



**CITY ZONING COMMISSION**  
**AGENDA-Tuesday, February 4, 2020, 4:30 p.m.**  
**Miller Building, 1st Floor Conference Room**  
**2825 3rd Avenue North, Billings, Montana**

NOTICE TO THE PUBLIC

Public Comment:

There will be a Public Comment Section as noted on the agenda. This is the time members of the public may comment on any item not appearing on the agenda. Under State law, matters presented under this section cannot be discussed or acted upon by the Zoning Commission during this time. For items appearing on the agenda, the public will be invited to make comments at the appropriate time. It is very important to speak clearly, and state your name and address for the record. Please limit your comments to three (3) minutes or less.

**Call the meeting to order.**

**Introduction of City Zoning Commission Members and Planning Department Staff.**

**Public Comment**

**Approval of Minutes:**

The minutes of the Board meeting of January 7, 2020

**Disclosure of any Conflict of Interest-Members of the Commission and Staff**

**Disclosure of an Outside (Ex Parte Communication)-Members of the Commission and Staff**  
**a. The Exparté Communication Binder is available at the Sign-In and Agenda Station.**

**Regular Business:**

- A. Opening of public hearings.
- B. Reading of rules for the procedure by which the public hearings will be conducted.
- C. Reading of notices of the public hearings on the following items:

**Public Hearings:**

- a. City Special Review 981 – NW Corner of Shiloh Road and Central Ave. – Car Wash – A special review request to allow a stand-alone car wash facility, on Lot 22A, Block 2 of Certificate of Survey 2727M, a 4.708 acre parcel of land. The parcel is currently outside the City limits of Billings. There is a pending annexation request. Presented by Karen Husman, Planner I.

## **Other Business/Announcements**

## **Adjournment**

**The City Council has designated Monday, February 24, 2020, at 5:30 p.m. in the City Council Chambers as the time and place to hear testimony for or against the special review.**

Before taking any action on an application for a **special review use**, the City Council shall first consider the findings and recommendations of the City Zoning Commission. In no case shall the City Council approve a special review use other than the one advertised. The City Council shall take one of the following actions on these Special Review requests: 1) approve the application; 2) conditionally approve the application; 3) deny the application; 4) allow withdrawal of the application; or 5) delay the application for a period not to exceed thirty (30) days.

Testimony regarding the above mentioned item may also be submitted in writing to the Planning Division, 2825 3<sup>rd</sup> Avenue North, 4<sup>th</sup> Floor, Miller Building, Billings, MT 59101 (247-8676) or to the Mayor and City Council, P.O. Box 1178, Billings, MT 59103.

Additional information on any of these items is available in the Planning and Community Services Office. Public hearings are accessible to individuals with physical disabilities. Special arrangements for participation in the public hearings by individuals with hearing, speech, or vision impairment may be made upon request at least three days prior to the hearing. Please notify Robbin Bartley, Administrative Assistant, at 247-8676 or e-mail to [bartleyr@ci.billings.mt.us](mailto:bartleyr@ci.billings.mt.us)

**City Zoning Commission**

**Meeting Date:** 02/04/2020

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**Information**

**Subject**

The minutes of the Board meeting of January 7, 2020

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**Attachments**

BZC\_20200107

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## City of Billings Zoning Commission Meeting Minutes January 7, 2020

The City of Billings Zoning Commission met on Tuesday, January 7, 2020 in the Miller Building 1<sup>st</sup> Floor Conference Room, 2825 3<sup>rd</sup> Avenue North, Billings, Montana.

Chairman Wagner called the meeting to order at 4:30 p.m. The City Council has designated Monday, January 27, 2020 at 5:30 p.m. in the City Council Chambers as the time and place to hear testimony for or against the zoning applications.

Commission and Staff		0	0	0	0	0	0	0	0	0	0	1	1	1
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Mike Larson	Commissioner	1												
Daniel J. Brooks	Commissioner	E												
Jack King	Commissioner	1												
Greg McCall	Commissioner	1												
Vacant	Commissioner													
Wyeth Friday	Director, Planning & Community Services	-	-	-	-	-	-	-	-	-				
Monica Plecker	Division Planning Manager	-	-	-	-	-	-	-	-	-				
Nicole Cromwell	Planner Zoning Coordinator	1												
Tammy Deines	Planning Clerk	-												
Dave Green	Planner II	-	-	-	-	-	-	-	-	-				
Karen Husman	Planner I	1												
Robbin Bartley	Administrative Support	1												

<b>Total Number of 2019 Applications</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>T O T A L</b>
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<b>Zone Change</b>	2											2	
<b>Special Review</b>	0											0	

Chairman Wagner introduced the Planning Division Staff and Commission: Attending Staff were Nicole Cromwell, Zoning Coordinator, Karen Husman, Planner I, and Robbin Bartley, Administrative Assistant.

**In Attendance** : Alicia Christenson, Richard Miller, Scott Aspenlieder, Bill Morgan

**Public Comment**

**Chairman Pro Tem Larson** called for public comments. There were no public comments. **Chairman Pro Tem Larson** closed the public comment portion of the meeting.

**Approval of Minutes:**

**Chairman Pro Tem Larson** called for approval of the November 5, 2019 meeting minutes.

**Motion**

Commissioner King made a motion and Commissioner McCall seconded the motion to approve the November 5, 2019 meeting minutes.

<b>COMMISSIONER</b>	<b>Yes</b>	<b>No</b>	<b>ABSTAINED</b>	<b>ABSENT</b>
Mike Larson	X			
Daniel J. Brooks				X
Jack King	X			
Greg McCall	X			
Vacant				

**The motion for approval then carried with a unanimous voice vote 3-0.**



**Disclosure of Conflict of Interest**

<b>COMMISSIONER</b>	<b>Yes</b>	<b>No</b>	<b>ABSTAINED</b>	<b>ABSENT</b>
Mike Larson		X		
Daniel J. Brooks				X
Jack King		X		
Greg McCall		X		
Vacant				

**Disclosure of Outside Communication**

<b>COMMISSIONER</b>	<b>Yes</b>	<b>No</b>	<b>ABSTAINED</b>	<b>ABSENT</b>
Mike Larson		X		
Daniel J. Brooks				X
Jack King		X		
Greg McCall		X		
Vacant				

**Public Hearings:**

Chairman Pro Tem Larson reviewed the rules and the procedures by which the City Zoning Commission public hearings are conducted and advised the audience this would be heard by the City Council on January 27, 2020.

**Item #1**

Nicole Cromwell read aloud the legal notice for this application:

**City Zone Change 975 – SW corner of S 46<sup>th</sup> St. W & King Ave W - Modification to the Western Sky Planned Development** - A zone change request to amend the Planned Development Agreement (PDA) for Western Sky Subdivision, more specifically the underlying Neighborhood Commercial (NC) allowed uses to include certain light

manufacturing, ancillary warehousing and preparation facilities. The amendment also clarifies offices and manufacturing facilities shall conform to the setbacks in the Billings zoning code for all NC zone districts, however, any ancillary warehouse facilities shall be set back a minimum of 40 feet from the front property line along King Avenue West. Mini storage facilities will continue to be set back a minimum of 150 feet from the King Avenue West property line. The amendment includes an allowance for a 45-foot building height limit in the NC zone district. The amendment applies to Lots 2 & 3, Block 1, Western Sky Subdivision Amended, a 9.128 acre parcel of land. A pre-application neighborhood meeting was held on November 25, 2019, at the offices of Sanderson Stewart, 1300 N. Transtech Way. Tax ID: C15620 & D00614

**Recommendation**

Planning staff recommends approval of **Zone Change 975** for an amendment to the Planned Development agreement for Western Sky Subdivision.

**Questions for staff:**

Commissioner King asked if there are any landscaping specifications by staff. Staff replies regarding the existing landscaping requirements of the Planned Unit Development.

**Public Hearing** Chairman Pro Tem Larson opened the public hearing and asked for anyone wishing to speak in favor or against **City Zone Change 975**.

**Favor:**

**Bill Morgan, Sanderson Stewart, agent**

This is meant only to be an amendment. A possible purchase may require these additional uses. The height is allowable on adjacent properties. The building faces east. The truck movement is on the south side.

Questions: Commissioner King asked what kind of landscaping is to be expected. Compliance with all requirements.

**Opposed:**

NONE

Public Hearing CLOSED AT 4:49

**Discussion**

Chairman Pro Tem Larson called for questions and discussion from the Board.

**Motion**

**Commissioner McCall made a motion and Commissioner King seconded the motion to approve City Zone Change 975.**

COMMISSIONER	Yes	No	ABSTAINED	ABSENT
Mike Larson	X			
Daniel J. Brooks				X
Jack King	X			
Greg McCall	X			
Vacant				

**The Motion carried with a 3- 0 vote.**

**Item #2**

Nicole Cromwell read aloud the legal notice for this application: Karen Husman presenting:

**City Zone Change 976 – 727 Lincoln Lane - from R-70 to HC-** A zone change request from Residential-7000 (R-70) to Highway Commercial (HC), on Lots 1 & 2, Block 2 Bede Subdivision, a 25,200 square foot parcel of land. A pre-application neighborhood meeting was held on November 21, 2019, at 231 Main Street. Tax ID: A29430

**Recommendation**

Planning staff recommends approval and adoption of the findings of the 10 criteria for Zone Change 976.

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**Discussion**

Chairman Pro Tem Larson called for questions and discussion from the Board.

**Public Hearing**

Chairman Pro Tem Larson opened the public hearing and asked for anyone wishing to speak in favor or against **City Zone Change 976**.

**Scott Aspenlieder, Performance Engineering, agent**

There is an existing warehouse on this parcel. Existing zoning does not allow building permits. The owner would like to improve this structure.

**Questions:**

Commissioner McCall asked if there is a proposed use that could be made public. Mr. Aspenlieder replied the intent of the owner is to remain private.

**Favor:** NONE

**Opposed:** NONE

Chairman Pro Tem Larson closed the public hearing and called for a motion.

PUBLIC HEARING CLOSED AT 4:55pm

**Motion**

**Commissioner King made a motion and Commissioner McCall seconded the motion to forward a recommendation to City Council to conditionally approve with the conditions recommended by staff for City Zone Change 976.**

**Discussion** There was no discussion on the motion.

<b>COMMISSIONER</b>	<b>Yes</b>	<b>No</b>	<b>ABSTAINED</b>	<b>ABSENT</b>
Mike Larson	X			
Daniel J. Brooks				X
Jack King	X			
Greg McCall	X			
Vacant				

**The Motion carried with a 3- 0 vote.**

The City Council has designated **Monday, January 27, 2020** at **5:30** p.m. in the City Council Chambers as the time and place to hear testimony for or against the zoning applications.

**Other Business**

**Adjournment:** The meeting adjourned at 5:00 p.m.

**ATTEST:** Approved by a motion at the next scheduled meeting, February 4, 2020.



**City Zoning Commission**

**Meeting Date:** 02/04/2020

**SUBJECT:** City Special Review 981- To allow a car wash in a NC zone

**THROUGH:** Karen Husman

**PRESENTED BY:** Karen Husman

**Information**

**REQUEST**

City Special Review 981 – NW Corner of Shiloh Road and Central Ave. – Car Wash – A special review request to allow a stand-alone car wash facility, on Lot 22A, Block 2 of Certificate of Survey 2727M, a 4.708 acre parcel of land. The parcel is currently outside the City limits of Billings. There is a pending annexation request. Presented by Karen Husman, Planner I.

**RECOMMENDATION**

Planning staff has reviewed this application and is recommending conditional approval of Special Review 981.

**APPLICATION DATA**

OWNER: Amy Iwata, Trustee

AGENT: Bryan Alexander, Sanderson Stewart

LEGAL DESCRIPTION: Lot 22A, Block 2 of Certificate of Survey 2727M

ADDRESS: No address/generally located on the NW corner of Shiloh Road and Central Ave

CURRENT ZONING: Neighborhood Commercial

EXISTING LAND USE: Agricultural

PROPOSED USE: Car Wash

SIZE OF PARCEL: 4.708 Acres

**CONCURRENT APPLICATIONS**

Annexation 20-01.

**APPLICABLE ZONING HISTORY**

SUBJECT PROPERTY		DATE	FOR	APPROVED (Y/N)	ADDITIONAL DATA
	County ZC 347	12/13/1983	R-150 to NC	Yes	
SIMILAR PROPERTY	SR #	DATE	FOR	APPROVED (Y/N)	ADDITIONAL DATA
2335 Lewis Ave	980	11/5/19	Car wash	Y	SR approved, Concurrent ZC denied making SR invalid.

**SURROUNDING LAND USE & ZONING**

NORTH: Zoning: R-150

Land Use: Clydesdale Park (County)

SOUTH: Zoning: NC, RMF & R-96

Land Use: Cenex Zip Trip, Morning Star Senior Living, New YVEC substation and vacant commercial land

EAST: Zoning: CC

Land Use: Shiloh Commons (mixed use)

WEST: Zoning: R-150

Land Use: Shiloh Estates - single family county subdivision

## BACKGROUND

The applicant is requesting a special review to allow a stand-alone car wash facility, on Lot 22A, Block 2, of Certificate of Survey 2727M, a 4.708 acre parcel of land. The contract purchaser, Buggy Bath Carwash, is proposing development of the car wash on the northerly 2.22 acres and keeping the remaining 2.5 acres undeveloped at this time. The lot is currently outside the City limits of Billings and has a concurrent application for annexation being processed. The City Council will consider the petition for annexation and this Special Review recommendation during the same regular business meeting to ensure the property is annexed before the Special Review is acted upon.

A Traffic Impact Study was prepared by the current property owner, and is included with the application. The study concluded the proposed use would have low impact on traffic. No improvements were recommended for the intersection at this time to improve capacity. A Special Review is necessary for the intended use of a car wash in the existing NC zone. The developer intends to orient the site to minimize impacts on adjacent residential properties by facing dryers away from them, using low-noise dryers in the automatic tunnel and touch less automatic bay, and providing a six foot high block wall adjacent to the residential parcels.

## SUMMARY

Before a recommendation of approval or conditional approval can be made, each special review request must demonstrate conformance with three primary criteria: 1) the application complies with all parts of the Zoning Regulations, 2) the application is consistent with the objectives and purposes of the Zoning Regulations and the 2016 Growth Policy, and 3) the application is compatible with surrounding land uses and is otherwise screened and separated from adjacent land to minimize adverse impacts.

This application conforms to the *first* criteria in so far that the zoning regulations adopted by the City Council has designated all NC zoning districts can have a car wash as long as they go through the special review process. The subject property is also within the Shiloh Overlay District. The requirements for the Shiloh Overlay District are activated upon annexation to the city limits. There are requirements for landscaping and screening from residential uses next to commercial uses within the zoning regulations, the overlay district has additional requirements for landscaping, signage and building design. The proposed facility meets the requirements of the zoning regulations.

The application meets criteria from the *second* requirement, as it is consistent with some of the objectives of the 2016 Growth Policy:

- **Essential Investments:** Infill development and development near existing City infrastructure may be the most cost effective.

The proposed special review will promote development of a commercial service on a parcel where none currently exists on land zoned appropriately for this commercial use. The property is located on a principal arterial street near an intersection of two principal arterial streets. The property has easy access to City services and infrastructure.

- **Strong Neighborhoods:** Neighborhoods that are safe and attractive and provide essential services are much desired.

The proposed development of this land will provide services to the immediately adjacent neighbors as well as capture existing traffic from Shiloh Road and Central Avenue. The proposed use is not expected to generate much new traffic, but does take advantage of current high volume traffic on two arterial streets. Conditions of approval will be proposed to ensure this development does not impact the neighboring properties with excessive noise, light and other intrusions.

- **Community Fabric:** Attractive, aesthetically pleasing, uniquely Billings

Upon development of the site, this property will comply with current City standards on landscaping both within the property and adjacent the the public ROW. This property is within the Shiloh Overlay District and will be subject to

the development standards for the corridor.

The application also meets the *third* criteria in that it is compatible with surrounding land uses in the area. This site is in an area of Billings with commercial and residential uses. There are residential zoning and uses to the north and west, and commercial and residential mixed uses to the east, and commercial to the south. There are impacts from the proposed use that need to be mitigated. The conditions recommended with the special review should mitigate impacts on the surrounding properties.

## **PROPOSED CONDITIONS**

1. The special review approval is limited to on Lot 22A, Block 2, of Certificate of Survey 2727M, a 4.708 acre parcel of land generally located near the NW corner of Shiloh Road and Central Ave.
2. The special review is for the construction and operation of a stand-alone car wash. No other use is intended or implied.
3. The site shall be developed in substantial conformance with the site plan submitted.
4. To mitigate the long term impacts of this facility on the residential development to the west, a solid wall will be built to screen the residences from light and buffer noise emanating from the site.
5. There will be no construction activities, including site preparation such as grading, operating equipment or digging prior to 7 a.m. or after 8 p.m. daily.
6. The proposed development shall comply with all other limitations of Section 27-613 of the Zoning Regulations concerning special review uses, and all other City of Billings regulations and ordinances that apply.
7. These conditions of special review approval shall run with the land described in this authorization and shall apply to all current and subsequent owners, operators, managers, lease holders, heirs and assigns.

**\*\*NOTE\*\*** Approval of this Special Review does not constitute approval of a building permit, sign permit or fence permit. Compliance with all applicable local codes will be reviewed at the building permit level. This application is for a Special Review as noted above and no other request is being considered with this application. The Planning Division points out that the use and development of the property must be in accordance with the submitted site plan.

## **Zoning Commission Action**

The City Zoning Commission shall make a recommendation to the City Council to:

1. Deny the application for a special review use.
2. Grant the application for a special review use.
3. Conditionally grant the application for a special review use.
4. Delay action on the application for a period not to exceed thirty (30) days.
5. Give reasons for the recommendation.

Before recommending approval of a special review use, the Zoning Commission shall find that the contemplated use:

1. Complies with all requirements of this Article (27-1500);
2. Is consistent with the objectives and purposes of Chapter 27 and the Comprehensive Plan;
3. Is compatible with surrounding land uses or is otherwise screened and separated from adjacent land in such a way as to minimize adverse effects.

Further the Zoning Commission shall consider and may impose modifications or conditions concerning, but not limited to the following:

1. Street and road capacity;
2. Ingress and egress to adjoining streets;
3. Off-street parking;
4. Fencing, screening and landscaping;
5. Building bulk and location;
6. Usable open space;
7. Signs and lighting; and/or
8. Noise, vibration, air pollution and similar environmental influences.

## **RECOMMENDATION**

The Planning Division recommends conditional approval and adoption of the findings of the three criteria for Special Review 981. This application is pending approval of an application for annexation to the City of Billings.

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### **Attachments**

Zoning Map & Site Photos

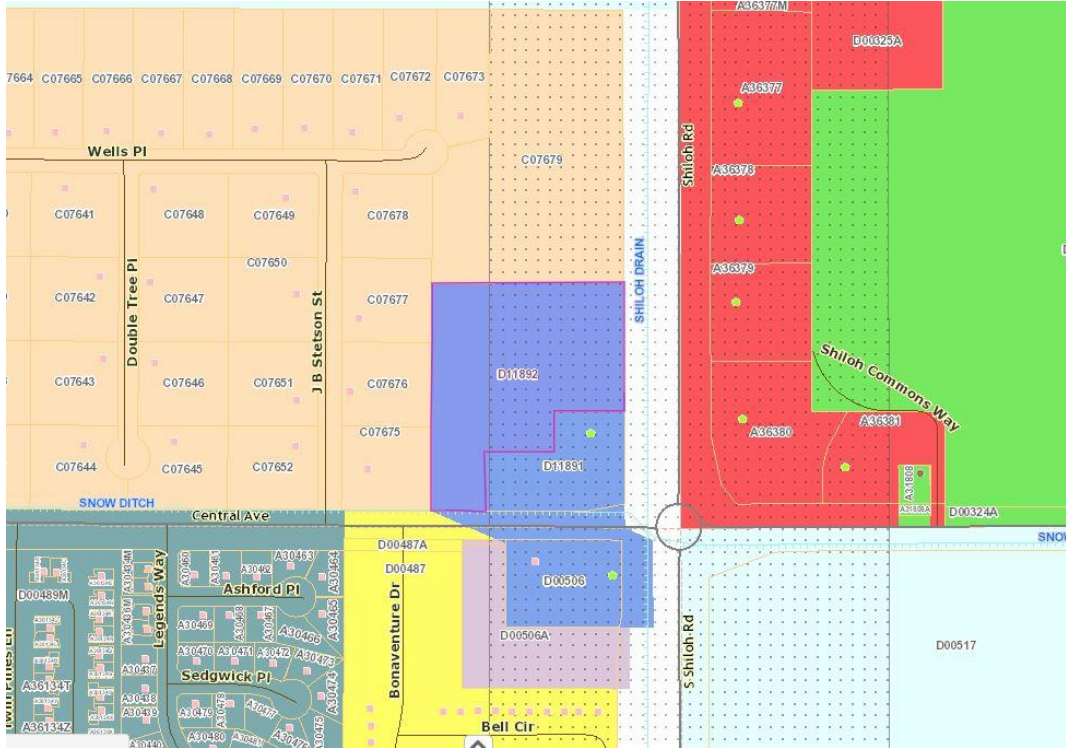
Application. Appl. Letter

Site Plan

Traffic Impact Study

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# Zoning Map & Site Photos



Zoning Map



Aerial photo



City Limits





North



East



South



West

Site photos from applicant





Application, Applicant Letter



APPLICATION FORM

CITY SPECIAL REVIEW Billings Special Review# \_\_\_\_\_ - Project # P2-20-0004

The undersigned as owner(s) of the following described property hereby request a Special Review as outlined in the City of Billings Zoning Regulations.

Present Zoning: Neighborhood Commercial  
Special Review Requested: Allow use of a stand-alone car wash facility

TAX ID# D11892 CITY ELECTION WARD # Ward 5 upon annexation

Legal Description of Property: Lot 22-A, Block 2 Certificate of Survey 2727M

Address or General Location (If unknown, contact City Engineering): Not addressed at this time.  
Northwest corner of Shiloh Road and Central Avenue surrounding Zip Trip site.

Size of Parcel (Area & Dimensions): 4.708 acres (480.73' x 567.58' minus 1.607 acres of Zip Trip site)

Present Land-Use: Vacant/undeveloped

Covenants or Deed Restrictions on Property: Yes \_\_\_\_\_ No X

If yes, please attach to application

\*\*\* Additional information may be required as determined by the Zoning Coordinator in order to fully evaluate the application.

Owner(s): Iwata, Amy Trustee  
(Recorded Owner) 16757 Charmel Lane, Pacific Palisades, CA 90272-2213  
(Address) (310) 936-8114 dramyiwata@gmail.com  
(Phone Number) (email)

Agent(s): Sanderson Stewart (Bryan Alexander)  
(Name) 1300 N. Transtech Way, Billings, MT 59102  
(Address) (406) 656-5255 balexander@sandersonstewart.com  
(Phone Number) (Email)

I understand that the filing fee accompanying this application is not refundable, that it pays for the cost of processing, and that the fee does not constitute a payment for a Special Review. Also, I attest that all the information presented herein is factual and correct.

Signature: [Signature] Date: 1-2-20  
(Recorded Owner)



2727-002-022A

**Buggy Bath Carwash**  
SPECIAL REVIEW APPLICATION

**Statement of Proposal**

The contract purchaser, Buggy Bath Carwash, is seeking a Special Review for the approximate 4.7-acre property located at the northwest corner of Central Avenue and Shiloh Road. The property is legally described as Lot 22-A, Block 2, Certificate of Survey 2727-M, in Yellowstone County, Montana. The purchaser is proposing development of the car wash on the northerly 2.22 acres and keeping the remaining 2.50 acres undeveloped at this time.

The existing zoning is Neighborhood Commercial and the applicant is requesting a Special Review to allow for a new car wash on the property. A conceptual site plan is attached showing the proposed car wash site. The existing lot is located within the County but is going through a concurrent process to Annex into the City. Once annexed, a Special Review is required to allow development of a standalone car wash facility in a Neighborhood Commercial zoned property.

A Traffic Impact Study (TIS) was prepared for the site by the current owner, which is attached and made part of this application. There are no recommended traffic improvements for development of the site for commercial use.

**Accompanying Responses to Questions in Special Review Application Form**

**1A. In what ways is your proposal consistent with the goals and policies of the adopted Growth Policy?**

**Essential Investments (Relating Public and Private Expenditures to Public Values)**

- *Landscaping of public rights-of-way and entryways makes Billings more visually appealing to residents and visitors*

To enhance the visual appeal of the property, landscaping along the property frontages of Shiloh Road and Central Avenue adjacent to the site will comply with the standards established in the Shiloh Corridor Overlay District (Article 27-1400 of City Code). This overlay zoning district is established to promote an aesthetically pleasing and distinct entryway corridor to make Billings more visually appealing.

- *Infill development and development near existing City infrastructure may be the most cost effective*

This property is located at the northwest corner of Shiloh Road and Central Avenue in the Billings West End and is adjacent to existing City infrastructure. This Special Review will allow for efficient infill development near existing City infrastructure improvements.

- *Neighborhoods that are safe and attractive and provide essential services are much desired*

If this Special Review is approved, it will allow development of a car wash that will be safe, attractive and will be able to better serve the nearby community. Also, the above-mentioned landscaping will make the neighborhood far more attractive.

**Place Making (Enhance, Maintain, Preserve, and Improve Existing Public Places)**

- *Enhancements and maintenance of public spaces and buildings through City stewardship is integral to a vibrant community*

As Billings has continued to grow, development of this property corner is an important part of promoting a vibrant community. By constructing a new building with site and landscaping amenities, the entire neighborhood will be improved visually.

- *The history and heritage of Billings are cornerstones of our community*

The west end of Billings is an integral part of our community and improving the appearance and safety of the properties located there further enhances the overall image of Billings for both local residents and visitors.

**Community Fabric (Attractive, Aesthetically Pleasing, Uniquely Billings)**

- *Cost-effective landscaping of public rights-of-way and entryways makes Billings more visually appealing to residents and visitors*

Upon development of the site, this property will comply with current City standards on landscaping both within the property and adjacent to the public right-of-way. This property lays within the Shiloh Corridor Overlay District and is an important corridor for Billings.

**Strong Neighborhoods (Livable, Safe, Social and Resilient Neighborhoods)**

- *Implementation of the Infill Policy is important to encourage development of underutilized properties*

The current property being considered for purchase is considered an undeveloped property along an important corridor in Westend Billings. Infilling will be enhanced if this property is allowed to develop from an undeveloped property.

***1B. Why is there a need for the intended use of the property at this location?***

West Billings has very few car wash facilities, especially along the Shiloh Road corridor. The nearest car wash to the proposed site is located a mile north at the intersection of Shiloh Road and Grand Avenue and the nearest to the east is located approximately two miles away at the intersection of Central Avenue and 24<sup>th</sup> Street West. The lack of available car washes in the area leads to long lines and waits at the existing washes.

***1C. How will the public interest be served if this application is approved?***

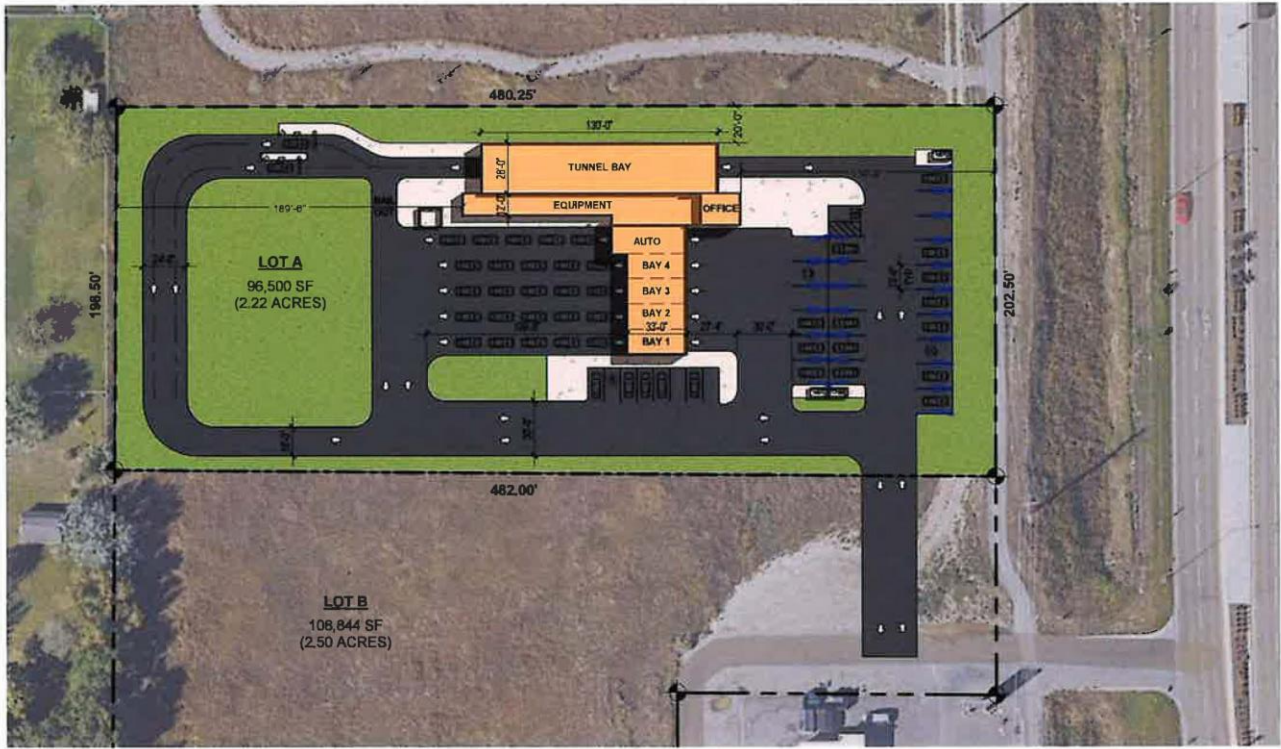
The public will be served by having convenient access from Shiloh Road to wash their vehicles. The new car wash will provide an additional option for a place to receive a car wash and help reduce wait times resulting from the lack of car washes in the area.

***1D. Prepare a written statement addressing what is intended to be done with the property, including new construction or change in the use of the property, and why the special review is being sought.***

A new car wash facility is proposed on the northerly 2.22 acres of the undeveloped site, which includes an automated tunnel car wash, touchless automatic bay, 4 self-service car wash bays, and vacuum stations. The site will be entirely new construction and will utilize the existing right-in/right-out approach from Shiloh Road as its primary access. The remaining 2.5 acres of the site will remain undeveloped. A TIS was prepared by the property, which recommends no traffic improvements for development of the site. The TIS does discuss a future access from Central Avenue; however, the future access is not proposed as part of this site development.

A Special Review is sought as it is necessary for the intended use of a car wash in the existing Neighborhood Commercial zone. The developer intends to orient the site to minimize impacts of sound on adjacent residential properties by facing dryers away from them, using low-noise dryers in the automatic tunnel and touchless automatic bay (rated at 65 dB at 50 feet away), and providing a 6-foot high block wall adjacent to the residential properties to the west to mitigate impacts to neighbors.

# Site Plan



M



# Iwata Subdivision Traffic Impact Study

Billings, Montana



Prepared For:

**Performance Engineering**  
608 North 29th Street  
Billings, MT 59101

**December, 2019**

130 South Howie Street  
Helena, Montana 59601  
406-459-1443

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# **Iwata Subdivision Traffic Impact Study Billings, Montana**

## **A. EXECUTIVE SUMMARY**

The Iwata Subdivision is a 4.7 acre neighborhood commercial development project currently proposed west of Shiloh Road in Billings, MT. Upon completion, the development would include four new neighborhood commercial lots and would produce approximately 700 new daily vehicle trips in this area. The development will be accessed from an existing approach onto Shiloh Road and a new approach onto Central Avenue. The proposed subdivision will benefit considerably from the existing roundabouts on Shiloh Road. All intersections will operate at acceptable levels of service with reserve capacity for future growth. No improvements are recommended for these intersections at this time to improve capacity. The developers should work with the City of Billings as necessary to help with the future widening needs along Central Avenue. The developers should also locate the new southern approach to the development site as far to the east as possible on their frontage of Central Avenue to help maximize the intersection spacing from the existing approaches on the roadway.

## **B. PROJECT DESCRIPTION**

This document studies the possible effects on the surrounding road system from a proposed commercial subdivision located west of Shiloh Road in Billings, MT. The site is located to the northwest of the intersection of Shiloh Road and Central Avenue. The document also identifies any traffic mitigation efforts that the developments may require. The Iwata Subdivision would be developed to include 4.7 acres of neighborhood commercial property. Based on conversations with the City of Billings planning staff, the study area selected for this project includes the intersections of Shiloh Road with Broadwater Avenue, Central Avenue, Monad Road, and the approaches to the proposed development site.

## **C. EXISTING CONDITIONS**

The Iwata Subdivision is currently proposed on a 4.7 acre parcel of land located on the northwest corner of the intersection of Shiloh Road and Central Avenue in Billings. The existing development property currently consists of an undeveloped section of land which is bordered by existing residential subdivisions to the west and commercial properties to the north, south, and east. The Cenex gas station is located southeast of the property. See **Figure 1** for a location map of the proposed development.

Figure 1- Proposed Development Site



### Adjacent Roadways

**Central Avenue** is an east/west principle arterial route that extends west from downtown Billings. The intersection of Central Avenue and Shiloh Road is controlled by a multi-lane roundabout. East of Shiloh Road, Central Avenue has a newly constructed four-lane urban cross-section. West of Shiloh Road, Central Avenue narrows to a 24-foot, two-lane rural cross-section. The posted speed limit along Central Avenue is 45 MPH. Traffic data collected in 2018 by MDT indicates that Central Avenue carries 4,500 Vehicles Per Day (VPD) west of Shiloh Road (40<sup>th</sup> Street) and 7,900 VPD east of Shiloh Road

**Shiloh Road/ 40<sup>th</sup> Street West** is a north/south urban principle arterial route that extends north from Interstate 90. Shiloh Road intersects with Central Avenue, Broadwater Avenue, and

Monad Road at roundabouts. Between Central Avenue and Grand Avenue Shiloh Road has a four-lane urban cross-section with raised medians and left-turn lanes at designated intersections. The posted speed limit in the area is 45 MPH. Traffic data collected in 2018 by MDT indicates that West Main Street carries 19,200 VPD between Central and Grand Avenue.

### Traffic Counts

The traffic data used for this report was collected on the surrounding road system by ATS in May and September of 2019. The collected data includes turning movement counts at the intersections of Central Avenue (May), Broadwater Avenue (September), and Monad Road (September) with Shiloh Road. ATS also performed 24-hour volume counts on the existing approach to the site from Shiloh Road. Refer to **Figure 1** for detail of the data collection/acquisition sites. The raw traffic data is included in **Appendix A** of this report.

The raw data collected for this project was adjusted for seasonal variation in accordance with the data collected from MDT's automatic count station located in Billings on Broadwater Avenue between 22<sup>nd</sup> Street and Gay Place (Station A-051). This count station data indicated that traffic counts collected in May and September are both approximately 103% of the AADT (Average Annual Daily Traffic) volume in this area.

Historic traffic data was collected for Central Avenue and Shiloh Road from the Montana Department of Transportation. The data for this location is presented in **Table 1**. The MDT data indicates that traffic volumes along Central Avenue have increased by an average of 2% over the last ten years, while volumes on Shiloh Road have increased by an average of 6% annually.

**Table 1 – Historic Average Daily Traffic Data**

Location	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Central W of Shiloh #56-4A-058	4,380	4,630	4,120	4,080	4,980	5,070	5,200	5,264	5,222	4,512
Central E of Shiloh #56-4A-059	6,520	6,310	5,500	5,930	6,830	6,840	5,980	7,678	7,816	7,925
Shiloh N of Central #56-4A-128	10,290	9,960	10,890	11,000	12,390	12,400	15,120	16,446	16,183	19,200
Shiloh S of Central #56-4A-127	9,750	9,440	9,850	11,020	11,440	12,450	14,610	15,679	16,440	16,670

### Level of Service

Using the data collected for this project, ATS conducted a Level of Service (LOS) analysis at area intersections. This evaluation was conducted in accordance with the procedures outlined in the Transportation Research Board's *Highway Capacity Manual (HCM) - Special Report 209* and the Highway Capacity Software (HCS) version 7.8. Intersections are graded from A to F representing the average delay that a vehicle entering an intersection can expect. Typically, a LOS of C or better is considered acceptable for peak-hour conditions.

**Table 2** shows the existing 2019 LOS for the AM and PM peak hours without the generated traffic from the Iwata subdivision. The LOS calculations are included in **Appendix C**. The analysis indicates that all of the study intersection are currently operating within normal operating limits and have considerable reserve capacity for future growth. No roadway modifications are recommended at this time to improve intersection capacity. Based on future growth projections in this area, the *2018 Billings Urban Area Long Range Transportation Plan* recommends widening Central to three lane from Shiloh Road to 48<sup>th</sup> Street West (Project R-48, estimated cost \$3,100,000).

**Table 2 – 2019 Level of Service Summary**

Intersection	AM Peak Hour		PM Peak Hour	
	Delay (Sec.)	LOS	Delay (Sec.)	LOS
Shiloh Road & Broadwater Ave.	7.6	A	7.9	A
Shiloh Road & Central Ave.	8.6	A	13.1	B
Shiloh Road & Monad Road	6.3	A	7.6	A

### Area Crash Data

ATS collected crash data for the study intersections from the MDT public crash database. This system contains records and basic information for all reported crashes which occur on public roads over the past five years. Intersection crashes are typically evaluated by the rate of Crashes per Million Vehicles Entering (MVE). Intersections with higher than normal crash rates are evaluated to determine if any crash trends exists which may be contributing to the observed crash trend. The results of this analysis for the study intersections is shown in **Table 2**. The data indicates that the crash rates for these intersection is 0.7 to 1.4 per MVE, which is in line with anticipated crash rates for urban controlled intersections.

**Table 3 – Intersection Crash Rates**

Intersection	Crashes 2013-2018	Crash Rate
Shiloh Road & Broadwater Ave.	64	1.4 MVE
Shiloh Road & Central Ave.	26	0.7 MVE
Shiloh Road & Monad Road	23	0.7 MVE

#### D. PROPOSED DEVELOPMENT

The Iwata Subdivision is proposed for the northwest corner of Shiloh Road and Central Avenue adjacent to the existing Cenex gas station. The project would include 4.7 acres of neighborhood commercial property which could include gas stations, restaurants, and light commercial uses. The specific land uses for this have not yet been identified. The property would be developed into four separate lots with an internal loop road constructed to the city of Billings road standards. The site would be accessed from Shiloh Road at an existing approach 200 feet north of Central Avenue and a new approach onto Central Avenue 500 feet west of Shiloh Road. The approach onto Shiloh Road (currently 400 VPD) is restricted by the existing medians on Shiloh Road to right-in/right-out turning movements only. The visibility from these two approach locations is unrestricted. The development would also have access to the existing approach to the Cenex gas station, but this approach was discounted for the purposes of this study to concentrate the potential development traffic to only two intersections and produce a more conservative analysis. The project will be constructed over the next 3-5 years with full build-out expected by 2025. The proposed development site plan is shown in **Figure 2**.

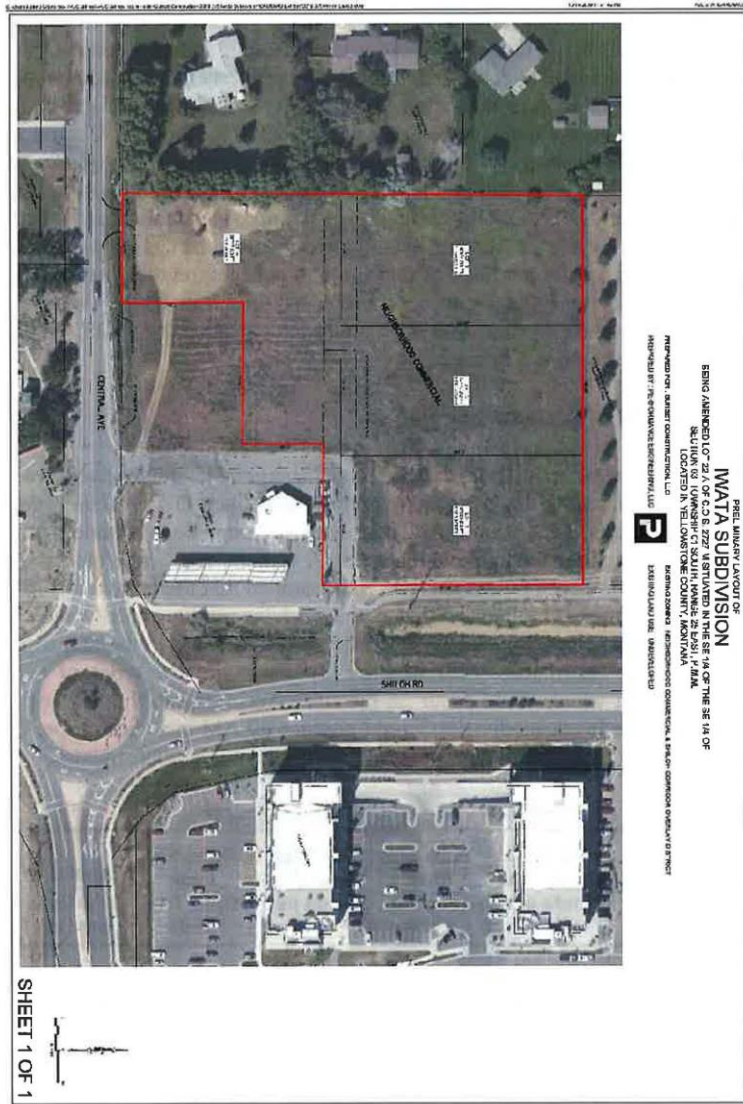
#### E. TRIP GENERATION AND ASSIGNMENT

ATS performed a trip generation analysis to determine the anticipated future traffic volumes from the proposed development using the trip generation rates contained in *Trip Generation* (Institute of Transportation Engineers, Tenth Edition). These rates are the national standard and are based on the most current information available to planners. A vehicle “trip” is defined as any trip that either begins or ends at the development site. ATS determined that the critical traffic impacts on the intersections and roadways would occur during the weekday morning and evening peak hours. With no specific land uses currently identified for the site, ATS selected the ITE trip generation rate for a business park (use code #770) which closely matches the types of neighborhood commercial development which could occur on the site. According to the ITE trip generation rates, at full build-out the Iwata subdivision would produce 89 AM peak hour trips, 79 PM peak hour trips, and 704 daily trips. See **Table 4** for detailed trip generation information

**Table 4 - Trip Generation Rates**

Land Use	Units	AM Peak Hour Trip Ends per Unit	Total AM Peak Hour Trip Ends	PM Peak Hour Trip Ends per Unit	Total PM Peak Hour Trip Ends	Weekday Trip Ends per Unit	Total Weekday Trip Ends
Business Park ITE #770	4.7	18.86	89	16.84	79	149.79	704

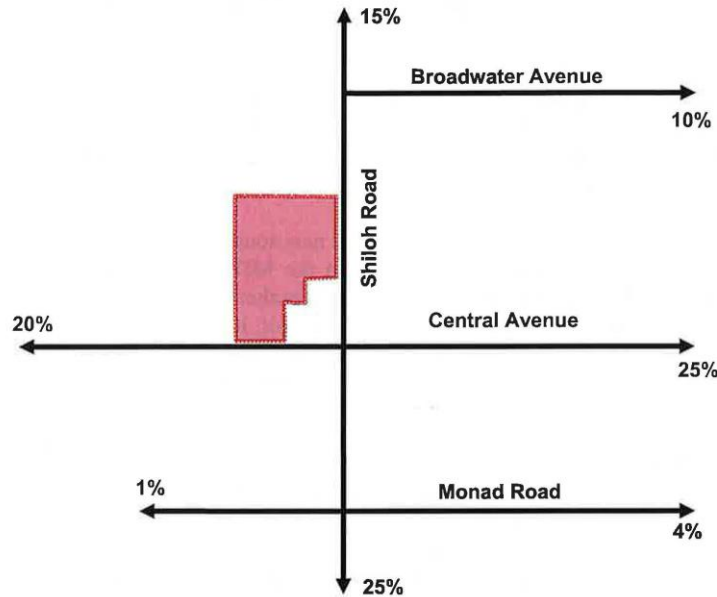
Figure 2 - Proposed Development



**F. TRIP DISTRIBUTION**

The traffic distribution and assignment for the proposed subdivisions was based upon the existing ADT volumes along the adjacent roadways and the peak-hour turning volumes. Traffic is expected to distribute onto the surrounding road network as shown on **Figure 3**.

**Figure 3 – Trip Distribution**



**G. TRAFFIC IMPACTS OUTSIDE OF THE DEVELOPMENT**

Using the trip generation and trip distribution numbers, ATS determined the future Level of Service for the area intersections. The anticipated intersection LOS with the Iwata Subdivision is shown in **Table 5**. The traffic volume calculations are included in **Appendix B** of this report and include a 20% background traffic volume growth rate to forecast regional traffic volume growth trends through 2025. The table indicates that the development of the Iwata Subdivision will not create any operational issues and any existing or proposed intersection with in the study area.

The development will benefit considerably from the placement of the existing roundabouts on Shiloh Road. The roundabout at Central Avenue will allow the drivers exiting the site to use the

right-out only intersection onto Shiloh Road and then use the roundabout to turn in any direction including making a U-turn to proceed to the north. All intersections will operate at acceptable levels of service with reserve capacity for future growth. The Iwata Subdivision will account for a traffic volume increase of 2% at the intersection of Central Avenue and Shiloh Road. No improvements are recommended for these intersections at this time to improve capacity.

**Table 5 –Future 2025 Level of Service Summary**

Intersection	AM Peak Hour		PM Peak Hour	
	Delay (Sec.)	LOS	Delay (Sec.)	LOS
Shiloh Road & Broadwater Ave.	9.9	A	10.4	B
Shiloh Road & Central Ave.	12.4	B	24.7	C
Shiloh Road & Monad Road	7.6	A	9.7	A
Shiloh Road & East Approach	12.5	B	13.2	B
Central Ave. & South Approach	15.0	C	17.6	C

\*Eastbound/Southbound Side Street LOS and Delay.

ATS also reviewed the left-turn lane warrants for the new south approach to the site from Central Avenue based on the recommended practices from the MDT Road Design Manual with the projected traffic from the Iwata Subdivision. This analysis showed that there will be nearly enough traffic to warrant a left-turn lane at this approach. However, it would be difficult to install a left-turn lane for this location without impacting the adjacent intersections of Bonaventure Drive and JB Stetson Street to the west. Ultimately, this entire section of road will need to be widened to a three-lane cross section with a center left-turn lane to address the future capacity needs of Central Avenue. The *2018 Billings Urban Area Long Range Transportation Plan* recommends widening Central Avenue from Shiloh Road to 48<sup>th</sup> Street West to a three-lane cross-section (Project R-48, estimated cost \$3,100,000). At this time, it is not recommended that the developers install a left-turn lane for the new south approach to the Iwata Subdivision, but the developers should work with the City of Billings as necessary to help with the future widening needs along Central Avenue. The developers should also locate the new southern approach to the development site as far to the east as possible on their frontage of Central Avenue to maximize the intersection spacing from the existing approaches on the roadway.

## H. IMPACT SUMMARY & RECOMMENDATIONS

As proposed the Iwata Subdivision will have a low impact on the traffic operations at the nearby intersections. No improvements are recommended for these intersections at this time to improve capacity. The developers should work with the City of Billings as necessary to help with the future widening needs along Central Avenue. The developers should also locate the new southern approach to the development site as far to the east as possible on their frontage of Central Avenue to maximize the intersection spacing from the existing approaches on the roadway.

# **APPENDIX A**

## **Traffic Data**

# Abelin Traffic Services

130 S. Havlic Street  
Helena, MT 59601

File Name : ShilohCentraltmc  
Site Code : 00000000  
Start Date : 5/30/2019  
Page No : 1

## Groups Printed- Class 1

Start Time	Shiloh Southbound					Central Westbound					Shiloh Northbound					Central Eastbound					Int. Total
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
07:30 AM	18	102	35	0	155	17	21	10	0	48	30	97	17	0	144	23	71	36	0	130	477
07:45 AM	17	149	36	0	202	25	22	18	0	65	30	112	12	0	154	31	72	42	0	145	566
Total	35	251	71	0	357	42	43	28	0	113	60	209	29	0	298	54	143	78	0	275	1043
08:00 AM	19	131	34	0	184	23	27	13	0	63	25	116	25	0	166	47	61	31	0	139	552
08:15 AM	12	140	31	0	183	18	21	12	1	52	18	115	16	0	149	25	45	29	0	99	483
*** BREAK ***																					
Total	31	271	65	0	367	41	48	25	1	115	43	231	41	0	315	72	106	60	0	238	1035
*** BREAK ***																					
04:30 PM	20	150	30	0	200	49	30	23	0	102	18	130	40	0	188	18	25	25	0	68	558
04:45 PM	26	145	32	0	203	36	23	29	0	88	23	153	53	0	229	17	32	18	0	67	587
Total	46	295	62	0	403	85	53	52	0	190	41	283	93	0	417	35	57	43	0	135	1145
05:00 PM	19	151	16	0	186	30	43	30	0	103	13	160	40	0	213	17	28	17	0	62	564
05:15 PM	26	170	21	0	217	31	33	47	0	111	22	216	50	0	288	10	33	28	0	71	687
Grand Total	157	1138	235	0	1530	229	220	182	1	632	179	1099	253	0	1531	188	367	226	0	781	4474
Apprch %	10.3	74.4	15.4	0		36.2	34.8	28.8	0.2		11.7	71.8	16.5	0		24.1	47	28.9	0		
Total %	3.5	25.4	5.3	0	34.2	5.1	4.9	4.1	0	14.1	4	24.6	5.7	0	34.2	4.2	8.2	5.1	0	17.5	

# Abelin Traffic Services

130 S. Main Street  
Helena, MT 59601

File Name : BroadwayTMC  
Site Code : 0000000  
Start Date : 9/25/2019  
Page No : 1

Groups Printed- Class 1 - Class 2

Start Time	Shiloh Southbound					Broadwater Westbound					Shiloh Northbound					Broadwater Eastbound					Int. Total
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
07:30 AM	0	234	73	0	307	23	0	40	0	63	39	137	2	0	178	0	0	1	0	1	549
07:45 AM	0	211	36	1	248	31	0	28	1	60	38	169	7	0	214	0	0	0	0	0	522
Total	0	445	109	1	555	54	0	68	1	123	77	306	9	0	392	0	0	1	0	1	1071
08:00 AM	0	148	40	1	189	18	0	21	2	41	32	137	1	0	170	0	0	0	0	0	400
08:15 AM	0	192	27	0	219	20	0	24	1	45	16	111	3	0	130	0	0	0	0	0	394
*** BREAK ***																					
Total	0	340	67	1	408	38	0	45	3	86	48	248	4	0	300	0	0	0	0	0	794
*** BREAK ***																					
04:30 PM	0	173	17	0	190	26	0	40	0	66	32	211	0	0	243	0	0	0	0	0	499
04:45 PM	0	157	25	0	182	39	0	31	0	70	28	220	0	0	248	0	0	0	0	0	500
Total	0	330	42	0	372	65	0	71	0	136	60	431	0	0	491	0	0	0	0	0	999
05:00 PM	0	187	24	0	211	37	0	51	0	88	54	235	0	0	289	0	0	0	0	0	588
05:15 PM	0	201	21	0	222	54	0	43	0	97	38	261	0	0	299	0	0	0	0	0	618
Grand Total	0	1503	263	2	1768	248	0	278	4	530	277	1481	13	0	1771	0	0	1	0	1	4070
Apprch %	0	85	14.9	0.1	46.8	0	52.5	0.8		13	15.6	83.6	0.7	0		0	0	100	0		
Total %	0	36.9	6.5	0	43.4	6.1	0	6.8	0.1	13	6.8	36.4	0.3	0	43.5	0	0	0	0	0	
Class 1	0 1495										1475										
% Class 1	0	99.5	96.6	0	98.9	99.6	0	99.3	0	98.7	99.6	99.6	0	0	98.9	0	0	100	0	100	98.9
Class 2	0 8 9 2 19 1										6 13 0 20										
% Class 2	0	0.5	3.4	100	1.1	0.4	0	0.7	100	1.3	0.4	0.4	100	0	1.1	0	0	0	0	0	1.1

# Abelin Traffic Services

130 S. Hauie Street  
Helena, MT 59601

File Name : MonadTMC  
Site Code : 00000000  
Start Date : 9/25/2019  
Page No : 1

## Groups Printed- Class 1 - Class 2

Start Time	Shiloh Southbound					Monad Westbound					Shiloh Northbound					Monad Eastbound					Incl. Total
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
07:30 AM	0	18	177	0	195	0	1	1	3	5	0	4	172	43	219	4	29	3	23	59	478
07:45 AM	1	24	133	0	158	0	1	0	0	1	0	6	166	32	204	2	15	0	21	38	401
Total	1	42	310	0	353	0	2	1	3	6	0	10	338	75	423	6	44	3	44	97	879
08:00 AM	1	15	131	3	150	0	0	1	4	5	0	4	127	33	164	1	11	2	29	43	362
08:15 AM	0	16	93	3	112	0	9	10	18	37	0	3	132	27	162	3	11	4	13	31	342
*** BREAK ***																					
Total	1	31	224	6	262	0	9	11	22	42	0	7	259	60	326	4	22	6	42	74	704
*** BREAK ***																					
04:30 PM	3	26	186	0	215	0	0	0	3	3	0	3	168	19	190	1	20	0	28	49	457
04:45 PM	0	19	203	0	222	0	0	1	3	4	0	4	168	24	196	1	34	1	24	60	482
Total	3	45	389	0	437	0	0	1	6	7	0	7	336	43	386	2	54	1	52	109	939
05:00 PM	0	30	247	0	277	0	0	1	1	2	0	5	214	29	248	0	45	1	34	80	607
05:15 PM	0	14	209	0	223	0	0	0	2	2	0	2	186	26	214	0	29	3	20	52	491
Grand Total	5	162	1379	6	1552	0	11	14	34	59	0	31	1333	233	1597	12	194	14	192	412	3620
Apprch %	0.3	10.4	88.9	0.4		0	18.6	23.7	57.6		0	1.9	83.5	14.6		2.9	47.1	3.4	46.6		
Total %	0.1	4.5	38.1	0.2	42.9	0	0.3	0.4	0.9	1.6	0	0.9	36.8	6.4	44.1	0.3	5.4	0.4	5.3	11.4	
Class 1	0	150	1379										1331								
% Class 1	0	92.6	100	100	98.9	0	100	92.9	100	98.3	0	41.9	99.8	100	98.7	0	100	71.4	100	96.1	98.5
Class 2	5	12	0	0	17	0	0	1	0	1	0	18	2	0	20	12	0	4	0	16	54
% Class 2	100	7.4	0	0	1.1	0	0	7.1	0	1.7	0	58.1	0.2	0	1.3	100	0	28.6	0	3.9	1.5

# Basic Volume Report: GAS STATION

**Station ID : GAS STATION**

Info Line 1 : ATS  
Info Line 2 : Unicorn #3

GPS Lat/Lon :

DB File : GAS STATION.DB

Last Connected Device Type : Unic-L

Version Number : 1.41

Serial Number :

Number of Lanes : 1

Posted Speed Limit : 0.0 mph

## Lane #2 Configuration

#	Dir.	Information	Volume Mode	Volume Sensors	Divide By 2	Comment
2.	E/W		Subtract	Axle	Yes	

## Lane #2 Basic Volume Data From: 10:00 - 09/25/2019 To: 08:59 - 09/26/2019

Date	DW	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	Total	
092519	W																										
092619	T	0	1	0	0	0	4	21	50	35		33	33	17	30	19	35	30	42	15	24	9	7	4	1	299	
Month Total :		0	1	0	0	0	4	21	50	35		33	33	17	30	19	35	30	42	15	24	9	7	4	1	410	
Percent :		0%	0%	0%	0%	0%	1%	5%	12%	9%		8%	8%	4%	7%	5%	9%	7%	10%	4%	6%	2%	2%	1%	0%		
ADT :		0	1	0	0	0	4	21	50	35		33	33	17	30	19	35	30	42	15	24	9	7	4	1	410	

	Sun	Mon	Tue	Wed	Thu	Fri	Sat		Total	Percent
DW Totals :	0	0	0	299	111	0	0	Weekday (Mon-Fri) :	410	100%
# Days :	0.0	0.0	0.0	0.6	0.4	0.0	0.0	ADT :	428	
ADT :	0	0	0	513	296	0	0	Weekend (Sat-Sun) :	0	0%
Percent :	0%	0%	0%	73%	27%	0%	0%	ADT :	0	

# **APPENDIX B**

## **Traffic Model**

**Iwata Subdivision**

Traffic Model

Existing

AM Peak Hour

(15 min x 4)

Seasonal Factor September

0.97

Seasonal Factor May

0.97



**Iwata Subdivision**

Traffic Model

Existing

PM Peak Hour

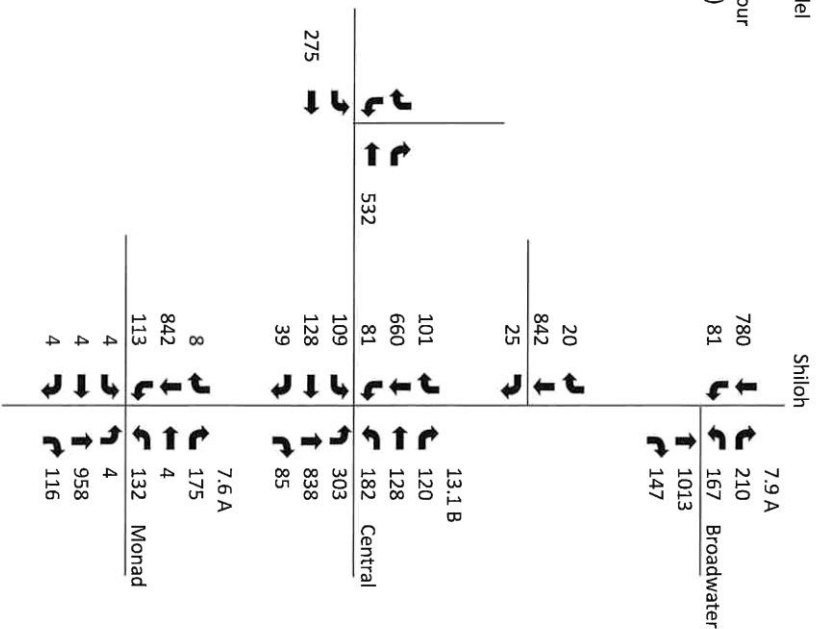
(15 min x 4)

Seasonal Factor September

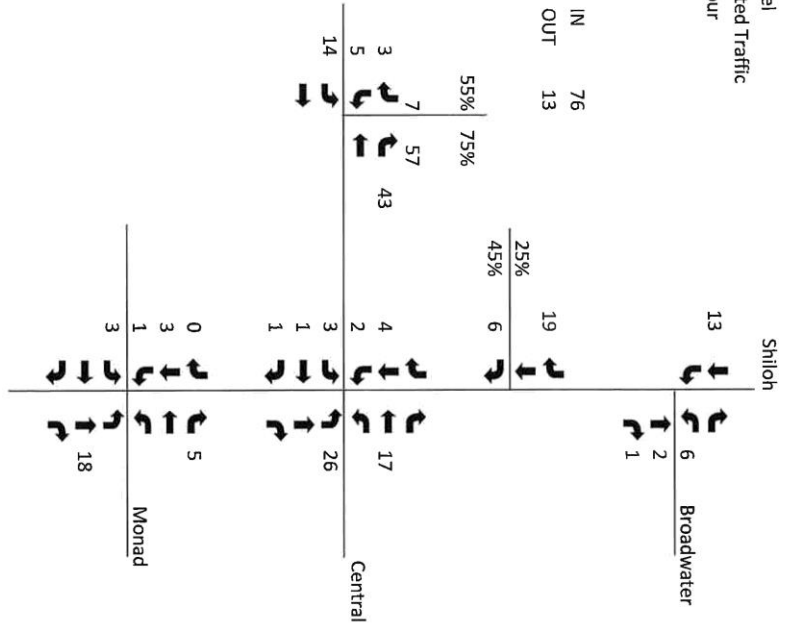
0.97

Seasonal Factor May

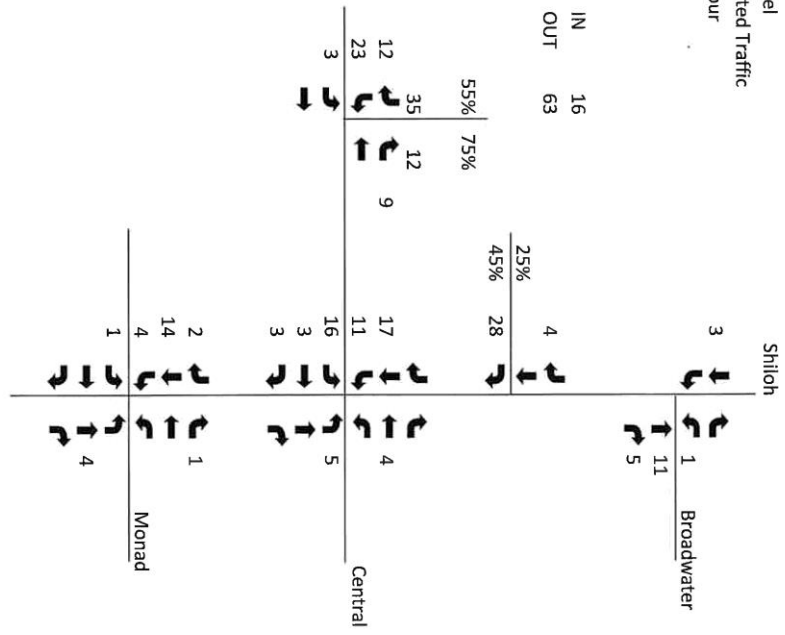
0.97



**Iwata Subdivision**  
 Traffic Model  
 Site Generated Traffic  
 AM Peak Hour



**Iwata Subdivision**  
 Traffic Model  
 Site Generated Traffic  
 PM Peak Hour



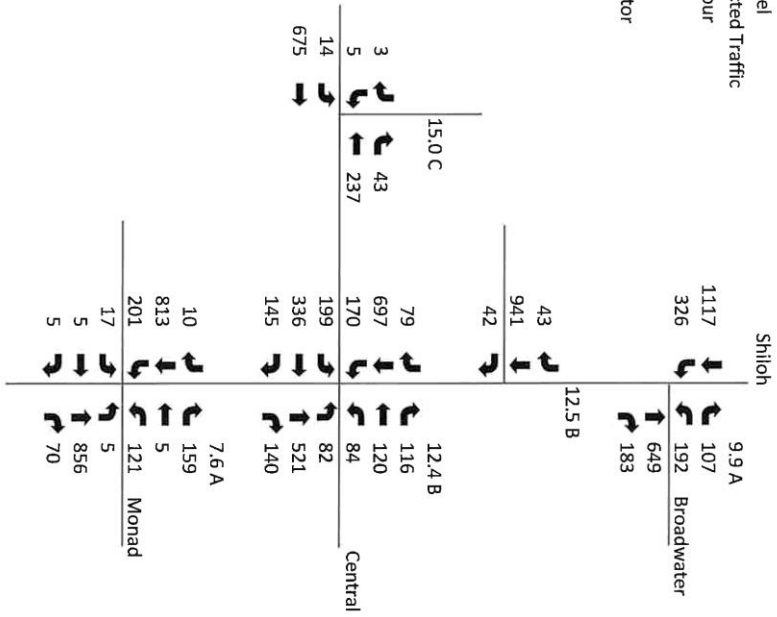
**Iwata Subdivision**

Traffic Model

Total Projected Traffic

AM Peak Hour

Growth Factor  
1.2

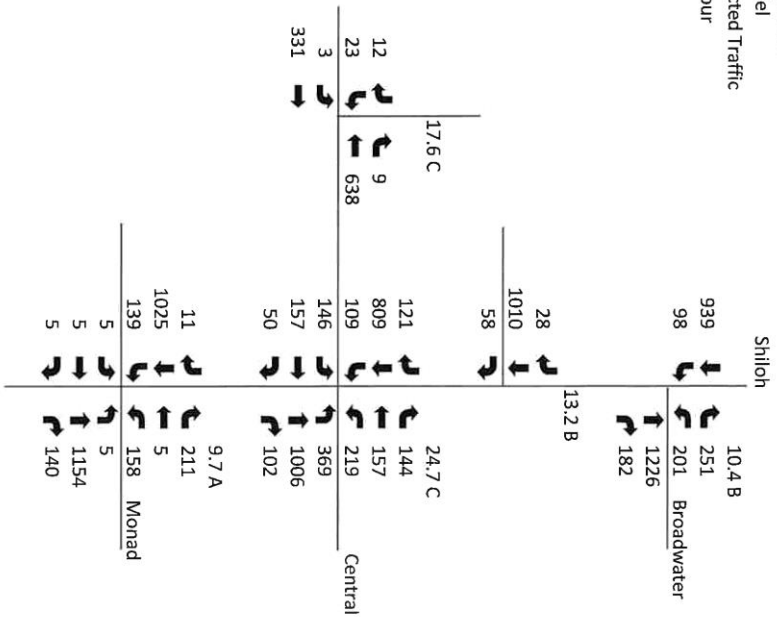


**Iwata Subdivision**

Traffic Model

Total Projected Traffic


PM Peak Hour



# **APPENDIX C**

## **LOS Calculations**

## HCS7 Roundabouts Report

General Information				Site Information				
Analyst	RLA				Intersection	Shiloh & Broadwater		
Agency or Co.	ATS				E/W Street Name	Broadwater Avenue		
Date Performed	12/1/2019				N/S Street Name	Shiloh Road		
Analysis Year	2019				Analysis Time Period (hrs)	0.25		
Time Analyzed	AM Peak Hour				Peak Hour Factor	1.00		
Project Description	Iwata Subdivision				Jurisdiction	City of Billings		

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	0	0	0	1	0	1	0	0	2	0	0	0	2	0
Lane Assignment					L		R		T		TR		LT		T	
Volume (V), veh/h					0	155		89	0		539	151	0	272	920	
Percent Heavy Vehicles, %					3	3		3	3		3	3	3	3	3	
Flow Rate (v <sub>pc</sub> ), pc/h					0	160		92	0		555	156	0	280	948	
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes					2				1				1			
Pedestrians Crossing, p/h					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	Left	Right	Bypass
Critical Headway (s)				4.6453	4.3276		4.5436	4.5436		4.5436	4.5436				
Follow-Up Headway (s)				2.6667	2.5352		2.5352	2.5352		2.5352	2.5352				

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	Left	Right	Bypass
Entry Flow (v <sub>e</sub> ), pc/h				160	92		334	377		577	651				
Entry Volume, veh/h				155	89		324	366		560	632				
Circulating Flow (v <sub>c</sub> ), pc/h	1388			555			280			160					
Exiting Flow (v <sub>e</sub> ), pc/h	436			0			647			1108					
Capacity (c <sub>pcp</sub> ), pc/h				810	886		1101	1101		1228	1228				
Capacity (c), veh/h				787	860		1069	1069		1192	1192				
v/c Ratio (x)				0.20	0.10		0.30	0.34		0.47	0.53				

Delay and Level of Service															
Approach	EB			WB			NB			SB					
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh				6.7	5.2		6.3	6.8		8.0	9.0				
Lane LOS				A	A		A	A		A	A				
95% Queue, veh				0.7	0.3		1.3	1.5		2.6	3.2				
Approach Delay, s/veh				6.1			6.6			8.6					
Approach LOS				A			A			A					
Intersection Delay, s/veh   LOS				7.6						A					

## HCS7 Roundabouts Report

### General Information

Analyst	RLA
Agency or Co.	ATS
Date Performed	12/1/2019
Analysis Year	2019
Time Analyzed	PM Peak Hour
Project Description	Iwata Subdivision

### Site Information

Intersection	Shiloh & Broadwater
E/W Street Name	Broadwater Avenue
N/S Street Name	Shiloh Road
Analysis Time Period (hrs)	0.25
Peak Hour Factor	1.00
Jurisdiction	City of Billings



### Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	0	0	0	1	0	1	0	0	2	0	0	0	2	0
Lane Assignment					L		R		T		TR		LT		T	
Volume (V), veh/h					0	167		210	0		1013	147	0	81	780	
Percent Heavy Vehicles, %					3	3		3	3		3	3	3	3	3	
Flow Rate (v <sub>pc</sub> ), pc/h					0	172		216	0		1043	151	0	83	803	
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes					2				1				1			
Pedestrians Crossing, p/h					0				0				0			

### Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)				4.6453	4.3276		4.5436	4.5436		4.5436	4.5436	
Follow-Up Headway (s)				2.6667	2.5352		2.5352	2.5352		2.5352	2.5352	


### Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v <sub>e</sub> ), pc/h				172	216		561	633		416	470	
Entry Volume, veh/h				167	210		545	614		404	456	
Circulating Flow (v <sub>c</sub> ), pc/h	1058			1043			83			172		
Exiting Flow (v <sub>e</sub> ), pc/h	234			0			1259			975		
Capacity (c <sub>pc</sub> ), pc/h				517	585		1317	1317		1214	1214	
Capacity (c), veh/h				502	568		1278	1278		1179	1179	
v/c Ratio (x)				0.33	0.37		0.43	0.48		0.34	0.39	

### Delay and Level of Service

Approach	EB			WB			NB			SB		
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh				12.4	11.8		7.0	7.8		6.4	6.9	
Lane LOS				B	B		A	A		A	A	
95% Queue, veh				1.4	1.7		2.2	2.7		1.5	1.9	
Approach Delay, s/veh				12.1			7.4			6.6		
Approach LOS				B			A			A		
Intersection Delay, s/veh   LOS				7.9						A		

## HCS7 Roundabouts Report

General Information		Site Information		
Analyst	RLA		Intersection	Central & Shiloh
Agency or Co.	ATS		E/W Street Name	Central Avenue
Date Performed	12/1/2019		N/S Street Name	Shiloh Road
Analysis Year	2019		Analysis Time Period (hrs)	0.25
Time Analyzed	AM Peak Hour		Peak Hour Factor	1.00
Project Description	Iwata Subdivision		Jurisdiction	City of Billings

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	2	0	0	0	2	0	0	0	2	0	0	0	2	0
Lane Assignment	LT		TR		LT		TR		LT		TR		LT		TR	
Volume (V), veh/h	0	163	279	120	0	70	85	97	0	47	435	116	0	140	578	66
Percent Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Flow Rate (v <sub>pc</sub> ), pc/h	0	168	287	124	0	72	88	100	0	48	448	119	0	144	595	68
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	2				2				2				2			
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)	4.6453	4.3276		4.6453	4.3276		4.6453	4.3276		4.6453	4.3276		
Follow-Up Headway (s)	2.6667	2.5352		2.6667	2.5352		2.6667	2.5352		2.6667	2.5352		

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 <sub>e</sub> ), pc/h	272	307		122	138		289	326		379	428		
Entry Volume, veh/h	264	298		119	134		281	316		368	415		
Circulating Flow (v <sub>c</sub> ), pc/h	811			664			599			208			
Exiting Flow (v <sub>e</sub> ), pc/h	550			204			716			791			
Capacity (c <sub>pc</sub> ), pc/h	640	713		733	808		778	853		1115	1190		
Capacity (c), veh/h	622	692		712	784		755	829		1082	1155		
v/c Ratio (x)	0.43	0.43		0.17	0.17		0.37	0.38		0.34	0.36		

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	12.1	11.2		6.9	6.4		9.4	8.9		6.7	6.7		
Lane LOS	B	B		A	A		A	A		A	A		
95% Queue, veh	2.1	2.2		0.6	0.6		1.7	1.8		1.5	1.7		
Approach Delay, s/veh	11.7			6.6			9.1			6.7			
Approach LOS	B			A			A			A			
Intersection Delay, s/veh   LOS	8.6						A						

## HCS7 Roundabouts Report

### General Information

Analyst	RLA
Agency or Co.	ATS
Date Performed	12/1/2019
Analysis Year	2019
Time Analyzed	PM Peak Hour
Project Description	Iwata Subdivision



### Site Information

Intersection	Central & Shiloh
E/W Street Name	Central Avenue
N/S Street Name	Shiloh Road
Analysis Time Period (hrs)	0.25
Peak Hour Factor	1.00
Jurisdiction	City of Billings

### Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	2	0	0	0	2	0	0	0	2	0	0	0	2	0
Lane Assignment	LT		TR		LT		TR		LT		TR		LT		TR	
Volume (V), veh/h	0	109	128	39	0	182	128	120	0	303	838	85	0	81	660	101
Percent Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Flow Rate (v <sub>ccs</sub> ), pc/h	0	112	132	40	0	187	132	124	0	312	863	88	0	83	680	104
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	2				2				2				2			
Pedestrians Crossing, p/h	0				0				0				0			

### Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)	4.6453	4.3276		4.6453	4.3276		4.6453	4.3276		4.6453	4.3276	
Follow-Up Headway (s)	2.6667	2.5352		2.6667	2.5352		2.6667	2.5352		2.6667	2.5352	

### Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v <sub>e</sub> ), pc/h	133	151		208	235		594	669		407	460	
Entry Volume, veh/h	130	146		202	228		576	650		396	446	
Circulating Flow (v <sub>c</sub> ), pc/h	950			1287			327			631		
Exiting Flow (v <sub>e</sub> ), pc/h	303			548			1099			907		
Capacity (c <sub>flow</sub> ), pc/h	563	633		413	476		999	1075		755	831	
Capacity (c), veh/h	547	615		401	462		970	1044		733	806	
v/c Ratio (x)	0.24	0.24		0.50	0.49		0.59	0.62		0.54	0.55	

### Delay and Level of Service

Approach	EB			WB			NB			SB		
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh	9.8	8.9		20.3	17.6		12.0	12.1		13.2	12.6	
Lane LOS	A	A		C	C		B	B		B	B	
95% Queue, veh	0.9	0.9		2.7	2.7		4.1	4.5		3.3	3.5	
Approach Delay, s/veh	9.3			18.9			12.0			12.9		
Approach LOS	A			C			B			B		
Intersection Delay, s/veh   LOS	13.1						B					

## HCS7 Roundabouts Report

General Information				Site Information				
Analyst	RLA				Intersection	Shiloh & Monad		
Agency or Co.	ATS				E/W Street Name	Monad Road		
Date Performed	12/1/2019				N/S Street Name	Shiloh Road		
Analysis Year	2019				Analysis Time Period (hrs)	0.25		
Time Analyzed	AM Peak Hour				Peak Hour Factor	1.00		
Project Description	Iwata Subdivision				Jurisdiction	City of Billings		

### Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	2	0	0	0	2	0	0	0	2	0	0	0	2	0
Lane Assignment	LT		TR		LT		TR		LT		TR		LT		TR	
Volume (V), veh/h	0	12	4	4	0	101	4	128	0	4	698	58	0	167	675	8
Percent Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Flow Rate (v <sub>pc</sub> ), pc/h	0	12	4	4	0	104	4	132	0	4	719	60	0	172	695	8
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	2				2				1				1			
Pedestrians Crossing, p/h	0				0				0				0			

### Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)	4.6453	4.3276		4.6453	4.3276		4.5436	4.5436		4.5436	4.5436	
Follow-Up Headway (s)	2.6667	2.5352		2.6667	2.5352		2.5352	2.5352		2.5352	2.5352	

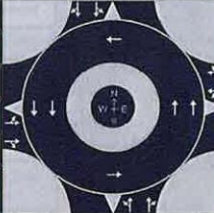
### Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v <sub>e</sub> ), pc/h	12	8		108	132		368	415		411	464	
Entry Volume, veh/h	12	8		105	128		357	403		399	450	
Circulating Flow (v <sub>c</sub> ), pc/h	971			735			188			112		
Exiting Flow (v <sub>e</sub> ), pc/h	236			16			863			803		
Capacity (c <sub>pc</sub> ), pc/h	553	622		687	760		1197	1197		1282	1282	
Capacity (c), veh/h	536	604		667	738		1162	1162		1245	1245	
v/c Ratio (x)	0.02	0.01		0.16	0.17		0.31	0.35		0.32	0.36	

### Delay and Level of Service

Approach	EB			WB			NB			SB		
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh	7.0	6.1		7.2	6.8		6.0	6.5		5.9	6.3	
Lane LOS	A	A		A	A		A	A		A	A	
95% Queue, veh	0.1	0.0		0.6	0.6		1.3	1.6		1.4	1.7	
Approach Delay, s/veh	6.6			7.0			6.3			6.1		
Approach LOS	A			A			A			A		
Intersection Delay, s/veh   LOS	6.3						A					

## HCS7 Roundabouts Report

General Information		Site Information		
Analyst	RLA		Intersection	Shiloh & Monad
Agency or Co.	ATS		E/W Street Name	Monad Road
Date Performed	12/1/2019		N/S Street Name	Shiloh Road
Analysis Year	2019		Analysis Time Period (hrs)	0.25
Time Analyzed	PM Peak Hour		Peak Hour Factor	1.00
Project Description	Iwata Subdivision		Jurisdiction	City of Billings


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	2	0	0	0	2	0	0	0	2	0	0	0	2	0
Lane Assignment	LT		TR		LT		TR		LT		TR		LT		TR	
Volume (V), veh/h	0	4	4	4	0	132	4	175	0	4	958	116	0	113	842	8
Percent Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Flow Rate (v <sub>pc</sub> ), pc/h	0	4	4	4	0	136	4	180	0	4	987	119	0	116	867	8
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	2				2				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	Left	Right	Bypass
Critical Headway (s)	4.6453	4.3276		4.6453	4.3276		4.5436	4.5436		4.5436	4.5436		4.5436	4.5436	
Follow-Up Headway (s)	2.6667	2.5352		2.6667	2.5352		2.5352	2.5352		2.5352	2.5352		2.5352	2.5352	

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	Left	Right	Bypass
Entry Flow (v <sub>e</sub> ), pc/h	6	6		140	180		522	588		466	525				
Entry Volume, veh/h	5	6		136	175		507	571		452	510				
Circulating Flow (v <sub>c</sub> ), pc/h	1119			995			124			144					
Exiting Flow (v <sub>e</sub> ), pc/h	239			16			1171			1007					
Capacity (c <sub>pc</sub> ), pc/h	482	549		540	610		1268	1268		1246	1246				
Capacity (c), veh/h	468	533		525	592		1232	1232		1209	1209				
v/c Ratio (x)	0.01	0.01		0.26	0.30		0.41	0.46		0.37	0.42				

Delay and Level of Service															
Approach	EB			WB			NB			SB					
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh	7.8	6.9		10.5	10.1		7.0	7.7		6.6	7.2				
Lane LOS	A	A		B	B		A	A		A	A				
95% Queue, veh	0.0	0.0		1.0	1.2		2.0	2.5		1.8	2.1				
Approach Delay, s/veh	7.3			10.3			7.4			6.9					
Approach LOS	A			B			A			A					
Intersection Delay, s/veh   LOS	7.6						A								

## HCS7 Roundabouts Report

General Information				Site Information				
Analyst	RLA				Intersection	Shiloh & Broadwater		
Agency or Co.	ATS				E/W Street Name	Broadwater Avenue		
Date Performed	12/1/2019				N/S Street Name	Shiloh Road		
Analysis Year	2025				Analysis Time Period (hrs)	0.25		
Time Analyzed	AM Peak With Development				Peak Hour Factor	1.00		
Project Description	Iwata Subdivision				Jurisdiction	City of Billings		

### Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	0	0	0	1	0	1	0	0	2	0	0	0	2	0
Lane Assignment					L		R		T		TR		LT		T	
Volume (V), veh/h					0	192		107	0		649	183	0	326	1117	
Percent Heavy Vehicles, %					3	3		3	3		3	3	3	3	3	
Flow Rate (v <sub>pc</sub> ), pc/h					0	198		110	0		668	188	0	336	1151	
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes					2				1				1			
Pedestrians Crossing, p/h					0				0				0			

### Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)				4.6453	4.3276		4.5436	4.5436		4.5436	4.5436	
Follow-Up Headway (s)				2.6667	2.5352		2.5352	2.5352		2.5352	2.5352	


### Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v <sub>e</sub> ), pc/h				198	110		402	454		699	788	
Entry Volume, veh/h				192	107		391	440		679	765	
Circulating Flow (v <sub>c</sub> ), pc/h	1685			668			336			198		
Exiting Flow (v <sub>e</sub> ), pc/h	524			0			778			1349		
Capacity (c <sub>pc</sub> ), pc/h				730	805		1046	1046		1186	1186	
Capacity (c), veh/h				709	781		1015	1015		1151	1151	
v/c Ratio (x)				0.27	0.14		0.38	0.43		0.59	0.66	

### Delay and Level of Service

Approach	EB			WB			NB			SB		
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh				8.3	6.0		7.7	8.4		10.5	12.4	
Lane LOS				A	A		A	A		B	B	
95% Queue, veh				1.1	0.5		1.8	2.2		4.0	5.4	
Approach Delay, s/veh				7.5			8.1			11.5		
Approach LOS				A			A			B		
Intersection Delay, s/veh   LOS	9.9						A					

## HCS7 Roundabouts Report

General Information				Site Information				
Analyst	RLA				Intersection	Shiloh & Broadwater		
Agency or Co.	ATS				E/W Street Name	Broadwater Avenue		
Date Performed	12/1/2019				N/S Street Name	Shiloh Road		
Analysis Year	2025				Analysis Time Period (hrs)	0.25		
Time Analyzed	PM Peak With Development				Peak Hour Factor	1.00		
Project Description	Iwata Subdivision				Jurisdiction	City of Billings		


Volume Adjustments and Site Characteristics																
Approach	EB				WB				NB				SB			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	0	0	0	1	0	1	0	0	2	0	0	0	2	0
Lane Assignment					L		R		T		TR		LT		T	
Volume (V), veh/h					0	201		251	0		1226	182	0	98	939	
Percent Heavy Vehicles, %					3	3		3	3		3	3		3	3	
Flow Rate (v <sub>pc</sub> ), pc/h					0	207		259	0		1263	187	0	101	967	
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes					2				1				1			
Pedestrians Crossing, p/h					0				0				0			

Critical and Follow-Up Headway Adjustment												
Approach	EB			WB			NB			SB		
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)				4.6453	4.3276		4.5436	4.5436		4.5436	4.5436	
Follow-Up Headway (s)				2.6667	2.5352		2.5352	2.5352		2.5352	2.5352	

Flow Computations, Capacity and v/c Ratios												
Approach	EB			WB			NB			SB		
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v <sub>e</sub> ), pc/h				207	259		682	769		502	566	
Entry Volume, veh/h				201	251		662	746		487	550	
Circulating Flow (v <sub>c</sub> ), pc/h	1275			1263			101			207		
Exiting Flow (v <sub>e</sub> ), pc/h	288			0			1522			1174		
Capacity (c <sub>ped</sub> ), pc/h				422	485		1295	1295		1176	1176	
Capacity (c), veh/h				410	471		1258	1258		1142	1142	
v/c Ratio (x)				0.49	0.53		0.53	0.59		0.43	0.48	

Delay and Level of Service												
Approach	EB			WB			NB			SB		
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh				19.4	18.7		8.6	9.9		7.6	8.4	
Lane LOS				C	C		A	A		A	A	
95% Queue, veh				2.6	3.1		3.2	4.1		2.2	2.7	
Approach Delay, s/veh				19.0			9.3			8.1		
Approach LOS				C			A			A		
Intersection Delay, s/veh   LOS	10.4						B					

## HCS7 Roundabouts Report

General Information				Site Information				
Analyst	RLA				Intersection	Central & Shiloh		
Agency or Co.	ATS				E/W Street Name	Central Avenue		
Date Performed	12/1/2019				N/S Street Name	Shiloh Road		
Analysis Year	2025				Analysis Time Period (hrs)	0.25		
Time Analyzed	AM Peak With Development				Peak Hour Factor	1.00		
Project Description	Iwata Subdivision				Jurisdiction	City of Billings		


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	2	0	0	0	2	0	0	0	2	0	0	0	2	0
Lane Assignment	LT		TR		LT		TR		LT		TR		LT		TR	
Volume (V), veh/h	0	199	336	146	0	84	120	116	0	82	521	140	0	170	697	79
Percent Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Flow Rate (v <sub>PCS</sub> ), pc/h	0	205	346	150	0	87	124	119	0	84	537	144	0	175	718	81
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	2				2				2				2			
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)	4.6453	4.3276		4.6453	4.3276		4.6453	4.3276		4.6453	4.3276		
Follow-Up Headway (s)	2.6667	2.5352		2.6667	2.5352		2.6667	2.5352		2.6667	2.5352		

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 <sub>e</sub> ), pc/h	329	372		155	175		360	405		458	516		
Entry Volume, veh/h	320	361		151	170		349	394		444	501		
Circulating Flow (v <sub>c</sub> ), pc/h	980			826			726			295			
Exiting Flow (v <sub>e</sub> ), pc/h	665			289			861			955			
Capacity (c <sub>PCB</sub> ), pc/h	548	617		631	704		692	766		1029	1105		
Capacity (c), veh/h	532	599		613	683		672	744		999	1073		
v/c Ratio (x)	0.60	0.60		0.25	0.25		0.52	0.53		0.44	0.47		

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	19.5	17.7		9.0	8.2		13.6	12.8		8.7	8.6		
Lane LOS	C	C		A	A		B	B		A	A		
95% Queue, veh	3.9	4.0		1.0	1.0		3.0	3.1		2.3	2.5		
Approach Delay, s/veh	18.5			8.6			13.2			8.6			
Approach LOS	C			A			B			A			
Intersection Delay, s/veh   LOS	12.4						B						

## HCS7 Roundabouts Report

General Information				Site Information				
Analyst	RLA				Intersection	Central & Shiloh		
Agency or Co.	ATS				E/W Street Name	Central Avenue		
Date Performed	12/1/2019				N/S Street Name	Shiloh Road		
Analysis Year	2025				Analysis Time Period (hrs)	0.25		
Time Analyzed	PM Peak With Development				Peak Hour Factor	1.00		
Project Description	Iwata Subdivision				Jurisdiction	City of Billings		

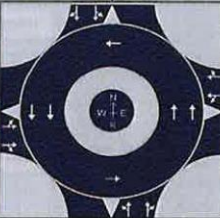
Volume Adjustments and Site Characteristics																
Approach	EB				WB				NB				SB			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	2	0	0	0	2	0	0	0	2	0	0	0	2	0
Lane Assignment	LT		TR		LT		TR		LT		TR		LT		TR	
Volume (V), veh/h	0	146	157	50	0	219	157	144	0	369	1006	102	0	109	809	121
Percent Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Flow Rate (v <sub>pc</sub> ), pc/h	0	150	162	52	0	226	162	148	0	380	1036	105	0	112	833	125
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	2				2				2				2			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment													
Approach	EB			WB			NB			SB			
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	
Critical Headway (s)	4.6453	4.3276		4.6453	4.3276		4.6453	4.3276		4.6453	4.3276		
Follow-Up Headway (s)	2.6667	2.5352		2.6667	2.5352		2.6667	2.5352		2.6667	2.5352		

Flow Computations, Capacity and v/c Ratios													
Approach	EB			WB			NB			SB			
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	
Entry Flow (v <sub>e</sub> ), pc/h	171	193		252	284		715	806		503	567		
Entry Volume, veh/h	166	187		245	276		694	783		488	551		
Circulating Flow (v <sub>c</sub> ), pc/h	1171			1566			424			768			
Exiting Flow (v <sub>e</sub> ), pc/h	379			667			1334			1111			
Capacity (c <sub>pm</sub> ), pc/h	460	525		320	375		914	990		666	739		
Capacity (c), veh/h	446	510		310	364		887	961		647	718		
v/c Ratio (x)	0.37	0.37		0.79	0.76		0.78	0.81		0.76	0.77		

Delay and Level of Service													
Approach	EB			WB			NB			SB			
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	
Lane Control Delay (d), s/veh	14.6	13.0		47.8	38.7		20.8	21.8		24.4	23.4		
Lane LOS	B	B		E	E		C	C		C	C		
95% Queue, veh	1.7	1.7		6.3	6.0		8.1	9.3		6.9	7.3		
Approach Delay, s/veh	13.7			43.0			21.4			23.9			
Approach LOS	B			E			C			C			
Intersection Delay, s/veh   LOS	24.7						C						

## HCS7 Roundabouts Report

General Information				Site Information				
Analyst	RLA				Intersection	Shiloh & Monad		
Agency or Co.	ATS				E/W Street Name	Monad Road		
Date Performed	12/1/2019				N/S Street Name	Shiloh Road		
Analysis Year	2025				Analysis Time Period (hrs)	0.25		
Time Analyzed	AM Peak With Development				Peak Hour Factor	1.00		
Project Description	Iwata Subdivision				Jurisdiction	City of Billings		


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	2	0	0	0	2	0	0	0	2	0	0	0	2	0
Lane Assignment	LT		TR		LT		TR		LT		TR		LT		TR	
Volume (V), veh/h	0	17	5	5	0	121	5	159	0	8	856	70	0	201	813	10
Percent Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Flow Rate (v <sub>pc</sub> ), pc/h	0	18	5	5	0	125	5	164	0	8	882	72	0	207	837	10
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	2				2				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)	4.6453	4.3276		4.6453	4.3276		4.5436	4.5436		4.5436	4.5436		
Follow-Up Headway (s)	2.6667	2.5352		2.6667	2.5352		2.5352	2.5352		2.5352	2.5352		

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 <sub>e</sub> ), pc/h	18	10		130	164		452	510		495	559		
Entry Volume, veh/h	17	10		126	159		439	495		481	542		
Circulating Flow (v <sub>c</sub> ), pc/h	1169			908			230			138			
Exiting Flow (v <sub>e</sub> ), pc/h	284			23			1064			967			
Capacity (c <sub>pc</sub> ), pc/h	461	526		586	656		1152	1152		1252	1252		
Capacity (c), veh/h	447	510		568	637		1118	1118		1216	1216		
v/c Ratio (x)	0.04	0.02		0.22	0.25		0.39	0.44		0.40	0.45		

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	8.6	7.3		9.2	8.8		7.2	8.0		6.9	7.6		
Lane LOS	A	A		A	A		A	A		A	A		
95% Queue, veh	0.1	0.1		0.8	1.0		1.9	2.3		1.9	2.3		
Approach Delay, s/veh	8.1			9.0			7.6			7.2			
Approach LOS	A			A			A			A			
Intersection Delay, s/veh   LOS	7.6						A						

## HCS7 Roundabouts Report

General Information				Site Information				
Analyst	RLA				Intersection	Shiloh & Monad		
Agency or Co.	ATS				E/W Street Name	Monad Road		
Date Performed	12/1/2019				N/S Street Name	Shiloh Road		
Analysis Year	2025				Analysis Time Period (hrs)	0.25		
Time Analyzed	PM Peak With Development				Peak Hour Factor	1.00		
Project Description	Iwata Subdivision				Jurisdiction	City of Billings		

Volume Adjustments and Site Characteristics																
Approach	EB				WB				NB				SB			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	2	0	0	0	2	0	0	0	2	0	0	0	2	0
Lane Assignment	LT		TR		LT		TR		LT		TR		LT		TR	
Volume (V), veh/h	0	5	5	5	0	158	5	211	0	5	1154	140	0	139	1025	11
Percent Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Flow Rate (v <sub>cs</sub> ), pc/h	0	5	5	5	0	163	5	217	0	5	1189	144	0	143	1056	11
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	2				2				1				1			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment													
Approach	EB			WB			NB			SB			
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	
Critical Headway (s)	4.6453	4.3276		4.6453	4.3276		4.5436	4.5436		4.5436	4.5436		
Follow-Up Headway (s)	2.6667	2.5352		2.6667	2.5352		2.5352	2.5352		2.5352	2.5352		

Flow Computations, Capacity and v/c Ratios												
Approach	EB			WB			NB			SB		
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v <sub>e</sub> ), pc/h	7	8		168	217		629	709		569	641	
Entry Volume, veh/h	7	8		163	211		611	688		552	623	
Circulating Flow (v <sub>c</sub> ), pc/h	1362			1199			153			173		
Exiting Flow (v <sub>e</sub> ), pc/h	292			21			1411			1224		
Capacity (c <sub>pc</sub> ), pc/h	386	446		448	512		1235	1235		1213	1213	
Capacity (c), veh/h	374	433		435	498		1199	1199		1178	1178	
v/c Ratio (x)	0.02	0.02		0.38	0.42		0.51	0.57		0.47	0.53	

Delay and Level of Service												
Approach	EB			WB			NB			SB		
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh	9.9	8.6		15.0	14.6		8.6	9.8		8.1	9.1	
Lane LOS	A	A		C	B		A	A		A	A	
95% Queue, veh	0.1	0.1		1.7	2.1		3.0	3.8		2.6	3.2	
Approach Delay, s/veh	9.2			14.8			9.3			8.6		
Approach LOS	A			B			A			A		
Intersection Delay, s/veh   LOS	9.7						A					

## HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	RLA	Intersection	North Approach
Agency/Co.	ATS	Jurisdiction	City of Billings
Date Performed	12/11/2019	East/West Street	North Approach
Analysis Year	2025	North/South Street	Shiloh Road
Time Analyzed	AM Peak With Dev.	Peak Hour Factor	1.00
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Iwata Subdivision		

### Lanes



### Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	1		0	0	0	0	0	0	0	0	0	2	0
Configuration				R											T	TR
Volume (veh/h)				42											941	43
Percent Heavy Vehicles (%)				3												
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized		No														
Median Type   Storage		Undivided														

### Critical and Follow-up Headways

Base Critical Headway (sec)				6.9												
Critical Headway (sec)				6.96												
Base Follow-Up Headway (sec)				3.3												
Follow-Up Headway (sec)				3.33												

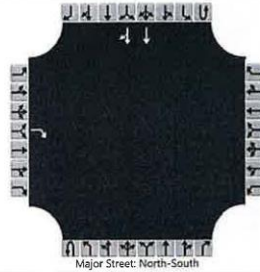
### Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)				42												
Capacity, c (veh/h)				520												
v/c Ratio				0.08												
95% Queue Length, Q <sub>95</sub> (veh)				0.3												
Control Delay (s/veh)				12.5												
Level of Service (LOS)				B												
Approach Delay (s/veh)		12.5														
Approach LOS		B														

## HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	RLA	Intersection	North Approach
Agency/Co.	ATS	Jurisdiction	City of Billings
Date Performed	12/11/2019	East/West Street	North Approach
Analysis Year	2025	North/South Street	Shiloh Road
Time Analyzed	PM Peak With Dev.	Peak Hour Factor	1.00
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Iwata Subdivision		

### Lanes



### Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	1		0	0	0	0	0	0	0	0	0	2	0
Configuration				R											T	TR
Volume (veh/h)				58											1010	28
Percent Heavy Vehicles (%)				3												
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized		No														
Median Type   Storage		Undivided														

### Critical and Follow-up Headways

Base Critical Headway (sec)				6.9												
Critical Headway (sec)				6.96												
Base Follow-Up Headway (sec)				3.3												
Follow-Up Headway (sec)				3.33												

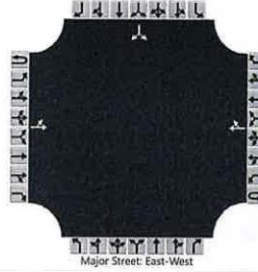
### Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)				58												
Capacity, c (veh/h)				499												
v/c Ratio				0.12												
95% Queue Length, Q <sub>95</sub> (veh)				0.4												
Control Delay (s/veh)				13.2												
Level of Service (LOS)				B												
Approach Delay (s/veh)		13.2														
Approach LOS		B														

## HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	RLA™	Intersection	Central Approach
Agency/Co.	ATS	Jurisdiction	City of Billings
Date Performed	12/11/2019	East/West Street	Central Avenue
Analysis Year	2025	North/South Street	West Approach
Time Analyzed	AM Peak With Dev.	Peak Hour Factor	1.00
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Iwata Subdivision		

### Lanes



### Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Movement	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Priority																
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	1	0
Configuration		LT						TR							LR	
Volume (veh/h)		14	675				237	43						5		3
Percent Heavy Vehicles (%)		3												3		3
Proportion Time Blocked																
Percent Grade (%)														0		
Right Turn Channelized																
Median Type   Storage		Undivided														

### Critical and Follow-up Headways

Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.13												6.43		6.23
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.23												3.53		3.33

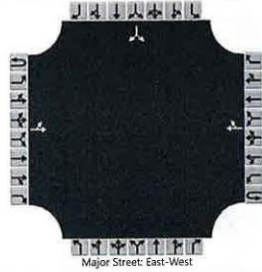
### Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		14													8	
Capacity, c (veh/h)		1277													366	
v/c Ratio		0.01													0.02	
95% Queue Length, Q <sub>95</sub> (veh)		0.0													0.1	
Control Delay (s/veh)		7.9													15.0	
Level of Service (LOS)		A													C	
Approach Delay (s/veh)		0.3												15.0		
Approach LOS														C		

## HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	RLA™	Intersection	Central Approach
Agency/Co.	ATS	Jurisdiction	City of Billings
Date Performed	12/11/2019	East/West Street	Central Avenue
Analysis Year	2025	North/South Street	West Approach
Time Analyzed	PM Peak With Dev.	Peak Hour Factor	1.00
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Iwata Subdivision		

### Lanes



### Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound				
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R	
Movement	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12	
Priority																	
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	1	0	
Configuration		LT						TR								LR	
Volume (veh/h)		3	331				638	9						23		12	
Percent Heavy Vehicles (%)		3												3		3	
Proportion Time Blocked																	
Percent Grade (%)														0			
Right Turn Channelized																	
Median Type   Storage		Undivided															

### Critical and Follow-up Headways

Base Critical Headway (sec)		4.1													7.1		6.2
Critical Headway (sec)		4.13													6.43		6.23
Base Follow-Up Headway (sec)		2.2													3.5		3.3
Follow-Up Headway (sec)		2.23													3.53		3.33

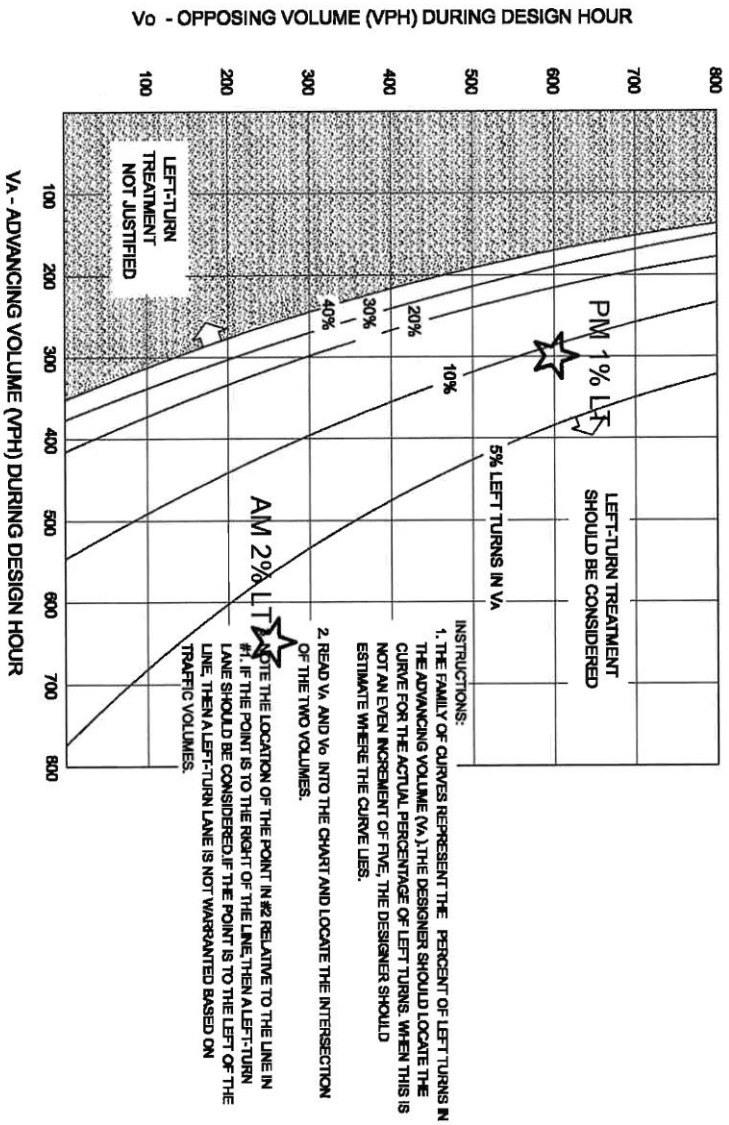
### Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		3														35	
Capacity, c (veh/h)		934														321	
v/c Ratio		0.00														0.11	
95% Queue Length, Q <sub>95</sub> (veh)		0.0														0.4	
Control Delay (s/veh)		8.9														17.6	
Level of Service (LOS)		A														C	
Approach Delay (s/veh)		0.1												17.6			
Approach LOS														C			

# **APPENDIX D**

## **Turn- Lane Warrants**

# South Approach To Central Avenue



**VOLUME GUIDELINES FOR LEFT-TURN LANES AT UNSIGNALIZED INTERSECTIONS ON 2-LANE HIGHWAYS 45 mph (70 km/h)**

Figure 13.3F