show the separation between the sanitary sewer, water main, and other utilities.

1.7.2.11 Length of each sanitary sewer lateral and length of any lateral risers.

1.7.2.12 Elevations of sewer and water shall refer to flowline or invert of pipe.

1.7.2.13 Name of each roadway and any intersecting roadways in which the sanitary sewer will be located.

1.7.2.14 All manholes, valves, and hydrants should be labeled.

1.7.2.15 Proposed or existing storm sewer and appurtenances (existing-dashed, proposed-solid).

1.7.2.16 All improvements are stationed.

1.7.2.17 All obstructions/appurtenances located within the project limits including but not limited to trees, signs, utilities, fences, light poles, structures, etc.

1.7.3 Profile View

1.7.3.1 Existing and proposed surface profiles over the sanitary sewer.

1.7.3.2 The proposed label, diameter, rim and invert elevations of sanitary sewer manholes (inches) for existing and proposed.

1.7.3.3 Invert of sanitary sewer pipe if different than structure invert elevation.

1.7.3.4 Pipe material, slope and diameter of sanitary sewer between each manhole as plus or minus foot per foot.

1.7.3.5 Center-to-center distance between manholes.

1.7.3.6 The proposed water main pipe material and its diameter.

1.7.3.7 Center of hydrant nozzle, and hydrant shoe elevations shall be indicated.

1.7.3.8 Limits of gravel, spoil, and/or slurry backfill.

1.7.3.9 Proposed or existing storm sewer and appurtenances (existing-dashed, proposed-solid).

1.7.3.10 Crossings with existing or proposed underground improvements shall be drawn with the name, diameter, elevation and station indicated.

1.7.3.11 Material and size of any existing sanitary sewer and water main to be tied into.

1.7.3.12 Stationing shall be done for all appurtenances.

1.7.3.13 Areas of concrete cradle and envelope shall be dimensioned and labeled.

1.8 Roadway Plans

1.8.1 General

1.8.1.1 Typical roadway cross-sections shall be shown on the Plan and Detail sheets. Cross-sections details shall also be shown for a typical cul-de-sac and an "eyebrow".

1.8.1.2 Elevations shall refer to finished centerline grade.

1.8.1.3 Plans shall state that paving construction shall be according to WIS DOT Standard Specifications for Road and Bridge Construction, latest edition.

1.8.2 Plan View

1.8.2.1 Right-of-way and its width.

1.8.2.2 Edge of pavement face and back of curb and sidewalk.

1.8.2.3 Stationing along the centerline of the roadway, including cul-de-sacs and "eyebrows".

1.8.2.4 Stations shall be indicated by tick marks along the centerline and every station shall be labeled.

1.8.2.5 Width of pavement.

1.8.2.6 Lot lines, numbers and frontage lengths.

1.8.2.7 Name of each roadway and any adjoining roadways.

1.8.2.8 Curb radii shall be dimensioned to the back of curb (25 ft. radius is the minimum acceptable.)

1.8.2.9 Flange lines and back-of-curb lines shall be drawn.

1.8.2.10 Flange elevations shall be shown at the beginning, end, and change of slope, at all curb and gutter sections, cul-de-sacs, and warped pavement sections. Length of curve and slope shall also be shown.

1.8.2.11 Specific details of all existing roadways being connected to. Pavement, shoulders, ditches, curb alignment and grades shall be shown as needed to adequately make the transition.

1.8.2.12 All driveways within 500 feet of the proposed development.

1.8.2.13 All roadside ditch locations, flow line elevations at 100 foot intervals, and slope of the ditch.

1.8.2.14 All obstructions/appurtenances located within the project limits including but not limited to: trees, signs, utilities, fences, light poles, structures, etc.

1.8.3 Profile View

1.8.3.1 Existing and proposed roadway profiles along centerline of roadway, cul-de-sacs and "eyebrows".

1.8.3.2 Stationing and final centerline grades at all fifty and hundred foot stations and at all grade breaks. All stations shall coincide with accented vertical lines.

1.8.3.3 Proposed grades and stationing shall be shown at each station, at intersections, at street lines extended and at 25 foot intervals, P.C., P.T., and P.I., of vertical and horizontal curves.

1.8.3.4 Slopes shall be indicated as plus or minus foot per foot.

1.9 Preliminary Plat

1.9.1 Two (2) copies of a preliminary plat shall be submitted with the other required preliminary plans for initial review.

1.9.2 Three (3) copies of an approved preliminary plat conforming to Section 236.11 (1)(a) of the Wisconsin Statutes shall be required at least three days prior to the start of any construction.

1.10 Final Plat

1.10.1 The final plat will not be certified by the Village until conditions of the development agreement are met.

1.10.2 One (1) full size 24" x 36" and one (1) 8½"x11" 200 scale copy of the final plat on 4 mil thick double matte mylar conforming to Section 236.25 (2)(c) and (d) of the Wisconsin Statutes shall be submitted to the Village within 10 days of recording. Copies shall be a black line mylar. A digital file compatible with AutoCad 14 in DWG format shall also be submitted.

1.10.3 The AutoCad digital plat will be mapped using the Wisconsin State Plane Coordinate System – South Zone and based on the North American Datum of 1927. All construction plans and record documents will be based on this same survey requirement. The coordinates of all section and quarter section monuments are available from the Village Engineering Department.

1.11 Plan Set Submittal Schedule

1.11.1 Village of Germantown

1.11.1.1 When submitting plans to the Village for: sanitary sewer, water main, storm sewer, paving, grading, and erosion control, provide the following number of plan sets:

- A. For the FIRST submittal, the plans shall go through the Village Planner and receive Village board approval. Their requirements shall be followed.
- B. For each SUBSEQUENT submittal after approval by Village Board, two (2) copies of each plan set.
- C. For the FINAL submittal, two (2) copies of each plan set.

1.11.1.2 The Village must be copied on all correspondence to and from governing agencies including MMSD, DNR, ACOE.

1.11.2 Sanitary Sewer Plan Submittal to MMSD/DNR

1.11.2.1 Sanitary Sewer submittals shall follow the requirements of NR 110 and all other chapters, along with MMSD Chapter 2.

1.11.2.2 Projects eligible for DNR 'Fast-Track'

- A. Five (5) copies of plans and specifications (plans and specifications need signature and seal of designer)
- B. Two (2) copies of the relevant system plan
- C. Two (2) copies of the design computations (not required for 8-inch diameter sanitary sewers designed to carry a peak flow less than or equal to 0.7 cubic feet per second (cfs) when ½ full)
- D. SEWRPC 208 letter indicating conformance with regional land use plans (sanitary extensions only)
- E. For public sewer systems, the following WDNR forms:
 - 3400-59 Sanitary Sewer Extension Submittal
 - 3400-95 Sewer Specification Checklist
 - 3400-105 Acknowledgement of Receipt by DNR
 - 3400-160 Fast-Track project approval request and approval letter
 - 3400-168 (only necessary if lift station included)
- F. One (1) transmittal letter/Village approval letter
- G. One (1) MMSD Sewer Plan Review Request form

1.11.3 Projects not eligible for 'Fast-Track'

1.11.3.1 Six (6) copies of plans and specifications (plans and specifications need signature and seal of designer)

1.11.3.2 Two (2) copies of the relevant system plan

1.11.3.3 Two (2) copies of the design computations (not required for 8-inch diameter sanitary sewers designed to carry a peak flow less than or equal to 0.7 cubic feet per second (cfs) when ½ full)

1.11.3.4 SEWRPC 208 letter indicating conformance with regional land use plans (sanitary extensions only)

1.11.3.5 For public sewer systems, the following WDNR forms:

- A. 3400-59 Sanitary Sewer Extension Submittal
- B. 3400-95 Sewer Specification Checklist
- C. 3400-105 Acknowledgement of Receipt by DNR
- D. 3400-168 (only necessary if lift station included)

1.11.3.6 One (1) transmittal letter/Village approval letter

1.11.3.7 One (1) MMSD Sewer Plan Review Request

1.11.4 Any additional data or documents required by MMSD or DNR shall be furnished by the consulting Engineer.

1.11.5 Water main Plan Submittal to DNR

1.11.5.1 Water Main Extensions shall follow the requirements of NR 811 and all other applicable chapters.

- A. One copy of the cover letter/Village approval letter.
- B. One set of plans and specifications.
- C. Form 3400-105 Acknowledgement of Receipt by DNR
- D. Form 3300-66 Water Main Submittal Checklist

1.11.6 Any additional data or documents required by MMSD or DNR shall be furnished by the consulting Engineer.

1.11.7 Storm Sewer Submittal to MMSD

1.11.7.1 Storm Sewer shall follow the requirements of Chapter 2.

- A. One copy of the cover letter/Village approval letter.
- B. One copy of the plans and specifications.
- C. One copy of the relevant system plan
- D. One copy of the design computations.

1.11.8 Storm Water Management Plan Submittal to MMSD/DNR

1.11.8.1 An electronic copy of the Storm Water Management Plan shall be submitted to MMSD via Sharepoint and shall follow the requirements of Chapter 13 and the Surface Water and Storm Water Rules.

1.11.8.2 Construction activities that disturb more than 1 acre of land must apply for an NOI and an NOT from the DNR and shall follow the requirements of NR 216 and NR 151.

1.11.8.3 Chapter 30 permits and Water Quality permits shall be obtained as required. ACOE permits for work in wetlands shall also be obtained.

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2 WATER SYSTEM

All labor and material shall be governed by requirements of the latest edition and all amendments thereto of the Standard Specifications for Sewer and Water Construction in Wisconsin (SWS), Public Service Commission (PSC) Rules and Wisconsin Department of Natural Resources (WDNR) Regulations, unless otherwise specified in these Specifications, whichever is more restrictive.

2.1 SPECIFICATIONS

2.1.1 WATER MAIN PIPE

2.1.1.1 MATERIALS

2.1.1.1.1 All pipe used for water main shall comply with SWS and the following:

- A. 6" PVC – Hydrant leads
- B. 8" PVC or Fusible PVC C-900 and/or C90/RJIB Certa-Lok
- C. 12" PVC or Fusible PVC C-900 and/or C90/RJIB Certa-Lok
- D. 16" PVC or Fusible PVC C-900 and/or C90/RJIB Certa-Lok
- E. Sizing of private mains requires approval by the Village Engineer.

2.1.1.1.2 PVC or PVCO water main for sizes 4" through 16" diameter, excepting service laterals shall conform to the OD of Ductile Iron pipe and be AWWA C-900 or AWWA C-909, Class 150 or 200, DR-18 or -14. Must conform to Standard Specifications Ch. 4.6.0 and 8.20.0. All pipe shall be furnished with Push-On type integral elastomeric bell-spigot joints. USA manufactured products only.

2.1.1.1.3 Fire and Combination Fire/Water service lines from the connection at the main to the backflow prevention device connection, shall be:

- A. PVC/PVCO for sizes 3" through 12" diameters only, conforming to the OD of Ductile Iron pipe, AWWA C-900 or AWWA C-909, Class 200, DR-14
- B. All pipe shall be furnished with Push-On type integral elastomeric bell-spigot joints.

2.1.1.2 DESIGN STANDARDS

2.1.1.2.1 Main sizes (Minimum).

- A. Residential: 8" minimum

- B. Multifamily and commercial : 12" subject to Village Engineer approval.
- C. Industrial: 12" subject to Village Engineer approval.

2.1.1.2.2 Watermain Location

- A. In streets & easements: 10 feet from sanitary sewer; north and east.

2.1.1.2.3 Watermain Bury Depth/Pipe Design Cover

- A. Turf – 6.5 feet (Ultimate grade);
- B. Paved Areas - 7 feet minimum
- C. Special situations (i.e.: ditches, etc.)- 5 feet minimum cover with insulation.
- D. Under 4 feet of cover water main must be offset to achieve 6 foot cover.

2.1.1.2.4 Tracer wire installation is required on all water mains, branches, and services.

2.1.2 WATER SERVICES

2.1.2.1 MATERIALS

2.1.2.1.1 Sizes thru 2" diameter shall be of one manufacturer only, as follows:

- A. Service Lines
 - i. CTS Copper Tube or PVC
 - ii. 250 psi pressure rated, SDR-09,
 - iii. copper tube size, ASTM D-2737, NSF 14, AWWA C-901
 - iv. with tracer wire run to the building
 - v. There shall be no joints between the corporation valve and curb stop and no joint between the curb stop and meter horn valve.
 - vi. Laying length of PVC lines shall afford enough slack to allow for thermal contraction of the plastic and in such manner as to avoid placing it under any undue tension.
- B. Fittings
 - i. Terminal couplings on PVC services shall be made with a pressure tight joint with a Buna-N beveled gasket, and stainless steel insert sleeve equal to Ford 50-series, and compression fitting which includes a grooved clamp equal to:
 - a. USA manufactured products only.
- C. Valves
 - i. Corporation (Ball) Valves: Mueller B-25008N; Ford FB1000-Q-NL; A.Y. McDonald 74701BQ.
 - ii. Curb (Ball) Valves: Mueller B-25155N; Ford B44-Q-NL; A.Y. McDonald 76104T.
 - iii. Curb Boxes: (Minn. Pattern) Mueller H-10300 and H-10302; Ford E.M. 2-65-56/57 and 2-70-56/57; A.Y. McDonald 5614/15.
 - iv. Poly wrap the box and all exposed brass. Any curb stop valve that cannot be keyed with a standard 8' curb stop wrench will be required to install a stainless steel curb stop rod extension, so an 8' curb stop key can be used.

2.1.2.1.2 Sizes 3" diameter and larger shall be as follows for Service Lines, Valves, and Fittings:

- A. Connection to Main: Anchoring tee with service line valve anchored to the main branch tee or tapping sleeve and reducing fitting, when appropriate.

- B. Lines: Per "Water Main – Materials" section.
- C. (Curb) Valves: Per "Valves – Materials" section.
- D. Valve Boxes: Per "Valve Boxes – Materials" section.
- E. Fittings: Per "Fittings – Materials" section.

2.1.2.1.3 All stop boxes and service valves shall be exposed, plumb, clean, and operable, when initially installed during new construction, as well as during rehabilitation or repaving projects.

2.1.2.2 DESIGN STANDARDS

2.1.2.2.1 Location, as you face the property, shall be to the left of the sanitary sewer lateral. Each habitable building shall have its own unshared service connection to the main.

2.1.2.2.2 On new construction, curb stop shall not be located within 5 feet of the driveway.

2.1.2.2.3 Water services shall have a trench check dam installed on the property side of the curb stop. See Specification 2.1.3 and Detail Figure 20.

2.1.2.2.4 Pipe design cover:

- A. Turf (Ultimate grade) - 6 feet minimum
- B. Paved areas - 7 feet minimum
- C. Special Situation (i.e.: ditches, etc.) - 5 feet minimum cover with insulation
- D. Under 4 feet of cover water main must be offset to achieve 6 foot cover.

2.1.2.2.5 Following sizes are minimums, larger sizes may be required based upon fixture units and point of service pressure:

Type	Distance (building to main)	No. Of Units	Size
Single Family	<55'		1 ¼" ID
	>55'		1 ½" ID
Two Family	<55'		1 ½" ID
	>55'		2" ID
Multi-Family		<=4	2" ID
		<=8	4" ID
		<=12	4" ID
		<=24	6" ID
		<=48	8" ID
Commercial			2" ID
Industrial			2" ID

2.1.2.2.6 Laterals 2" diameter and smaller may be installed in common trench with the sanitary sewer; Place the shut off at the (future) ROW or easement line.

2.1.2.2.7 Laterals greater than 2" diameter shall be installed a minimum of 8.0 feet away from sanitary or storm laterals; place the shut off at the water main connection tee.

2.1.2.2.8 Generally, PVC service lines shall be installed in accordance with SWS Chapters 5.1.0, 5.2.0 and 5.5.0, and File Nos. 50 & 51, and the following requirements:

- A. PVC service pipe 1½" diameter and smaller shall be installed with NO coupling or joint from the corporation stop to the curb stop valves, and the run from the curb stop valve to the meter horn.
- B. PVC service pipe 1½" and 2" diameter shall be installed with NO coupling or joint from the corporation stop to the curb stop valve, and the run from the curb stop to the meter horn. In the event of a run greater than 55 ft., then the shortest pipe length shall be 20 ft.

2.1.2.2.9 Existing laterals not used in a development shall be abandoned at the main when a development, land division or building razing occurs. See Section 2.2 regarding Abandonment.

2.1.3 TRENCH CHECK DAM

2.1.3.1 MATERIALS

2.1.3.1.1 Clay material shall have no organic material and shall be compacted to 95 percent standard proctor. Or;

2.1.3.1.2 Pre-approved equals such as: AquaBlok®, slurry and others.

2.1.3.2 DESIGN STANDARDS

2.1.3.2.1 Trench check dam shall be installed on all water services.

2.1.3.2.2 The check dam shall be located on the property side of the curb stop.

2.1.3.2.3 See Detail Figure No. 20.

2.1.4 VALVES

2.1.4.1 MATERIALS

All valves shall be Resilient type; acceptable valves are:

2.1.4.1.1 Butterfly Valves - for 16" and larger diameters, conforming to AWWA C504-94, stems sealed by at least two O-Rings, and worm gear operators for 2" square valve key operation from above, turn left (CCW) to open. Install with operating nut on North or East side of water main. Acceptable valves include:

- A. M & H 4500
- B. Pratt Groundhog
- C. Mueller LineSeal III-3211-20 or XP-5227-20, or

D. Pre-approved equal.

2.1.4.1.2 RW Gate Valves - for 10" and smaller diameters, conforming to AWWA C-509-94, non-rising stems sealed with two O-Rings, MJ ends (or MJ-F), turn left (CCW) to open, 2" square operating nut. Acceptable valves include:

A. Clow R/W

B. Kennedy R/W – 4571

C. Mueller R/W A-2361 or 2362

D. Pre-approved equal.

2.1.4.1.3 All exposed and non-epoxy coated bolts and nuts on hydrants and valves shall be stainless steel; T-Bolts shall be Cor-Blue or have a fluoropolymer coating as pre-approved by the Village Engineer.

2.1.4.1.4 All valves shall be furnished with interior and exterior epoxy coatings per AWWA C-550-90. All valves not installed in vaults or manholes shall be installed per SWS File No. 37, and shall be wrapped with polyethylene per Section 2.1.10 of these Specifications.

2.1.4.2 DESIGN STANDARDS

2.1.4.2.1 Valve locations.

A. On all legs of branch lines: Mega-lugged to watermain

2.1.4.2.2 Maximum spacing between valves:

A. At each intersection.

B. Every 800 feet.

C. Not greater than 24 residential equivalent units. (i.e.: 24 SF units; 3 – 8 Family Units).

2.1.5 VALVES BOXES

2.1.5.1 MATERIALS

2.1.5.1.1 Valve boxes shall be cast iron, manufactured in the USA, and shall properly accommodate the selected valves. Acceptable manufacturers are:

A. Tyler Series 6860 US Domestic

B. Pre-approved equal.

2.1.5.1.2 Valve & enclosure type.

Size	Box	Type	Manhole Vault
4"	YES	RW-GV	
6"	YES	RW-GV	
8"	YES	RW-GV	(Special Circumstances)
12"	YES	RW-GV	(Special Circumstances)
16"	YES**	RW-BV	(6 Foot Diameter Option**)

2.1.5.1.3 All valve boxes deeper than 8.0 ft. from top of the operating nut to finish grade shall have solid extension rods with a centering ring. The stainless steel extension rod shall be pinned to operating nut as approved by the Utility Department. In these cases, if there is no hydrant to run tracer wire up, install at the end of the water main 2' inline with the main shut off valve inside a 6860 top section set on bricks.

2.1.5.1.4 A valve box #6 base adaptor by Adapter, Inc., or pre-approved equal, shall be furnished as part of the complete valve box for direct-bury gate & butterfly valves.

2.1.5.1.5 Top sections of valve boxes shall be whole factory lengths. Breaking of the top section to shorten its length is not acceptable.

2.1.5.1.6 Screw-in risers are acceptable and preferred. Slip in risers may be used with prior approval.

2.1.5.1.7 Valve box cover shall be a 5-1/4" "MWW" drop in lid with the word "Water" stamped on the top surface.

2.1.5.1.8 All valve boxes shall be wrapped with polyethylene per Section 2.1.10 of these Specifications.

2.1.5.1.9 All valve boxes shall be installed straight and plumb when initially installed during new construction, as well as during rehabilitation or repaving projects. The top of the valve box shall be set 3/8" – 1/2" below pavement grade to avoid damage from snowplows and streets cleaning equipment.

2.1.5.1.10 Valve boxes shall be operable, cleaned and free of debris after installation, after rehabilitation or repaving projects or after any work done by non-Utilities and Streets Department personnel.

2.1.5.1.11 Adjustment to road boxes can be made using slip type, screw insert type and/or slip rings to accommodate a 5 1/4" lid. Smaller than 5 1/4" will not be allowed.

2.1.6 VALVE VAULTS

2.1.6.1 MATERIALS

2.1.6.1.1 When designated on the plans or required by the Village Engineer, valve vaults/manholes shall be installed in accordance with this Section.

2.1.6.1.2 All manholes shall be pre-cast concrete with integral base and reinforced concrete flat slab top, or approved equal.

2.1.6.1.3 All pre-cast manhole barrel joints shall be made with preformed butyl rubber gasket material (ie. 'Easy Stik' or equal).

2.1.6.1.4 All manhole steps shall comply with SWS, Section 8.40.1.A or B.

2.1.6.1.5 All pre-cast manhole barrel sections shall be rotated to align all manhole steps vertically in the manhole.

2.1.6.1.6 All manhole lids shall be equal to Neenah R-1900-D with gasketed lid.

2.1.6.1.7 All frame/casting adjusting rings shall be reinforced concrete rings having 36" I.D. The minimum height for a chimney section shall be the height associated with the proper placement of one 2" adjusting ring. The maximum height of adjusting rings above the cone as measured from the slab top is 16". If more than 16" of adjusting rings are needed to set the casting to finished grade, then an additional barrel section shall be installed on the manhole. Paving rings which have an adjustable diameter are not allowed.

2.1.6.1.8 All chimney joints, including the frame-chimney joint, and all barrel & cone section lifting holes shall be sealed with a premixed, non-metallic, high-strength, non-shrink cementitious grout such as Pennegrout by IPA Systems, or approved equal, which meets requirements of ASTM C-1-91 and C-827 as well as CRD C-588 and C-621.

2.1.6.1.9 Waterproofing mastic shall be placed over all lift holes and exterior of manhole chimneys that are approved to remain raised above existing grade. Trowelable grade mastic, Tremco 60 or approved equal, shall be applied to a minimum 50 mil WFT.

2.1.6.1.10 An external sealing wrap shall be placed at all joints between pre-cast manhole sections. The external sealing wrap shall meet, or exceed, the requirements of ASTM C-877, Type II. External joint seals shall be MacWrap, as manufactured by Mar-Mac Manufacturing Co. Inc. or pre-approved equal.

2.1.6.1.11 Coal-tar epoxy coating (two coats @ 8.0 mils DFT each) shall be applied to the exterior of ALL manholes in accordance with SWS 8.7.0. Alternate waterproofing materials and application may be pre-approved by the Village Engineer.

2.1.6.1.12 Pipe-Manhole Connection device shall be Kor-N-Seal boot with stainless steel Snap-In banding rings or pre-approved equal.

2.1.6.2 Sample Station

2.1.6.2.1 Eclipses #88SS SMPL STN 7'-0" Extreme Cold

2.1.6.2.2 Installed with its own water curb stop and curb box

2.1.6.2.3 Reference detail 21.

2.1.7 HYDRANTS

2.1.7.1 MATERIALS

2.1.7.1.1 Acceptable Manufacturers are:

- A. Clow Medallion UL/FM
- B. Kennedy Guardian K-81 UL/FM
- C. U.S. Pipe-Sentinel 250
- D. Pre-approved equal.

2.1.7.1.2 All hydrants shall be provided as follows:

- A. MJ connection
- B. Turn left to open
- C. depth of bury 6.5'
- D. Painted Brite Hydrant Red (5 mil DFT)
- E. Break flange (traffic) type
- F. 5.25" main valve opening
- G. Two 2.5" hose nozzles
- H. One 4.5" pumper nozzle
- I. One 4' long fiberglass, red reflective tape and white reflective tape with spring hydrant marker. Part #35000W (R&W)-10501

2.1.7.1.3 If during installation and construction the village deems the coating has been compromised. It will be sand blasted and repainted per section 2.1.7.1.8 at the contractor's expense.

2.1.7.1.4 Hydrant leads shall be six (6) inch, C900.

2.1.7.1.5 Tapping saddle will be an all stainless steel Smith Blair 663 with a stainless steel MJ outlet or Romac SST-MJ stainless steel MJ outlet or equal use core-10 blue bolts. Poly wrap fitting, valves. With Valve box-Tyler only - #6860/MWW lid, Adaptor Inc. #6 base adaptor.

2.1.7.1.6 All fasteners will be stainless steel on all valves and hydrants and on all MJ fittings will be, Cor-Blue T-bolts Birmingham Fastener or equal.

2.1.7.1.7 Contractor shall provide for a 6.5' burial depth for all hydrant leads shown on plans. If a water main burial depth is greater than 6.5', Contractor shall install fitting(s) to raise the hydrant lead to meet the required burial depth.

2.1.7.1.8 Hydrants that are not placed in service shall have a "Not in Service" tag attached to the pumper nozzle and baggy wrapped and tapped.

2.1.7.1.9 Preparation for painting – Sandblast to 100% clean white metal from ground level up to top of hydrant. Dispose of spent materials. Fully enclose hydrant during blasting, priming, and painting. Air dryer must be used to prevent moisture in the air supply.

2.1.7.1.10 Primer-Devoe 224 high build epoxy primer (or Engineer-approved equal) to a thickness of 4-8 mils (1 mil = 25.4 millimeters).

2.1.7.1.11 Topcoat – Devoe 379UVA urethane epoxy (or Engineer-approved equal) with a minimum thickness of 4 mils. All hydrants must be fully enclosed during blasting, priming, and painting.

2.1.7.2 DESIGN STANDARDS

2.1.7.2.1 Location:

- A. Maximum spacing: 400-ft. diameter from center of hydrant to center of hydrant. If different spacing is required, verify differing condition with Village Engineer and Fire Chief.
- B. At all high points in distribution system.
- C. At intersections, far end of cul-de-sac at lot line extended, and mid-block at lot line extended, where practical. In the event a hydrant location conflicts with a valve location at an intersection, the hydrant tee shall be located 6 feet away from the main valve.
- D. Rural: 3 feet off Right-of-Way. Provide 5-ft. deep x 10-ft. wide hydrant easement.
- E. Urban: 4 feet behind back of curb line.
- F. Side paths, recreation trails and other pedestrian ways: Minimum separation distance from edge of pathway to closest physical feature of the hydrant shall be 18".

2.1.7.2.2 Design height: Pumper nozzle above surrounding finish ground = 18" to 24".

2.1.7.2.3 Design cover: 6.5 feet minimum bury.

2.1.7.2.4 Branch pipe design cover:

- A. Turf – 6.5 feet (Ultimate grade);
- B. Paved Areas - 7 feet minimum
- C. Special situations (i.e.: ditches, etc.) - 5 feet minimum cover with insulation.
- D. Under 4 feet of cover water main must be offset to achieve 6 foot cover.

2.1.7.2.5 Break flange must be at grade or not greater than 6 inches above grade.

2.1.7.2.6 Branch tee shall be Anchor T with gate valve at the tee.

2.1.7.2.7 An asphalt service drive with culvert shall be installed in all ditch crossings greater than 2.0 feet deep or that have traverse slopes greater than 4H:1V.

- A. The service drive shall be 10 feet wide and extend to 2 feet behind the hydrant. The drive shall be constructed with 10 feet wide by 6" deep of No.2 open graded base course and 10 feet wide by 3" depth of asphalt.
- B. Culverts shall be hydraulically sized for each location consistent with Section 4 of the Development Handbook.

2.1.8 FITTINGS

2.1.8.1 MATERIALS

2.1.8.1.1 All pipe fittings used for water main shall comply with SWS and be manufactured in the USA.

2.1.8.1.2 All fittings shall be Ductile Iron and be Class 350 or greater, conforming to the current ANSI/AWWA C-153/A21.53.

2.1.8.1.3 Fittings shall have a cement mortar lining on the interior in accordance with current (USA Domestic Only) ANSI/AWWA C-104/A21.4.

2.1.8.1.4 Fittings and accessories shall be furnished with mechanical-type joints with lugged retainer glands in accordance with current (USA Domestic Only) ANSI/AWWA C111/A21.11.

2.1.8.1.5 All nuts and bolts shall be stainless steel on hydrants and valves. All T-Bolts shall be Cor-Blue.

2.1.8.1.6 All tees and fittings shall be anchored with restraints or pre-approved equal.

2.1.8.1.7 Angle Fittings shall be as follows:

- A. All 90° bends: Full body, long radius, anchored, and mega-lugged or buttressed.
- B. Other Angle Fittings: Short body acceptable; anchored and buttressed.

2.1.8.1.8 Acceptable Manufacturers of Ductile Iron pipe fittings include the following:

- A. American Cast Iron Pipe Co.
- B. Clow Water Systems, Co.
- C. Tyler Union
- D. Water Main Couplers
- E. Hymax 4"-16"
- F. Romac 4"-12"

2.1.8.1.9 Acceptable restraints include the following:

- A. EBAA Mega-lug
- B. Romac Roma Grip
- C. Or approved equal

2.1.8.2 DESIGN STANDARDS

2.1.8.2.1 All fittings shall be wrapped with polyethylene per Section 2.1.10 of these Specifications.

2.1.9 WATER METERING REQUIREMENTS

2.1.9.1 DESIGN STANDARDS

2.1.9.1.1 Refer to Village of Germantown Code Chapter 13.37 for general requirements.

2.1.9.1.2 Two-Family units shall require a split service lateral into the building in accordance with Standard Detail Figure No. 19.

2.1.9.1.3 Multi-Family Condominium buildings: A water metering room shall be required at the water service entrance location. Each water meter room shall be designed to meet the requirements of the Germantown Water Utility, including an outside doorway. An entry key shall be provided to the Germantown Water Utility. An individual meter required for each unit.

2.1.9.1.4 Multi-Tenant Commercial and Industrial buildings: A water metering room shall be required at the water service entrance location. Each meter room shall be designed to meet the requirements of the Germantown Water Utility, including an outside doorway. All commercial and industrial buildings shall have ball valves installed on the inlet, outlet, and bypass for water meters. An entry key shall be provided to the Germantown Water Utility. An individual meter required for each unit.

2.1.9.1.5 The water meter room shall:

- A. Be large enough to allow work on the water meters. The size of the meter room would vary depending on the meter size(s) and number of meters going into the building. The Utility Department must approve the size of the meter room.
- B. Be unobstructed by water softeners, vacuum cleaners, garbage cans, electric service, phone services, etc.
- C. Not be used for cleaning supply storage or storage area.
- D. Have adequate heating and lighting
- E. Have a floor drain
- F. The size of the water meter shall be on the plan to make sure the room is big enough to house the entire meter.
- G. Not installed in a ceiling
- H. Minimum 2'-3' off the floor
- I. If meter is installed in a cabinet, minimum 2'x2' removable opening.

2.1.9.1.6 At the meter setting 1"-2" valves will be all brass USA made only, full port ball valves and brass nipples, 600psi rated Nibco T-585-70 or equal.

2.1.9.1.7 All gate valves used for branch piping at the meter setting inlet, outlet, and bypass piping 3" and greater will be AWWA resilient wedge epoxy coated C509, NRS (non-rising stem). MJ connection and flanged face at the meter, all stainless-steel bolts and washers-install anti-corrosive agent on threads.

2.1.9.1.8 Irrigation and/or Sprinkler Meter:

- A. Must be connected prior to the main water meter of the residence or building.
- B. Shall not be connected after the main meter under any circumstances.

2.1.10 POLYETHYLENE WRAP

2.1.10.1 MATERIALS

2.1.10.1.1 Polyethylene film materials shall comply with SWS, Chapter 8.21.0.

2.1.10.1.2 Wrap all ductile iron pipe, valves, fittings and valve boxes with polyethylene film.
When wrapping valve boxes, only wrap the bell portion and the bottom of the first section.

2.1.11 TRACER WIRE

2.1.11.1 MATERIALS

2.1.11.1.1 Open cut-Tracer wire will be Copperhead #1230-HS-30mil

2.1.11.1.2 Directional drilling/boring – Copperhead SoloShot #1245-EHS

2.1.11.1.3 Pipe bursting – Copperhead SoloShot Extreme – 7x7 stranded

2.1.11.1.4 Terminate wire at the back side of each hydrant inside 3" x 4' PVC pipe with a threaded cap if no hydrant is available install wire/s inside a separate Tyler #6860 top section set on bricks road box location field verified. All wires will have a minimum of 2' slack.

2.1.11.1.5 All mainline tracer wires must be interconnected in intersections, at mainline tees and mainline crosses.

2.1.11.2 DESIGN STANDARDS

2.1.11.2.1 Tracer Wire Required on ALL mains and services:.

2.1.11.3 INSTALLATION

2.1.11.3.1 Open cut-Tracer wire will be Copperhead #1230-HS-30mil.

2.1.11.3.2 Directional drilling/boring-Copperhead SoloShot#1245-EHS

2.1.11.3.3 Pipe bursting-Copperhead SoloShot Extreme-7x7 stranded

2.1.11.3.4 Terminate wire at the back side of each hydrant inside 3" x 4' PVC pipe with a FNPT x Spigot

2.1.11.3.5 PVC DWV clean-out adapter with plug and threaded cap

2.1.11.3.6 if no hydrant is available install wire/s inside a separate Tyler top section set on brick #6860

2.1.11.3.7 Road box location field verified. All wires will have a minimum of 2' slack.

2.1.11.3.8 All mainline tracer wires must be interconnected in intersections, at mainline tees and mainline crosses

2.1.11.3.9 Tracer wire splicing and connecting to existing tracer wires will use a Copperhead 3-Way Twist lock water proof connector for 30mil for direct bury-Part #LSC1230B-CTR25. And at the hydrant lead us a "Service lateral lug" connector Part #3WB-01

2.1.11.3.10 At the termination points install ground rod Copperhead #ANO-12. Connect the red wire to the blue tracer wire inside the 3" tube with a wire nut to accommodate this wire size.

2.1.11.3.11 If no hydrant is available install wire inside a separate Tyler top section set on brick #6860 road box location field verified

2.1.11.3.12 Install tracer wire from main to the building using "Copperhead" 1230-HS-Blue wire connect the new tracer wire to existing wire at the main using a Copperhead lockable water proof connector for direct bury.

2.1.11.3.13 Service Laterals-Terminate tracer wire by building using Copperhead ANO-12 termination rod, connect the red termination wire to the blue tracer wire using a standard wire nut sized for this wire and install the two wires in a 3" X 4' long PCV tube with thread cap. The exposed end needs to be a minimum of 6"-12" visible after finished grade.

2.1.11.3.14 If tracer wire does not exist at the main, install the wire with the service and terminate wire at the main using a Copperhead ANO-12 termination rod. Splice the red wire with the blue wire using a Copperhead lockable water proof connector for direct bury.

2.1.11.3.15 Proper stripping of HDPE coating will be made using an approved electrical stripping tool, NOT a pocket knife.

2.1.11.3.16 Service Lateral private property-Connect the red wire from the grounding rod and the blue tracer wire using a Copperhead water proof connector-no ANO-12 termination is needed at the building.

2.1.11.3.17 Install tracer wire in a 3" X 4' long PVC tube with thread cap. . The exposed end needs to be a minimum of 6"-12" visible after finished grade.

2.1.11.3.18 Testing-All new tracer wire installation shall be located using a low frequency line tracing equipment, witnessed by the inspector/owner/engineer. This verification shall be performed after rough grading and before finished grade and asphalt.

2.1.12 TAPPING

2.1.12.1 MATERIALS

2.1.12.1.1 Service saddles shall be used on all corporation valve sizes larger than 1", subject to specific pipe manufacturer restrictions for the pipe to be tapped. Saddles shall be all 304 stainless, double bolt saddle. Acceptable products for service sizes through 2" corps include:

- A. Romac SS1
- B. Smith-Blair 264
- C. Power Seal 3131AS
- D. Hymax Tapped Clamp
- E. Pre-approved equal.

2.1.12.1.2 Tapping sleeves, that have a flanged outlet, shall be used when tapping all existing pipe in service for branch lines 3" and larger in size. The body shall be 304 stainless steel, have a minimum of 1/3 of the interior surface fully lined with a raised "donut" area around the branch opening, and a test port. All bolts, washers, and nuts shall be stainless steel. Acceptable tapping sleeves include:

- A. Romac Series SST with 204 stainless steel MJ Outlet
- B. Smith-Blair 663 – with stainless steel outlet
- C. Power Seal 3480MJ-CS Tapping Sleeve
- D. Pre-approved equal.

2.1.12.2 DESIGN STANDARDS

2.1.12.2.1 Location of all taps, tapping devices or fittings/valves for ALL water pipes shall be in accordance with the following:

2.1.12.2.2 The minimum distance from the beginning/end of the Bell or MJ of a water pipe, fitting or another tap shall be:

- A. Corporation direct tap = 2.0 ft.
- B. Corporation Tapping Saddle (up to 2" size) = not less than 2.0 ft.
- C. Branch Tapping Sleeve = not less than 4.0 ft.

2.1.12.3 INSTALLATION

2.1.12.3.1 Activation of tap can only be authorized by the Water Utility after passing pressure tests and safe water tests. A Utility representative shall be present on-site during tapping and sleeve work and any connection(s) to existing main(s). Two working days advance notice before making the connection is required by the Water Utility.

2.1.12.3.2 All taps to water mains shall be made under full system pressure, with the main full of water. No taps may be made on an inactive or non-pressurized main.

2.1.12.3.3 All curb stops shall be installed under full system pressure prior to hydrostatic testing for acceptance of installation.

2.1.12.3.4 When tapping, thoroughly clean and inspect the pipe surface. Wet the pipe surface with a soap/water solution prior to placing a saddle, sleeve or repair clamp. Confirm that the main OD falls within the tapping device's OD range. Ensure that the tapping device is properly aligned to connect with the branch pipe. Ensure that the tapered ends of the gasket are smooth, not folded or rolled in any manner.

2.1.12.3.5 The saddle, sleeve or repair clamp shall be installed and all bolts finger-tightened for uniform gap. Tighten all bolts working from the ends to the center using torque wrenches in accordance with manufacturers specifications. After approximately 10 minutes to allow the gasket to fully compress, all bolts shall be re-tightened to manufacturer's specifications. Make sure the tapping device and tapping machine are fully supported and all cutting edges sharpened. Teflon tape or Teflon pipe dope shall be used on the corporation stop and all other pipe threads.

2.1.12.3.6 If tapping device is for 3" or larger branch line, the sleeve shall have a test port and be tested at 100 psi for 5 minutes by the Contractor BEFORE the actual tap proceeds. A Water Utility representative shall witness the tapping device installation, pressure test and tapping procedure.

2.1.12.3.7 All taps to existing and new mains shall be "live" or "wet" taps, utilizing a tapping machine with appropriate cutting tools and sharp cutting heads. All tap cut-outs shall be given to the Construction Inspector or Water Utility representative witnessing the tap.

2.1.12.3.8 No taps will be permitted to begin after 1:00 P.M. Additionally, pre-approval by the Water Utility is required for tapping on a Friday or preceding a holiday.

2.1.12.3.9 Two business days prior notice to Water Utility is required to be given prior to installation of new taps on existing mains.

2.1.12.3.10 Notice shall also be given to the Superintendent Of Water Utility (Department of Public Works 262-253-7780) for new taps on existing mains.

2.1.13 BEDDING/COVER/BACKFILL

2.1.13.1 MATERIALS

2.1.13.1.1 Pipe Bedding: In accordance with SWS, Section 8.43.2: 3/8" limestone chips for PVC/PVCO pipe. No. 1 clean stone shall be placed within a 5 ft. radius of valves and valve boxes.

2.1.13.1.2 Cover Material: In accordance with SWS, Section 8.42.2 & 8.43.3, 12" above top of pipe. No stone, rock or other similar material with a sieve size greater than 3/8" shall be permitted. Sand & gravel are prohibited.

2.1.13.1.3 Granular Backfill: In accordance with SWS, Section 8.43.4, Table 39 Graded Aggregates, 1 1/2" graded limestone. In spot construction in trench lengths less than 50' Granular Backfill shall be crushed limestone per SWS, Section 8.43.6.

2.1.13.1.4 Spoil Backfill: In accordance with SWS, Section 8.43.5. No stone, rock or other similar material with a sieve size greater than 3-inches shall be permitted within 2.0 ft. above or beside the pipe. For HDPE service lines, the sieve size shall not be greater than 1 1/4" within 2.0 ft. above or beside the pipe.

2.1.13.1.5 Slurry Backfill: Aggregate slurry in accordance with SWS, Section 8.43.8, or in accordance with a street opening permit, when issued. In special cases, Village Engineer may require Sand Slurry consisting of 50 pounds of flyash and a 1/2 bag of Portland cement per cubic yard of mix.

2.1.13.2 DESIGN STANDARDS

2.1.13.2.1 Mechanically compact all trench backfill per Section 2.6.14(b) of SWS. Conform to 95% Standard Proctor Density tested at Contractor's expense.

A. Initial lift – 2 ft. max; Subsequent lifts – 1 1/2 ft. max.

2.1.13.2.2 Backfill in accordance with all street opening permit(s); generally, this will be slurry aggregate. All areas not within 5 ft. of paved surface (and above a 45-degree intercept line) may receive suitable spoil backfill as provided herein. Prohibited: Debris, frozen material, large clods or stones, organic material, blast rock, stones larger than 6", sand. Contractor shall haul away and dispose of these materials at Contractor's expense.

2.1.14 CAPS & PLUGS

2.1.14.1 MATERIALS

2.1.14.1.1 Acceptable caps & plugs include:

A. Clow F-1155, F-1159 and F-1165 solid cap or pre-approved equal.

B. Poured buttresses shall be used

C. Mega-lugs or pre-approved equal shall also be used when appropriate.

2.1.15 CASING/CARRIER PIPE

2.1.15.1 MATERIALS

2.1.15.1.1 Installation of water lines within casings shall be accomplished by using Stainless Steel Casing Spacers installed in accordance with the manufacturer's recommendations. Spacers shall be:

- A. Style CCS by Cascade Waterworks Mfg. Co. of Yorkville, IL
- B. Model 4810 by PowerSeal Pipeline Products of Wichita Falls, TX
- C. Pre-approved equal.

2.1.15.1.2 End seals, installed on both ends of each casing, shall be:

- A. Cascade Style CCES
- B. PowerSeal 4810ES
- C. Pre-approved equal.

2.1.15.1.3 Water mains within the casing shall be installed with mechanical joints and mega-lugs or pre-approved equal.

2.1.15.2 DESIGN STANDARDS

2.1.15.2.1 Casing watermain shall be used for all plastic pipe crossing a right-of-way and for all arterial crossings.

2.2 ABANDONMENT

2.2.1 General

2.2.1.1 All existing water mains and service lines that will not be used in new construction, or re-used for reconstruction of existing building sites shall be abandoned at the main.

2.2.1.2 A representative from the Village Engineering or Water Utility shall be present to witness the abandonment.

2.2.1.3 All excavations within public rights-of-way shall require Village (Department of Engineering, 262-250-4723) and/or County Permits.

2.2.1.4 Excavations within 5 ft. of and under paved surfaces shall be backfilled with Slurry Aggregate per the SWS to within 1.0 ft. of surface, followed by appropriate street restoration and not less than 3-inches of binder and 2-inches of wearing surface bituminous pavements.

2.2.1.5 In special circumstances, when approved in writing by the Village Engineer, water service lines may be temporarily made inactive at the right-of-way or easement boundary. The service shut-off valve shall be turned off and the pipe plugged or capped at the property line. Water services not abandoned at the main shall meet the following conditions:

- A. As part of the demolition permit, a certified check or Letter of Credit, in the amount of \$5,000 per lateral, shall be submitted to the Village Engineer to guarantee the permanent abandonment of the service at the main is completed in a timely manner.
- B. Any service line that is not abandoned at the main shall be subject to separate "availability" or "ready to serve" charges in the interim period until properly abandoned.
- C. Water lines made inactive in this manner shall be marked with a marker post placed 1 ft. from the end of the pipe and extending from the pipe to 3 ft. above the ground surface and painted a blue color.
- D. The location of the terminal pipe locations shall be surveyed or otherwise "tied" to permanent objects that will remain undisturbed at the site, with an as-built drawing provided to the Village Engineer and Utility Department for record purposes.

2.2.2 Water Services

2.2.2.1 All water services 2" diameter and smaller shall be abandoned at the street main by Turning off the main, remove the corp. and install a Smith Blair 261 or equal stainless steel repair clamp.

2.2.2.2 The remaining service line may be left in place, but the valve box/curb stop shall be removed.

2.2.2.3 The completed work shall be double wrapped with polyethylene per SWS, Chapter 6.21.0.

2.2.2.4 For water service lines larger than 2" diameter, the abandonment procedure would consist of:

- A. Removal of the service shut-off valve (if at the main), plus 2 - 3 ft. of service pipe at the street main branch fitting. If a blind flange can not be installed on the T, and the Village deems the fittings are defective the main will be shut down. Cut and remove that section of pipe fittings. Install new pipe with two water main couplers and wrap with baggy.
- B. Installation of a gasketed blind flange or MJ plug at the branch fitting, as appropriate.

2.2.2.5 All bolts and gaskets shall comply with these standards.

2.2.2.6 In the event that the shut-off valve is not at the street main branch fitting, then 2 - 3 ft of the service pipe shall be removed and a gasketed blind flange or plug installed onto the branch fitting at the main.

2.2.2.7 The valve box/curb stop shall be removed.

2.3 INSPECTION

2.3.1 SUBMITTALS AND SAMPLES

2.3.1.1 Material samples shall be taken as provided in SWS 8.1.0 and the Contract Documents.

2.3.1.2 All materials delivered to the Work Site shall have legible markings in accordance with ANSI, ASTM, AWWA and SWS 8.3.0.

2.3.1.3 All materials of each type or use shall be from a single manufacturer for the entire Contract.

2.3.1.4 Prior to the start of work, the Contractor shall submit six (6) sets of the following for approval:

- A. Letter of Certification and representative test reports by manufacturer for all pipe delivered to the Work Site for EACH material item furnished.
- B. Representative test reports for EACH material item furnished to the Work Site.
- C. Installation manuals for all valves, operators, hydrants, etc.
- D. Maintenance manuals for all mechanical equipment furnished to the Work Site.
- E. Generally, installation shall be in accordance with SWS and as modified by these Specifications.
- F. All material specifications to be in PDF form.

2.3.2 DISINFECTING

2.3.2.1 No chlorination or flushing between safe samples.

2.3.2.2 Use only calcium hypochlorite tablets affixed to the top interior wall of the pipe (no powder) to disinfect pipelines and service/fire lines in accordance with SWS, Section 4.3.12. The Water Utility will collect samples of the chlorinated water for safe water testing. Contractor shall supply all labor assistance to flush mains and to take sample(s).

2.3.2.3 Water wasted to surface may not contain any substances in concentrations that adversely affect the water as determined by the Wisconsin Administrative Code, NR 105 and 106. For chlorine, no total residual chlorine may be measured in the water being discharged to a surface water greater than ambient total chlorine residual in system water supply (typically 0.5 mg/L). Advise the Water Utility and Village Engineer of proposed discharge schedule to arrange DNR-required chlorine residual measurements for main flushing water.

2.3.3 ACCEPTANCE TESTING

2.3.3.1 General

2.3.3.1.1 Pressure and leakage testing shall include all installed system components, such as mains, branches, services and fire protection taps to terminus of all lines to be installed under the Contract.

2.3.3.1.2 Two (2) business days' notice to the Engineering Department (262-250-4721) and Water Utility shall be required.

2.3.3.1.3 Water for filling, testing and flushing for safe sampling of watermain will be supplied only by permission of the Water Utility via permit. All water that is used for filling new mains, pressure testing, flushing of mains, trench flushing, and safe sampling etc., will be witnessed by an inspector or Utility employee. Water used will be charged at the current rate.

2.3.3.2 Tests

2.3.3.2.1 Prior to pre-punch list work, tracer wires shall be tested by Contractor prior to Village accepting the work. The Utility Department has the option to spot check the continuity of the tracer wires.

2.3.3.2.2 Pressure and leakage tests shall be performed in accordance with SWS and under the jurisdiction of the Engineering Project Inspector and Water Utility.

2.3.3.2.3 Pressure Test: After the test connections are made and the main filled with water, the test section shall be subjected to water pressure normal to the area. After examination of exposed parts of the system, the test pressure will be increase to 150 psi on the main at the lowest elevation. The main shall be examined and if any defects are found, the Contractor shall immediately make the necessary repairs at his own expense. The pressure test shall be repeated until no defects can be found. The duration of the final pressure test shall be one hour. The pipe shall pass if the final pressure is within 5% of the test pressure for 1 hour. If it is found unnecessary to add water during the duration of the pressure test, the leakage test may be waived at the direction of the Inspector and Water Utility. If waived by the Inspector and Water Utility, a combination leak/pressure test will be performed.

A. For HDPE pipe, test duration to be less than 8 hours. If testing is not completed for any reason, de-pressurize and allow to "relax" for 8 hours before resuming test.

B. PVC Pipe: Conform to Standard Specifications Ch. 4.15.0

2.3.3.2.4 Leakage Test: The leakage test, if required, shall be conducted after satisfactory completion of the pressure test. The test section shall be subjected to approximately 100 psi gauge pressure at the point of highest elevation of the main under test. The duration of the leakage test shall be two hours unless otherwise specified. Should any test section fails to meet the leakage test, the Contractor shall immediately make the necessary repairs at his own expense. The duration of the final leakage test shall be one continuous hour.

2.3.3.2.5 Fire and Combination water/fire service lines shall be tested at 200 psi for 2.0 hours.

2.3.3.2.6 Contractor is responsible for taking samples, witnessed by the Village and samples put in a sealed chain of custody bag provided by the Village.

A. No first sample will be taken on a Friday, weekend, or adjacent to a holiday.

B. Bacteriological Testing: Conform to Standard Specifications Ch. 4.16.0 and NR 811.07.

Contractor shall provide analysis results to Village Engineering Dept in PDF form. If the bacteriological test fails, conform to Standard Specifications Ch. 4.16.3 to re-chlorinate the main.

2.3.3.2.7 Tracer Wire Connectivity: All new tracer wire installation shall be located using a low frequency line tracing equipment, witness by the inspector/owner/engineer. This verification shall be performed after rough grading and before finished grade and asphalt.

2.4 Other Requirements

2.4.1 Specifications

2.4.1.1 Contractor shall be responsible for Digger's Hotline locates, site safety, resident access, traffic control, erosion & sediment control, and protection of existing facilities, features and structures at all times

2.4.1.2 At end of each day and during breaks, Contractor shall install water-proof, leak-proof plugs.

2.4.1.3 At end of each day, open excavations shall not exceed 25 ft. in length.

2.4.1.4 All lateral trenches shall be backfilled at end of day.

2.4.1.5 At end of each day, contractor shall erect barricades with flashers and snow fencing surrounding excavations.

2.4.1.6 Mainline Installation: Conform to Standard Specifications Ch. 4.3.0 Sawcut Exist Pavements: Wheel-mounting saw required. Sawcut full-depth.

2.4.1.7 List Of Standard Village Details

- A. HDPE Hydrant Branch
- B. Standard Hydrant Bollard
- C. Relocate Water Main HDPE Pipe
- D. Relocated Existing Water Main PVC Pipe Only
- E. HDPE Joint Restraint
- F. Water Main Reconnection
- G. Water Main Service Lateral Schematic
- H. Tracer Wire Construction Layout
- I. Sample Station Detail
- J. Meter Sizes/Laying Lengths and Charges
- K. Bulk Water Purchasing Process and Charges

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3. SANITARY SYSTEM

All labor and material shall be governed by requirements of the Milwaukee Metropolitan Sewerage District (MMSD) and the latest edition and all amendments thereto of the Standard Specifications for Sewer and Water Construction in Wisconsin (SWS), Public Service Commission (PSC) Rules and Wisconsin Department of Natural Resources (WDNR) Regulations, unless otherwise specified in these Specifications, whichever is more restrictive.

3.1. SPECIFICATIONS

3.1.1. SANITARY SEWER MAIN

3.1.1.1. MATERIALS

3.1.1.1.1. All pipe used for sanitary and private main interceptor sewers shall be:

- A. PVC (solid wall) SWS Section 8.10.0, ASTM D-3034, SDR-26, SDR-35
- B. PVC (solid wall, green in color for in-ground identification) SWS Section 8.20.0, AWWA C-900 or C-905

3.1.1.2. DESIGN STANDARDS

3.1.1.2.1. Design flow coefficients as determined by the Village Engineer, subject to the following:

A. Residential/Multi-Family (Per MMSD Flow Allocation Worksheet):

Base Sanitary Flow	102 gpcd
Max Daily	1,269 gpcd
Residential densities are to be determined per MMSD Annual Cost Recovery Manual	

B. Industrial & Institutional Areas (Per MMSD Flow Allocation Worksheet):

Base Sanitary Flow	1,500 gpd/Acre
Max Daily	3,250 gpd/Acre

C. Large Commercial (Per MMSD Flow Allocation Worksheet):

Base Sanitary Flow	2,250 gpd/Acre
Max Daily	4,000 gpcd/Acre

3.1.1.2.2. Design flows and peaking factors are to be referenced to MMSD Rules and Regulations and as determined by the Engineering Services Division. Design objectives shall result in elimination, to the greatest extent possible, of all infiltration and inflow.

3.1.1.2.3. Minimum Main sizes:

Residential	8"
Industrial/Commercial/Multi-Family & PUD	8"
Shall accommodate future tributary areas as directed by the Village Engineer	

3.1.1.2.4. Minimum slopes.

A. Pipes slopes shall achieve self-cleansing velocities for peak design flows as directed by the Village Engineer. Generally, minimum velocity of 2.0 fps shall be met at half-full conditions.

Pipe Size	Minimum Slopes
8"	0.40% (Dead end reach 0.60%)
10"	0.28% (Dead end reach 0.40%)
12"	0.22%
15"	0.15%
18"	0.12%
21"	0.10%
Other Sizes	Per Engineering Services Division

3.1.1.2.5. Complete sewer design calculations and sewer system plans are required with construction plan submittals.

3.1.1.2.6. Conceptual sewer system plans are required for proposed developments located within the Ultimate MMSD Service Area even if sanitary sewer currently is not available. A determination is needed at the conceptual stage that future gravity sewer systems will work when needed.

3.1.1.2.7. Center of manhole shall coincide with street centerline, and center of main shall be within 5 feet of centerline on curvilinear street segments.

3.1.1.2.8. Invert shall not be less than:

Distance below the centerline grade of the street	Road ROW Width
11.0 Feet	60/66 FT
12.0 Feet	80 FT
13.0 Feet	>80 FT and Cul-De Sacs

3.1.1.2.9. Minimum sewer depth shall be 8 feet from finished grade to top of pipe under exceptional circumstances and approval of Village Engineer.

3.1.1.2.10. All sewer pipes shall be laid in accordance with SWS, Chapter 3.2.0

3.1.1.2.11. All connections to manholes shall be in accordance with SWS, Section 3.5.7.

Connections to manholes with preformed troughs in the shall be made in accordance with the procedure described in Section 3.1.7.3.5.

3.1.1.2.12. All sewer pipes shall terminate at the inside wall of the manhole. All annular spaces shall be filled with a cementitious filler to prevent the breakage of the pipe while jetting.

3.1.2. SANITARY SEWER LATERALS (From main to lot line)

3.1.2.1. MATERIALS

3.1.2.1.1. All pipe used for sanitary laterals shall be:

- A. PVC (solid wall) SWS 8.10.0, ASTM D-3034, SDR-35 or 26
- B. PVC (solid wall) SWS, Section 8.20.0, AWWA C-900 or C-905

3.1.2.1.2. Risers shall be as required by the plans in accordance with these standards or as pre-approved by the Village Engineer.

3.1.2.1.3. Risers (shall be tees): Minimum depth below road centerline shall be per Section or 5 feet below basement, whichever is greater. Sewer depth to be greater than 14 feet for riser. (Per SWS File Nos: 10A, 10B, 10C, 10D, & 10E).

3.1.2.2. DESIGN STANDARDS

3.1.2.2.1. Sites are allowed one (1) sanitary lateral connection. In special circumstances, additional laterals may be allowed with the written permission of the Village Engineer and the Wastewater Superintendent.

3.1.2.2.2. Minimum size shall be 6" diameter.

3.1.2.2.3. Slope at $\frac{1}{4}$ " per foot. Under exceptional conditions, the Village Engineer may permit minimum slope = $\frac{1}{8}$ " per foot in ROW/easement.

3.1.2.2.4. All connections to existing mains and manholes shall be in accordance with Section 3.1.3.

3.1.2.2.5. Lateral connections to manholes shall not be made unless pre-approved by the Wastewater Superintendent. Connections to manholes in new construction shall not be above the outlet sewer crown and have a smooth paved channel constructed to convey lateral waste to main outlet channel.

3.1.2.2.6. Laterals may not connect to manholes except in cul-de-sacs (permanent end of line). In cul-de-sacs, special manhole detail and construction of benches and lateral pipe connections are required.

3.1.2.2.7. If it is deemed necessary to install a lateral to an existing manhole, and the manhole has to be cored and booted to accept this lateral, this manhole shall be vacuum tested according to the SWS.

3.1.2.2.8. Existing laterals not used in a development shall be abandoned at the main when a development, land division or building razing occurs. See Section 3.2.

3.1.2.2.9. Each habitable building shall have a separate lateral connection to the sewer main.

3.1.2.2.10. Sanitary laterals shall have a trench check dam installed at the property line. See Specification 3.1.4 and Detail Figure 20.

3.1.3. LATERAL CONNECTIONS

3.1.3.1. Connection of New Sanitary Laterals to Existing Mains shall be as follows based on existing main material:

3.1.3.1.1. ABS - Truss Pipe

- A. Location - not closer than 36" to an existing joint or fitting.
- B. Hole - Core drill or saw-cut with appropriate cutting tools. Deliver "cut-out" to Construction Inspector or Utility Department representative.
- C. Insert Tee only allowed connection. With exception on 8" only, a wye shall be used.

3.1.3.1.2. Concrete Pipe

- A. Location - not closer than 24" to an existing joint or fitting.
- B. Hole - Core with appropriate cutting tools. Deliver "cut-out" to Construction Inspector or Utility Department representative.
- C. Insert Tee only allowed connection. With exception on 8" only, a wye shall be used.

3.1.3.1.3. PVC Pipe

- A. Location - Not closer than 36" to an existing joint or fitting.
- B. Hole - Core drill or saw-cut with appropriate cutting tools. Deliver "cut-out" to Construction Inspector or Utility Department representative.
- C. Inserts Tee on 10" pipe and manufactured wye on 8" pipe and below shall be used.
- D. 15" dia. Or less DIPS = PSM SDR-35 PVC. Conform to Standard Specifications Ch. 8.10.0 and ASTM D-3034.
- E. 18" dia. Or greater DIPS = pipe stiffness of 46 psi. Conform to ASTM F-679

3.1.3.1.4. Vitrified Clay Pipe

- A. Location - not closer than 24" to an existing joint or fitting.
- B. Hole - Core with appropriate cutting tools. Deliver "cut-out" to Construction Inspector or Utility Department representative.
- C. Insert tee or wye shall be installed for connection device.

3.1.3.1.5. Due to increasing incidents with plugs being left in sewer lines, the Village of Germantown Utility Department is requiring Contractors use a mechanical plug only. This shall be performed and documented by the Germantown Utility personnel. The Germantown Utility shall be notified when a plug is to be removed.

3.1.3.1.6. Prior to applying curing material on the concrete, the face of the curb shall be "branded" with a "S" designating the location(s) of sanitary laterals. Physical placement of the branding shall be reasonably accurate in a vertical plane above the respective lateral.

3.1.3.2. Connection of New Sanitary Laterals to Existing Sanitary Manholes will only be allowed on a case-by-case basis and when pre-approved by Village Engineer and the Utility Department, and shall be subject to following requirements:

3.1.3.2.1. Location: Invert of new lateral may be permitted a maximum of 12" above spring line of outlet sewer, or use outside drop inlet per SWS for main sewers;

3.1.3.2.2. Connection Device: Kor-N-Seal boot or pre-approved equal with stainless steel snap-in ring.

3.1.3.2.3. Any lateral that is connected into a manhole shall have a smooth concrete bench/channel placed to convey lateral waste flow into mainline channel.

3.1.3.2.4. Prior to applying curing material on the concrete, the face of the curb shall be "branded" with a "S" designating the location(s) of sanitary laterals. Physical placement of the branding shall be reasonably accurate in a vertical plane above the respective lateral.

3.1.4. TRENCH CHECK DAM

3.1.4.1. MATERIALS

3.1.4.1.1. Clay material shall have no organic material and shall be compacted to 95 percent standard proctor. Or;

3.1.4.1.2. Pre-approved equals such as: AquaBlok®, slurry and others.

3.1.4.2. DESIGN STANDARDS

3.1.4.2.1. Trench check dam shall be installed on all sanitary laterals.

3.1.4.2.2. The check dam shall be located at the property line.

3.1.4.2.3. See Detail Figure No. 20.

3.1.5. SANITARY FORCE MAIN

3.1.5.1. MATERIALS

3.1.5.1.1. All pipe used for sanitary force (pressure) mains shall be:

- A. PVC (solid wall) SWS 8.51.2, AWWA C-900 or C-905
- B. PVCO AWWA C-909, Class 150
- C. High density black Polyethylene Force Main Pipe SWS 8.51.3, ASTM F-714; or
- D. Fusible PVC C-900
- E. Linked PVC C-900

3.1.5.1.2. All pipe shall conform to Ductile Iron Pipe OD.

3.1.5.1.3. Valves shall be:

- A. Dezurik Series 100 Eccentric Valves
- B. cast iron epoxy-coated body, hard rubber-lined
- C. MJ
- D. low friction Buna-vee packing
- E. neoprene plug facing
- F. ABG6H6 actuator
- G. with stainless steel bolts
- H. and plug valve adaptor bracket with valve box
- I. Alternatives must be pre-approved by the Village Engineer.

3.1.5.2. DESIGN STANDARDS

3.1.5.2.1. Valve spacing not to exceed: 800 feet or $\frac{1}{2}$ the length of the force main for mains less than 1,000 feet. For force mains in excess of 2,400 feet, valves shall be located at the $\frac{1}{4}$ points of the main up to noted maximum.

3.1.5.2.2. Minimum design depth shall have 8 feet of cover.

3.1.5.2.3. Buried tracer location wire is required above the force main.

3.1.5.2.4. Maximum spacing of location boxes: 400 feet or as directed by the Village Engineer.

3.1.5.2.5. Velocity/Size:

- A. Hazen-Williams formula "C" value of 120.
- B. Velocity 2.0 – 6.0 fps for lowest energy pumping cost, as approved by the Village Engineer.

3.1.5.2.6. High/Low Points:

- A. Air relief valve sizing calculations shall be submitted with Plans.
- B. Clean-outs shall be installed at designated points.
- C. 6-ft. diameter manhole enclosures shall be installed.

3.1.5.2.7. HDPE Connections & Fittings: Joined by heated butt fusion for HDPE. Conform to ASTM D2657 and manufacturer specifications. Internal/external beads shall not be removed.

3.1.5.2.8. HDPE Main & branch joints: Joined by electrofusion conforming to manufacturer specifications. Internal/external beads shall not be removed.

3.1.5.2.9. PVC water class pipe. 4" thru 12" dia. = Class 150-DR18 conforming to AWWA C-900, conforming to standard specifications Ch. 4.6.0 and 8.20.01.

- A. Fittings = ductile iron conforming to Standard Specification 8.22.0.
- B. 4" thru 12" dia. = Class 250 mechanical joints
- C. Nuts & Bolts = Cor-Blue
- D. Mechanical joint retainer glands = Mega-Lug; Buttresses also required.
- E. Tees, crosses, bends, offsets, and other fittings shall conform to Standard Specification CH. 8.22.0. Acceptable supplier shall be Tyler or equal.
- F. Triple wrap all ductile iron fittings with polyethylene. Conform to Standard Specifications Ch. 4.4.4 and 8.21.0

3.1.5.3. Warning Tape

3.1.5.3.1. Terra Tape Standard 250 manufactured by Reef Industries, Inc., Shieldtec manufactured by Empire Level Manufacturing Corp., Milwaukee, WI, (or Engineer approved equal). Tape shall read "Caution – Sanitary Line Buried Below". Tape shall be green and 3" wide. Install over the cover material.

3.1.6. POLYETHYLENE WRAP & CORROSION PROTECTION

3.1.6.1. MATERIALS

3.1.6.1.1. Polyethylene film materials shall comply with SWS, Section 8.21.0.

3.1.6.2. DESIGN STANDARDS

3.1.6.2.1. All metallic pipe, fittings and valves shall be wrapped and protected per SWS, Section 4.4.4 and 4.4.5.

3.1.7. SANITARY MANHOLES

3.1.7.1. MATERIALS

3.1.7.1.1. All sanitary manholes shall be pre-cast concrete conforming to Standard Specifications Ch. 8.39.0 and File No. 12

3.1.7.1.2. All sanitary manholes shall have a wall thickness of 5" minimum.

3.1.7.1.3. The manholes shall be sized as follows:

Downstream Pipe Size	Minimum Manhole I.D.
8-24"	48"
30-42"	60"
>42"	72"
Sampling Manholes	48"

3.1.7.1.4. All sanitary manhole cone sections shall be eccentric. Concentric cones are prohibited.

3.1.7.1.5. All manholes shall have spray epoxy coating:

- A. MH Exterior: 2 coats (black) of Ameron International, Amercoat 78 HB at 8-10 mils. each.
- B. MH Interior: 2 coats (white) of Permite PCS-9043 Type II Permox pipe glaze at 20 mils. each.
- C. Coatings shall be applied by suppliers at the plant.

3.1.7.1.6. All joint seals shall consist of one of the following:

- A. Kentseal butyl rubber sealant
- B. Or Engineer approved equal
- C. External joint seals shall consist of following:
- D. MacWrap External Joint Sealers by MarMac Manufacturing
- E. Or Engineer approved equal

- 3.1.7.1.7. External joint seals will have 9" wide collar, outer layer of polyethylene, min. 4000 psi tensile strength, min. 1500 psi tear resistance, under layer of rubberized mastic reinforced with woven polypropylene fabric.
- 3.1.7.1.8. External joint seals will have 2 stainless steel straps within the collar $\frac{3}{4}$ " from edges confided with tube isolated from mastic and allowed to slip freely.
- 3.1.7.1.9. External joint seals will have minimum 6" overlap with closing flap to cover straps.
- 3.1.7.1.10. External for MH w/ Precast Outside Drop: EZ-Wrap by Press Seal Gasket Corp. primed with EZ-Stick No. 4 Primer
- A. Extruded butyl adhesive tape bonded to the concrete.
- 3.1.7.1.11. Chimneys shall use HDPE or EPP 5000 Series rings meeting ASTM D4976 or ASTM D3575.
- 3.1.7.1.12. HDPE Rings in pavements:
- A. Drill two $\frac{1}{2}$ " diameter holes 180o apart on mandatory 2" thick EPP ring (Cretex part number 40-27GF-200). Drill into corbelled section of the manhole, ring shall be drilled prior to placing on manhole.
- B. Apply 2 beads of M-1 adhesive $\frac{1}{2}$ "x $\frac{1}{2}$ " on corbal. Install drilled EPP ring and anchor
- C. with a 4" Rawl Power Bolt utilizing a 2" diameter fender washer. Tighten until bolt head is flush with the top of the 2" ring.
- D. Install $\frac{1}{4}$ " Ladtech topper ring set in M-1 Adhesive as described above.
- E. Dry stack chimney to proper height, including solid HDPE topper ring. Pay special attention to slope and use appropriate slope rings.
- F. Once desired height and slope are achieved, mark rings to align desired stacking order and placement.
- G. Apply bead of caulk around lip of adjusting ring and re-stack rings. Apply 2 beads of caulk on topper ring, one towards the outside and one towards the inside. Topper ring does not have a locking lip so be cautious ring does not slip during seal installation.
- H. Install seal per manufactures specifications.
- 3.1.7.1.13. Adhesives: M-1 (Chem-Link Corp.) used on EPP rings. Gun grade butyl rubber adhesive sealant on HDPE rings.
- 3.1.7.1.14. Seals to have order-to-fit Adapter internal/external with rubber sleeve sealing exterior from frame to corbel.
- 3.1.7.1.15. PE wrap to be installed using double 8-mil polyethylene wrap from top of frame to 84" min. depth.
- 3.1.7.1.16. Prohibited materials for chimneys are as follows:
- A. Cracked rings
- B. All forms of wedges

C. Back plastering

3.1.7.1.17. EPP Rings in turf to adhere to following:

- A. Drill two ½" diameter holes 180° apart on mandatory 2" thick EPP ring (Cretex part number 40-27G-200). Drill into corbelled section of the manhole, ring shall be drilled prior to placing on manhole.
- B. Apply 2 beads of M-1 adhesive 1/2"x1/2" on corbal. Install drilled EPP ring and anchor with a 4" Rawl Power Bolt utilizing a 2" diameter fender washer. Tighten until bolt head is flush with the top of the 2" ring.
- C. Dry stack chimney to proper height, including solid Grade Finish ring. Pay special attention to slope and use appropriate slope rings.
- D. Once desired height and slope are achieved, mark rings to align desired stacking order and placement.
- E. Apply 2 beads of M-1 in keyway area of adjusting rings and re-stack rings.
- F. Adjusting rings will be lag bolted in 4" height increments with a ½" x 5" steel wood lag bolt and 2" fender washer with bolts alternating 180° apart with each 4" rise in height
- G. Install seal per manufacturer's specifications.

3.1.7.1.18. For frames in pavement, use Neenah R-1661 frame with solid gasketed lid and 2 concealed pick holes. Conform to Standard Specifications Ch. 3.5.0 For frames in turf, use : Neenah R-1661 bolt-down frame w/ solid gasketed lid and 2 concealed pick holes. Conform to Standard Specifications Ch. 3.5.0. Bolts coated with anti-seize compound. Frames to be anchored to chimney with 1/2" dia. steel wood lag bolts extending 6" into chimney or to a depth that is practical for the chimney height and sealed with Permatex Ultra Series black, blue or grey silicone adhesive.

3.1.7.1.19. Pavement Ring required to be Neenah R-1979 Series Ref. #1661-7158.

3.1.7.1.20. Grout, if approved by Village Engineer and Utility Superintendent, can be acrylamide or polyurethane grout for manhole repair/rehabilitation.

3.1.7.2. DESIGN STANDARDS

3.1.7.2.1. Maximum manhole spacing for 15" diameter or less DIPS mainline = 400'.

3.1.7.2.2. Maximum manhole spacing for > 15" diameter DIPS mainline shall conform to NR 110.13(3)(b) .

3.1.7.2.3. Manholes shall connect 2 pipes having differing diameter.

3.1.7.2.4. Minimum elevation difference between influent and effluent pipes in manholes = 0.1'.

3.1.7.2.5. Maximum elevation difference between influent and effluent pipes without outside drop in manholes = 2.0'.

- 3.1.7.2.6. Lift holes: Exterior lift holes only (interior lift holes are prohibited).
- 3.1.7.2.7. Full benches are prohibited. Conform to Standard Specifications Ch. 3.5.4© and File No. 13. w/e full benches and with long radii.
- 3.1.7.2.8. Outside drops to conform to Standard Specifications Ch. 3.5.8 and Fil No. 19/20
- 3.1.7.2.9. One full-length of pipe shall precede the tee connecting the manhole and the drop segment.
- 3.1.7.2.10. Chimney depth to be at minimum 2" and maximum 16" (measured bottom of frame to top of cone).
- 3.1.7.2.11. Elevation for top of frame shall be equal to binder grade. Paving ring required for surface lift adjustment.
- 3.1.7.2.12. Connections shall be cored. Cutting or breaking is prohibited.
- 3.1.7.2.13. Bulkheads for future connections shall conform to Standard Specifications Ch. 3.2.25 and File #13A.
- 3.1.7.2.14. Manhole steps shall conform to Standard Specifications Ch. 2.5.4(g) and 8.40.0, and File #15 and #12. Steps in chimney are prohibited.
- 3.1.7.2.15. Sampling manholes are required at all commercial laterals and must conform to Village of Germantown detail and Standard Specifications Ch. 3.5.8(f), File #23
- 3.1.7.2.16. Sampling manholes to be minimum 48" diameter.
- 3.1.7.2.17. Manhole installations to be inspected by Village Engineer or Utility.

3.1.8. GREASE INTERCEPTORS

All buildings with food service preparation on-site (now or at any future time) shall be required to install, maintain and operate an exterior or interior grease interceptor tank sized in accordance with the Department of Safety and Professional Services (DSPS). State plumbing reviews by the DSPS must be completed before a plumbing permit will be issued. Construction of the Grease Interceptor shall, in addition to requirements of the Plumbing Code, conform to the following standards. These standards are intended to minimize the potential for groundwater infiltration and inflow or rainwater from entering the sanitary sewer system via this system component.

3.1.8.1. MATERIALS

3.1.8.1.1. Interior grease interceptors shall be constructed in a watertight manner of one of the following materials:

- A. Precast reinforced concrete
- B. Reinforced monolithic concrete
- C. Coated 12-gauge steel
- D. Fiberglass
- E. Plastic
- F. Other approved materials

3.1.8.1.2. Exterior grease interceptors shall be pre-cast concrete with integral base when required by the Village Engineer and shown on the Plans.

3.1.8.1.3. Exterior grease interceptors shall be equipped with water-tight locking frame and lids.

3.1.8.1.4. The exterior walls of the tank shall be coated with coal-tar epoxy per SWS, Chapter 8.49.2, (2 coats at 8 mil DFT minimum each, totaling 16 mil DFT minimum). The coating material shall be equal to:

- A. Tnemec Series 253 H.S. Tnemec Tar; or
- B. ICI Devoe DEVTAR 5A; or
- C. Pre-approved equal.

3.1.8.1.5. Coating(s) shall be applied in accordance with the coating manufacturer's recommendations and preferably at the place of tank manufacture. Each manhole section shall be inspected and marked for proof of inspection prior to delivery to the project site. Alternate waterproofing materials and application may be used if pre-approved by the Village Engineer. Manhole sections that are not properly coated with coal-tar epoxy will be rejected and shall be removed from the project site.

3.1.8.1.6. All barrel joints shall have a mastic or gasket type joint seal. The exterior shall be wrapped with an additional joint seal that meets requirements of ASTM C-877, Type II, such as "Mac-Wrap" or pre-approved alternate.

3.1.8.1.7. All manhole or tank access or inspection chimneys will be HDPE or EPP adapter seal frame – R1661 – Bolt down.

3.1.8.2. DESIGN STANDARDS

3.1.8.2.1. The approach section of pipe approaching the tank must be straight for a distance of at least 20 pipe diameters with no connections, drops, or bends.

3.1.8.2.2. There should be no grade changes, angle points, or connections at the structure.

3.1.8.2.3. In Flood Plain Areas: Tank access or inspection chimneys shall be 2.0 feet above 100-yr Flood elevations as determined via FEMA Mapping.

3.1.8.2.4. When practicable, grade earth at 5H:1V slope around manhole openings. In paved areas, slope drainage away from the manhole openings.

3.1.8.2.5. Because inlet and outlet pipe slopes are critical, the location of the exterior grease trap tank shall require prior approval of the Village Engineer for location and grades. For projects requiring prior Site Plan Approval requirements, this site element must be included on the Site Plan Submittal(s).

3.1.9. LIFT STATIONS

3.1.9.1. Consult with Engineering Services Division and the Utility Wastewater Department for design requirements.

3.1.10. TRACER WIRE

3.1.10.1. MATERIALS

3.1.10.1.1. A solid copper #10 AWG, THHN green coating, shall be laid parallel with and above the centerline of the main and taped at not greater than 10-foot intervals.

3.1.10.1.2. Tracer wire to come through cone chimney joint.

3.1.10.2. DESIGN STANDARDS

3.1.10.2.1. Tracer wire on sanitary sewer shall be installed as required by the Utility Department.

3.1.10.2.2. Tracer wire shall be required on all force mains.

3.1.10.3. INSTALLATION

3.1.10.3.1. Contractor shall verify during backfilling of cover material that the tracer wire has remained on top of the main.

3.1.10.3.2. Branch or connections with the tracer wire shall require 10 full turns of exposed and undamaged copper-to-copper contact and watertight wrap to prevent corrosion or any deterioration of electrical conductivity (i.e. Western Union Splice).

3.1.10.3.3. Tracer wire shall be terminated at start-end points and all intermediate valve boxes.

3.1.10.3.4. A ½" diameter PVC electrical conduit placed inside of the valve box shall carry the wire from bottom to top of each valve box. A 1.5-ft. pigtail of excess tracer wire shall stick out of the top of the conduit.

3.1.11. BEDDING/COVER/BACKFILL

3.1.11.1. MATERIALS

3.1.11.1.1. Pipe Bedding/Cover: In accordance with SWS, as follows –

- A. Flexible wall pipe shall be Class "B" up to 12" above top of pipe; 3/8" limestone chips.
- B. Rigid wall pipe with diameters equal to or less than 21" shall have 3/8" limestone chips up to 12" above top of pipe.
- C. Rigid wall pipe with diameters greater than 21" shall have ¾" limestone chips up to 12" above top of pipe.
- D. Ductile Iron pipe shall be Class B to 12" above top of pipe, torpedo sand.
- E. Fittings/Valves shall be Class B to 12" above top of pipe, torpedo sand.

3.1.11.1.2. Cover Material: In accordance with SWS, Section 8.43.3. No stone, rock or other similar material with a sieve size greater than 1" shall be permitted.

3.1.11.1.3. Granular Backfill: In accordance with SWS, Section 8.43.4. No stone, rock or other similar material with a sieve size greater than 3" shall be permitted. Granular backfill shall be crushed limestone per SWS, Section 8.43.6.

3.1.11.1.4. Spoil Backfill: In accordance with SWS, Section 8.43.5. No stone, rock or other similar material with a sieve size greater than 3" shall be permitted within 2.0 ft. above the pipe.

3.1.11.1.5. Slurry Backfill: Aggregate slurry in accordance with SWS, Section 8.43.8 and requirements of Village Engineer, or in accordance with street opening permit, when issued. In special cases, Village Engineer may direct the use of Sand Slurry consisting of 50 pounds of fly ash and a ½ bag of Portland cement per cubic yard of mix.

3.1.11.2. DESIGN STANDARDS

3.1.11.2.1. Backfill in accordance with all street opening permit(s), generally will be slurry aggregate. All areas greater than 5 ft. from a paved surface (and above a 45-degree intercept line) may receive suitable spoil backfill as provided herein.

3.1.11.3. INSTALLATION

3.1.11.3.1. Care shall be taken by the Contractor when backfilling to prevent any movement of the pipe from proper alignment and grade. Contractor is responsible for determining that the finished sewer remains at the required elevation and grade.

3.1.11.3.2. Mechanically compact all trench backfill to a minimum 95% standard Proctor density per SWS, Section 2.6.14(b). The initial lift to be compacted shall have a 2 ft. loose thickness. Each subsequent lift to be compacted shall have a maximum 18" loose thickness. Contractor shall place smaller lifts if the required compaction cannot be achieved.

3.1.12. CASING PIPE

3.1.12.1. MATERIALS

3.1.12.1.1. Installation of sewer lines and force mains within casings shall be accomplished by using Stainless Steel Casing Spacers installed in accordance with the manufacturer's recommendations. Spacers shall be:

- A. Cascade Style CCS; or
- B. PowerSeal 481; or
- C. Pre-approved equal.

3.1.12.1.2. End seals shall be installed on either end of each casing and shall be one of the following:

- A. Cascade Style CCES; or
- B. PowerSeal 4810 ES; or
- C. Pre-approved equal.

3.1.12.1.3. Force main piping within the casing shall be installed with mechanical joints and mega-lugs.

3.1.13. INSULATION

3.1.13.1. MATERIALS

3.1.13.1.1. Minimum of 2" thick Styrofoam plastic foam boards as manufactured by :

- A. Upjohn; or
- B. Dow Chemical Company, or
- C. Pre-approved equal.

3.1.13.2. DESIGN STANDARDS

3.1.13.2.1. All sanitary sewer pipes (mains, force mains & laterals), having less than 5.0 ft. of cover material, shall be insulated.

3.2. ABANDONMENT

3.2.1. General

3.2.1.1. All existing sanitary sewer mains and service lines, that will not be used in new or re-used in reconstruction of existing building sites, shall be abandoned at the main.

3.2.1.2. Abandonment shall be witnessed by the Village Inspector or a Utility Representative.

3.2.1.3. Main and/or service abandonment at the street main shall be a condition of any site demolition permit(s) issued or in the case of duplication, service lines that will remain unused on new construction.

3.2.1.4. All excavations within public rights-of-way shall require Village and/or County Permits.

3.2.1.5. Excavations within 5 ft. of and under paved surfaces shall be backfilled with Slurry Aggregate per the SWS to within 1.5 ft. of surface, followed by appropriate street restoration and not less than 3-inch of binder and 2-inch of wearing surface bituminous pavements.

3.2.1.6. In special circumstances, when approved in writing by the Village Engineer and the Utility Manager, sanitary sewer service lines may be temporarily made inactive at the right-of-way or easement boundary. Sanitary sewer lines shall be plugged or capped to be made water tight at the property line. Sewer service lines not abandoned at the main shall meet the following conditions:

3.2.1.6.1. As part of the demolition permit, a certified check or Letter of Credit, in the amount of \$5,000 per lateral, shall be submitted to the Village Engineer to guarantee the permanent abandonment of the service at the main is completed in a timely manner.

3.2.1.6.2. Any service line that is not abandoned at the main shall be subject to separate "availability" or "ready to serve" charges in the interim period until properly abandoned.

3.2.1.6.3. Sanitary lines made inactive in this manner shall be marked with a marker post placed 1 ft. from the end of the pipe and extending from the pipe to 3 ft. above the ground surface and painted a brilliant green color.

3.2.1.6.4. The location of the terminal pipe locations shall be surveyed or otherwise "tied" to permanent objects that will remain undisturbed at the site, with an as-built drawing provided to the Village Engineer and Utilities Department for record purposes.

3.2.2. Sanitary Sewer

3.2.2.1. All sanitary lines shall be abandoned at the street main fitting by disconnecting and removing 2 - 3 ft. of pipe and installing a water-tight cap or plug at the main fitting and on the abandoned line.

3.2.2.1.1. For Poly Vinyl Chloride (PVC) gasketed fittings, a Spigot Plug shall be installed.

3.2.2.1.2. A cured in-place plug will be allowed to abandon services deemed by the Utility to be 100% effective.

3.2.2.1.3. For PVC solvent weld or glued joint fittings, a gasketed Cap shall be installed on an undisturbed and undamaged max. 1.0 ft. spool piece.

3.2.2.1.4. For Concrete, Vitrified Clay, ABS/Truss, DIP or CIP (NOT soil pipe), a PVC Spigot Plug shall be installed using the appropriate Fernco coupling onto an undisturbed and undamaged max. 1.0 ft. spool piece.

3.2.2.1.5. All Cast Iron Soil Pipe shall be removed and ONE of the above procedures used.

3.2.2.1.6. If connection to the main is via a "break-in", then an appropriate length of main shall be cut and removed, with an identical length of PVC SDR 35 or 28 installed using appropriate Fernco couplings.

3.2.2.1.7. "Buffalo type" saddles are not acceptable for concrete and PVC pipe materials. Use of solvent weld or glued caps or plugs will not be acceptable.

3.2.2.2. Sanitary or other special manholes or structures that are part of an abandoned system shall also be abandoned by removing the casting, chimney and cone or corbel sections, followed by plugging the outlet and inlet pipe(s) with non-shrink cementitious grout.

3.2.2.3. The manhole barrel shall be filled with crushed stone compacted to 95% minimum standard Proctor density.

3.2.2.4. The property owner shall be responsible for proper disposal of all manhole components removed. All waste materials shall be removed from pipelines and structures before abandonment.

3.3. INSPECTION

When starting an installation, the farthest downstream location of the new sanitary sewer system shall have a plug installed and maintained by the utility Contractor. That plug shall not be removed until the system has been accepted by the Village Engineer and deemed operational by the Village and/or the Utility Department.

3.3.1. SUBMITTALS AND SAMPLES

3.3.1.1. All materials of each type or use shall be from a single manufacturer. Contractor shall submit for approval six (6) sets of material specifications, certification and testing results by manufacturer on EACH material item required on the Project.

3.3.2. ACCEPTANCE TESTING

3.3.2.1. General

3.3.2.1.1. Deflection and Leakage tests in accordance with SWS and under supervision of the Engineering Project Inspector and the Wastewater Utility.

3.3.2.1.2. All sewer pipes shall be laid uniformly to line and grade. Noticeable variation from true alignment and grade will be considered to be sufficient cause for rejection of the work by the Village. Care should be taken to insure that the entering pipe is forced tightly against the last pipe laid.

3.3.2.1.3. Sanitary main and lateral alignment shall be uniform in line and grade as measured from the inlet to the outlet of the pipe section. Vertical misalignment of greater than $\frac{3}{4}$ " in a single pipe section or a sag in the pipe grade extending for more (longer) than one-and-one-half (1.5) sections of pipe shall be cause for rejection. Any correction by the Contractor shall be at no cost to the Village or Utility.

3.3.2.1.4. Two (2) business days notice is required to be given to the Village's Inspector and the Wastewater Utility.

3.3.2.1.5. All water that is used for construction purposes will be charged at the current rates for such use. A PERMIT IS REQUIRED FROM THE WATER UTILITY PRIOR TO ANY WATER USE.

3.3.2.2. Tests

3.3.2.2.1. Deflection testing for flexible mains shall be at the 95% of specified minimum I.D.

3.3.2.2.2. Leakage testing shall include all installed system components, such as mains, branches, laterals, risers and taps to the terminus of lines installed. For each foot that the test section is

below ground water level, the test pressure shall be increased by 0.43 PSI for each foot that the average ground water height for the test section is above the spring line. In absence of recorded data on ground water table above pipe invert, it shall be assumed to begin at six (6) feet below finished manhole grade. Therefore, the minimum increase in test pressure shall be 6.6 psi and the maximum test pressure shall be 10.0 psi.

3.3.2.2.3. Sanitary Manholes shall be vacuum tested for leakage in accordance with standard test methods outlined in ASTM C-1244-93 or current edition, and minimum test time periods of:

42" & 48" dia. Manholes	60 sec.
60" dia. Manholes	75 sec.
72" dia. & greater Manholes	90 sec.

3.3.2.2.4. Interior manhole walls to be vacuum tested shall be dry. As required by MMSD, sanitary manholes shall be vacuum tested from the lid down to the invert. If a vacuum test fails, all remedial sealing is to be done on the exterior of the manhole prior to re-testing following proper curing time. Manholes receiving repairs shall be vacuum tested again after repairs are completed.

3.3.2.2.5. As an alternative, sanitary manholes may be vacuum tested from the top of the cone to the invert provided that the frame/cone internal seal and extension, if installed, are water tested during installation as required by MMSD. Reports summarizing the vacuum testing shall be submitted to the Utility Department.

3.3.2.2.6. Follow hydrostatic testing procedures outlined in SWS, Section 4.15, at 100 psi and no leakage.

3.3.2.2.7. Testing of both internal and external seals must be with a gallon of dyed water behind the seal for a period of 1 minute without any leakage through the bottom clamp.

3.3.2.2.8. Prior to pre-punch list work, tracer wires shall be tested by Contractor prior to Village accepting the work. The Utilities Department has the option to spot check the continuity of the tracer wires.

3.3.2.2.9. As part of the pre-punch list work, Contractor required to notify when CCTV is ready to start. CCTV will be completed by the Village.

3.3.3. CLEANING

3.3.3.1. Cleaning Precautions

3.3.3.1.1. During the cleaning process, all efforts shall be made to keep foreign materials and water from adjoining sewer systems.

- 3.3.3.1.2. Contractor shall clean all sanitary sewer line sections between manholes using high-velocity jet, or mechanically powered equipment. All dirt, sand, rocks, and other solid or semi-solid material resulting from the construction of the system shall be removed before acceptance.
- 3.3.3.2. Contractor shall be required to repair all visible damage and leaks in the mains.
- 3.3.3.3. This procedure is in addition to any testing required by SWS and/or MMSD.
- 3.3.3.4. Acceptance of sewer line cleaning and construction will be made upon the successful completion of the CCTV inspection and to the satisfaction of the Utility Department. If the CCTV inspection shows the cleaning to be unsatisfactory, the Contractor shall be required to re-clean and re-inspect the sewer line until the cleaning is shown to be satisfactory.
- 3.3.4. CCTV – Private Interceptor Sewers
- 3.3.4.1. Contractor has the option to contract directly with the Utility Department for performing CCTV inspection. A copy of the CCTV video and report shall be provided to the Utility Department.
- 3.3.4.2. Color videotape recordings of the data shall be made by the Contractor. Copies of each videotape, in USB digital format (USB flashdrives) or approved media, shall be provided to the Utility Department. PipeTech Compatible P.A.C.P. codes are required.
- 3.3.4.3. A set of system map Plan Sheets shall be included with all CCTV report books.

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4. STORM SYSTEM

4.1. SPECIFICATIONS

All labor and material provided under this contract shall be governed by the latest edition and all amendments thereto of the Standard Specifications for Sewer and Water Construction in Wisconsin (SWS) and State of Wisconsin Department of Transportation Standard Specifications for Road and Bridge Construction, unless otherwise specified in these Specifications, whichever is more restrictive. A full-time inspector is required to be at the project site to observe pipe unloading, inspect construction materials, and observe and document the construction of storm sewers and laterals. THESE STANDARDS SHALL APPLY TO ALL PUBLIC STORM SEWERS. Any and all modifications to these Specifications must be approved by the Village Engineer.

Design shall follow SWS Specifications, Milwaukee Metropolitan Sewerage District (MMSD) Rules, Village of Germantown Municipal Code Chapter 27 and be designed in accordance with the NOAA Atlas 14. For private property in new development, if Department of Commerce procedures are used, the designer shall verify that off-site flows meet all of the requirements of the Rational Method or TR-55 Method. Design shall also conform to the following:

4.1.1. STORM SEWER PIPE

4.1.1.1. MATERIALS

- 4.1.1.1.1. All storm sewers shall be constructed with a minimum Class III reinforced concrete pipe per SWS, Section 8.6.0 or as approved by Village Engineer :
- A. Reinforced Concrete Pipe – ASTM C76
 - B. Horizontal Elliptical Reinforced Concrete Pipe – ASTM C507.
 - C. Joints for concrete storm sewer pipe shall have rubber gaskets conforming to SWS, Section 8.41.2.

4.1.1.2. DESIGN STANDARDS

- 4.1.1.2.1. Minimum size: 12"
- 4.1.1.2.2. Location:
- A. In streets and easements: 10 feet west or south of the sanitary sewer.
- 4.1.1.2.3. Pipe cover:
- A. 3 feet minimum from finish design grade to outside top of storm sewer.
- 4.1.1.2.4. Storm sewers with diameters greater than 24" equivalent, daylighting in ditches shall have safety grates, meeting design standards, installed at the upstream and downstream ends.
- 4.1.1.2.5. Mainline and conveyance storm sewer design storm: 25-yr.; Storm sewers may not be surcharged in a 25-yr. or less design storm condition. Surge condition is defined as to the crown of pipe (full pipe flow - no pressure).
- 4.1.1.2.6. Minimum slope shall be 0.2% and achieve minimum velocity = 2.0 feet per second when pipe is flowing half-full. Village Engineer may waive the 0.2% minimum slope for runs of pipe longer than 400 feet. Village Engineer may limit maximum velocities.
- 4.1.1.2.7. Complete sewer design calculations are required with submittals, including Drainage Areas Map.
- 4.1.1.2.8. Storm sewer shall be required in public Rights-of-Way in new developments where the depth of proposed ditches exceed 3 feet as measured from the edge of pavement.

4.1.2. STORM LATERALS (From main to lot line)

4.1.2.1. MATERIALS

4.1.2.1.1. Unless otherwise specified, All pipe used for storm laterals shall be:

- A. Class III concrete sewer pipe; or
- B. PVC (SDR 26) pipe

4.1.2.2. DESIGN STANDARDS

4.1.2.2.1. Minimum size in ROW/easement areas shall be 6" diameter.

4.1.2.2.2. The minimum slope on laterals shall be 1/8" per foot.

4.1.2.2.3. The maximum slope on laterals shall be 1/2" per foot.

4.1.2.2.4. Minimum cover for storm sewer laterals in paved areas shall be 12" as measured from the top of the pipe to the top of the subgrade.

4.1.2.2.5. A clay dam across the trench shall be constructed adjacent to pavement low points with all storm sewer laterals.

4.1.2.2.6. Connection of laterals to storm sewer shall be subject to following:

- A. Location of invert of new lateral may be permitted a maximum of 12" above spring line of outlet sewer, or use outside drop inlet per SWS for main sewers.
- B. Hole - Core drill only. Deliver "cut-out" to the Construction Inspector.
- C. Connection Device - Kor-N-Seal boot, or pre-approved equal with stainless steel snap-in ring.
- D. Any lateral that is connected into a manhole shall have a smooth concrete bench/channel placed to convey lateral flow into the storm sewer.

4.1.2.2.7. Storm sewer lateral lines shall be designed to receive the storm water runoff from window wells, footing drains and sump pumps.

4.1.2.2.8. In areas with storm sewer, a storm sewer lateral shall be provided for each lot or building. The Village Engineer may waive this requirement for lots that are adjacent to and drain to adjacent public drainage easements, wetlands or waters of the State.

4.1.2.2.9. Sump discharges for all buildings shall be located at the front of building (facing street). Village Engineer may waive this requirement for lots that are adjacent to and drain directly to public drainage easements, wetlands or waters of the State.

4.1.2.2.10. Storm laterals shall be located to the right of sanitary sewer lateral when looking from the street.

4.1.2.2.11. Covers installed on lateral cleanouts shall not be bolted to the cleanout pipe.

4.1.3. CULVERTS

4.1.3.1. MATERIALS

4.1.3.1.1. Culverts shall be manufactured and installed in accordance with the requirements of the Standard Specifications for Highway and Bridge Construction in Wisconsin.

4.1.3.1.2. Damaged or rusted culvert pipes shall not be reused.

4.1.3.2. DESIGN STANDARDS

4.1.3.2.1. Culverts located in a Primary Storm Water Management System (PSMS) shall provide at least the 100-year level of protection for capacity and road overtopping.

4.1.3.2.2. Culverts located in a minor storm water management system shall be designed to safely convey surface water runoff from a 10-year storm event. Culverts may not be surcharged in a 10-year or less design storm condition. Surge condition is defined as to the crown of pipe (full pipe flow – no pressure).

4.1.3.2.3. Minimum size shall be 12" diameter for driveways and 15" for roadway cross culverts.

4.1.3.2.4. Minimum culvert lengths:

< 24" diameter	20 feet
24" – 30" diameter	22 feet
36" – 42" diameter	24 feet
48" and larger diameters	26 feet

4.1.3.2.5. Culverts less than 24 feet in length shall consist of one piece of pipe.

4.1.3.2.6. All crossroad culverts shall be designed to provide a minimum of 12" of cover to the top of the pipe at the edge of the finished pavement of the road.

4.1.3.2.7. See Masonry Endwalls Section 4.1.4 or Flared End Sections Section 4.1.5 of these specifications for end treatment specifications.

4.1.4. MASONRY ENDWALLS

4.1.4.1. MATERIALS

4.1.4.1.1. Endwalls shall be:

- A. poured or pre-cast concrete; or
- B. mortared stone; or

C. Other masonry material as approved by the Village Engineer.

4.1.4.1.2. Endwalls shall be manufactured and installed in accordance with the requirements of the Standard Specifications for Highway and Bridge Construction in Wisconsin.

4.1.4.2. DESIGN STANDARDS

4.1.4.2.1. In areas with less than 35 miles per hour posted speed limit, masonry endwalls shall be required to be installed on the ends of driveway culverts.

4.1.4.2.2. Endwalls shall be extended through the entire cross section of the ditch to prevent water infiltrating around the culvert.

4.1.5. FLARED END SECTIONS

4.1.5.1. MATERIALS

4.1.5.1.1. The end sections shall be manufactured and installed in accordance with the requirements of the WisDOT Standard Specifications, Section 521 or Section 522 as applicable.

4.1.5.2. DESIGN STANDARDS

4.1.5.2.1. In areas with greater than 35 miles per hour, flared end sections shall be required to be installed on the ends of driveway culvert.

4.1.6. DITCHES

4.1.6.1. DESIGN STANDARDS

4.1.6.1.1. Slopes.

4.1.6.1.2. Grassed Invert

- A. 1½% minimum
- B. 4% maximum

4.1.6.1.3. Concrete Invert:

- A. Greater than 4% or less than 1½%.
- B. 10 % maximum, 0.7% minimum.
- C. Invert shall be placed on a minimum of 3" of crushed aggregate base course.
- D. Place sod within the initial 1½ feet of ditch side slopes adjacent to the concrete invert.
- E. 2-ft. minimum width, v-bottom
- F. V-bottom formed by 4H:1V sloped top surface

G. Minimum concrete thickness: 6"

4.1.6.1.4. Alternative methods may be used after approval of the Village Engineer is obtained.

4.1.6.1.5. Fore slope: 4H:1V maximum.

4.1.6.1.6. Backslope: 4H:1V maximum.

4.1.6.1.7. The minimum ditch depth shall be 12" below the shoulder point at roadway high points. Other ditch locations shall have a minimum depth of 20" below the shoulder point and be graded to accommodate a properly sized driveway culvert.

4.1.6.1.8. Adopt and administer the WDNR Technical Standards 1053, 1058, and 1059 for erosion control. All roadside ditches shall be covered with a minimum of 4" of topsoil, and either seeded, fertilized and matted or sodded. Sod placement shall be required on longitudinal slopes greater than 4%

4.1.6.1.9. If the back slope of a ditch extends beyond the right-of-way, drainage easements shall be required adjacent to the street right-of-way at a uniform distance from the road centerline, as approved by the Village Engineer.

4.1.6.1.10. Turf reinforcement may be used as a substitute for concrete invert in ditches with slopes between 4% - 5%. Village Engineer must pre-approve turf reinforcement type.

4.1.7. STORM MANHOLE & JUNCTION CHAMBERS

4.1.7.1. MATERIALS

4.1.7.1.1. All storm manholes shall be pre-cast concrete with integral base, with pre-cast flattops (slab or deck) with an opening for the casting.

4.1.7.1.2. The manholes shall be sized as follows:

Downstream Pipe O.D.*	Minimum Manhole I.D.
27" or less	42"
28" – 30"	48"
31" – 36"	60"
37" – 42"	72"
>42"	Special Design Requiring Village Engineer Approval
*O.D. is the largest horizontal outside pipe dimension	

4.1.7.1.3. Where field conditions allow, the manhole shall be constructed with an offset cone.

4.1.7.1.4. All chimney joints, including the frame-chimney joint, and all barrel & cone section lifting holes shall be sealed with a cementitious grout with a struck joint. Grout shall be premixed, non-metallic, high-strength, non-shrink, Pennegrout, by IPA Systems, or approved equal, which meets requirements of ASTM C-1-91 and C-827 as well as CRD C-588 and C-621. When mixed to a mortar or "plastic" consistency, the grout shall have a minimum 1-day and 28-day compressive strength of 6,000 and 9,000 psi, respectively. Dry stacking of riser rings or flat decks shall not be permitted. They shall be laid in a bed of grout as described above.

4.1.7.1.5. Steps meeting the requirements of SWS, Section 6.40.1 shall be installed in all manholes or junction chambers deeper than 4', from floor to rim.

4.1.7.1.6. Drop pipes or other energy-dissipating structures shall be provided for all sewers entering a manhole with their invert at an elevation more than 24" above the invert of the sewer leaving the manhole.

4.1.8. CATCH BASINS

4.1.8.1. MATERIALS

4.1.8.1.1. Shall consist of masonry, pre-cast or monolithic construction in accordance with Chapter 3.6.1 and File No. 25 or 26 of SWS. All catch basins shall be designed and constructed to allow easy access for maintenance and cleaning.

4.1.8.1.2. Steps meeting the requirements of SWS shall be installed in all catch basins deeper than 4', from floor to rim.

4.1.8.1.3. Size (minimum).

A. Rectangular 24" x 36" (Internal Dimensions).

B. Round 48" ID.

C. Manhole inlets - Allowed only in cases where an angle point in the storm sewer occurs under the curb line. (These shall be avoided whenever possible.)

4.1.8.1.4. A continuous 4" diameter perforated, corrugated polyethylene drain pipe, meeting the requirements of AASHTO Designation: M-252, shall be installed under the curb and gutters and extend 50 feet in either direction from storm water catch basins located at low points. For catch basins in other locations, the 50-ft length of drainage pipe shall be connected only to the upstream side.

4.1.8.1.5. Where underdrain pipe is specified, a 4" diameter hole shall be cored in opposite sides of each catch basin located at low points to allow the connection of 4" diameter perforated, corrugated polyethylene underdrain pipe. Catch basins located in other locations shall have a 4" diameter hole cored in the upstream side to allow the connection of 4" diameter underdrain pipe. The holes must be cored at an elevation that is below the subgrade elevation to allow for

positive drainage and proper placement of the underdrain. Village Engineer may waive underdrain requirement.

- 4.1.8.1.6. All chimney joints, including the frame-chimney joint, and all barrel & cone section lifting holes shall be sealed with a cementitious grout bed with a struck joint. Grout shall be premixed, non-metallic, high-strength, non-shrink, Pennegrout. by IPA Systems, or approved equal, which meets requirements of ASTM C-1-91 and C-827 as well as CRD C-588 and C-621. When mixed to a mortar or "plastic" consistency, the grout shall have a minimum 1-day and 28-day compressive strength of 6,000 and 9,000 psi, respectively.

4.1.8.2. DESIGN STANDARDS

- 4.1.8.2.1. Inlet capacity design storm: 25-yr. storm event. In a 25-yr. storm event, the maximum spread of ponded storm water shall be 8 feet as measured from the face of curb.

- 4.1.8.2.2. Inlet capacity design storm: 50-yr. storm event for areas with no overland flow relief. In roadways, storm water ponding shall not exceed 6" on paved parking areas and 4" at the centerline in a 100-yr. storm event.

- 4.1.8.2.3. At low points, curb pan shall be pitched a ½ inch five feet on both sides of catch basins.

- 4.1.8.2.4. Where only front yard drainage flows to the curb, maximum separation or run to a catch basin is 300 feet unless in the opinion of the Village Engineer a lesser distance is required. Where the collective drainage from more than one lot discharges over the curb at a single point, a catch basin shall be required at the lot line extended

4.1.9. FIELD INLETS

4.1.9.1. MATERIALS

- 4.1.9.1.1. Shall consist of masonry, pre-cast or monolithic construction in accordance with Chapter 3.6.3 and File No. 28 or 29 of SWS.

- 4.1.9.1.2. Inlets shall be designed and constructed to allow easy access for maintenance and cleaning.

- 4.1.9.1.3. All chimney joints, including the frame-chimney joint, and all barrel & cone section lifting holes shall be sealed with a cementitious grout bed with a struck joint. Grout shall be premixed, non-metallic, high-strength, non-shrink, Pennegrout. by IPA Systems, or approved equal, which meets requirements of ASTM C-1-91 and C-827 as well as CRD C-588 and C-621. When mixed to a mortar or "plastic" consistency, the grout shall have a minimum 1-day and 28-day compressive strength of 6,000 and 9,000 psi, respectively.

4.1.9.2. DESIGN STANDARDS

4.1.9.2.1. Inlet capacity design storm: 25-yr. storm event. In a 25-yr. storm event, the maximum spread of ponded storm water shall be 8 feet as measured from the face of curb.

4.1.9.2.2. Inlet capacity design storm: 50-yr. storm event for areas with no overland flow relief. In roadways, storm water ponding shall not exceed 6" on paved parking areas and 4" at the centerline in a 100-yr. storm event.

4.1.10. ROAD UNDERDRAINS

4.1.10.1. MATERIALS

4.1.10.1.1. Underdrain systems shall be installed under curb and gutters to collect water and convey it to catch basins.

4.1.10.1.2. The underdrain system shall be constructed with:

- A. 4" diameter perforated, corrugated polyethylene drainage pipe meeting the requirements of AASHTO Designation: M-252.
- B. Pipe perforations may be holes or slots and may be in 3 or 4 lines spaced around the circumference of the pipe at 120° or 90° respectively.

4.1.10.1.3. The trench shall be backfilled with open graded $\frac{3}{4}$ " crushed stone.

4.1.10.1.4. Geotextile fabric, as specified in Section 612.2.8 of the Standard Specifications, shall be used to line the underdrain trench before the drainage pipe is installed and backfilled. Enough fabric must be provided as to cover the sides and bottom of the trench and overlap across the top of the trench by a minimum of 4 inches.

4.1.10.2. DESIGN STANDARDS

4.1.10.2.1. The 4" drainage pipe shall be laid in an 8" deep by 8" wide trench with flat bottom with square sides as shown in the Figure 7 of the Details. The trench, constructed at an elevation lower than the base course, shall extend 50 feet in either direction from a storm water catch basin located at the low point of the road, aligned with the proposed centerline of the flange of the curb and gutter. For catch basins in other locations, the 50' drainage pipe shall be connected only to the upstream side.

4.1.10.2.2. The drainage pipe shall be connected to catch basins in cored holes and grouted in-place in the cored holes. The end of drainage pipe opposite the catch basin shall be capped with a cap suitable for installing on the drainage pipe.

4.1.11. BEHIND CURB COLLECTORS

4.1.11.1. MATERIALS

4.1.11.1.1. All behind the curb collector systems shall be constructed with minimum 6" diameter PVC (SDR 35) pipe.

4.1.11.1.2. The clean out shall consist of a standard pre-cast 24" x 36" box inlet with a Neenah R-1878-B7L frame and lid as shown in Figure 15 of the Details.

4.1.11.2. DESIGN STANDARDS

4.1.11.2.1. Connected to sump pump drainage lines in lieu of storm sewer.

- A. 36" from flow line to surface.
- B. 1 % minimum grade.
- C. 300-ft. maximum run to outlet.
- D. Maximum run of 250 feet in curvilinear street.
- E. Maximum of 4 lots contributing area.

4.1.11.2.2. Behind the curb collector systems shall be installed 2' behind the curb at cul-de-sacs and hill crests where storm sewers are not located.

4.1.11.2.3. The collector pipe shall be connected to the nearest catch basin.

4.1.11.2.4. A clean out shall be installed at the upstream end of the collector system.

4.1.11.2.5. Sump lines for lots not served by the storm sewer shall be connected to the PVC collector pipe by a wye or tee fitting.

4.1.11.2.6. Tracer wire installation is required on all behind the curb collector pipe.

4.1.12. FRAMES, GRATES AND LIDS

4.1.12.1. MATERIALS

4.1.12.1.1. Vertical curb catch basin frames and grates shall be

- A. Neenah R-3228-K,
- B. or equal as pre-approved by the Village Engineer.
- C. Driveway frame and grate shall be 3290-A.

4.1.12.1.2. Mountable curb catch basin frames and grates shall be:

- A. Neenah R-3501-R,
- B. or equal as pre-approved by the Village Engineer. (Add a flat frame and grate for driveway curb head reductions)

4.1.12.1.3. Field inlet frames and grates shall be:

- A. Neenah R-3210-A,
- B. or equal as pre-approved by the Village Engineer.
- C. A Neenah R-2560-E1 or R-2561 series beehive grate shall be used where required by the Village.

4.1.12.1.4. Manhole frames and grates in field inlet applications shall be:

- A. Neenah R-2577-1, or
- B. equal as pre-approved by the Village Engineer.

4.1.12.1.5. Manhole frames and lids in pavement applications shall be:

- A. Neenah R-1661, or
- B. equal as pre-approved by the Village Engineer.

4.1.12.1.6. Covers shall have machined bearing surface and will be permitted to have eight (8) vent holes.

4.1.12.1.7. A pipe grate with maximum opening size of 6" shall be installed on storm sewer inlets 18" or larger. Grate shall be hot-dipped galvanized after fabrication or be constructed of corrosion resistant material approved by Village Engineer.

4.1.13. FRAME ADJUSTMENTS

4.1.13.1. MATERIALS

4.1.13.1.1. All frame/casting adjusting rings for manholes, catch basins and inlets shall be:

- A. Reinforced concrete rings having 26-inch I.D., or
- B. Pro-Ring™ by Cretex, or
- C. approved equal

4.1.13.1.2. The minimum for a chimney section shall be the height associated with the proper placement of one 2" adjusting ring. The maximum height of adjusting rings above the cone or slab top is 16 inches as measured from the top of cone or slab top. If more than 16 inches of adjusting rings are needed to set the casting to finished grade, then an additional barrel section shall be installed on the manhole.

4.1.13.1.3. The minimum thickness of individual pre-cast concrete adjusting rings shall be a nominal 2". The maximum thickness shall be a nominal 4".

4.1.14. SUMP PUMPS, DOWN SPOUTS, AND ROOF DRAINS

4.1.14.1. DESIGN STANDARDS

4.1.14.1.1. Sump pumps shall be connected to a storm sewer system if one exists adjacent to the lot.

4.1.14.1.2. Down spouts and roof drains, if not buried, may be connected to a sump collector. If buried, they shall be connected to sump collector.

4.1.14.1.3. If storm sewer is not provided or if a rural roadway section exists, then sump pumps shall be installed to receive and discharge ground water from footing drains.

4.1.14.1.4. Sump pumps, down spouts and roof drains shall discharge on the ground to the front of the lot so that:

- A. Adjoining properties are not adversely affected.
- B. If no drainage easement exists along a side or rear lot line, the discharge point within the site, shall be at least 10' from the lot line.
- C. If a public open drainage easement exists adjacent to any lot, the discharge point for down spouts and/or roof drains shall be discharged directly into the easement.

4.1.15. BEDDING/COVER/BACKFILL

4.1.15.1. MATERIALS

4.1.15.1.1. Pipe Bedding/Cover: In accordance with SWS as follows -

- A. Flexible wall pipe shall be Class "B" up to 12" above the top of pipe; 3/8" limestone chips.
- B. Rigid wall pipe with diameters equal to or less than 21" shall have 3/8" limestone chips up to 6" above the top of pipe.
- C. Rigid wall pipe with diameters greater than 21" shall have 3/4" limestone chips up to 6" above the top of pipe.

4.1.15.1.2. Cover Material: In accordance with SWS, Section 8.43.3. No stone, rock or other similar material with a sieve size greater than 1" shall be permitted.

4.1.15.1.3. Granular Backfill: In accordance with SWS, Section 8.43.4. No stone, rock or other similar material with a sieve size greater than 3" shall be permitted. Granular material shall be crushed limestone.

4.1.15.1.4. Spoil Backfill: In accordance with SWS, Section 8.43.5. No stone, rock or other similar material with a sieve size greater than 3-inches shall be permitted. In areas where excavated material(s) are determined to be not acceptable, in the judgement of the Village Engineer, then imported backfill material meeting the requirements of SWS will be required.

4.1.15.1.5. Slurry Backfill: Aggregate slurry in accordance with SWS, Section 8.43.8 and requirements of the Village Engineer, or in accordance with street opening permit, when issued. In special cases, the Village Engineer may direct the use of Sand Slurry consisting of 50 pounds of fly ash and a ½ bag of Portland cement per cubic yard of mix.

4.1.15.2. DESIGN STANDARDS

4.1.15.2.1. Backfill in accordance with all street opening permit(s), generally this will be aggregate slurry. All areas greater than 5 ft from a paved surface (and above a 45-degree intercept line) may receive suitable spoil backfill as provided herein.

4.1.15.3. INSTALLATION

4.1.15.3.1. Care shall be taken by the Contractor when backfilling to prevent any movement of the pipe from proper alignment and grade. Contractor is responsible for determining that the finished sewer remains at the required elevation and grade.

4.1.15.3.2. Mechanically compact all trench backfill per SWS, Section 2.614(b). The initial lift to be compacted shall have a 2' loose thickness. Each subsequent lift to be compacted shall have a maximum 18" loose thickness. Contractor shall place thinner lifts if the required compaction cannot be achieved.

4.1.16. PIPE TO MANHOLE CONNECTIONS

4.1.16.1. MATERIALS

4.1.16.1.1. In accordance with SWS, Section 3.5.7, except as modified below:

4.1.16.1.2. Amend the last sentence of Section 3.5.7(a) by adding the following: "using boots or cast-in-place cementitious material."

4.1.16.1.3. Delete the last paragraph of Section 3.5.7 (c) & replace with: "To maintain seal flexibility, the annular space between the pipe and manhole wall shall be plugged with flexible butyl rubber gasket material prior to pouring the manhole invert and bench in accordance with SWS, Section 6.41.6. When connecting pipe to existing pre-cast concrete manholes, core hole in manhole wall prior to installing pipe to manhole seal."

4.2. INSPECTION

4.2.1. SUBMITTALS AND SAMPLES

4.2.1.1. All materials and installations shall conform to SWS and are subject to the Village Engineer's approval. All materials of each type or use shall be from a single manufacturer. Contractor shall submit for approval six (6) sets of material specifications, certification and testing results by manufacturer on EACH material item required on the Project.

4.2.2. ACCEPTANCE TESTING

4.2.2.1. General

4.2.2.1.1. Installation shall be in accordance with SWS, and these specifications.

4.2.2.1.2. All storm sewer pipe shall be laid uniformly to line and grade. Noticeable variation from true alignment and grade will be considered, by the Village, sufficient cause for rejection of the work. Care should be taken to insure that the entering pipe is forced tightly against the last pipe laid.

4.2.2.1.3. Storm sewer, storm sewer inlets, storm sewer catch basins, and lateral alignment shall be uniform in line and grade as measured from the inlet to the outlet of the pipe section. Vertical misalignment of greater than $\frac{3}{4}$ " in a single pipe section or a crest in the pipe grade extending for more (longer) than one-and-one-half (1-1/2) sections of pipe shall be cause for rejection and correction by the Contractor at no cost to the Village.

4.2.2.1.4. Manhole barrel joint(s) gasket material ("E-Z-Stik") shall be placed on the vertical slope of each joint and shall be of the size necessary to fill the annular space of the joint. Lifting holes shall be grouted with Pennegrout and struck smooth on the interior and exterior surfaces. Chimney joints shall be grouted with Pennegrout. The grout shall extend the full width of each grade ring and each joint shall be struck-off vertically, even with the inside and outside chimney surfaces.

4.2.2.1.5. Rim elevations for manholes located in paved areas shall be set $\frac{3}{8}$ " – $\frac{1}{2}$ " below the asphalt binder grade elevation. Ramping of manholes will not be allowed.

- 4.2.2.1.6. Final adjustments to raise rim elevations to $\frac{1}{2}$ " below the grades shown on the final paving plans shall be made by installing adjusting rings as needed just prior to placement of the final lift of the pavement (surface course).
- 4.2.2.1.7. Catch basins shall be initially constructed to approximate $\frac{3}{4}$ " below binder grade prior to the curb and gutter construction. When curb and gutter is constructed, the concrete curb and gutter shall be stopped 5 feet on either side of the inlet. At intersections, catch basins are to be constructed 5 feet from the end of radii (to side of inlet). Temporary curb and gutter in the 5-foot gap on either side of the inlet shall be constructed with asphalt transitioning from the final grades of the concrete curb and gutter to the grade of the grate set at binder grade.
- 4.2.2.1.8. At the time of placement of the final surface course of pavement, the temporary asphaltic curb and gutter shall be removed and the inlet frame shall be set to final grade by adding one 2" adjusting ring and applying Type "M" mortar per SWS, Section 6.37.1. The concrete curb and gutter shall be completed. No wood shims shall be left in place. With this method, tuck pointing beneath the frame should not be required.
- 4.2.2.1.9. Any catch basin out of horizontal alignment by more than 2 inches shall be reconstructed to match the curb and gutter.
- 4.2.2.1.10. Contractor shall furnish and place a temporary 2" x 6" stake at the end of each storm lateral.
- 4.2.2.1.11. Existing field tiles shall be connected to a storm sewer or have a positive outfall provided.
- 4.2.2.1.12. All storm sewers shall be free from debris, sedimentation, or garbage prior to Village acceptance.
- 4.2.2.1.13. Downspout cleanouts and catch basins shall be inspected by the Village prior to acceptance by the Village.

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5. ROAD SYSTEM

Follow AASHTO guidelines unless otherwise noted. Street designs shall be consistent with the Village's adopted Comprehensive Plan. All local roadways shall be posted at 25 mph and have a design speed of 30 mph. Private roads must be designed in accordance with public road standards, even in PUD's.

5.1. GEOMETRICS

5.1.1. RIGHT-OF-WAY WIDTHS

Type	Minimum ROW Width (feet)
Local Street	60
Service Alley	30
Manufacturing and Industrial	80
Collectors and Arterials	Per adopted County Highway Width Map and/or Official Village Map

• Per Table 2 & 2A from Chapter 18 of Village of Germantown Municipal Code

5.1.2. PAVEMENT WIDTHS

5.1.2.1. Pavement widths are measured from edge of pavement to edge of pavement.

Standard Urban Residential Section Using Curb & Gutter (Face of curb to face of curb)	30 Feet
Standard Rural Residential Section With Open Ditches (Face of curb to face of curb)	24 Feet
Standard Commercial or Industrial Section	40 Feet

• Per Table 2 & 2A from Chapter 18 of Village of Germantown Municipal Code

5.1.3. BOULEVARD SECTIONS

5.1.3.1. Entrance

5.1.3.1.1. Minimum pavement width (flange to flange of curb and gutter) shall be 16 feet for a single lane.

5.1.3.1.2. Minimum pavement width (flange to flange of curb and gutter) shall be 24 feet for a double lane.

5.1.3.2. Exits

5.1.3.2.1. Minimum pavement width (flange to flange of curb and gutter) shall be 24 feet (double lane).

5.1.3.3. Minimum median width shall be 20 feet back of curb to back of curb.

5.1.3.4. Median length shall be adequate for queuing, but generally shall not extend beyond the first side street.

5.1.4. CUL-DE-SACS

5.1.4.1. Local streets open at one end only shall end with a cul-de-sac.

5.1.4.2. No less than 3 parcels and no more than 15 parcels may be served by a cul-de-sac. Block length between intersections shall not exceed 1,500 feet nor be less than 500 feet. Block length is measured from the center line of the right-of-way to the center line of the right-of-way of the two cross streets.

5.1.4.3. Residential:

5.1.4.3.1. All pavement widths for a standard residential cul-de-sac shall have a minimum bulb radius of 42 feet as measured from the center of the cul-de-sac to the edge of pavement.

5.1.4.3.2. The minimum bulb radius for the Right-of-Way shall be 66 feet as measured from the center of the cul-de-sac.

5.1.4.4. Commercial or Industrial:

5.1.4.4.1. All pavement widths for a standard commercial or industrial cul-de-sac shall have a 48-ft. radius measured from the center of the cul-de-sac to the face of curb.

5.1.4.4.2. The minimum radius for the Right-of-Way shall be 66 feet.

5.1.4.5. Central planting islands are acceptable in the middle of the cul-de-sac.

5.1.4.5.1. Minimum pavement width (edge of pavement to edge of pavement for rural cross-section or flange to flange for curb and gutter) shall be 16 feet for a single lane.

5.1.4.5.2. Plantings should be installed outside of the 5' clear zone for snow plowing.

5.1.5. CLOSE/LOOP STREET

5.1.5.1. The close or loop street, may be used in lieu of a short cul-de-sac, and shall be designed as two parallel lanes, 16-ft. wide lanes separated by a central planting strip or bio-retention area having a minimum width of 50 feet.

5.1.5.2. Maximum length for a close or loop street shall be 1,200 feet.

5.1.6. STREET GRADES

Type	Max Grade
Arterial	4%
Collector	7%
Local	10%

5.1.6.1. Urban roadway sections shall have a minimum 0.7% centerline profile gradient.

5.1.7. CROSS SLOPE

5.1.7.1. All roadway sections (urban or rural) shall have a crown, with a cross slope of 3% from the pavement centerline to the edge of pavement.

5.1.8. HORIZONTAL CURVES

5.1.8.1. Minimum horizontal curve requirements, per AASHTO Geometric Design of Highways and Streets, Current Edition including all updates.

5.1.8.2. Compound Curves

5.1.8.2.1. Compound curves are only allowed on roads with a posted speed limit of 25 mph or less.

5.1.8.2.2. A minimum horizontal curve radius of 250 feet is required along the roadway centerline.

5.1.8.2.3. A horizontal curve radius of 200 feet may be accepted when a 100' long tangent length is provided between curves.

5.1.9. VERTICAL CURVES

5.1.9.1. Maintain "K" Values per AASHTO Geometric Design of Highways and Streets, Current Edition including all updates.

5.1.10. SIGHT DISTANCE

5.1.10.1. For minimum sight distance requirements at intersections and driveways, refer to AASHTO Geometric Design of Highways and Streets, Current Edition including all updates.

5.1.11. CORNER RADII

5.1.11.1. Internal to development for minor streets (measured from the edge of pavement/flange line):

5.1.11.1.1. Residential and multi-family: 25 feet

5.1.11.1.2. Commercial and industrial: 42 feet

5.1.11.2. Corner radii at intersections to external roadways, shall be as approved by the Village Engineer.

5.1.12. ACCELERATION/DECELERATIONS/BYPASS LANES

5.1.12.1. Any roadway intersecting with a collector or arterial street projected to have more than 100 ADT shall require Acceleration/Decelerations/Bypass Lanes per Detail Figure No. 4.

5.1.13. TRANSITIONS

5.1.13.1. Transitions areas, such as lane additions, bypass lanes, traffic shifting lanes, and areas between existing pavement and new pavement sections with varying widths, shall be transitioned at a ratio of 15:1 (widen 1 foot in 15 feet).

5.2. SPECIFICATIONS

These standards shall apply to all public and private roadways. Any and all modifications to these Specifications must be approved by the Village Engineer.

5.2.1. SUBGRADE

5.2.1.1. DESIGN STANDARDS

5.2.1.1.1. Soil borings to a minimum depth of 10 feet below finish grade shall be taken every 500 feet along the proposed centerline of the roadway. A site map showing the location of the borings along with laboratory soils classifications for each boring shall be submitted to the Village Engineer.

5.2.1.1.2. Should the geotechnical data submitted to the Village not be sufficient to satisfy the Village Engineer, the Developer shall grant the Village with a right of entry to obtain the required data. Costs associated with obtaining the required data shall be at the Developer's sole expense.

5.2.1.2. INSTALLATION

5.2.1.2.1. The subgrade must be proof rolled, checked for proper grade and approved by the Village Engineer or designee before the geotextile fabric and crushed stone base is to be applied.

5.2.1.2.2. All earth fills under roadways shall be placed in 12" maximum lifts and a Proof Roll shall be approved by the Village Inspector.

5.2.1.2.3. All soft spots located as a result of proof rolling with a fully loaded tri-axle truck approved by Village Engineer or designee shall be undercut, and filled in a manner agreed upon by the Contractor and the Village Engineer.

5.2.1.2.4. All repaired soft spots shall be re-proof rolled after subgrade elevation has been re-established. Process shall be repeated until the project passes proof roll.

5.2.1.2.5. In unstable soil conditions, undercutting in excess of 3' shall be backfilled with 3" TB or breaker run or other materials as approved in writing by the Village Engineer.

5.2.1.2.6. If open graded material is used, drainage at the bottom of the undercut is required by use of a French drain or perforated pipe bedded in crushed stone, where grades allow. In many situations, dense graded coarse TB shall be used to eliminate water that would be trapped if clear stone was used.

5.2.1.2.7. In unstable soil conditions, additional subdrains may be required as directed by the Village Inspector.

5.2.1.2.8. Method of drainage of the filled area shall be approved by the Village Inspector.

5.2.1.2.9. Geotextile fabric shall be installed on all roadways. Type based on field conditions per WisDOT.

5.2.2. GEOTEXTILE FABRIC

5.2.2.1. MATERIAL

- 5.2.2.1.1. Geotextile fabric conforming to WisDOT Standard Specification, Section 645 shall be pre-approved by the Village Engineer prior to installation for :
- A. subgrade separation and stabilization (Type SAS)
 - B. drainage filtration (Type DF)
 - C. subgrade reinforcement (Type SR)
 - D. under riprap (Types R & HR).

5.2.2.2. INSTALLATION

- 5.2.2.2.1. Geotextile fabric shall be placed on the subgrade on all areas that will receive crushed aggregate base course material, unless a Clear Stone Frost Barrier is to be used. Geotextile fabric is not required where Clear Stone Frost Barrier is to be used.
- 5.2.2.2.2. Geotextile fabric shall have a minimum 24" overlap for longitudinal seams and minimum 36" overlap for transverse seams.
- 5.2.2.2.3. Subsequent open cuts of the pavement requiring excavations below the subgrade of roadways having geotextile fabric in place shall be backfilled with approved compacted granular fill up to original subgrade elevation. Pavement and base shall be removed a minimum 6" on each side of excavation or extent of damaged fabric to allow new geotextile repair fabric to be installed with a minimum 6" overlap on all sides.

5.2.3. BASE COURSE

5.2.3.1. MATERIALS

- 5.2.3.1.1. The crushed aggregate base course for the roadway shall consist of dense graded base conforming to WisDOT Standard Specification Section 305.2.2.1 for 1 ¾-inch.

5.2.3.2. INSTALLATION

- 5.2.3.2.1. The finished base course elevation shall be a minimum of:
- A. 10" above the approved subgrade for a local roadway,
 - B. 14" above the approved subgrade for a commercial or industrial roadway

5.2.3.2.2. New Construction or Reconstruction:

- A. Bottom Layer: 3" gradation crushed interlocking limestone aggregate from a quarry source
- B. Middle Layer: 1 ¼" gradation crushed interlocking limestone aggregate from a quarry source
- C. Quarry Source: Quarry source shall be listed on the WisDOT Pit and Quarry Listing (latest edition)
- D. Gradations Gradation shall conform to WisDOT Standard Specifications Sec. 305

5.2.3.2.3. Pulverize & Overlay: Pulverized pavement acceptable when recommended by Geotechnical Services Report.

5.2.3.2.4. The dense graded base shall be spread, shaped, compacted, and proof-rolled to produce a stabilized base which conforms to the required cross-sections.

5.2.3.2.5. Special compaction testing may be required dependent on site conditions in accordance with 301.3.4.3 of the WisDOT Standard Specifications.

5.2.3.2.6. Surface Elevation tolerance to be +/- 0.05 ft.

5.2.3.2.7. Base course to be compacted to 95% Modified Proctor and conform to WisDOT Standard Specification 305.3.2

5.2.4. FROST BARRIER

5.2.4.1. MATERIALS

5.2.4.1.1. The Frost Barrier shall be #3 Clear Stone with a minimum depth of 12" or as specified for a given project.

5.2.4.2. DESIGN STANDARDS

5.2.4.2.1. Where specified by the Village, a layer of Clear Stone Frost Barrier shall be required to prevent or minimize future frost heave damage to the roads.

5.2.5. SHOULDERS

5.2.5.1. MATERIALS

5.2.5.1.1. The aggregate for shoulder shall consist of : Crushed stone conforming to WisDOT Standard Specification Section 305.2.2.1 for ¾-inch dense graded base; or Recycled asphalt as approved by the Village Engineer.

5.2.5.2. DESIGN STANDARDS

5.2.5.2.1. For rural cross sections, a 3-ft. wide shoulder shall be constructed along both edges of pavement.

5.2.6. ASPHALT PAVEMENT

5.2.6.1. MATERIALS

5.2.6.1.1. Asphalt pavement materials shall conform to the requirements of WisDOT Standard Specification Section 460. Asphaltic concrete shall be PG 58-28 or PG 64-22.

5.2.6.1.2. When a "Superpave" mix design is proposed to be used, the Contractor must submit the mix design and receive the approval of the Village Engineer two weeks prior the preconstruction conference. The following applies:

	Binder			Surface		
	Mix Design	Aggregate	Thickness	Mix Design	Aggregate	Thickness
Residential Streets	3 LT 58-28S	19 mm	3" (one lift)	4 LT 58-28S	12.5 mm	2"
Commercial & Industrial	3 MT 58-28S	19 mm	4" (two lift)	4 MT 58-28S	12.5 mm	2"

- A. Mix designs for all other classifications shall be as approved by the Village Engineer.
- B. Mix designs changed in 2016. Follow the WisDOT mix design at that time.

5.2.6.2. INSTALLATION

5.2.6.2.1. All asphalt binder courses shall be constructed on a substantially surface-dry, rolled and compacted crushed stone base, free of loose and foreign materials. Hand operated vibrating compactors shall be used around all manholes and valve boxes.

5.2.6.2.2. A tack coat, meeting the requirements of WisDOT Standard Specification Section 455.2.5, shall be used as a bonding agent between binder and surface courses, and the separate lifts of binder when not placed on the same day. The binder surface shall be thoroughly cleaned and any vegetation removed prior to applying the tack coat. Tack coat shall be uniformly applied at a rate of 0.07 gallon per square yard with an allowable variation of +/- 0.02 gallon per square yard over the entire receiving surface. Daily application of the tack coat shall be limited to approximately that area of surface that can reasonably be expected to be paved during the same day.

5.2.6.2.3. Sawcutting

- A. When sawcutting existing concrete or asphalt pavements, curb and gutter, driveways, or sidewalks, the saw cut shall be straight, and shall be full depth.
- B. No payment shall be made for sawing that is not straight or for sawing where the sawing debris is not washed off of the pavement or driveways that are open to traffic.
- C. Longitudinal joints in the surface course shall at no time be placed immediately over similar joints in the binder course beneath, with the exception of the centerline. A minimum distance of 6" shall be required between the location of the joints in any given course and the location of similar joints in the course placed above it.

5.2.6.2.4. Paving shall be done in lengths so that the first pass does not cool below 125° F, prior to second pass of the next lane.

5.2.6.2.5. Any asphalt paving after October 1st of any year shall be done only with special, alternate methods approved by the Germantown Village Engineer.

5.2.6.2.6. If the roadway will not receive the final lift prior to October 1st, a minimum 18" wide wedge of asphalt shall be placed against the curb and gutter for protection.

5.2.6.2.7. On roadways with rural cross-section, the edge of the pavement shall be sloped and no materials shall extend beyond the limits of the previous layer. Irregularities in alignment along the outside edges shall be corrected by adding or removing asphalt. Excess asphalt deposited on the existing base, binder or surface course outside the limits of the lane being laid, shall be immediately removed.

5.2.6.2.8. Prior to placement of the surface course:

- A. All foreign matter shall be removed from the binder course surface.
- B. On streets with curb and gutter, the 18" wide wedge of protective asphalt previously placed against the curb and gutter shall be removed.
- C. Developer/Contractor, at his sole expense, shall repair any depressions or other signs of failure in the binder course as directed by the Village Engineer.
- D. Developer/Contractor, at his sole expense, shall repair any damaged curb and gutter as directed by the Village Engineer.

E. All manhole rims and water valve boxes shall be left 3/8" –1/2" below binder course and adjusted to 3/8" –1/2" below the final pavement elevation just prior to placement of surface course of asphalt. Paving rings which have an adjustable diameter are not allowed.

5.2.6.2.9. All excavations associated with manhole adjustments shall be backfilled with aggregate slurry as specified in Standard Specification for Sewer and Water Construction in Wisconsin Section 8.43.8. The aggregate slurry shall be backfilled to 5-inches below final pavement elevation for residential streets and 6-inches below the final pavement elevation for commercial and industrial streets.

5.2.6.2.10. Asphalt pavement installation will not be permitted after October 1st unless approved by the Village Engineer.

5.2.6.2.11. Asphaltic binder course shall not be installed after September 1st, unless approved by the Village Engineer.

5.2.6.2.12. Asphaltic surface course shall be installed in the same calendar year as the binder course, unless approved by the Village Engineer.

5.2.7. CONCRETE PAVEMENT

The use of concrete pavement requires the approval of the Village Engineer.

5.2.7.1. MATERIALS

5.2.7.1.1. Portland Cement used in all concrete mixes shall conform to WisDOT Standard Specification Section 501.

5.2.7.1.2. Aggregates used in concrete shall conform to the requirements of WisDOT Standard Specification Section 501.

5.2.7.1.3. Concrete shall be air entrained, Grade A, conforming to WisDOT Standard Specification Section 501, and in particular, meet the following requirements:

- A. Minimum concrete content, 6.0 sacks per cubic yard;
- B. Compressive strength after 28 days cured: 3,500 psi;
- C. Maximum amount of water per bag of cement: 6.0 gallons;
- D. Size of course aggregates required: No. 1 plus No. 2;
- E. Slump: 1"-3"; and
- F. Air content: 4.5% - 7.5%.

5.2.7.2. DESIGN STANDARD

Pavement Thickness (in)	Dowel Bar Dia. (in)	Joint Spacing (ft)
5 ½, 6, 6 ½	None	12
7, 7 ½	1	14
8, 8 ½	1 ¼	15
9, 9 ½	1 ¼	15
10 and above	1 ½	15

5.2.7.2.1. Alternative designs shall be as approved by the Village Engineer.

5.2.7.3. INSTALLATION

5.2.7.3.1. Contractor must submit a mix design and receive the approval of the Village Engineer prior to paving.

5.2.7.3.2. A pre-pour meeting must be scheduled with the Engineering Division prior to paving to discuss materials and joint locations.

5.2.7.3.3. Water used shall conform to WisDOT Specification Section 501.2.4. If Village water is used, it will be charged at the current rates for such use; a PERMIT IS REQUIRED from the Water Utility for any Village water use.

5.2.7.3.4. The consistency of the freshly mixed concrete shall be such that when measured by means of a 4" x 8" x 12" slump cone, the slump shall not exceed 3".

5.2.7.3.5. Test cylinders shall be required meeting AASHTO standards, stored under site conditions and then tested at Contractor expense.

5.2.7.3.6. Concrete pavement shall be constructed in accordance with WisDOT Standards Specifications, Section 415.

5.2.7.3.7. Curing Time and Cleanup

A. Concrete pavements shall be closed to all traffic for 7 days unless otherwise directed by the Village Engineer. When directed to open the street to vehicular traffic, the Contractor shall clean the area of all forms, lumber, dirt and other debris to the satisfaction of the Village Engineer. The Contractor shall then flush and sweep the street.

B. When a concrete saw has been utilized to cut joints, the Contractor will be required to flush the pavement with water, removing all residual materials of the sawing operation, prior to opening the street to vehicular traffic.

5.2.7.3.8. Concrete Placement During Cold Weather

A. Concrete shall not be placed on a frozen subgrade. The Contractor shall remove and replace at his expense any concrete damaged by frost or freezing.

- B. When placing concrete during cold weather, the water and the aggregates in the concrete mixture may be heated. When specifically allowed by the Village Engineer, the Contractor may use magnesium free calcium chloride as an admixture in the concrete. The maximum quantity to be used shall not exceed 1% of the cement content of the mix.
- C. When the air temperature is expected to drop below freezing, the Contractor shall cover the surface of the concrete with straw or hay to a sufficient depth to prevent freezing and such protection shall be furnished for at least 5 days after the concrete has been poured. Other methods of protection from freezing may be used when approved by the Village Engineer.

5.2.8. ADMIXTURES

5.2.8.1. Water Reducing

The Contractor may incorporate into the concrete mixture an approved water reducing admixture meeting the requirements of AASHTO Specification M-194, Type A or D when approved by the Village Engineer. The cement content may be reduced to 5.8 sacks per cu. yd. when the admixture is used at the manufacturer's recommended rate.

5.2.8.2. Accelerator

When specifically allowed by the Village Engineer, the Contractor may use magnesium free calcium chloride as an admixture in the concrete. The maximum quantity to be used shall not exceed 1% of the cement content of the mix.

5.2.9. CURB AND GUTTER

5.2.9.1. MATERIALS

5.2.9.1.1. All concrete curb construction shall conform to WisDOT Standard Specification, Section 601.

5.2.9.1.2. Concrete for curbs shall be air entrained, Grade A, conforming to WisDOT Standard Specification Section 501, and in particular, meet the following requirements:

- A. Minimum concrete content: 6.0 sacks per cubic yard;
- B. Compressive strength after 28 days cured: 3,500 psi;
- C. Size of coarse aggregates required: No. 1;
- D. Slump: 1" - 3"; and
- E. Air content: 4.5% - 7.5%.

5.2.9.1.3. Concrete that is rejected on the work site for any reason shall not be re-tempered and used in the work without specific approval of the Village Engineer.

5.2.9.1.4. Concrete Curb and Gutter shall be a standard 6" vertical face curb and gutter type that is 30" wide (6" top curb and 24" flange), 9½" deep at the flange and 14" deep at the back of curb.

5.2.9.1.5. Concrete Curb joints to be space at 10 ft. intervals.

5.2.9.1.6. A V-Bottom mountable curb and gutter type that is 30" wide, 9" deep at the flange and 12" deep at the back of curb may be allowed at the discretion of the Village Engineer, on local streets only.

5.2.9.1.7. Where connection is made to existing curb, dowels are required. Dowels conforming to WisDOT Standard Specification Section 505.2.6, shall be installed per WisDOT Standard Specification Section 416.3.6.

5.2.9.2. DESIGN STANDARDS

5.2.9.2.1. Minimum curb grade: 0.7 % (along the gutter flow line).

5.2.9.3. INSTALLATION

5.2.9.3.1. Before the concrete is placed, the crushed aggregate base course under the curb and gutter shall be checked for correct elevation.

5.2.9.3.2. The concrete shall be placed in as nearly a continuous operation as possible.

5.2.9.3.3. Prior to applying curing material on the concrete, the face of the curb shall be "branded" with a "W" designating the location(s) of water services, "S" designating the location(s) of sanitary laterals and "SS" for storm sewer laterals. Physical placement of the branding shall be reasonably accurate in a vertical plane above the respective lateral.

5.2.9.3.4. The concrete surface shall be sealed, directly after finishing operations, by spraying a uniform coating of white curing material meeting the requirements of WisDOT Standard Specification Section 415.2.4, in such a manner as to provide a continuous water-impermeable film on the entire concrete surface.

5.2.9.3.5. Transverse contraction joints for curbs shall be cut or sawed at a maximum 10-foot intervals. One inch expansion joints shall be provided at ends of radii, points of considerable change in grade and alignment, at intervals not to exceed 300 feet and where abutting existing curb and gutter.

5.2.9.3.6. Concrete curb and gutter shall cure a minimum of 4 days prior to backfilling and crushed stone base installation.

5.2.9.3.7. Four days after the curbs have been placed and the Village has approved the concrete work, the Contractor shall immediately backfill behind the curbs to preclude any erosion or undermining.

5.2.10. ROAD UNDERDRAIN PIPE

5.2.10.1. MATERIALS

5.2.10.1.1. A continuous 4" diameter perforated, corrugated polyethylene drain pipe, meeting the requirements of AASHTO Designation: M-252, shall be installed under the curb and gutters and extend 50 feet in either direction from storm water catch basins located at low points. For catch basins in other locations, the 50-ft. drain pipe shall be connected only to the upstream side.

5.2.10.1.2. Pipe perforations may be holes or slots and may be in 3 or 4 lines spaced around the circumference of the pipe at 120° or 90° respectively. The end of the drainage pipe opposite the catch basin shall be capped with a cap suitable for installing on the drainage pipe.

5.2.10.1.3. Enough geotextile fabric must be provided as to cover the sides and bottom of the trench and overlap across the top of the trench by a minimum of 4 inches or the pipe in a sock may be used, see Detail Figure No. 7.

5.2.10.1.4. The trench shall be backfilled with open graded $\frac{3}{4}$ " clear stone.

5.2.10.2. INSTALLATION

5.2.10.2.1. The 4" drainage pipe shall be laid in an 8" deep by 8" wide trench with flat bottom with square sides. The trench, constructed at an elevation lower than the base course, shall be aligned with the proposed centerline of the flange of the curb and gutter. Any damaged drain pipe shall be replaced before the open graded stone is backfilled in the trench.

5.2.11. DRIVEWAYS

5.2.11.1. DESIGN STANDARDS

5.2.11.1.1. Driveway approaches are to be constructed by removing existing curb and gutter and installing poured in-place concrete. This activity requires a Driveway Approach Permit issued by the Village.

5.2.11.1.2. Driveway slopes shall not exceed 10%.

5.2.11.1.3. Driveway slopes shall not exceed 5% in all areas within 25 feet of a building.

5.2.11.1.4. For commercial, industrial and multi-family buildings, if the initial 25 feet of driveway is deemed to be an accessible passenger loading zone, the American Disabilities Act (ADA) requires accessibility routes with longitudinal slopes of not greater than 5% and cross slopes of 2% to be connected to the loading zone and the accessible building entrance.

5.2.11.1.5. AASHTO Sight Distance requirements shall be required at all driveway locations.

5.2.11.2. RESIDENTIAL DRIVEWAYS

5.2.11.2.1. Only one driveway is allowed per parcel for residential developments.

5.2.11.2.2. For multi-family developments, the Plan Commission may grant one or more additional access points, based on the size of the development.

5.2.11.2.3. All residential driveways along roadways with vertical face curb and gutter and side path shall be constructed with a driveway apron.

5.2.11.2.4. Residential width at curb or shoulder = 25' max

5.2.11.3. COMMERCIAL DRIVEWAYS

5.2.11.3.1. The number of commercial driveways shall be the minimum necessary to provide reasonable access for regular traffic and emergency vehicles, while preserving operations and safety along the public roadway. Unless a Traffic Impact Analysis (TIA) shows that a single driveway cannot provide this, only one driveway access will be permitted unless one or more of the following conditions are met.

5.2.11.3.2. The continuous frontage of the parcel is over 300 feet long, in which case an additional driveway per each 300 feet or frontage may be granted by the Plan Commission. Commercial or Retail width at curb or shoulder = 45' max

5.2.11.3.3. Two one-way driveways may be permitted along frontage of at least 150 feet provided the driveways do not interfere with operations at other driveways or along the street.

5.2.11.3.4. The Plan Commission may determine additional driveways are justified due to the amount of traffic generated by the use without compromising traffic operations along the public street.

5.2.11.3.5. All commercial driveways along roadways with vertical face curb and gutter shall be constructed with a minimum of a driveway apron. Certain locations with heavy amounts of traffic will need to use a street type entrance as directed by the Village Engineer.

5.2.11.4. INSTALLATION

5.2.11.4.1. The concrete surface shall be sealed, directly after finishing operations, with a uniform coating of curing material meeting the requirements of WisDOT Standard Specification Section 415.2.4, in such a manner as to provide a continuous water-impermeable film on the entire concrete surface.

5.2.11.4.2. Concrete driveway approaches shall be a minimum of 7" thick.

5.2.11.4.3. Asphalt driveway approaches shall be a minimum of 3" thick.

5.2.11.4.4. The modification of the curb and gutter and the construction of the driveway approach shall be done in accordance with the driveway approach permit.

5.2.11.4.5. Concrete curb and gutter shall not be saw cut horizontally at driveways. Reconstruction of the curb and gutter is required.

5.2.11.4.6. Expansion joint material, ½" thick for full depth of concrete, shall be placed between the curb and gutter and the approach. Dowels shall be required at the joints between existing curb and new curb.

5.2.12. PARKING LOTS

5.2.12.1. (The Reader is referred to Village of Germantown Code Section 17.45 for additional Parking Lot Standards)

5.2.12.2. Off street parking lots shall be designed to accommodate traffic volumes and pedestrian circulation based on the land use served. And should be situated as close to accessible building entrances as possible.

5.2.12.3. The internal circulation pattern shall be designed with 24-ft. wide driving aisles (measured from edge of pavement marking to edge of pavement marking) for two-way traffic to allow users to maneuver in an efficient & safe manner.

5.2.12.4. The use of landscaped islands & medians shall be used to provide positive guidance to motorist and establish proper driving patterns.

5.2.12.5. Sidewalks adjacent to parking stalls shall be 8 feet wide. Smaller sidewalks may be allowed with prior Village approval. Appeals may be made to the Plan Commission.

5.2.12.6. Turning radii for a single unit truck (SU Design Vehicle) shall be provided as a minimum to all portions of the lot.

5.2.12.7. Slope shall be 2% max in all directions

5.2.12.8. The van-to-regular accessible space ration should equal 1:6.

5.2.12.8.1. Stall dimensions should be as follows:

A. Stall Lengths = 20' min.

B. Stall Widths:

i. Car = 108" min.

ii. Van = 132" min; or 96" min with 96" aisle.

5.2.12.9. Signage and pavement marking required for each stall.

5.2.12.10. Pavement:

5.2.12.10.1. General parking areas are recommended to have at least a minimum of 8-inches of crushed aggregate base course and 2-inches of 3 LT 58-28S Asphaltic Concrete and 2 inches of 4 LT 58-28S Asphaltic Concrete.

5.2.12.10.2. Areas of heavy traffic, such as loading docks, shall have at least a minimum of 10-inches of crushed aggregate base course and 4-inches of 3 LT 58-28S Asphaltic Concrete and 4 inches of 4 LT 58-28S Asphaltic Concrete. Inverted parking lots are discouraged.

5.2.13. SIDEPATHS AND TRAILS

5.2.13.1. MATERIALS

5.2.13.1.1. Concrete for side paths shall be air entrained, Grade A, conforming to WisDOT Standard Specifications, Section 501, meeting the following requirements:

- A. Minimum concrete content, 6.0 sacks per cubic yard;
- B. Compressive strength after 28 days cured: 3,500 psi;
- C. Maximum amount of water per bag of cement: 6.0 gallons;
- D. Size of course aggregates required: No. 1 plus No. 2;
- E. Slump: 1"-3"; and
- F. Air content: 4.5% - 7.5%.

5.2.13.1.2. Side paths are to be constructed of 5-inches of concrete over a 4-inch crushed aggregate base course.

5.2.13.1.3. Driveway crossings shall be 7-inches of concrete over a 6-inch crushed aggregate base course.

5.2.13.1.4. Trails shall be constructed of a 4 LT 58-28S mix asphalt 3-inches thick over a 5-inch crushed aggregate base course or as directed by the Village Engineer.

5.2.13.2. DESIGN STANDARDS

5.2.13.2.1. Current and future planned side path and trail locations are identified in the Village's Comprehensive Plan. Any development that occurs on or adjacent to these locations is required to connect to, or construct its portion of the system, if not currently in place, or provide detailed rationale and request a waiver from the Plan Commission and/or Common Council

5.2.13.2.2. Side paths shall be separated from the street by a minimum 6-foot wide grassy terrace with shade trees.

5.2.13.2.3. The outside edge of side paths shall be located 1-foot from the right-of-way line or as directed by the Village Engineer except at intersection crossings. At intersection crossing, the proper placement shall be determined by the location of the crosswalk and as directed by the Village Engineer.

5.2.13.2.4. Width of Sidepath:

Local Roads	5 Feet
Collectors and Arterials	6 Feet

5.2.13.2.5. Trails shall be a minimum of 10 feet wide with 1 foot of gravel shoulder on both sides and in conformance with AASHTO's Guide for the Development of Bicycle Facilities.

5.2.13.2.6. Traverse grade of 2% (1/4" per foot) draining toward the road.

5.2.13.2.7. The maximum allowed longitudinal grade shall be 5%. This grade shall not be exceeded unless the road grade is of a steeper grade, in which case the longitudinal sidewalk grade shall not exceed the road grade.

5.2.13.3. INSTALLATION

5.2.13.3.1. Sidewalk shall be placed by formed methods.

5.2.13.3.2. Contraction joints shall be not less than $\frac{1}{4}$ " wide and $\frac{1}{2}$ " deep. Contraction joint spacing shall be 5' or as directed.

5.2.13.3.3. Expansion joints shall be located at a minimum 100 ft O.C. Finished joints shall have $\frac{1}{4}$ " radius. After floating, troweling, and jointing, the concrete shall be brushed with a damp bristle brush.

5.2.13.3.4. The concrete surface shall be sealed, directly after finishing operations, with a uniform coating of white curing material meeting the requirements of WisDOT Standard Specification Section 415.2.4, in such a manner as to provide a continuous water-impermeable film on the entire concrete surface.

5.3. INSPECTION

Contractor shall be responsible for the horizontal and vertical control.

5.3.1. ACCEPTANCE TESTING

5.3.1.1. Tests

5.3.1.1.1. Prior to the installation of stone base, or sub-base, the subgrade shall be proof rolled with a fully loaded tri-axle truck. Proof rolling shall be scheduled with the Village Inspector.

5.3.1.1.2. The subgrade shall be inspected before the crushed stone base may be applied. This inspection is done by the Village Inspector or its contracted inspection services. An average tolerance of ± 0.04 -ft. from the approved subgrade elevation shall be allowed.

5.3.1.1.3. The base course shall be inspected and approved by the Village Inspector before the first layer of asphalt can be placed. An average tolerance of ± 0.04 -ft. from the approved base course thickness shall be allowed. Additional proof rolling of base course may be required if, in the opinion of the Village Inspector, conditions have changed.

- 5.3.1.1.4. A Village Inspector shall be present for the placement of all-concrete curb and gutter. This includes the inspection of the base under the curb and gutter, and a check of the alignment and grade of the curb and gutter.
- 5.3.1.1.5. Three test cylinders per 1,000 lineal feet shall be taken during the course of the curb and gutter operations. A testing firm, hired by the Developer, shall pick up the cylinders at the project site within 24 hours of paving, break the cylinders at the appropriate time (7, 14, and 28 days) and submit a test report to the Developer. The Developer shall submit a copy of the report to the Village Engineer or designee.
- 5.3.1.1.6. Curb and gutter elevations will be considered acceptable if certified elevations are within $\frac{1}{4}$ " of design elevations.
- 5.3.1.1.7. If evidence indicates that there is standing water in the gutter flange, that portion of the curb and gutter shall be reconstructed to establish positive drainage.
- 5.3.1.1.8. A Village inspector shall be present whenever any asphalt pavement is being constructed.
- 5.3.1.1.9. Asphalt to be placed on a roadway, shall arrive at the job site at a temperature of 275° F +/- 25° F. The asphalt inspector will periodically test the temperature of the arriving trucks for the temperature of the asphalt. Any trucks not falling within the guidelines for asphalt temperatures shall be rejected. Paving shall not be done at temperatures below 40 degrees F.
- 5.3.1.1.10. Both the binder course and the surface course shall be compacted to not less than 91.5% maximum density. Contractor shall have testing done by an independent Lab unless otherwise approved.
- 5.3.1.1.11. An average tolerance of +/- 0.04-ft. for the binder thickness and +/- 0.04-ft. from the approved final pavement surface elevation shall be allowed.

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6. PROJECT CLOSE-OUT DOCUMENTS

6.1. CONSTRUCTION INSPECTOR BINDER

Village Inspector shall provide the Village with a Construction Inspection Binder including the following documents.

6.1.1. Material Submittals

6.1.2. Inspection Reports

6.1.3. Test Results/Reports

6.1.4. Change Orders / Substitutions

6.1.5. Pay Applications

6.1.6. Final Record Set of Construction Plans

6.2. LIEN WAIVERS

Developer shall provide the Village with all lien waivers pertaining to the Public Infrastructure prior to final acceptance by the Village.

6.3. RECORD DRAWINGS

6.3.1. GENERAL

6.3.1.1. Plans shall be prepared on sheets measuring 12" high by 36" wide. Sheets shall have minimum margins of ½ inch on all sides.

6.3.1.2. The title block shall be in the lower right corner of the as-built and include at a minimum, the following information:

6.3.1.2.1. Village of Germantown or Consultants Logo

6.3.1.2.2. Location of Utility: Street or Easement

6.3.1.2.3. Record Drawing File Number (Provided by Village Engineering Services Division)

- 6.3.1.2.4. Inspected By
- 6.3.1.2.5. Date of Plan Approval
- 6.3.1.2.6. Name of Contractor
- 6.3.1.2.7. Date of Construction
- 6.3.1.2.8. Scale (text and line)
- 6.3.1.2.9. Signature Line for Village Engineer.
- 6.3.1.3. North shall be to the top or right of the sheet and shall be shown by a 2" long north arrow, clearly, shown without intrusion.
- 6.3.1.4. The scale of the record drawings shall be same as construction drawings, 1"=50' or 1"=40'. This shall be shown with a graphic scale and text.
- 6.3.1.5. The seal and signature of the professional engineer responsible for the preparation of the record drawing shall be shown immediately adjacent to the title block.
- 6.3.1.6. All existing lot, property, and utility easement lines in the area in which the utility is located shall be shown.
- 6.3.1.7. Screen any existing features, including but not limited to building corners and parking lots.
- 6.3.1.8. The address, lot and block numbers, and subdivision or development name shall be indicated. Addresses shall be labeled with italics. Unplatted lands and the address of any home on such lands shall be so indicated.
- 6.3.1.9. All street names shall be clearly shown.
- 6.3.1.10. Two SEWRPC reference benchmarks shall be shown on each sheet.
- 6.3.1.11. Plan sheets shall start and terminate at match lines.
- 6.3.1.12. Pipe invert elevations shall be clearly shown.
- 6.3.1.13. Screening of existing sanitary sewer, storm sewer and watermain and service locations either in screened or dashed format.
- 6.3.1.14. Concurrent with the hard copy submittal.
- 6.3.1.15. Provide complete set of records in PDF format.

6.3.1.16. Provide complete set of records in AutoCAD (.DWG) format on CD tied to the Wisconsin State Plane NAD 1927 Wisconsin South Grid coordinate system.

6.3.1.17. The cost of archiving the record drawings and insertion of the data into the Village's GIS System shall be the sole responsibility of the DEVELOPER. Cooperation and submission of the aforementioned data will keep costs to a minimum.

6.3.2. SANITARY SYSTEM

6.3.2.1. A general note on each sheet giving the size, class, type, ASTM designation, and manufacturer of every main and lateral shall be shown, with material quantities clearly tabulated. Complete information on manhole frames / lids / barrel structure shall be noted. Manholes shall be ID'd with Systems Plan Number provided by Village Engineer on record drawing.

6.3.2.2. Sanitary mainline should be thickest line on plan.

6.3.2.3. The percent grade, direction of flow, and center to center length of sanitary sewer installed between manholes and laterals shall be shown.

6.3.2.4. All laterals shall have invert elevations at right-of-way lines or easement line and lengths clearly shown.

6.3.2.5. The following information shall be shown for each manhole:

6.3.2.5.1. Invert elevation of each sewer pipe

6.3.2.5.2. Rim Elevation

6.3.2.5.3. Pipe size of each sewer

6.3.2.5.4. Type of frame to chimney seal

6.3.2.6. Indicate External seals or internal chimney seals

6.3.2.7. All record drawings shall reference NVGD 1929

6.3.3. WATER SYSTEM

6.3.3.1. The size, class, type, and manufacturer of every main shall be shown. The location of the main shall be dimensioned from the centerline of the right-of-way. The center to center length of main installed between valves, fittings, and laterals shall be shown.

6.3.3.2. Water mainline shall be the thickest line on plan.

6.3.3.3. The location of all fittings (including valves, tees, crosses, reducers, air vents, bends, and lateral taps) shall be dimensioned from/to centerline of each fitting. All fittings shall be suitably labeled for identification.

6.3.3.4. Curved lines shall indicate deflected pipe (with curve data provided); lines shall be straight between fittings.

6.3.3.5. Show which side of the main the operating nut for butterfly valves is located on.

6.3.3.6. A general note on each sheet giving the brand and manufacturer (model, size, etc.) for each valve used shall be provided, with quantities of each clearly tabulated. Services shall include footage and count. Complete information on valve boxes and manhole frames / lids / barrel structure shall be noted.

6.3.3.7. All laterals shall be shown giving the length and type of material used. The manufacturer and model of tapping saddle or tee, corporation, curb stop, and box shall be given.

6.3.3.8. Contractor to include latitude, longitude and elevation of the location of all:

6.3.3.8.1. Valves, tees, crosses, reducers, air vents, bends and lateral taps.

6.3.3.8.2. The location shall be tied-in by distance to at least two permanent surface points. These can be manholes, hydrants, other valves, or other suitable points. The point used should be clearly referenced.

6.3.3.8.3. Hydrants.

6.3.3.8.4. The size and type of every hydrant shall be also shown.

6.3.3.8.5. The shutoff valve shall be tied-in to at least two permanent surface points.

6.3.3.8.6. All hydrants differing from 6.5' bury shall have the bury depth or length of extensions installed noted.

6.3.3.8.7. Elevation of each hydrant tied to the northwest nut of the top flange should be shown.

6.3.4. STORM SYSTEM

6.3.4.1. The size and type of all mains and leads shall be shown. Their location relative to the centerline of the right-of-way shall be dimensioned. The total length of sewer installed shall be shown.

6.3.4.2. The center-to-center distance between laterals and/or manholes shall be shown.

6.3.4.3. GPS coordinates, using State Plane NAD 1927 Wisconsin South coordinate system size, type and manufacturer of all manholes, catch basins, inlets, or outlet sections shall be shown. Material quantities shall be clearly tabulated.

6.3.4.4. Elevations of all rims, flow lines, catch basins, gutter inlets, and outlet sections shall be given. Invert elevations shall be given for gutter inlets, catch basins, and manholes. Elevations shall be based on the Village of Germantown datum.

6.3.5. GRADING CERTIFICATION PLAN

6.3.5.1. In preparing a Certification Plan, the Developer's Design Grading Plan shall be shown as screened background.

6.3.5.2. Record drawing grades shown on lot lines shall be no less than 0.30 ft. lower than final grades shown on approved master grading plan or higher than 0.10 ft. above the final grades shown on approved master grading plan. The Developer is required to establish final grades within 5 feet of side lot lines, rear lot lines and the front right-of-way area between the front line lot line and the back of curb in an urban setting or edge of shoulder in a rural setting. These areas shall be described as a "no-touch zone". All grades within the "no-touch zones" shall be certified by Developer's Engineer. Developer shall typically show spot grades alongside lot line at front curb, front property corners, front setback, back of house extended, any high points, and rear property corners.

6.3.5.3. The grades alongside lot lines are needed even in wooded, ungraded areas.

6.3.5.4. Existing house pad grade (elevation taken at the center and each corner of a typical 66' x 54' house, except for lots designed for rear exposure house show existing grade at front and back of typical house). House pads are to be left 1.75' below finish yard grade with a +/- 3" tolerance.

6.3.5.5. Elevations every 50 feet along developer graded swales and ditches.

6.3.5.6. Elevations every 100-ft. Station along the road alignment. Locations shall include:

6.3.5.6.1. Pavement centerline and edges

6.3.5.6.2. Edge of shoulder

6.3.5.6.3. Ditch flowline

6.3.5.6.4. Top of embankment on the backslope of the ditches.

6.3.5.7. After analyzing certified grades, Developer shall identify on plan those areas not within above tolerance. Show areas to be regraded, or areas where it may be desirable to revise the proposed grades in the Master Grading Plan.

6.3.6. STORM WATER BMP CERTIFICATION PLAN

6.3.6.1. Elevations (minimum of every 50')

6.3.6.1.1. Top of Berm

6.3.6.1.2. Top of Slope

6.3.6.1.3. Toe of Slope

6.3.6.1.4. Safety Shelf Edges

6.3.6.1.5. Bottom of BMP

6.3.6.2. Spillway-Top of Slope & Toe of Slope (detailing length, width and height)

6.3.6.3. Structure Locations and Elevations

6.3.6.3.1. Outfall (invert elevation and size)

6.3.6.3.2. Overflow structures (corners of opening) and Piping (invert elevation and size)

6.3.6.3.3. Inlet Structures (center of manhole) and Piping (invert elevation and size)

6.3.6.3.4. Outlet Structures (center of manhole) and Piping (invert elevation and size)

6.3.6.3.5. Weirs (invert elevation and size)

6.3.6.3.6. Orifice (invert elevation and size)

6.3.6.3.7. Inlet/Outlet (invert elevation and size)

6.3.7. EASEMENTS

6.3.7.1. GENERAL

6.3.7.1.1. The Developer shall prepare formal written easement documents, including exhibits and written legal description attachments for each easement and record the same with the County Register of Deeds after review and approval by the Village of Germantown for each utility easement shown on the subdivision plat (or CSM) as a condition of Final Plat (CSM) approval.

6.3.7.1.2. All ponds are to be located in platted outlots.

6.3.7.1.3. No encroachment by structures, berms, trees, shrubs, paved surfaces or changes in grade greater than 4" are allowed in easement areas without approval of the Village Engineer.

6.3.7.1.4. 20-ft. wide minimum width for a single utility. The utility shall be located in the center of the final easement based on record drawing. Easement width may be increased to 50 feet based on pipe size and depth.

6.3.7.1.5. Easements with multiple utilities, the minimum separation from outside of the utility to the easement line shall not be less than 10 feet subject to approval by the Village Engineer. Add not less than 10 feet per additional utility in the easement.

6.3.7.1.6. Maximum ground slope along easements:

- A. transverse: 25%
- B. longitudinal: 10%.

6.3.8. STORM SYSTEM

6.3.8.1. The Village requires public storm sewer and/or drainage easements for any storm water conveyance system that drains public ROW areas or neighboring off-site areas.

6.3.8.2. A storm sewer running along the rear lot lines within a subdivision, specifically to drain backyards, does not warrant a public easement. The Village considers this to be a private system built for the lot owners of the subdivision and owned/maintained by the property owners.

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7. SURVEYING STANDARDS

7.1. GENERAL

7.1.1. Surveys shall conform to the provisions of Chapter 236 of the Wisconsin Statutes, A-E7 of the Wisconsin Administration Code and all applicable ordinances of the Village of Germantown.

7.2. HORIZONTAL AND VERTICAL CONTROL

7.2.1. Horizontal and vertical control shall be maintained throughout the entire project area from the staking of rough grading to final restoration.

7.2.2. Horizontal and vertical control points shall be clearly marked and protected (i.e. lath) during construction.

7.2.3. Second order precision shall be required for vertical control, and the following formula will be used in determining the second order of precision. $E = 0.035 \div M$; where E = error and M = length of the line in miles.

7.2.4. Vertical control points shall be established at least every 800 feet and within 100 feet of any improvement proposed. These control points will be established in accordance with Section 1.1.6, 1.1.7, and 1.1.8 of these Standards.

7.2.5. When plans are submitted for approval to the Village Engineer, the Project Engineer will also at this time submit a list of all permanent benchmarks, all temporary benchmarks, a description of their location and the basis or origin of the vertical control network and the error of closure for the entire network. This section must be complied with before the Village of Germantown will schedule inspections.

7.2.6. All benchmarks shall be run in from one of the following; listed in priority order.

7.2.7. A U. S. Coastal and Geodetic survey monument.

7.2.8. A National Geodetic Survey monument.

7.2.9. A U. S. Public land survey monument and its accompanying reference benchmark.

7.2.10. Permanent benchmarks shall be set only on the following objects:

7.2.10.1. Concrete door stoops.

7.2.10.2. Concrete headwalls.

7.2.10.3. Existing permanent manhole rim (note: manhole must not be located in the general construction area, nor is it to be affected in any way by the project construction).

7.2.11. Fire hydrants on marked flange bolt.

7.2.12. Temporary benchmarks may be set in the following objects.

7.2.13. Power poles.

7.2.14. Trees 12 inches in diameter or greater.

7.2.15. The error in latitude and departure closure for horizontal traverses shall be no greater than the ratio of one in 10,000 (1:10,000).

7.3. CONSTRUCTION STAKING

7.3.1. Roadways shall be staked for subgrade and for final gravel grade and meet the following conditions:

7.3.2. Stakes shall be set along the centerline of the roadway, or approved offset.

7.3.3. Stakes shall be set at 50-foot intervals.

7.3.4. Stakes shall be set for vertical curves at a maximum of 50-foot intervals.

7.3.5. Stakes shall be set for horizontal curves having a degree of curve greater than 30° at a maximum of 50-foot intervals.

7.3.6. Stakes shall be set at points of curvature, points of tangency, and all low/high points on vertical curves.

7.3.7. Lath shall be set next to all roadway stakes and shall have the station labeled with indelible magic marker.

7.3.8. Staking for curb and gutter will be done on a minimum three (3) foot off back of curb with cut/fill to the top of curb.

7.3.9. Staking for sanitary sewer/watermain shall be centerline type or on an offset as requested by the contractor and approved by the Village Engineer.

7.3.10. Staking for sanitary sewer/watermain shall be done every fifty (50) feet along the pipe centerline, or agreed to interval between the Village and contractor.

7.3.11. Manholes shall have stakes at the following locations:

7.3.11.1. Centerline of manhole.

7.3.11.2. Offset (determined by contractor and approved by the Village Engineer—minimum 10-foot).

7.3.11.3. Straddle point.

7.3.12. Catch basins, and hydrants shall have an offset stake (minimum offset 5-foot).

7.4. MONUMENTS

7.4.1. Lot corner monuments (i.e. iron pipe, rebar) shall be pounded flush with existing ground, thus conforming with Wisconsin Statute 236.15 (1).

7.4.2. All 1-inch iron pipe or iron rebar to be used to monument a lot corner it shall include a plastic or aluminum survey cap on top which bears the project surveyor's state registration number. Both types of monuments are to conform to the current minimum length and weight requirements

7.4.3. A subdivision corner which is also a U.S. Public Land Survey corner shall be monumented using the following type of monument in the specified area:

7.4.4. 6-inch x 6-inch concrete monument with 4-inch brass cap Monuments will be supplied by the Washington County Surveyor. The County Surveyor shall be notified in writing of any USPLSS corners that will be disturbed by construction 30 days prior to the start of construction. This is a Wisconsin Statutory requirement. Replacement monuments will then be installed by the County Surveyor and/or the Village of Germantown. This will be done at the Developer's expense.

7.5. PLATTING

7.5.1. Final subdivision plats will be signed by the Village once all construction has been completed and accepted, all punch list items resolved, all record drawings have been submitted and approved and all boundary markers have been set in conformance

STATUS OF PROJECTS

SEPTEMBER 4, 2019

- 1) Goldendale Road_Ph 1 Sanitary & Water; Minor punch list items remain. Railroad track settling issue remains under sanitary sewer installation, contractor and Railroad personnel working at correcting problem.
- 2) Goldendale Road/Holy Hill Road Sanitary Sewer Ph 2; Sanitary sewer is Complete. Pavement binder course placed. Turf restoration has started. Surface asphalt scheduled for mid September.
- 3) Goldendale Road/Holy Hill Road Water Main Ph 2; system is on-line, Turf restoration started week of August 26, 2019.
- 4) Design of future sanitary sewer and water main to the NW corner of Holy Hill Road and Goldendale Road is complete. Site of new Dielectric facility in 2019. Change Order for work approved by Village Board on August 5, 2019. Contractor to start work week of September 2, 2019. When this work on Holy Hill Rd is completed contractor to get Holy Hill Rd paved while installation of pipe continues northerly of Holy Hill Rd. Plan to have Holy Hill Rd reopened by October 1, 2019
- 5) NE Interceptor (sanitary sewer) serves the Wrenwood Development Area and areas south of Mequon Rd and east of Country Aire Dr including Pheasant Ln. Minger has started work on Country Aire Dr. working from the north to the south. First section of 421 lf is completed and northern most manhole is backfilled. One Easement required at property owned by Ken & Marge Miller, Title Search & Appraisal have been completed and agreement to the cost of easement finalized.
- 6) Booster station pump and associated water main have been installed, tested and placed in service. Submittal to PSC for Booster Station/Pressure Reducing Station has been sent
- 7) Zilber Buildings #2 & #3 construction has begun. Bldg #3 & Bldg #2 walls are complete, install of roog materials in progress. Concrete loading dock pads have been placed. The estimated target date for completion is December 2019 for Bldg #3 with bldg. #2 following shortly thereafter.
- 8) Design of Holy Hill Road reconstruction plans have not been started. RFP for Engineering Consultant in September 2019

- 9) Application to the WIDNR for the new well site in TID #8 (SE corner of Gateway Crossing & Rockfield Road) has been submitted. WIDNR has approved the New Well #12 site. Design of site layout is underway and Well submittal to be in October 2019
- 10) Water Tower design is in progress, 500,000 gal capacity. Formal submittal sent to PSC. Start date TBD
- 11) CIPP (pipe lining) project bid on April 4, 2019. Contracts are executed pre-construction meeting to be held with Lanzo Technologies at a future date.
- 12) Park Avenue Reconstruction; Work was started on July 10, 2019 with pavement milling, tree removal is complete, sanitary sewer, water & storm sewer installation is completed. Unexpected bed rock removal with the sanitary sewer relay has caused some delay, the revised estimated completion date for the project is October 1, 2019
- 13) PP/II project--direction from MMSD received regarding approved materials for lining laterals. DPW, Waste Water Superintendent & Village Engineer met with MMSD staff to obtain current MMSD requirements on August 27, 2019. MMSD staff informed Germantown that they are experiencing failures in the pipe lining that has been completed. MMSD is gathering information regarding the failed lining and is currently re-evaluating the lateral lining procedure. Village staff directed to delay bidding Village work until more information is obtained regarding the current lining processes.
- 14) Sidewalk on Hilbert Dr north of Squire Dr—Plans are complete, estimate to construct in 2019
- 15) Sanitary Sewer and Water Main for the Dielectric site will start week of September 2, 2019. This sanitary sewer and water main will also service the site being developed by the Dickman Group (southwest corner of Goldendale Rd & Rockfield Rd) for the Illing Company.
- 16) Wrenwood Development_ Ph #1 started grading with utilities to follow in mid-September, tree/brush clearing complete.
- 17) Traffic Coordination Project on County Line Road (CTH Q); This is the coordination of the traffic signals from Division Rd to Appleton Ave. Work (after nearly 6 years) is near completion, waiting for new controllers from WIDOT to arrive and be installed. This is a group effort between the Village of Germantown, Village of Menomonee Falls and the Wisconsin Department of Transportation. Anticipate up and running very soon, delay in software on WIDOT side.

- 18) 2019 Road Improvement project; The paving portions of the 2019 Road Program have been completed. It should be noted that there were significant undercuts required on Merkel Drive, Woodland Drive, Oakview Ave and Rosewood Ave due to very poor base material. Recycled asphalt shoulders have been installed and restoration work on the remaining shoulders is scheduled for late September.
- 19) Remaining walkway on Wasaukee Rd from Prairie Glen II development to Mequon Rd complete this year. Estimate of time TBD
- 20) Glenwood Area sanitary sewer, water main and road project schedule remains undetermined.
- 21) PASER Rating of Roads: Pavement And Surface Evaluation Rating (PASER) of Germantown's roads commenced in mid-August. Staff are making a concerted effort to thoroughly inspect every segment of road maintained by Germantown. It is anticipated that the inspections will be completed in November, and the pavement ratings are to be submitted to WisDOT by December 15, 2019. Based on the updated road ratings, we intend to bring a revised 10-year Road CIP to the committee for review and approval.
- 22) GIS Progress Report; Public Works transitioned to a GIS tool called AssetAlly in mid-2019. Staff were also trained on the capabilities and uses of the new software package as it relates to each department. Work continues on adding and improving upon the information in the Village's GIS system.
- 23) The Village of Richfield has made preliminary inquiries related to the Village of Richfield obtaining sanitary sewer and water services from the Village of Germantown. The area being looked at is the area immediately west of I41 and north of Holy Hill Road (north of the Kwik Trip site). MMSD has been contacted by the Village of Germantown with preliminary questions regarding capacity and procedure.