



YELLOWSTONE COUNTY BOARD OF PLANNING

CITY OF BILLINGS AND
YELLOWSTONE COUNTY, MONTANA



AGENDA

WEDNESDAY, MAY 28, 2025 MEETING

TIME: 6:00 p.m.

City Council Chambers, 5th Floor
316 N 26th St, Billings MT

NOTICE TO THE PUBLIC

Citizens are invited to:

. Review the Agenda Packet on the City's website at: <https://ci.billings.mt.us/117/Agendas-Minutes>
Public comment will be taken only during the Public Comment periods as indicated on the agenda and during the Public Hearings, if any are scheduled, under the Regular agenda. Comments may be sent to the Board via email before 12:00 pm on the meeting date. All emails received prior to this time will be entered into the record for the public hearing. Comments may be submitted by:

- . Mail: City/County Planning Division PO Box 1178, Billings MT 59103
- . Email: plnonline@billingsmt.gov
- . NOTICE: All meetings and official activities of the MPO are held in buildings and locations that comply with accessibility standards according to the Americans with Disabilities Act (ADA). A TTY number for the hearing impaired, 406-657-3079, is available upon request. 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 Brenda Berns, Planning Clerk at bernsb@billingsmt.gov or call 406-247-8610.

1. **CALL TO ORDER - Planning Board President:** Welcome and Introduction Board Members and Staff.
2. **APPROVAL OF AGENDA*** - including any additions or deletions to agenda. The agenda for a regular meeting will be closed at 5:00 p.m. three (3) working days prior to the date of the meeting.
3. Approval of Meeting Minutes of May 13, 2025
4. **PUBLIC COMMENT PERIOD** -- As required (3 minute maximum per person). *Any member of the public may be heard on any subject that is not on the agenda. The Planning Board will not take any action on these items at this time, but could choose to add an item to the next meeting's agenda for discussion.*
 - 4a) **Comments on items not on agenda and requests to add items to future agendas**
 - 4b) **Comments on items on the non-public hearing agenda items**
5. **DISCLOSURE OF CONFLICT OF INTEREST:**
6. **DISCLOSURE OF EX PARTE COMMUNICATION:**
7. **OLD BUSINESS** (Agenda items that were not discussed or not completed in a previous meeting or items requiring action).
 - a. **PUBLIC HEARINGS/PUBLIC HEARING PARTICIPATION GUIDELINES.** The County Planning Board welcomes public input on matters brought before the Board. To ensure a fair and effective public comment process, we ask that you consider the following guidelines when presenting your comments: Address the Planning Board directly. You must state your name and address before commenting. This is an opportunity to explain how you will be affected by the decision and why that is an important consequence. By state law, the Planning Board must consider only certain criteria when reviewing subdivisions (76-3-608(a), MCA). Please see the attached guidelines for the criterion.
 - b. **Board Recommendation and Motion. Clearwater Estates Subdivision, 2nd Filing.** The subdivision creates 69 lots for residential and commercial development. The subject property is generally located south of Central Avenue, and west of Twin Pines Townhomes. The property is zoned CMU1 - Corridor Mixed Use 1, N2 - Mid-Century Neighborhood Residential, NX1 - Mixed Residential 1, NX2 - Mixed Residential 2.

- c. **Board Recommendation and Motion. 44 West Subdivision.** The subdivision creates 62 lots for residential and commercial development. The subject property is generally located south of Central Avenue, and west of Twin Pines Townhomes. The property is zoned NX2 - Mixed Residential 2 (2 to 8 units) and NX1 - Mixed Residential 1 (1 to 4 units).
- 8. **NEW BUSINESS:** (Agenda items new to this meeting).
 - a. **Presentation. BPAC Annual Presentation to the Governing Bodies.** Elyse Monat, Transportation Planner
- 9. **OTHER BUSINESS:**
 - a. (Standing Item) Long Range Strategic Issues and an overview of future City and County issues and projects.
- 10. **ADJOURNMENT**
FUTURE AGENDA ITEMS

CITY/COUNTY PLANNING BOARD
City Council Chambers, 5th Floor
316 N 26th St, Billings MT



Public Hearing Participation Guidelines

NOTICE: All meetings and official activities of the MPO are held in buildings and locations that comply with accessibility standards according to the Americans with Disabilities Act (ADA). A TTY number for the hearing impaired, 406-657-3079, is available upon request. 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 the Planning Division Office, at 406-247-8610.

The County Planning Board welcomes public input on matters brought before the Board. To ensure a fair and effective public comment process, we ask that you consider the following guidelines when presenting your comments: **Address the Planning Board directly. You must state your name and address before commenting.** This is an opportunity to explain how you will be affected by the decision and why that is an important consequence. Be informed of the process and the requirements of the Board. If you are commenting about a subdivision, please limit your comments to the review criteria.

By state law, the Planning Board must consider only certain criteria when reviewing subdivisions (76-3-608(a), MCA). These criteria include:

-Effect on agriculture and agricultural water user facilities; Effect on local services; -Effect on the natural environment; Effect on wildlife and wildlife habitat; Effect on public health and safety

Provide specific information about why you are concerned about the pending application, how the decision will impact the review criteria listed above, and provide suggestions on how to minimize or eliminate the impact.

Respect the right of others to participate. Wait until the previous speaker has completed their comments before making your own comments. Do not talk over the person commenting or with other people in attendance.

The public hearing is not an opportunity to question or accuse the applicant or their agent. If you have questions of the Board, the applicant or the agent, ask questions directly to the Board during the public hearing portion of the meeting. The Board will respond or request the applicant or agent to respond after the public comment portion of the hearing is closed.

After the public comment portion of the hearing is closed, no further comments are allowed unless you are addressed directly by a Board member.

You should expect the Board to make a balanced recommendation in accordance with its statutory responsibilities. The Board's ability to make reasonable and thoughtful recommendations is dependent on a fair consideration of everyone's interests.

Thank you for participating.

Date: 05/28/2025
Title:
Presented by:
Department: Planning & Community Services
Presentation:

Information

RECOMMENDATION

MEETING MINUTES: May 13, 2025

BACKGROUND (Consistency with Adopted Plans and Policies, if applicable)

ALTERNATIVES

City Council may:

- Approve; or,
- Not Approve

FISCAL EFFECTS

Attachments

Minutes of May 13, 2025

CITY/COUNTY PLANNING BOARD

TUESDAY, May 13, 2025 at 6:00pm

	Position	01/14/2025	01/28/2025	02/11/2025	02/25/2025	03/11/2025	03/26/2025	04/08/2025	04/22/2025	05/13/2025	05/28/2025	06/10/2025	06/24/2027	07/08/2025	07/22/2025	08/12/2025	08/26/2025	09/09/2025	09/23/2025	10/14/2025	10/28/2025	11/12/2025	11/26/2025	12/09/2025	12/23/2025
Jim Ronquillo	Billings Ward I	1	A	1	1	A	1	1	1	A															
Roger Gravgaard President	Billings Ward II	1	1	1	1	1	1	1	1	1															
Dennie Stephenson	Billings Ward III	1	1	1	1	1	1	1	1	1															
John Staley Vice President	Billings Ward IV	V	1	1	1	1	1	1	1	1															
David Nordel	Billings Ward V	A	V	V	A	V	A	1	V	1															
Troy Boucher	YC District 1	A	A	A	A	A	A	A	A	A															
Dennis Cook	YC District 2	A	1	1	1	1	1	1	1	1															
Vacant	YC District 3	-	-	-	-	-	-	-	-	-															
Vacant	YC District 4	-	-	-	-	-	-	-	-	-															
Woody Woods	YC District 5	1	1	1	1	1	1	1	A	1															
Alexis Bonogofsky	YC District 6	1	1	V	1	V	1	1	1	A															
Morgan Tuss	YC District 7	A	A	A	A	A	A	A	A	A															
Vacant	YC Cons. District	-	-	-	-	-	-	-	-	-															
Scott Reiter	Ex-Officio SD2	A	A	A	A	A	A	A	A	A															

Please note: "A" stands for excused absence, "1" stands for present, "V" stands for Zoom participation, "C" stands for Canceled

Call the Meeting to Order: President Gravgaard called the meeting to order at 6:00 p.m.

Introduction of Planning Board Members and Planning Department Staff

President Gravgaard called for introductions of the members of the Planning Board and staff.

Attending Staff: Wyeth Friday, Planning & Community Services Director; Anna Vickers, Planning Division Manager; Lora Mattox, Transportation Planning Coordinator; Dave Green, Planner; Brenda Berns, Planning Clerk

1. Others in Attendance: Mac Fogelsong, Engineering Department Manager

2. Approval of Agenda

Motion

Motion made by Board member Staley, seconded by Board member Stephenson to approve the agenda as submitted. Motion passed unanimously.

3. Approval of Minutes: April 8, 2025 & April 22, 2025

Motion

Motion made by Board member Stephenson, seconded by Board member Cook to approve the meeting minutes of April 8, 2025. Motion passed unanimously.

Motion made by Board member Stephenson, seconded by Board member Nordel to approve the meeting minutes of April 22, 2025. Motion passed unanimously.

4. Public Comment: As required (3 minutes maximum per person). Any member of the public might be heard on any subject that is not on the agenda. The Planning Board will not take any action on these items at this time but could choose to add an item to the next meeting agenda for discussion. There were no comments from the public.

5. Disclosure of Outside (Ex-Parte) Communication – There was none.

6. Disclosure of Conflicts of Interest – There was none.

7. Old Business – There was none.

8. New Business:

a. Public Hearing. Board Presentation. Transportation Alternatives Program.

Elyse Monat clarified that no vote would be taken by the board at this meeting. She noted that the board is already familiar with the Transportation Alternatives Program and provided a brief overview. A funding round took place in 2023, with federal funds allocated through the Montana Department of Transportation (MDT) to the Metropolitan Planning Organization (MPO).

Applications are submitted directly to the MPO. The available funding for this round is \$1,784,111 - Eligible applicants include city, county, and tribal governments. Non-profit organizations are not eligible to apply as primary applicants but may participate with sponsorship from a local government entity.

TAP Process

- Grant process – Local review with project recommendation to MDT for programming.
- Default is for the local entity to administer the project under the MDT LAG (Local Agency Guidelines) program.
- All projects must include a local match of 13.42%. Instructions on developing the budget were included in the TA instructions.

Elyse Monat presented the two applications for the Transportation Alternatives Program Funding. The City of Billings submitted a proposal for a bundle of safe routes to school projects across seven focus areas, requesting approximately \$1.3 million in federal funds with a \$200,000 local match. Yellowstone County, on behalf of the Lockwood Pedestrian Safety District, applied for the Johnson Lane sidewalk Connector Project, seeking about \$256,000 in federal funds with a \$40,000 local match.

The Technical Advisory Committee has requested clarification on the cost estimate for the Lockwood portion of a sidewalk project, particularly for 500 feet of sidewalk. The planning team is reaching out to consultant Erin Claunch for more details on the cost breakdown. While the project's validity is not in question, there are concerns about potentially high estimates, which have been common in past projects due to market conditions. The project will be brought back for review at the first meeting in June, possibly with a revised application.

Board Discussion

No concerns were raised regarding the projects. A question was brought up about the cost estimates, and clarification was sought from the consultant. It was noted that estimates are often on the higher side due to rising material costs, and there is no guarantee on project timelines—some, like Johnson Lane, have faced multi-year delays. There were no questions about the validity of the projects themselves; the inquiry was solely to clarify cost details.

Public Hearing

President Gravggaard opened the public hearing. Seeing no members of the public, the public hearing was closed.

b. Presentation and Board Discussion. Clearwater Estates Subdivision, 2nd Filing. The subdivision creates 69 lots for residential and commercial development. The subject property is generally located south of Central Avenue, and west of Twin Pines Townhomes. The property is zoned CMU1 – Corridor Mixed Use 1, N2 - Mid-Century Neighborhood Residential, NX1 - Mixed Residential 1, NX2 - Mixed Residential 2.

Dave Green discussed the Clearwater Estates Subdivision's second filing, which proposes to develop large lots into smaller residential and commercial areas. The subdivision will have 69 lots, with sizes ranging from 7,100 square feet to 2.69 acres. The developers plan to provide 0.58 acres of parkland and a cash contribution for the remaining required dedication. The project includes plans for road connections, pedestrian access, and future expansions. The traffic study for the entire planned development area has been conducted, and the developers will pay their proportional share for intersection improvements. The Parks department is requesting a minimum one-acre park in the center of the subdivision, with potential for more parkland in future filings.

Staff is recommending conditional approval of the proposed subdivision, subject to the 5 conditions of approval as presented in the staff report.

Board Discussion

Concerns were raised about traffic safety on Central Avenue, particularly following a reported incident involving a pedestrian. It was noted that there are currently no plans to widen Central, which lacks turn lanes and sees high vehicle speeds, especially in favorable weather. Members emphasized the need for a long-term plan to improve and expand Central Avenue, as no significant upgrades have occurred in over a decade.

Questions arose regarding future access to Monad and whether the existing infrastructure, including the Monad drain, can support ongoing development. There was an emphasis on the importance of coordinated planning as multiple subdivisions, such as Clearwater and 44 West, move forward simultaneously.

The Traffic Impact Study (TIS) for both Clearwater and 44 West has been submitted. It was proposed that engineering staff attend the next meeting to present the findings and clarify the methodology used in the analysis.

Board members expressed concern about the capacity of west-end schools and the additional strain that continued development may place on public services. It was noted that schools are already full, and the district may need to implement busing to manage enrollment. There was discussion about the financial challenges of maintaining parks and roads, especially with limited tax revenue and ongoing efforts to pass mill levies. Members agreed on the importance of engaging with school district representatives to better understand and plan for these impacts.

Clarification was requested on the phasing of the Clearwater and 44 West subdivisions, which are being developed by the same entity. It was confirmed that both are expected to begin at the same time, and that water and sewer infrastructure will be installed simultaneously. Concerns were also raised about temporary connections and how the developments will be coordinated during construction.

The proposed park was confirmed to meet and exceed frontage requirements. It will include sidewalks and streetlights, and its design aligns with local standards.

Discussion around a proposed private gated road raised several issues, including long-term maintenance, signage, and the potential for public confusion if the road is not clearly marked. Questions were asked about whether lot assessments would cover road maintenance. While maintenance is expected to be managed through HOA covenants, there were concerns about the long-term effectiveness of HOAs, particularly as enforcement of covenants often diminishes over time. Some members expressed hesitation about relying on HOAs but acknowledged they may be necessary in this case. Alternatives to gated access, such as chains or simplified barriers, were also mentioned. It was suggested that the board invite the school superintendent to a future meeting to provide insight into current capacity issues and how the district is planning for continued growth in the area. The board agreed that such collaboration would be valuable for future planning decisions.

A Public Hearing and recommendation will be at the next Board meeting, Wednesday, May 28, 2025.

c. Presentation and Board Discussion. 44 West Subdivision. The subdivision creates 62 lots for residential and commercial development. The subject property is generally located south of Central Avenue, and west of Twin Pines Townhomes. The property is zoned NX2 – Mixed Residential 2 (2 to 8 units) and NX1 Mixed Residential 1 (1 to 4 units).

Dave Green discussed the 44 West subdivision, developed by the McCalls, and will have 62 lots south of Central and west of Twin Pines, with plans for future expansion. The subdivision will feature lanes for garage access, private parkland, and connections to neighboring developments. The board also reviews traffic studies, parkland dedication, and utility plans for both subdivisions. Mr. Green provided details on the layout, including the future extension of Bell Avenue to Shiloh Road, and addressed concerns about potential confusion with the Carriage Lane road system.

Staff is recommending conditional approval of the proposed subdivision, subject to the 4 conditions of approval as presented in the staff report.

Board Discussion

The board discussed the 44 West subdivision proposal, which includes a 34-foot wide public street with boulevard-style sidewalks. Staff recommends conditional approval with four conditions, including coordination with the postal service and providing a proportionate share of contribution for traffic improvements. The board raises questions about road connections and future development plans.

A Public Hearing and recommendation will be at the next Board meeting, Wednesday, May 28, 2025.

9. Other Business.

Discussion began with a question from the board regarding mail delivery requirements in new developments. It was clarified that as long as there is a mail service provider—whether public or private—mail delivery must be accommodated. Addressing is handled by the city, and typically, centralized box units are required. There was a brief exchange about the potential privatization of mail services. While mail delivery is not one of the six key impact areas reviewed under state subdivision law, it remains a requirement under local subdivision regulations. A question was raised about whether mailbox placement—such as requiring boxes on one side of the street—would change under a privatized system, which was noted as an open question worth exploring.

An update on legislative matters was also discussed. Anna Vickers noted that an overview of relevant changes from the most recent session would be provided. When asked about the impact on mill levies, it was indicated that only limited information could be shared at this time, though more details will be provided from Wyeth Friday. Some changes may affect the general fund, and inquiries have been made by City Council regarding anticipated impacts.

There was also a question about the timeline for separation of boards. It was confirmed that the Land Use separation is still scheduled for May 2026, although recent legislative changes—some still awaiting the governor’s signature—are creating uncertainty. Ongoing legal developments are being monitored to understand their potential effects.

a. (Standing Item) Long Range Strategic Issues and an overview of future City and County issues and projects.

10. Future Agenda Items

ADJOURNMENT: 7:19 PM

Brenda J Berns, Planning Clerk

Planning Board

Date: 05/28/2025
Title: Clearwater Estates Subdivision, 2nd Filing - Preliminary Major Plat - Public Hearing
Presented by: David Green
Department: Planning & Community Services
Presentation: Yes

Information

RECOMMENDATION

Staff recommends the Planning Board listen to the staff presentation, conduct a public hearing, and forward a recommendation to the City Council to conditionally approve the preliminary plat of Clearwater Estates Subdivision, 2nd Filing, and adopt the Findings of Fact as presented in the staff report.

BACKGROUND (Consistency with Adopted Plans and Policies, if applicable)

On April 1, 2025, Performance Engineering applied for preliminary major plat approval for Clearwater Estates Subdivision, 2nd Filing. The proposed subdivision creates 69 lots for residential and commercial development. The subject property is generally located south of Central Avenue, and west of Twin Pines Townhomes. The property is zoned Corridor Mixed Use 1 (CMU1), Mid-Century Neighborhood Residential (N2), Mixed Residential 1 (NX1), Mixed Residential 2 (NX2).

VARIANCES REQUESTED

No variances from the City Subdivision Regulations have been requested.

PROPOSED CONDITIONS OF APPROVAL

Pursuant to Section 76-3-608(4), MCA, the following conditions are recommended to reasonably minimize potential adverse impacts identified within the Findings of Fact.

1. To meet the requirements of subdivision regulations, prior to final plat approval, the applicant shall provide a break in block length of a minimum 30' wide for Lots 1-16, Block 5. Block design standards shall be in accordance with City of Billings Subdivision Regulations, Table 23-405.1 Required Block Design.
2. To minimize the effects on local services, prior to final plat approval, the applicant shall provide a proportionate share contribution as indicated within the Traffic Impact Study and approved by City of Billings Engineering.
3. To minimize the effects on local service prior to final plat approval, the applicant will coordinate with the USPS to determine what type of deliver system is preferred and to locate and provide the correct amount of space for safely delivering the mail to the residents and businesses.
4. Minor changes may be made in the SIA and final documents, as requested by the Planning, Legal or Public Works Departments to clarify the documents and bring them into the standard acceptable format.
5. The final plat shall comply with all requirements of the City of Billings Subdivision regulations, rules, policies, and resolutions of the City of Billings, and the laws and Administrative Rules of the State of Montana.

PROCEDURAL HISTORY

- Pre-application meeting February 27, 2025
- Preliminary plat application submitted to Planning Division on April 1, 2025
- Departmental review meeting April 17, 2025
- Subdivision resubmittal April 24, 2025
- Planning Board plat review May 13, 2025
- Planning Board public hearing May 28, 2025
- Preliminary plat to City Council June 23, 2025
- 60 working-day preliminary plat review period ends June 26, 2025

PLAT INFORMATION

General location: South of Central Avenue, and west of Twin Pines Townhomes

Legal Description: Being Lots 1, 2, and 3 of Clearwater Estates Subdivision

Owner/Subdivider: Brown Development, LLC

Engineer and Surveyor: Performance Engineering

Existing Zoning: CMU1, N2, NX1, NX2

Existing land use: Agricultural

Proposed land use: Residential / Commercial

Gross and Net area: 23.43 acres / 20.34 acres

Proposed number of lots: 69

Lot size: Max: 117,454 square feet / 2.69 acres
Min: 7,152 square feet

Parkland requirements: Parkland dedication requirement is 1.67 acres. The applicant is providing 0.58 acres. The applicant is proposing to provide a cash in lieu contribution for the remaining 1.10 acres of parkland.

Traffic Impact Study overview:

This traffic study was done for Clearwater Estates Subdivision 2nd Filing. The traffic study was completed for when all filings of the subdivisions are built out.

A traffic accessibility study has been completed for the Clearwater Estates Subdivision, 2nd Filing. All required intersection improvement contributions identified therein shall be completed by the Subdivider at the Subdivider's expense. The percent of traffic contributions to the following intersections shall be in accordance with the traffic accessibility study:

- a. S. 48th and Central -- 0.28%
- b. Shiloh and Broadwater -- 0.60%
- c. Shiloh and Central -- 1.64%
- d. Shiloh and Monad -- 0.39%

The cash contributions shall be based on the percent of traffic contributions to the intersections based on the total cost of an intersection as determined by City Engineering for the year in which the contribution is made. This subdivision will pay its proportional share of the cost of the improvements to intersections studied in the traffic impact study. These cash contributions for the intersection improvement will be made prior to final plat approval.

Parks and Recreation -- Parkland dedication requirement for this subdivision is 1.67 acres. The applicant is proposing to provide 0.58 acres. The applicant is proposing to provide a cash-in-lieu contribution for the remaining 1.10 acres of parkland. Billings Parks and Recreation have requested that the developer provide, with the future filings, additional park land be added to the proposed parkland with this filing. The request is that the developer have a minimum of a 1 acre park for the two filings. This park location is in the middle of the subdivision. There is a regional park to the east of this subdivision, Centennial Park, that is 1.3 miles away. Clearwater Estates plans for additional filings in the future to the south of this filing, so additional combining of park land for a larger space will be possible.

STAKEHOLDERS

Planning Board Plat Review - May 13, 2025

Staff gave a presentation about the proposed Clearwater Estates Subdivision, 2nd Filing. At the end of the presentation there were comments and several questions from the board. The Board asked for more information regarding turning lane analysis, in general, for TIS. Questions included: When is a turning lane required? Are there certain speed limits? Who is typically on the hook for installation? The Board also had questions about the future of Bell Avenue, including: Will it be upgraded to a different classification? Where are the future plans for that roadway? There are concerns that the two connections both accessing from Central will increase the danger of this area as far as traffic circulation. The Board asked if there any traffic-calming measures planned and if in future filings, will the City require either Clearwater or 44 West subdivisions to connect to Rocky Vista Way? Staff told the board the questions would be provided to the Engineering Division to get answers regarding specifics for turn lane requirements and traffic calming prior to the public hearing meeting. The board also asked why there is a private road within the public subdivision and how maintenance of the road would be handled. Staff indicated that conversations regarding the private road design were had with the agent and that private roads are typically maintained through a Homeowners Association.

ALTERNATIVES

In accordance with state law, the City Council has 60 working days to act upon this major preliminary plat. The 60 working day review period for the proposed plat ends on June 26, 2025. State and City subdivision regulations also require that preliminary plats be reviewed using specific criteria, as stated within this report. The City may not unreasonably restrict an owner's ability to develop land if the subdivider provides evidence that any identified adverse effects can be mitigated.

Within the 60 working day review period, the City Council is required to:

1. Approve;
2. Conditionally Approve; or
3. Deny the Preliminary Plat

FISCAL EFFECTS

This plat will have no fiscal impact on the City Planning Division.

SUMMARY

One of the purposes of the City's subdivision review process is to identify potential negative effects of property being subdivided. Negative effects that are identified become the subdivider's responsibility to mitigate. Various City departments, private service/utility providers and the affected school district/s, have reviewed this application and provided input on effects and mitigation. The Findings of Fact, which are presented as an attachment, discuss potential negative impacts of the subdivision and conditions of approval are recommended as measures to further mitigate any impacts. In this case, there were found to be minimal impacts from this proposed subdivision.

Attachments

Findings of Fact
Proposed Plat
Draft SIA
Traffic Study

FINDINGS OF FACT

The Planning staff has prepared the Findings of Fact for the preliminary plat of Clearwater Estates Subdivision, 2nd Filing. These findings are based on the preliminary plat application and supplemental documents and address the review criteria required by the Montana Subdivision and Platting Act (76-3-608, MCA) and the Billings Subdivision Regulations (Section 23-303(H), BMCC).

A. What are the effects on agriculture, local services, the natural environment, wildlife, wildlife habitat, and public health, safety and welfare? [MCA 76-3-608 (3) (a) and BMCC 23-302.H.2.]

1. Effect on agriculture and agricultural water user facilities

The subject property has been used for agricultural purposes in the past. The Monad Drain is to the south of this proposed subdivision and is not part of the proposed area to be subdivided. Perimeter ditches and drains shall remain in place and not be altered by the subdivider or subsequent owners. The subdivision should not affect agricultural water users' facilities. With farming activity wildlife habitat has not been maintained. Perimeter ditches are good for birds to hide in as well as deer. But the main body of the land having farm activity on it has left it open without cover.

2. Effect on local services

- a. **Utilities** – Water service will be provided by the City of Billings. A 16-inch water main will be extended along Central Avenue for the proposed subdivision. 12-inch and 8-inch water lines will be provided within the proposed subdivision. The 12-inch line will be installed in Double Haul Lane down to Tippet Trail and along Tippet Trail. 8-inch lines will be installed throughout the majority of the subdivision below Tippet Trail. New individual services will be provided to all the lots, and new fire hydrants will be installed as required by the City Fire Department.

Sanitary sewer service to Clearwater Estates Subdivision, 2nd Filing will be provided by connecting to the existing 10-inch gravity main running north from the Monad collector. The existing 10-inch gravity main is located in the parkland area in the southeast corner of the Subdivision. 8-inch sanitary sewer mains will be extended throughout the Subdivision.

The subdivider will install all new water lines and sewer lines in the local streets and individual services for each lot in accordance with design standards, specifications, rules, and regulations of the City of Billings Engineering/Public Works Department and MDEQ. This is outlined in the SIA under the heading VI Utilities.

Private utility companies will provide services to the subdivision. Any easement required by a private utility company will be coordinated with the subdivider and the utility company.

Stormwater – Stormwater drainage for the public streets is proposed to be provided by curb and gutters that discharge into storm water pipes. Stormwater drainage will discharge east to Lot 5 of Clearwater Estates Subdivision, 1st Filing. A ditch will convey stormwater drainage south to a stormwater detention facility that is located within an off-site area on Tract 3, Certificate of Survey No. 3844. This detention facility will be sized to accept runoff generated from the Clearwater Estates Subdivision, 2nd Filing. The detention facility will discharge into the Monad Drain.

This subdivision shall satisfy the criteria set forth by the *City of Billings Stormwater Management Manual* and will be subject to review and approval by the City Engineering Department. A Stormwater Report will be submitted for review and approval by City Engineering at the time of individual lot development. This is outlined in the SIA under the heading V Storm Drainage

- b. **Solid waste** – The City of Billings will provide solid waste collection and disposal. The City’s landfill has adequate capacity for this waste.
- c. **Streets** – The lots within the subdivision will be served by Central Avenue. The new internal roads, Tippet Trail, Double Haul Lane and Roads B, G, and F. Roads B, G, and F are temporary street names. Final street names are required before final plat. (BMCC Section 23-406 Streets and Roads A 15) Road F will be a private road within the subdivision. The streets will be built to grade with a satisfactory subbase, base course, curb and gutter, and asphalt surface. The design section of said streets shall be submitted to, and approved by, the City Engineer prior to construction.

The sidewalks will be installed by individual lot owners when the lots are developed. All sidewalks will be 5-foot-wide with a 5-foot-wide boulevard behind the curb to the edge of the sidewalk. ADA compliant ramps will be installed by the subdivider at all intersections and the frontage along the parkland.

Block layout is required to have a maximum length and perimeter to them. Blocks of lots begin and end with a street, a 30-foot-wide multi-use trail, or parkland with a trail through it. Lots 1-16, Block 5 exceed block length requirements. In order to meet the requirements of maximum block length the applicant needs to provide a 30 foot wide easement with a multi-use trail or an opening that will include some park area and a trail. **(Condition #1)**

Traffic Impact Study overview:

A traffic accessibility study update has been completed for Clearwater Estates Subdivision, 2nd Filing. All required intersection improvement contributions identified therein shall be completed by the Subdivider at the Subdivider’s expense.

This traffic study was done for both 44 West Subdivision and Clearwater Estates Subdivision 2nd Filing. The traffic study reflects full build out of all filings of both subdivisions.

The studied intersections are anticipated to operate similarly to existing conditions at the time this subdivision is fully built out.

Intersection*	Phase 1			Phase 2			Higher Total
	AM	PM	Higher	AM	PM	Higher	
Total							
1. S. 48th at Central	0.9%	1.1%	1.1%	0.7%	1.2%	1.2%	2.3%
2. Shiloh at Broadwater	1.9%	2.3%	2.3%	1.9%	4.2%	4.2%	6.5%
3. Shiloh at Central	5.3%	6.3%	6.3%	4.1%	7.2%	7.2%	13.5%
5. Shiloh at Monad	1.2%	1.5%	1.5%	0.9%	1.8%	1.8%	3.3%
Total Participation:			11.2%			14.4%	25.6%
x \$450,000			\$50,400			\$64,800	\$115,200

The cash contributions shall be based on the percent of traffic contributions to the intersections based on the total cost of an intersection as determined. The contributions will be made at the time of final plat. **(Condition #2)**

Street lighting is required for this subdivision. In the SIA the applicant has indicated that street lighting will be installed by private contract or SID. A Street Light Maintenance District will be created for operation and maintenance of the lighting at a future date and is included in the waiver of right to protest.

- d. **Emergency services** – The Billings Police and Fire Departments will respond to emergencies within the proposed subdivision. The fire station that provides service for this area is Fire Station #7, is located at 1501 54th Street West. The subdivision is located within the ambulance service area of American Medical Response (AMR).
- e. **Schools** – School District #2 provides service to students within this subdivision for elementary through high school. Meadowlark for elementary school, Ben Steele for middle school and West for high school. At the time of the writing of this staff report School District #2 had not responded to requests for comments.
- f. **Parks and Recreation** – Residential subdivisions are required by City of Billings Subdivision Regulations to provide parkland for the residents of the subdivision. This subdivision is required to provide 1.7323 acres of parkland. They are proposing to provide 0.575 acres of land as shown on the proposed subdivision plat. The applicant is proposing to provide a cash in lieu contribution for the balance, 1.10 acres. There is a small private park in the subdivision to the east, 44 West Subdivision, that connects directly to the proposed parkland in this subdivision. The applicant has indicated there will be additional parkland dedicated with future filings to the south as this development continues to expand.

Comments from the Parks Department are that they would like to see more parkland for the subdivision.

- g. **Mail Delivery** - The United States Postal Service will provide postal service to the subdivision. Location of mail delivery boxes will need to be coordinate with the developer and the postal service. (**Condition #3**)
- h. **Phasing of Development** - The applicant is not proposing to develop this subdivision in phases.

3. Effect on the natural environment

The subject property is currently vacant with the proposed use of residential development with a small portion of commercial. The property is not located within a floodplain. During development, storm water pollution prevention best management practices are required to be used and monitored to prevent erosion on exposed ground. Overall, the effect on the natural environment should be minimal.

4. Effect on wildlife and wildlife habitat

There are no known endangered or threatened species on the property. There is a paragraph in the SIA that warns future lot owners of the presence of wildlife in the area, which may cause damage to their landscaping. This subdivision should have a minimal effect on wildlife and wildlife habitat.

5. Effect on the public health, safety and welfare

There will be minimal impacts to public health, safety and welfare because of this subdivision.

B. Was an Environmental Assessment required? [(MCA 76-3-616 and BMCC 23-302.H.1.)]

The proposed subdivision is exempt from the requirement for an Environmental Assessment pursuant to Section 76-3-616, MCA.

C. Does the subdivision conform to the City of Billings 2016 Growth Policy, the 2014 Transportation Plan, and the Billings Area Bikeway and Trail Master Plan? [BMCC 23-302.H.4.]

1. City of Billings 2016 Growth Policy

The proposed subdivision is consistent with the following goals of the Growth Policy:

Strong Neighborhoods (livable, safe, sociable and resilient neighborhoods): Neighborhoods that are safe and attractive and provide essential services are much desired (p.8).

Home Base (healthy, safe and diverse housing options) Planning and construction of interconnected sidewalks and trails are important to the economy and livability of Billings.

Essential Investments (relating public and private expenditures to public values): Planning and construction of safe and affordable interconnected sidewalks and trails are important to the economy and livability of Billings.

2. 2023 Billings Urban Area Long Range Transportation Plan

The proposed subdivision adheres to the goals and objectives of the 2023 Transportation Plan and preserves the street network and street hierarchy specified in the plan. Central Avenue is identified as an arterial road, it will be widened to the standards of an arterial road.

3. Billings Area Bikeway and Trail Master Plan (BABTMP)

The proposed subdivision is within the Billings Area Bikeways and Trail Master Plan. There are no trails identified within the subdivision. There is a 10-foot-wide bike and pedestrian trail proposed along the south side of Central Avenue. This will be installed by private contract or SIA as outlined in the SIA. No additional improvements of this nature are anticipated.

D. Does the subdivision conform to the Montana Subdivision and Platting Act and to local subdivision regulations? [MCA 76-3-608 (3) (b) and BMCC 23-302.H.3.a.]

The proposed subdivision satisfies the requirements of the Montana Subdivision and Platting Act and the design standards specified in the local subdivision regulations. The subdivider and the local government have complied with the subdivision review and approval procedures set forth in the local and state subdivision regulations.

E. Does the proposed subdivision conform to all requirements of the zoning in effect? [BMCC 23-302.H.3.e.]

The subject property is located within CMU1 – Corridor Mixed Use 1, N2 - Mid-Century Neighborhood Residential, NX1 - Mixed Residential 1, NX2 - Mixed Residential 2. The lot frontages conform to the requirements of these zonings. Other building setbacks and structure specific requirements will be reviewed for compliance at the time of building permit review.

F. Does the proposed plat provide easements for the location and installation of any utilities? [MCA 76-3-608 (3) (c) and BMCC 23-302.H.3.b.]

The subdivider will provide utility easements as requested by private utility companies. Those easements will be shown on the face of the plat.

G. Does the proposed plat provide legal and physical access to each parcel within the subdivision and notation of that access on the plat? [MCA 76-3-608 (3) (d) and BMCC 23-302.H.3.c.]

Legal and physical access is provided to the proposed lots from existing roads and new roads within the proposed subdivision.

CONCLUSIONS OF FINDINGS OF FACT

- The preliminary plat of Clearwater Estates Subdivision, 2nd Filing, does not create any adverse impacts that warrant denial of the subdivision.
- The proposed subdivision conforms to several of the goals and policies of the 2016 Growth Policy and does not conflict with the Transportation or Bikeway/Trail Plans.
- The proposed subdivision complies with state and local subdivision regulations, local zoning, and sanitary requirements and provides legal and physical access to each lot.
- Any potential negative or adverse impacts will be mitigated with the proposed conditions of approval.

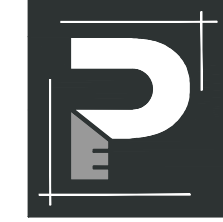
RECOMMENDATION

Staff proposes the Planning Board recommends to City Council that the preliminary plat of Clearwater Estates Subdivision, 2nd Filing, be conditionally approved and the Findings of Fact adopted as presented in the staff report.

PRELIMINARY PLAT OF CLEARWATER ESTATES SUBDIVISION, 2ND FILING

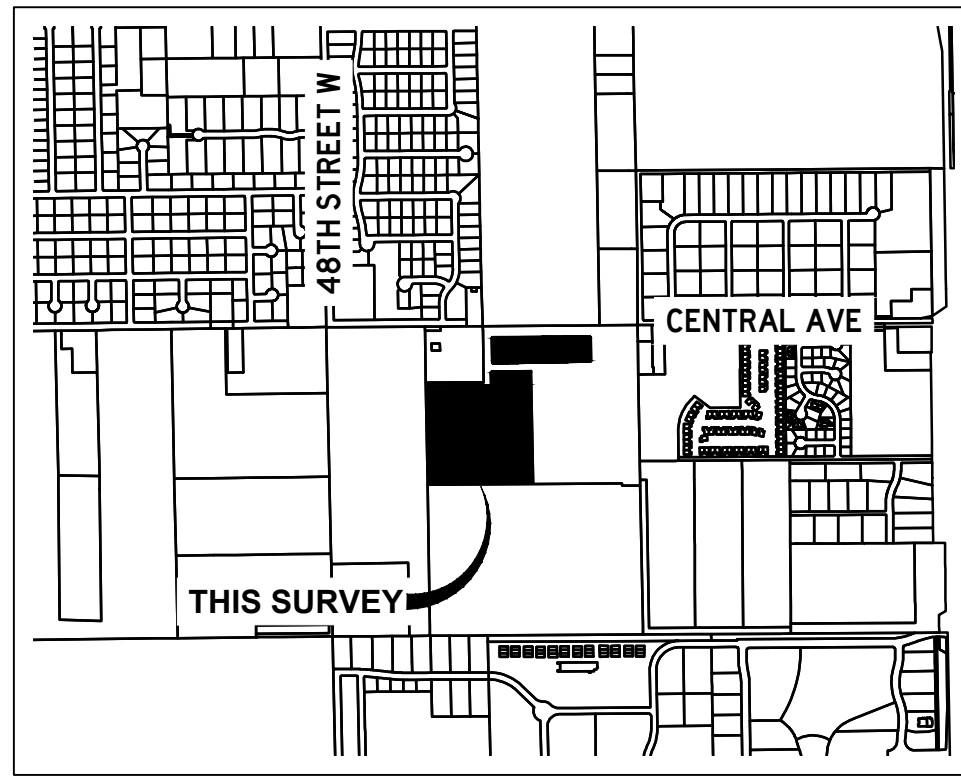
BEING LOTS 1, 2, AND 3 OF CLEARWATER ESTATES SUBDIVISION
LOCATED IN THE NW 1/4 OF SECTION 10, TOWNSHIP 01 SOUTH, RANGE 25 EAST, P.M.M., CITY OF BILLINGS,
YELLOWSTONE COUNTY, MONTANA

PREPARED FOR : BROWN DEVELOPMENT, LLC



PREPARED BY : PERFORMANCE ENGINEERING, LLC

TOTAL AREA OF SUBDIVISION : ± 23.43 ACRES
APRIL 2025

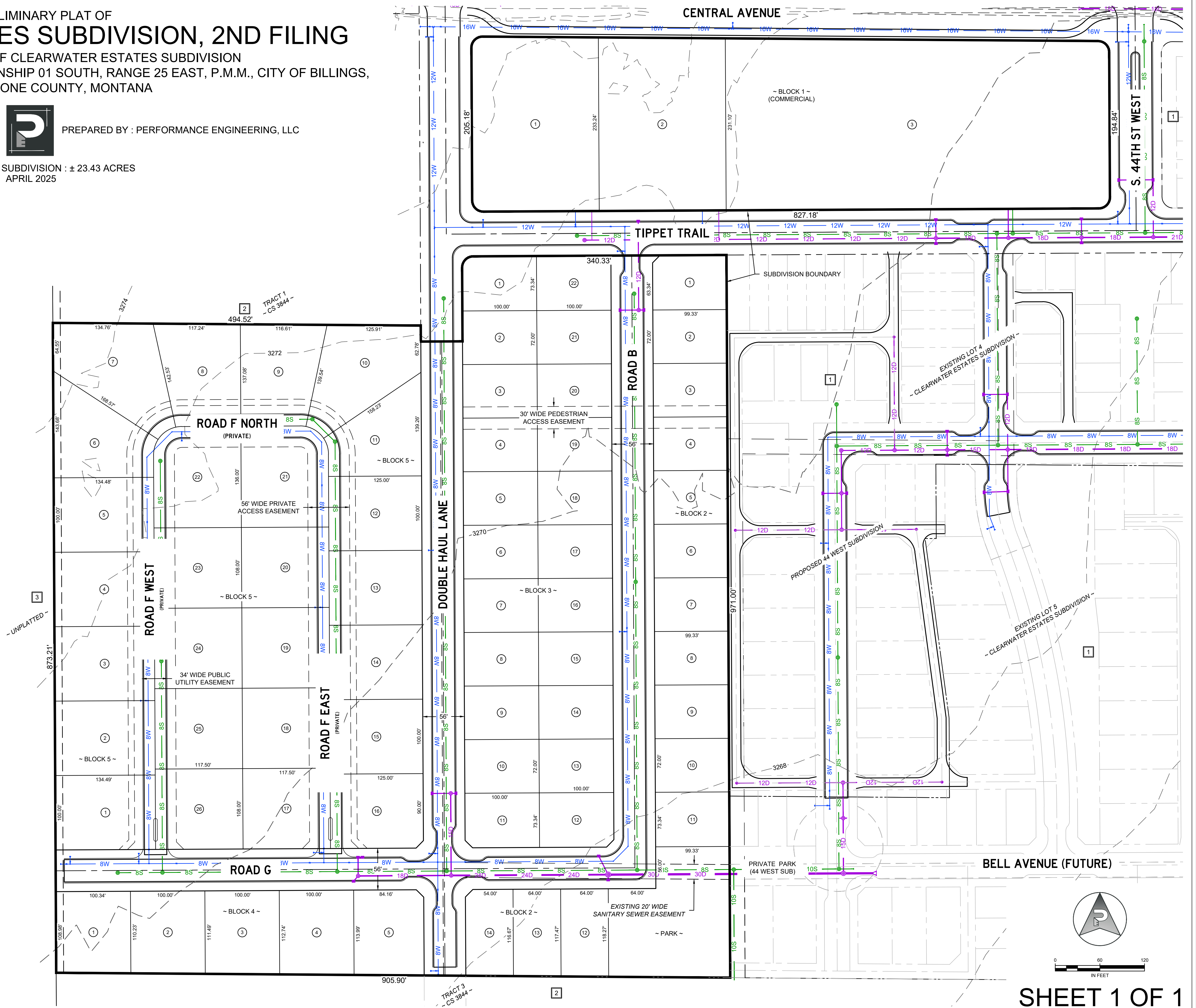


VICINITY MAP
NOT TO SCALE

SITE DATA	
GROSS AREA	23.43 ACRES
NET AREA	20.34 ACRES
LOT COUNT	69
MAX. LOT AREA	117,454 SF
MIN. LOT AREA	7,152 SF
ZONING	CMU1, N2, NX1, NX2
PARKLAND DEDICATION	25,047 SF
COMMERCIAL AREA	4.52 ACRES

ADJOINING PROPERTY OWNER INFORMATION

- 1 BROWN DEVELOPMENT, LLC
745 SOUTH 56TH STREET WEST
BILLINGS, MT 59106
- 2 BRADLEY W & TAMMY JO HARDT
4620 CENTRAL AVENUE
BILLINGS, MT 59106
- 3 STALEY FAMILY TRUST
335 SOUTH 48TH STREET WEST
BILLINGS, MT 59106



0 60 120
IN FEET

**SUBDIVISION IMPROVEMENTS AGREEMENT
& WAIVER OF RIGHT TO PROTEST FUTURE SPECIAL IMPROVEMENT
DISTRICTS**

Clearwater Estates Subdivision, 2nd Filing

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(City of Billings)

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**SUBDIVISION IMPROVEMENTS AGREEMENT
& WAIVER OF RIGHT TO PROTEST FUTURE SPECIAL
IMPROVEMENT DISTRICTS**

Clearwater Estates Subdivision, 2nd Filing

This agreement is made and entered into this ____ day of _____, 20__, by and between *Brown Development, LLC*, whose address for the purpose of this agreement is **745 South 56th Street West, Billings, MT 59106**, hereinafter referred to as “Subdivider,” and **CITY OF BILLINGS**, Billings, Montana, hereinafter referred to as “City.”

WITNESSETH:

WHEREAS, the plat of *Clearwater Estates Subdivision, 2nd Filing*, located in Yellowstone County, Montana was submitted to the Yellowstone County Board of Planning; and

WHEREAS, at a regular meeting conducted on ____ day of _____, 20__, the Board of Planning recommended conditional approval of a preliminary plat of *Clearwater Estates Subdivision, 2nd Filing*; and

WHEREAS, at a regular meeting conducted on ____ day of _____, 20__, the City Council conditionally approved a preliminary plat of *Clearwater Estates Subdivision, 2nd Filing*; and

WHEREAS, a Subdivision Improvements Agreement is required by the City prior to the approval of the final plat.

WHEREAS, the provisions of this agreement shall be effective and applicable to *Clearwater Estates Subdivision, 2nd Filing* upon the filing of the final plat thereof in the office of the Clerk and Recorder of Yellowstone County, Montana. The Subdivision shall comply with all requirements of the City of Billings Subdivision Regulations, the rules, regulations, policies, and resolutions of the City of Billings, and the laws and administrative rules of the State of Montana.

THEREFORE, THE PARTIES TO THIS AGREEMENT, for and in consideration of the mutual promises herein contained and for other good and valuable consideration, do hereby agree as follows:

I. VARIANCES

A. Subdivider has requested, and the City hereby grants, the following variances by City Council from the strict interpretation of the City’s Subdivision Regulations (Section 23.1101, BMCC):

1. No variances are requested.

II. PROPERTY CONDITIONS AND INFORMATION FOR LOT PURCHASERS

- A.** Lot owners will be required to construct that segment of the required sidewalk that fronts their property at the time of lot development. If sidewalk is not constructed within 5 years, the City has the right to construct the sidewalk and assess the property owners.
- B.** Lot owners should be aware that this subdivision is being built in close proximity to prime deer and antelope habitat and it is likely that homeowners will experience problems with damage to landscaped shrubs, flowers, and gardens. The Montana Fish, Wildlife, and Parks Department does not provide damage assistance unless there is damage to commercial crops and/or a threat to public health and safety.
- C.** Lot owners should be aware that soil characteristics within the area of this subdivision, as described in the 1972 Yellowstone County Soil Survey, indicate that there could be potential limitations for proposed construction on the lots, which may require a geotechnical survey prior to construction.
- D.** No water rights have been transferred to the lot owners. Irrigation ditches that exist on the perimeter of this development are for the benefit of other properties. Perimeter ditches and drains shall remain in place and shall not be altered by the Subdivider or subsequent owners.
- E.** There is attached hereto a Waiver waiving the right to protest the creation of the special improvement district or districts which by this reference is expressly incorporated herein and made as much a part hereof as though fully and completely set forth herein at this point. The Waiver will be filed with the plat, shall run with the land, and shall constitute the guarantee by the Subdivider and property owner or owners of the developments described herein. Said Waiver is effective upon filing and is not conditioned on the completion of the conditions set forth in this Agreement. The Subdivider and owner specifically agree that they are waiving valuable rights and do so voluntarily.
- F.** The subdivider and subsequent contractors/builders acknowledge that there is a Stormwater Pollution and Prevention Plan (SWPPP) filed with the City and the Montana Department of Environmental Quality (MDEQ). This SWPPP shall be adhered to during all phases of construction and shall be updated as required by MDEQ under the General Permit for Stormwater Discharges Associated with Construction Activity, Chapter 28, BMCC and the Billings Stormwater Management Manual.
- G.** Individual lot owners should be aware that Best Management Practices for stormwater control shall be required for new construction on lots. Best Management Practices are defined within Section 28-201, BMCC and detailed in the Billings Stormwater Management Manual.

III. TRANSPORTATION

A. Streets

- All internal access roads and site improvements within the subdivision will be in accordance with the City of Billings Site Development Ordinance, City Zoning Ordinance, the Stormwater Management Manual, and other applicable City codes, rules, and regulations.
- Tippet Trail will be 34 feet back of curb to back of curb. The street improvements will be completed by private contract or SID.
- Double Haul Lane will be 44 feet back of curb to back of curb from Central Avenue to Tippet Trail.
- Road B, Road G, and Double Haul Lane south of the intersection with Tippet Trail will provide 34 feet back of curb to back of curb street width within a 56-foot wide right-of-way. The street improvements will be completed by private contract or SID.
- Road F East, Road F North, and Road F West will be located within a private access easement and will be considered a private road. These roads will be 34 feet back of curb to back of curb and will be gated. The street improvements will be completed by private contract.
- A traffic accessibility study has been completed for the *Clearwater Estates Subdivision, 2nd Filing*. All required intersection improvement contributions identified therein shall be completed by the Subdivider at the Subdivider's expense. The percent of traffic contributions to the following intersections shall be in accordance with the traffic accessibility study:
 - a. S. 48th and Central – 0.28%
 - b. Shiloh and Broadwater – 0.60%
 - c. Shiloh and Central – 1.64%
 - d. Shiloh and Monad – 0.39%

The cash contributions shall be based on the percent of traffic contributions to the intersections based on the total cost of an intersection as determined by City Engineering for the year in which the contribution is made. These cash contributions for the intersection improvement will be made prior to final plat approval.

B. Sidewalks

- Individual lot owners will be responsible for the construction of the sidewalks within public right-of-way or easements adjacent to or through their lot at the time of lot construction and shall be included in each building

permit. The Subdivider shall construct or bond for sidewalk adjacent to park areas prior to final plat approval.

- The sidewalk along the west side of Double Haul Lane extending from Central Avenue to the north boundary of Lot 10, Block 5 will be constructed by the Subdivider at the time of road construction. The remaining portions of sidewalk along Double Haul Lane shall be constructed by the adjacent individual lot owners.
- Sidewalks shall be 5-foot wide with a minimum 5-foot boulevard planting strip between the sidewalk and the curb with handicap ramps and aprons installed where necessary. All sidewalks will be constructed by lot owners. Handicap ramps and aprons will be constructed at the time of road construction.

C. Street Lighting

- Street lighting will be installed by private contract or SID. The proposed lighting plan will be reviewed and approved by City of Billings Public Works prior to installation. A Street Light Maintenance District will be created in the future and is included in the waiver of right to protest.

D. Traffic Control Devices

- Street name signs for streets within the subdivision, or located immediately adjacent thereto, shall be furnished and installed in accordance with the specifications of the City of Billings Public Works and Fire Departments.
- No traffic signals are required within this subdivision. Stop signs shall be installed along Double Haul Lane at two (2) intersections, the intersection with Central Avenue and with Road G.
- The Subdivider shall furnish and install all necessary traffic control devices in accordance with the Manual of Uniform Traffic Control Devices and approved by the City of Billings Public Works Department.

E. Access

- Access to the Subdivision will be provided by Central Avenue, Double Haul Lane, Tippet Trail, Road B, Road G, Road F East, Road F North, and Road F West.

F. Billings Area Bikeway and Trail Master Plan

- The Subdivision is within the Billings Area Bikeway and Trail Master Plan. A 10-foot-wide multi-use trail will be constructed along Central Avenue. The trail improvements will be completed by private contract or SID.

G. Public Transit

- MET Transit provides services along Central Avenue with the closest stop at the intersection of Central Avenue and Shiloh Road, approximately 0.5 miles east of the Subdivision. No improvements are required to ensure public transit service.

IV. EMERGENCY SERVICE

Construction of buildings made of combustible materials shall have adequate fire apparatus access roads and water supply (fire hydrants) in place to allow for fire suppression requirements. Prior to the issuance of a building permit for construction using combustible materials (i.e. lumber, plywood, wood trusses, etc.), fire apparatus access roads and water supply requirements shall be provided in accordance with the International Fire Code as adopted by the City of Billings.

At a minimum, the following is required:

- An unobstructed gravel road or gravel road base must be within 150 feet of the furthest portion of a building under construction as measured along the approved route.
- The access roads are required to support fire apparatus vehicle loading (40 tons) during all weather conditions and shall be a minimum of twenty (20) feet wide.
- An operational fire hydrant shall be located within 600 feet of the furthest portion of a residence under construction or within 400 feet of the furthest portion of a commercial building under construction as measured along the access roads to the site.
- The above requirements do not alter or effect the current minimum subdivision requirements for fire apparatus access and water supply.

V. STORM DRAINAGE

All drainage improvements shall comply with the provisions set forth in Chapter 28, BMCC, and the Stormwater Management Manual in place at the time of development. Additionally, a comprehensive drainage study has been completed for the Monad Drain with requirements that superseded the Stormwater Management Manual. The *Comprehensive Drainage Plan for the Monad Drain* is on-file at the City Engineering Department. A complete stormwater management plan shall be submitted to the Engineering Division for review and approval at the time of development.

Stormwater drainage will discharge east to Lot 5 or Clearwater Estates Subdivision, 1st Filing. A ditch will convey stormwater drainage south to a stormwater detention facility that is located within an off-site area on Tract 3, Certificate of Survey No. 3844. This detention facility will be sized to accept runoff generated from the *Clearwater Estates Subdivision, 2nd Filing*. The detention facility will outfall to the Monad Drain as described in the *Comprehensive Drainage Plan for the Monad Drain*.

Per the *Comprehensive Drainage Plan for the Monad Drain*, construction of a dike and control structure within the drain will be required as part of a future subdivision of Tract 3 of Certificate of Survey No. 3844, or as determined necessary by City Engineering. These improvements are included as part of the Waiver of Right to Protest a Special Improvement District.

VI. UTILITIES

The Subdivision Improvements Agreement does not constitute an approval for extension of or connection to water mains and sanitary sewers. The property owner shall make application for extension/connection of water mains and sanitary sewers to the Public Works Department – Engineering Division. The extension/connection of/to water mains and sanitary sewers is subject to the approval of the applications and the conditions of approval. Applications shall be submitted for processing prior to the start of any construction and prior to review and approval of any project plans and specifications.

The Developer/Owner acknowledges that the subdivision shall be subject to the applicable System Development Fees in effect at the time new water and/or sanitary sewer service connections are made.

The design/installation of sanitary sewers and appurtenances, and water mains and appurtenances (fire hydrants, etc.) shall be in accordance with design standards, specifications, rules, regulations of and as approved by the City of Billings Public Works Department, Fire Department and the Montana Department of Environmental Quality.

A. Water

- The Subdivision will be extending a 16-inch water main in Central Avenue. The City will reimburse the Developer for the cost of upsizing the water main from a 12-inch line to a 16-inch line. If requested by the Developer, City staff will forward a Compensation Agreement to City Council for approval of oversizing of the water main in accordance with the City's Rules and Regulations Governing Water and Wastewater Service.
- A 12-inch water main will be installed along Double Haul Lane down to Tippet Trail and along Tippet Trail.
- An 8-inch water main will be installed within Double Haul Lane south of

Tippet Trail, Road G, Road B, Road F East, Road F North, and Road F West.

- The water main within Road F East, Road F North, and Road F West will be installed within a public utility easement that is no wider than the road width.

B. Sanitary Sewer

- Sanitary sewer service to *Clearwater Estates Subdivision, 2nd Filing* will be provided by connecting to the existing 10-inch gravity main running north from the Monad collector. The existing 10-inch gravity main is located in the parkland area in the southeast corner of the Subdivision. 8-inch sanitary sewer mains will be extended throughout the Subdivision.
- The sanitary sewer main within Road F East, Road F North, and Road F West will be installed within a public utility easement that is no wider than the road width.

C. Power, Telephone, Gas, and Cable Television

- Private utility facilities currently exist to serve the subdivision. The private utility facilities will be installed within private utility easements included on the plat, as requested by the utility companies.

VII. PARKS/OPEN SPACE

Section 76-3-621 of the Montana Code Annotated covers the park dedication requirement. Paragraph (1) calls for park area to be 11 percent of the land proposed to be subdivided into parcels of one-half acre or smaller. The required Parkland Dedication for the *Clearwater Estates Subdivision, 2nd Filing* is 1.67 acres. Parkland dedications, in the amount of 0.575 acres, are depicted on the face of the plat as PARK. The remaining 1.10 acres of undedicated parkland will be paid as cash in lieu at the time of final plat filing.

VIII. IRRIGATION

No water rights have been transferred to the lot owners. Irrigation ditches that exist on the perimeter of this development are for the benefit of other properties. Perimeter ditches and drains shall remain in place and shall not be altered by the Subdivider or subsequent owners.

IX. SOILS/GEOTECHNICAL STUDY

A soils/geotechnical study has been performed for the subdivision. A copy of this report is included as part of the infrastructure permitting documents and made public record through the Engineering Department. Lot owners and contractors/builders are encouraged to review the report and its recommendations or complete a site-specific geotechnical investigation.

X. PHASING OF IMPROVEMENTS

The Subdivision is not proposed to be constructed in phases.

XI. FINANCIAL GUARANTEES

Except as otherwise provided, Subdivider shall install and construct said required improvements with cash or by utilizing the mechanics of a private contract secured by letters of credit or a letter of commitment to lend funds from a commercial lender, or by SID. All engineering and legal work in connection with such improvements shall be paid by the contracting parties pursuant to said private contract, and the improvements shall be installed as approved by the City Engineer and Utility Department Manager.

XII. LEGAL PROVISIONS APPLYING TO SUBDIVIDER

- A.** Subdivider agrees to guarantee all public improvements for a period of two (2) years from the date of final acceptance by the City of Billings.
- B.** The owners of the properties involved in this proposed Subdivision by signature subscribed herein below agree, consent, and shall be bound by the provisions of this Agreement.
- C.** The covenants, agreements, and all statements in this Agreement run with the land and apply to and shall be binding on the heirs, personal representatives, successors, assigns and transferees of the respective parties.
- D.** In the event it becomes necessary for either party to this Agreement to retain an attorney to enforce any of the terms or conditions of this Agreement or to give any notice required herein, then the prevailing party or the party giving notice shall be entitled to reasonable attorney fees and costs.
- E.** Any amendments or modifications of this Agreement or any provisions herein shall be made in writing and executed in the same manner as this original document and shall after execution become a part of this Agreement.
- F.** Subdivider shall comply with all applicable federal, state, and local statutes, ordinances, and administrative regulations during the performance and discharge of its obligations. Subdivider acknowledges and agrees that nothing contained herein shall relieve or exempt it from such compliance.

This agreement is hereby approved and accepted by the City of Billings, this ____ day of _____, 20__.

“CITY”
CITY OF BILLINGS
MONTANA

By: _____
Mayor

Attest: _____
City Clerk

STATE OF MONTANA)
 : ss
County of Yellowstone)

On this ____ day of _____, 20__, before me, a Notary Public in and for the State of Montana, personally appeared _____ and _____, known to me to be the Mayor and City Clerk, respectively, of the City of Billings, Montana, whose names are subscribed to the foregoing instrument in such capacity and acknowledged to me that they executed the same on behalf of the City of Billings, Montana.

Notary Public in and for the State of Montana
Printed Name: _____
Residing at: _____
My commission expires: _____

Waiver of Right to Protest

FUTURE SPECIAL IMPROVEMENTS DISTRICTS

FOR VALUABLE CONSIDERATION, the undersigned, being the Subdivider and all of the owners of the hereinafter described real property, do hereby waive the right to protest the formation of one or more Special Improvement District(s) for a period of no more than twenty years from the recording of this waiver, for street light maintenance and energy, and for the construction of streets, street widening, sidewalks, survey monuments, street name signs, curb and gutter, street lights, driveways, traffic signals, and traffic control devices, parks and park maintenance, trails, sanitary sewer lines, water lines, storm drains (either within or outside the area), and other improvements which the City of Billings may require.

This Waiver and Agreement is independent from all other agreements and is supported by sufficient independent consideration to which the undersigned are parties, and shall run with the land and shall be binding upon the undersigned, their successors and assigns, and the same shall be recorded in the office of the County Clerk and Recorder of Yellowstone County, Montana.

This Waiver is in addition to any other recorded waiver related to the property described herein and is not intended to replace, supersede, or invalidate any such waiver.

The real property hereinabove mentioned is more particularly described as follows:

Clearwater Estates Subdivision, 2nd Filing

Signed and dated this _____ day of _____, 20__.

Brown Development, LLC

By: _____

Title: _____

STATE OF MONTANA)
 : ss
County of Yellowstone)

On this ____ day of _____, 20__, before me, a Notary Public in and for the State of Montana, personally appeared _____, known to me to be the _____ of *Brown Development, LLC*, who executed the foregoing instrument and acknowledged to me that he/she executed the same.

Notary Public in and for the State of Montana
Printed Name: _____
Residing at: _____
My commission expires: _____

Clearwater Subdivision

Small/squarer photo here

Traffic Accessibility Study (DRAFT)

Prepared on behalf of:

Performance Engineering

February 2025

Larger/landscape image here – Consider Annafeld cottage view



Traffic Accessibility Study

Prepared for submittal to:



for the project:

Clearwater Subdivision

on behalf of:

Performance Engineering

608 N. 29th Street
Billings, MT 59101

by:

406 Traffic and Transportation Consulting

P.O. Box 249
Bozeman, MT 59771
406.922.7300

(signed stamp here when final)

February 2025

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1 INTRODUCTION

This report documents the Traffic Accessibility Study (TAS) conducted for the Clearwater Estates subdivision project in northwest Billings. This is a working title for the project. Some parts of the site could be marketed under a different name before final occupancy.

1.1 PROJECT SITE AND STUDY AREA

The overall subdivision site is shown in **Exhibit 1** along with the intersections studied. The existing study intersections were identified during preapplication review with City of Billing staff as:

1. S. 48th Street West at Central Avenue
2. Shiloh Road at Broadwater Avenue
3. Shiloh Road at Central Avenue
4. Shiloh Road at Bell Avenue
5. Shiloh Road at Monad Road

From here forward in the body of this report, existing intersections are generally referred to only by their distinguishing street names (e.g., “Shiloh at Central”) for the sake of brevity. The two new subdivision access points on the south side of Central Avenue have been analyzed for both future scenarios that include project traffic. In this report, these are generally referred to as the West Access and the East Access. The West access has the working name Double Haul Lane and the East Access has the working name S. 44th Street West in part because it is situated approximately halfway between Shiloh Road and S. 48th Street West. The site’s third access will be to existing Bell Avenue, which will be extended west into the site and, while not fully continuous, terminate at the western property edge. The western terminus of Bell will be built to accommodate a future connection to the property west of this site, but no specific street connection has been planned there at the time of this study. The east-west Bell Avenue alignment generally separates the subdivision site into northern and southern parts of similar size.

1.2 LAND USE AND PHASING

The site is currently agricultural land. The subdivision’s proposed land use will be almost exclusively residential, with 194 single-family detached homes and 262 attached ones. The latter will include duplexes, attached multi-story row houses (townhomes), and “cottage” units that would be smaller units not directly classifiable as apartments. One commercial lot sized to support a 25,000 square-foot building will be situated at the northwest corner of the site, abutting Central Avenue and Double Haul Lane.

The project is divided into two logical phases. All 262 of the “attached” type of residential units are included in Phase 1 and are located on the northern part of the site. Phase 1 also includes about one third (66) of the total single-family detached units. Phase 2 includes the commercial parcel and all residential lots on the southern part of the site, which are for the remaining 128 single-family homes.

Because the site is self-contained and generally rural today, the types and locations of specific pathways or other facilities for pedestrians and bicycles have not yet been identified. A brief examination of potential traffic calming needs indicated that the absence of long streets without homes on them will strongly limit the need for such measures. On-street parking is expected to be allowed throughout the site wherever street width is sufficient for it.

Exhibit 2 shows the Clearwater Estates site plan on which the analysis here is based. It includes land use types, streets, alleys, access points, and park parcels.

Exhibit 1. Overall Site Location and Study Intersections



Exhibit 2. Clearwater Estates Subdivision Site Plan



Excerpted from: Performance Engineering drawing provided 1/31/2025

1.3 ANALYSIS METHODS AND REFERENCES

Raw field traffic counts were gathered from other recent traffic study work in the area by Sanbell and provided to the Clearwater applicant team. These raw counts were then adjusted slightly for this TAS based on both (a) recent traffic growth and (b) 2024 City of Billings annualization factors prior to their use in impact analysis.

Trip generation rates, or equations as applicable, are from the Institute of Transportation Engineers (ITE) Trip Generation suite’s 11th edition. ITE trip generation data, when aggregated across enough varied sites, produce both simple average rates and best-fit equations, either linear or logarithmic, to help the analyst derive proper estimates for their situation. Equations are generally preferred over rates, especially for larger sites where trip generation per unit of land use can diminish with increasing project size. General ITE guidance calls for the use of the fitted curve equation when the data set for the land use type in question is comprised of studies from 20 or more separate sites and when the equation produces a correlation coefficient (R²) of 0.75 or higher, with 1.0 being the best possible fit.

Operational performance was analyzed at the study intersections through the use of the industry-standard methods presented in the USDOT’s Highway Capacity Manual (HCM), published in its modern form as Transportation Research Board Special Report 209. Synchro Studio 12 was employed as both a data repository and a capacity analysis tool, with reports for each intersection generated using Synchro’s application of the assumptions of the HCM’s 7th edition, the most recent available at the time of this study.

The HCM methodology for intersection capacity analysis produces delay estimates for each turning movement (or “lane group”, when multiple turning movements operate from the same lane). These delay estimates are assigned Level of Service (LOS) grades that range from A (best) to F (worst), as indicated in **Exhibit 3**. It’s also important to note that for unsignalized intersections with only side-street Stop sign control, LOS for the intersection is represented by the LOS for the worst lane group. “T” intersections with side-street stop control also fall under this category. All stop-controlled intersections in this study area, including the two new proposed accesses to Central, are “T” intersections, where the approach on the stem of the T, rather than a main street turning movement, contains the worst lane group.

Operations impacts are determined by how peak hour LOS relates to acceptability standards. Billings employs a LOS standard of C or better. When LOS without the project is D or worse, an operations impact is defined when the project would increase delay.

Exhibit 3. LOS Definitions

LOS	Delay, seconds per vehicle
A	0 - 10.0
B	10.1 - 15.0
C	15.1 - 25.0
D	25.1 - 35.0
E	35.1 - 50.0
F	50.1 or more

Source: HCM 7th Edition

2 EXISTING AND BACKGROUND CONDITIONS

2.1 STREETS AND INTERSECTIONS

Shiloh Road, which also carries the designation of MT-302, is a north-south urban principal arterial with two travel lanes in each direction and a speed limit of 45 mph in the study area. Shiloh Road has been a key facilitator of the city’s westward expansion, with substantial residential and commercial growth having occurred adjacent to it in recent years. It is characterized by a series of roundabouts at intersections with several of western Billings’s east-west arterials and collectors. It also provides access to Interstate 90 via Zoo Drive to the south. A raised median prevents left turns at many two-way stop-controlled intersections, including the one at Bell Avenue. Exclusive left-turn lanes exist at a few select site accesses and local streets. A sidewalk runs along the east side of the road, and a shared-use path called Shiloh Road Trail runs along the west side, much of it separated from the road by a large ditch. There are also two MET Transit bus stops on its east side between the Broadwater and Central roundabouts. These are not considered to be close enough to the project to site to provide meaningful transit access.

Central Avenue is an east-west road that is classified as an urban collector to the west of Shiloh Road and as an urban principal arterial to the east of it. Accordingly, it has one travel lane in each direction to the west of Shiloh, and two travel lanes in each direction to the east of it. It has a speed limit of 45 mph on both sides of Shiloh Road, but it becomes 50 mph to the west of 48th St W. It connects residential neighborhoods to many of western Billings' commercial centers. Central currently has no exclusive turning lanes or parallel multimodal facilities to the west of Shiloh Road.

48th Street W is a north-south local road with one travel lane in each direction. It has a speed limit of 45 mph to the north of Central Avenue and 50 mph to the south of it. It links residences and agricultural properties on the western edges of Billings to the east-west routes that lead into the city, such as Central Avenue and King Avenue. No exclusive turning lanes or multimodal facilities currently exist on 48th in the study area.

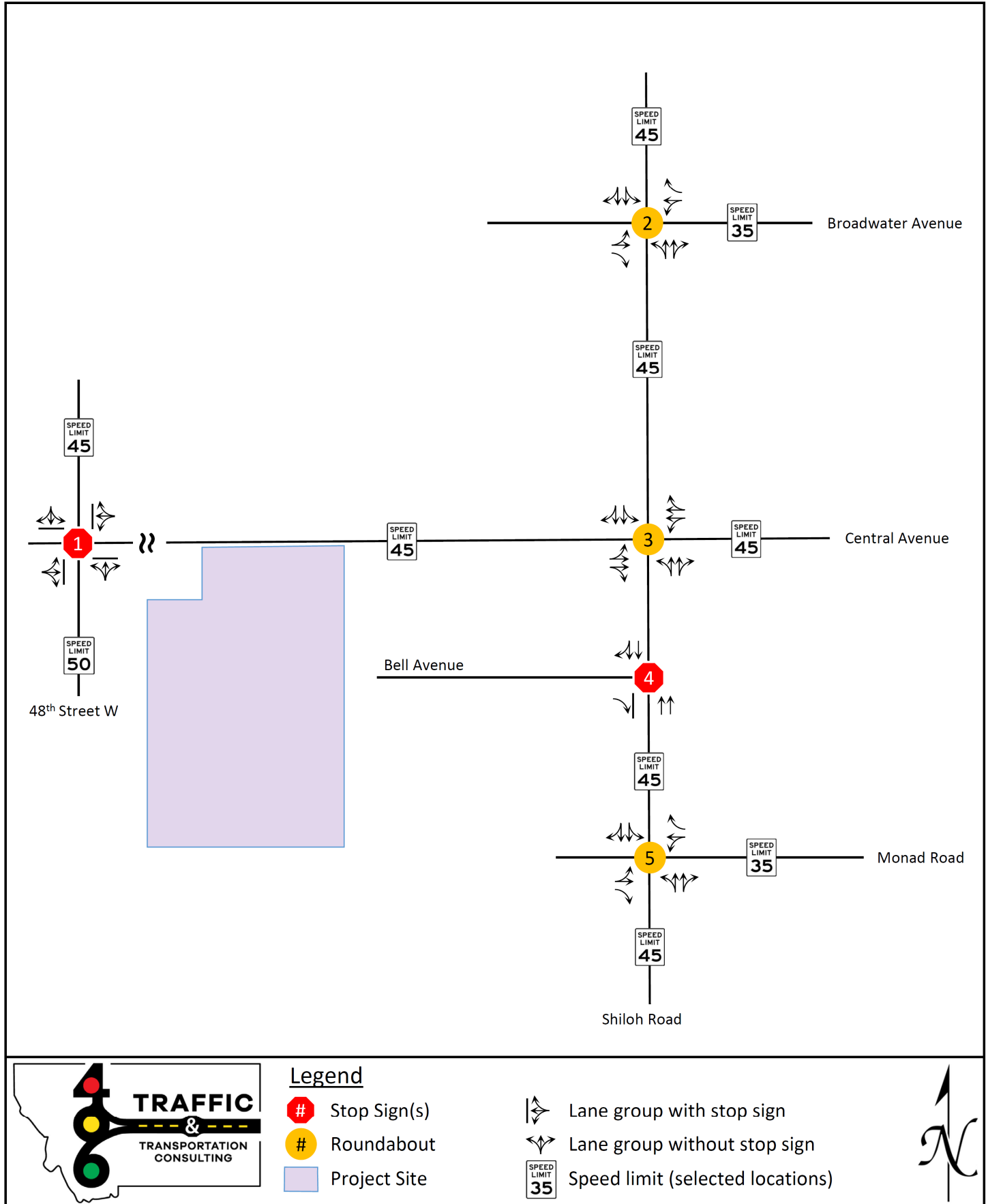
Bell Avenue is an east-west local street with one travel lane in each direction and no posted speed limit. Currently, it provides access to Shiloh Road for a private senior living community and a few other residences. Its eastern terminus is at its intersection with Shiloh Road, where left turns are prohibited. Its western terminus is at a dead-end approximately 2300 ft to the west of this intersection, just past Big Pine Court. While three other streets that intersect Bell Avenue also lead to Central Avenue, these streets traverse private property. As such, Bell Avenue has no outlet for non-residents. The street has no exclusive turning lanes or bike infrastructure, but there is a sidewalk along most of its northern side, starting from the Shiloh Road Trail.

Monad Road is an east-west road that is classified as an urban major collector to the east of Shiloh Road and as a local street to the west of it. West of Shiloh it has one travel lane in each direction, as well as a center left-turn lane. Its speed limit is 35 mph to the east of Shiloh, but it does not have a speed limit posted on the west side. It connects many of western Billings' residential neighborhoods to the industrial areas near the railroad tracks and to north-south routes such as 32nd St W and 24th St W that lead to large commercial centers. It has exclusive right-turn lanes on the east and west legs of the roundabout at Shiloh Road, as well as an exclusive left-turn lane at Henry Chapple Street. To the east of Shiloh Road, there are sidewalks, designated on-street parking, and unprotected bike lanes on both sides of the road. To the west of Shiloh, there is a shared-use path on much of the north side and a sidewalk on much of the south side of the street. There are also two nearby MET Transit bus stops on the south side of the road: one at Henry Chapple Street and the other at Hurdle Circle.

Broadwater Avenue is an east-west urban principal arterial with one travel lane in each direction and a speed limit of 35 mph in the study area. It serves as a link between residential neighborhoods in western Billings, some small commercial centers, and downtown Billings. Its eastern terminus is at its intersection with Division Street, 1st Ave N, and N 36th Street near downtown. Its western terminus is at a roundabout intersection with Shiloh Road. Currently, the roundabout's west leg only connects to two agricultural lots in active use, but the roundabout's infrastructure here has been built out in preparation for potential westward extension of the road. 48th St W also intersects a road called Broadwater Avenue, but this local road segment is currently disconnected from the rest of the arterial network and is only accessible via 48th St W. The arterial Broadwater Avenue has an exclusive westbound right-turn lane at the Shiloh roundabout. There is a shared-use path on the road's north side, and there is a sidewalk on the road's south side extending east.

Intersection traffic control comes in only two forms at the five existing study intersections: two-way stop control (TWSC) and roundabouts. Each leg of the three roundabouts has a crosswalk with a pedestrian refuge in the splitter island. Most of these crosswalks have two solar-powered rectangular rapidly flashing beacons. The intersection of Shiloh Road and Bell Avenue is considered two-way stop-controlled even though only one direction of traffic is stop-controlled. Only four movements are permitted at this intersection: northbound and southbound through movements and southbound and eastbound rights. Shiloh Road's center median prevents all left turns. The intersection of 48th Street and Central Avenue is all-way stop-controlled and is augmented with flashing red beacons facing all four directions. **Exhibit 4** shows traffic control and lane arrangements schematically at each existing intersection as well as posted speed limits on selected road segments.

Exhibit 4. Existing Road and Intersection Basics



Legend

- Stop Sign(s)
- Roundabout
- Project Site

- Lane group with stop sign
- Lane group without stop sign
- Speed limit (selected locations)



2.2 EXISTING TRAFFIC VOLUMES

Existing (2024) annualized volumes were estimated as described earlier in subsection 1.3 and are shown in **Exhibit 5**.

2.3 HISTORIC GROWTH AND BACKGROUND CONDITION TRAFFIC

The “Background Condition” described here is represented by the volumes and intersection performance after several years of traffic growth assumed to occur during the permitting, construction, and initial occupancy of Phase 1. This work is expected to take place in 2025, 2026, and 2027. Allowing for an additional year to ensure full/normal occupancy and for tripmaking behavior by residents to normalize, existing traffic at study intersections was grown to the year 2028. The resulting volumes and operating conditions form the basis for evaluating marginal delay effects of traffic generated by Phase 1 of the Clearwater Estates subdivision.

Phase 2 is currently projected by the applicant team to follow Phase 1 by approximately three years. As such, the study year for Phase 2 traffic is 2031, and traffic was grown in the same way to derive background volumes for that year.

In order to estimate traffic growth without the project, average daily traffic volumes were gathered from selected MDT periodic data collection locations in the study area. The best and most logical data set available was represented by the four legs of the Shiloh intersection at Central. Data were recorded or estimated by MDT annually on each leg dating back at least 20 years. This historical traffic information is shown in the chart in **Exhibit 6**.

Counts from the most recent 10 of these years were used to calculate the average annual growth rate in daily traffic for these four locations in aggregate, which was approximately 3.8% per year. This rate was then applied to the annualized peak hour intersection counts for the Phase 1 and Phase 2 study years. The resulting Background condition traffic volumes are shown for 2028 and 2031 in **Exhibits 7** and **8**, respectively.

Exhibit 5. Existing Traffic Volumes

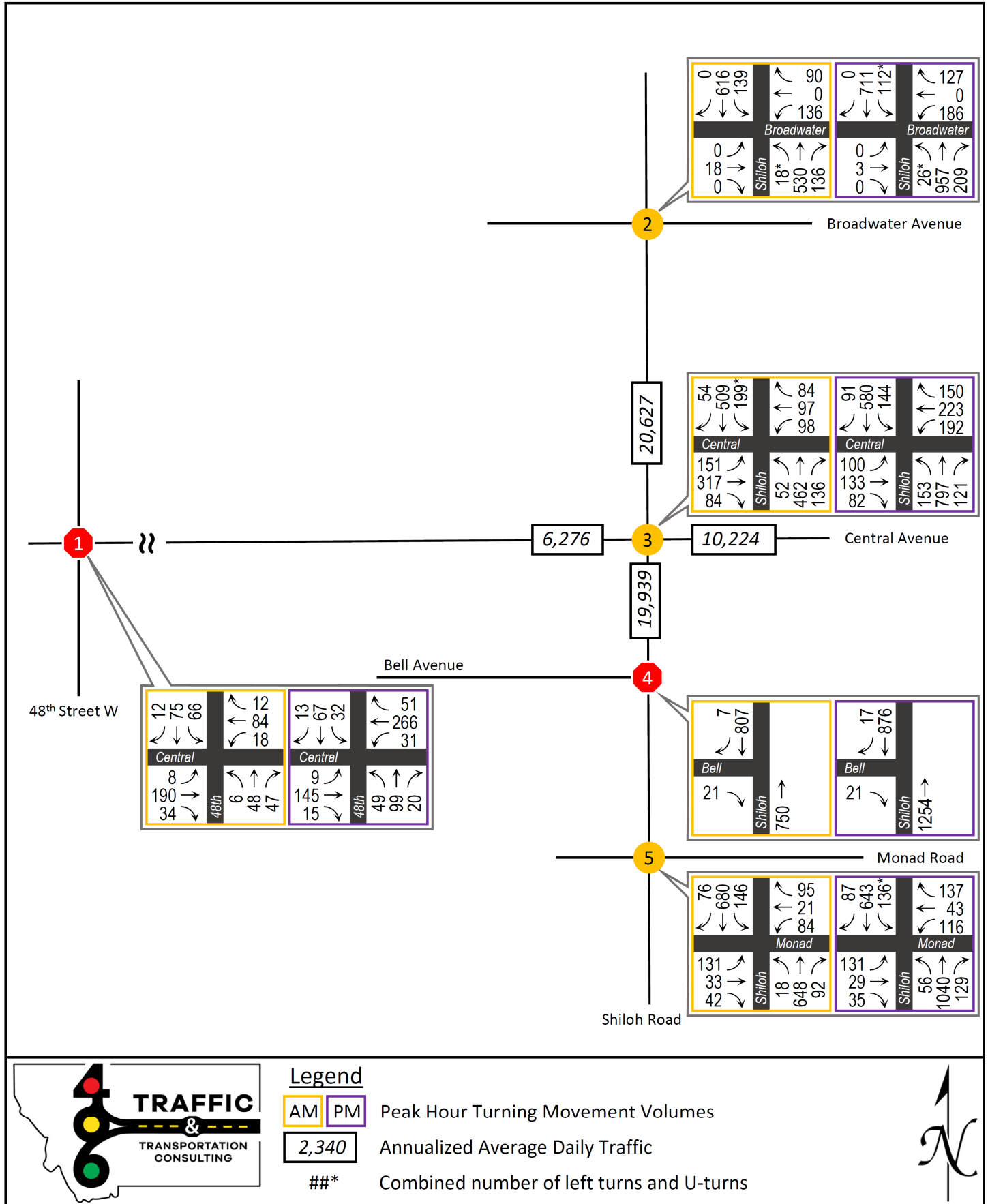


Exhibit 6. Historical Daily Traffic Volumes

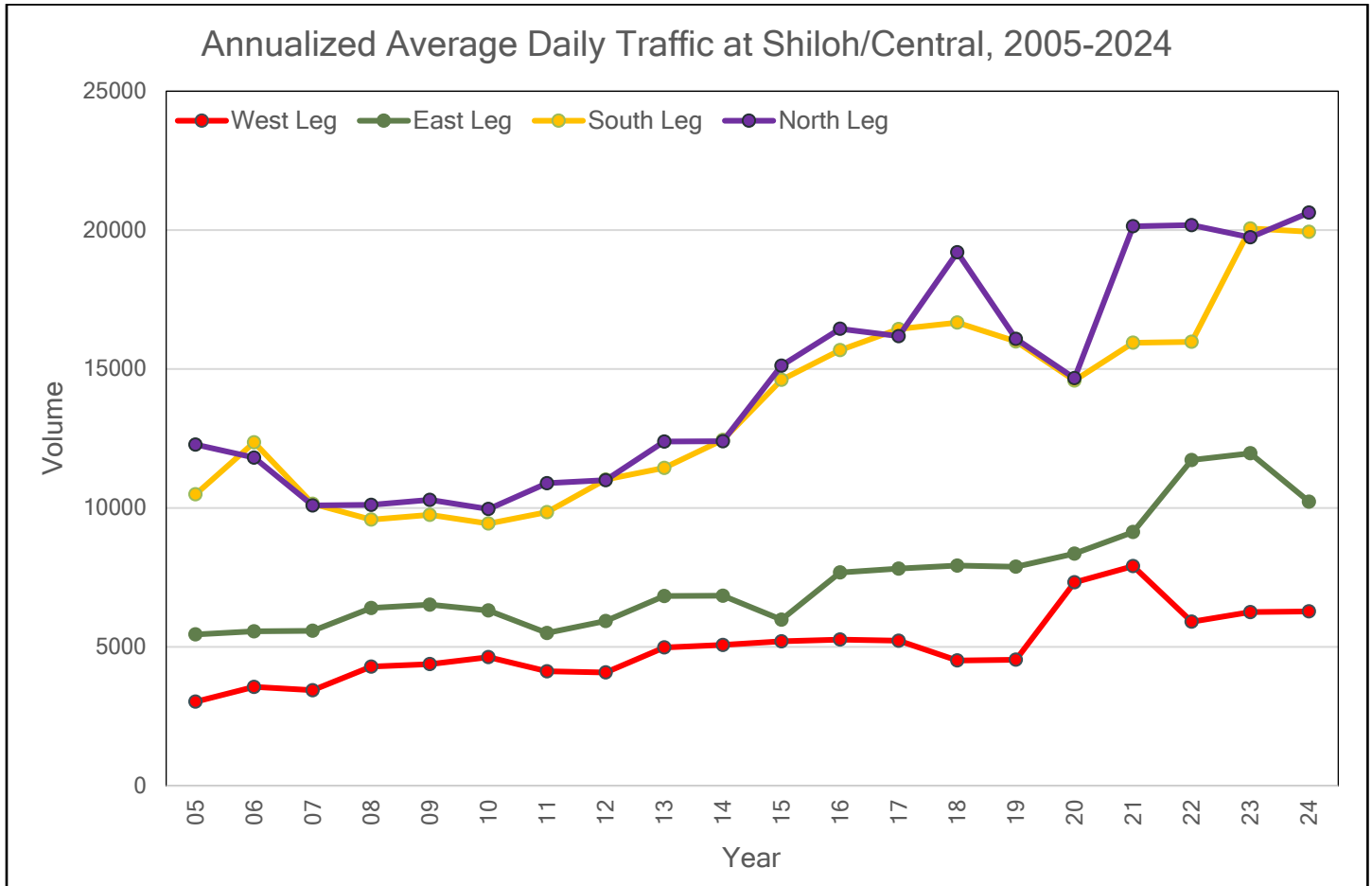


Exhibit 7. 2028 Background Traffic Volumes

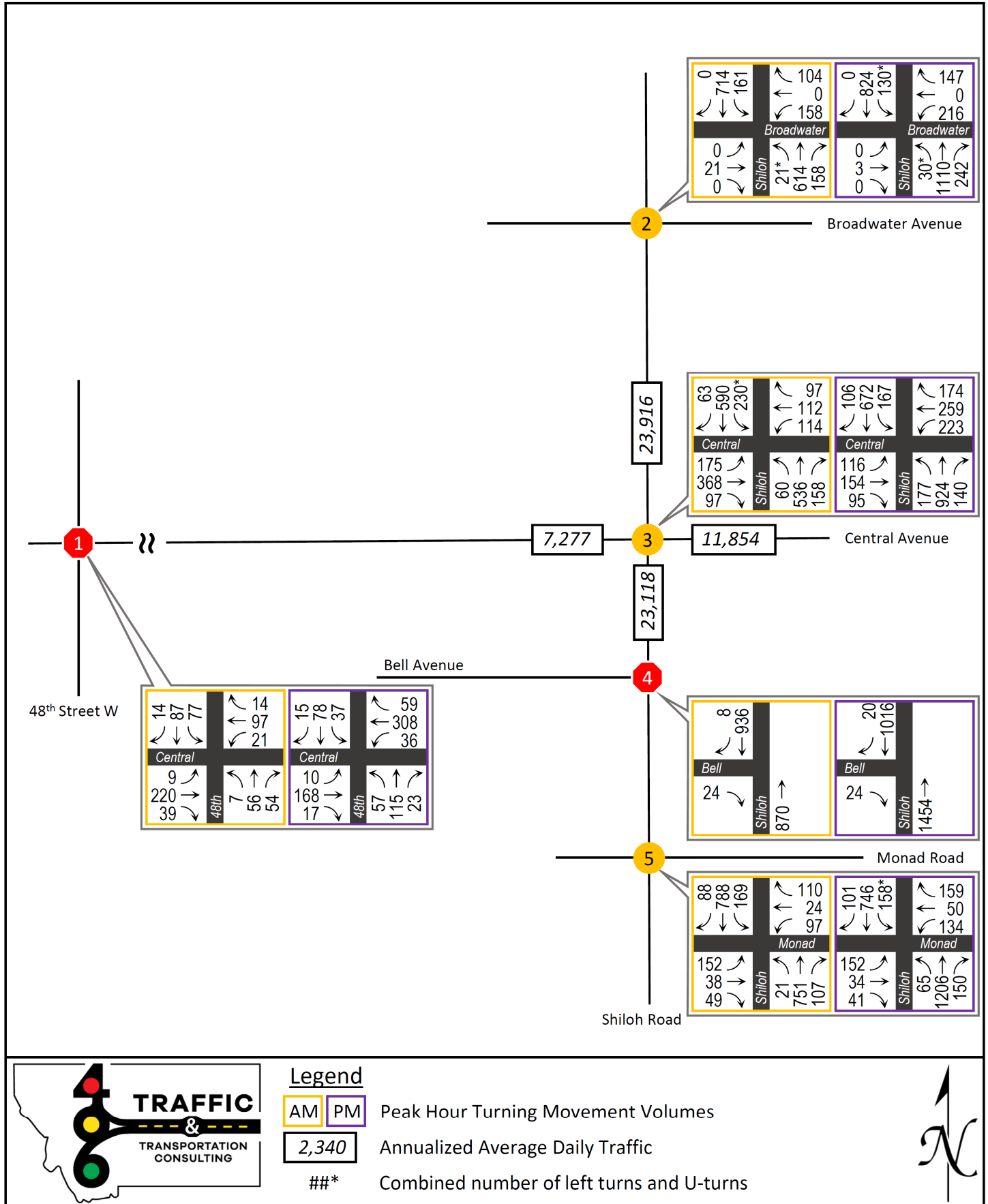
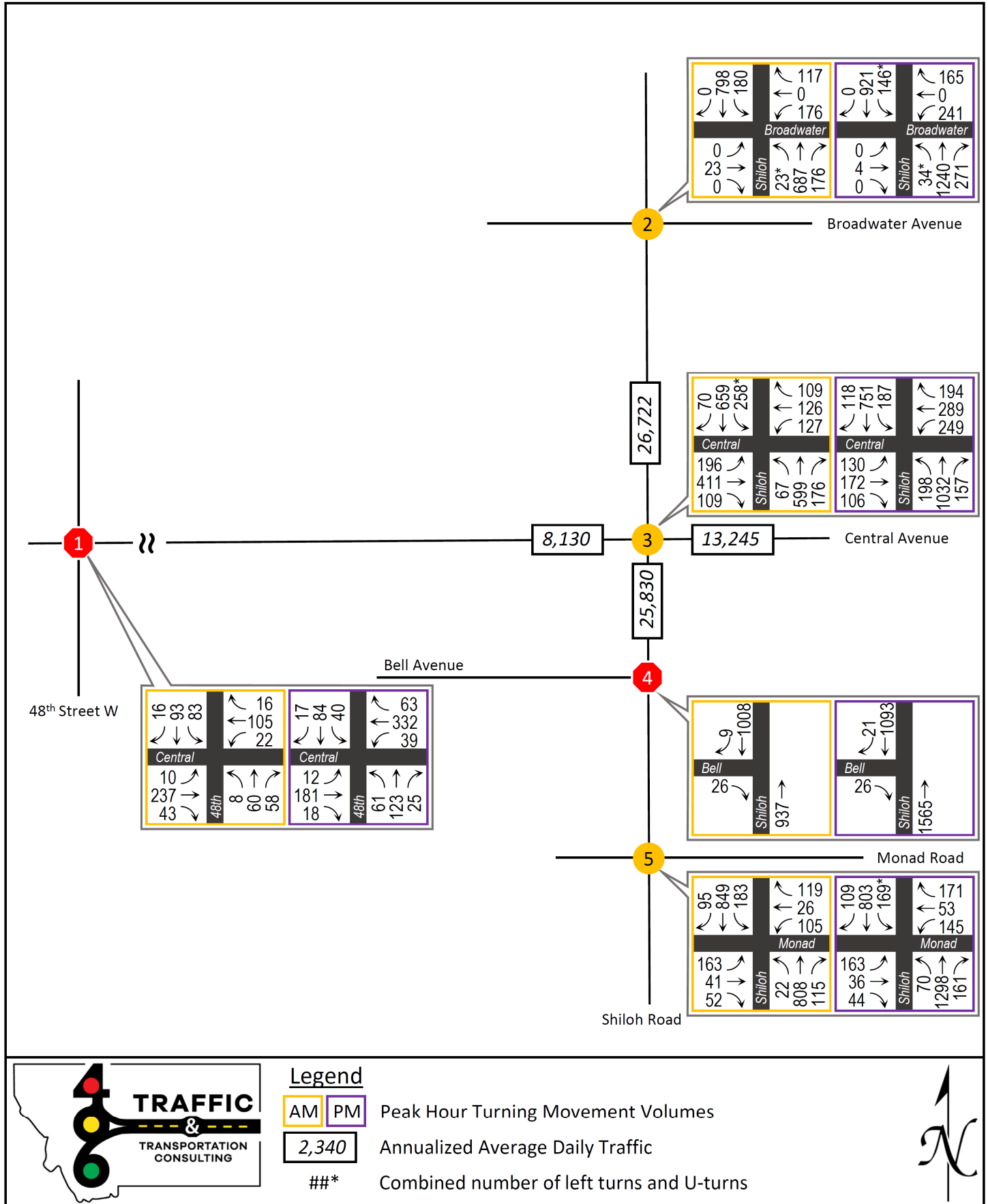


Exhibit 8. 2031 Background Traffic Volumes



2.4 INTERSECTION TRAFFIC OPERATIONS WITHOUT THE PROJECT

The existing and background peak hour intersection Level of Service (LOS) and delay results are shown in **Exhibit 9**. Analysis software results are provided in Appendix B.

Exhibit 9. Existing and Future Background Intersection LOS and Delay

	Intersection	Traffic Control	Peak Hour LOS (delay, in seconds/vehicle)		
			Existing	2028 Background	2031 Background
AM Peak Hour	1. 48 th at Central	AWSC	A (9.6)	B (10.6)	B (11.3)
	2. Shiloh at Broadwater	Roundabout	A (6.0)	A (6.9)	A (7.8)
	3. Shiloh at Central	Roundabout	B (11.2)	C (16.2)	D (25.6)
	4. Shiloh at Bell	TWSC*	B (11.8)	B (12.6)	B (13.2)
	5. Shiloh at Monad	Roundabout	A (9.0)	B (11.6)	B (13.7)
PM Peak Hour	1. 48 th at Central	AWSC	B (12.7)	C (16.1)	C (20.0)
	2. Shiloh at Broadwater	Roundabout	A (9.1)	B (11.8)	C (15.9)
	3. Shiloh at Central	Roundabout	B (13.6)	C (21.9)	E (40.0)
	4. Shiloh at Bell	TWSC*	B (12.1)	B (13.0)	B (13.6)
	5. Shiloh at Monad	Roundabout	B (10.0)	B (13.7)	C (16.9)

* Worst lane group is Eastbound at Intersection 4.

The results in the table indicate that in 2028, all intersections would meet the City's LOS standard of C or better. By 2031, background LOS at the Shiloh/Central roundabout is projected to degrade beyond that standard in both peak hours. Analysis details indicate that in the more severe peak (PM), the longest delays (around 1.5 minutes per vehicle) and queues (13 vehicles, at Synchro's 95th percentile design level) would be for the westbound approach. This background queue would be long enough to block the existing right-in/right-out access for the small mixed-use property on the northwest corner of the intersection, but not to block its $\frac{3}{4}$ access location farther east on Central.

3 PROJECT TRIP GENERATION AND DISTRIBUTION

3.1 TRIP GENERATION

Trip generation rates, or equations as applicable, are from the Institute of Transportation Engineers (ITE) Trip Generation package's 11th edition. ITE trip generation data, when aggregated across enough varied sites, produce both simple average rates and best-fit equations, either linear or logarithmic, to help the analyst derive proper estimates for their situation. Equations are generally preferred over rates, especially for larger sites where trip generation per unit of land use can diminish with increasing project size.

Clearwater Estates will consist almost entirely of residential land uses. Small park areas within the subdivision are designed and intended for use by residents and their guests, and will be similar to park spaces located in other residential areas around Billings. For that reason, they will not generate external traffic. The strip retail space in Phase 2, programmed for 25,000 square feet, has not had specific tenants or any sub-type(s) of retail use identified, but no drive-through activity is expected.

Three types of adjustments to trip generation were evaluated for this project. First, a discount is sometimes taken to reflect internal capture where multiple uses are present in a single project site. Second, a modal adjustment can be taken if a facility is clearly served by robust high-capacity transit and serves a clientele inclined to use transit to get there, or if the potential land use mix and walk/bike network are likely to lead to nonmotorized trips, either internal or external. Finally, some land uses such as gas stations or coffee shops attract trips that were already using the adjacent or nearby road network by virtue of improved convenience over a similar site that could have been used before. These are called "pass-by" and "diverted-linked" trips. Pass-by trips are those on streets bordering the site, while diverted-linked trips are those that might go slightly out of their way to stop at the establishment on their way to their destination.

The Phase 2 retail parcel is the only part of the site considered for these discounts. Due to its location, small size, and expected similarity to other sites along the Central Avenue corridor, only small discounts of the first two types were assumed here; it is not expected to support a use special enough or large enough to generate pass-by or diverted-linked trip activity. The estimate of combined reduction in vehicle trip use for the retail site due to (a) Clearwater residents' use and (b) nonmotorized trips applied here is 10%. **Exhibit 10** shows trip generation details for both phases of the project.

Exhibit 10. Clearwater Estates Trip Generation

	Daily	AM Peak Hour	PM Peak Hour
Phase 1: Single-Family Detached Housing – X = 66 dwelling units			
ITE Land Use 210 equation	$\text{Ln}(T)=0.92(X) + 2.68$	$\text{Ln}(T)=0.91(X) + 0.12$	$T=0.60(X) - 3.93$
Peak hour in/out split		25% / 75%	63% / 37%
Trips	688	51 (13 in / 38 out)	67 (42 in / 25 out)
Phase 1: Single-Family Attached Housing (combined townhome, duplex, and “cottage”) – X = 262 dwelling units			
ITE Land Use 215 equation	$T=7.62(X) - 50.48$	$T=0.52(X) - 5.70$	$T=0.60(X) - 3.93$
Peak hour in/out split		25% / 75%	59% / 41%
Trips	1,946	131 (33 in / 98 out)	153 (90 in / 63 out)
Phase 1 Total Trips	2,634	182 (46 in / 136 out)	221 (133 in / 88 out)
Phase 2: Single-Family Detached Housing – X = 128 dwelling units			
ITE Land Use 210 equation	$\text{Ln}(T)=0.92(X) + 2.68$	$\text{Ln}(T)=0.91(X) + 0.12$	$T=0.60(X) - 3.93$
Peak hour in/out split		25% / 75%	63% / 37%
Trips	1,266	93 (23 in / 70 out)	125 (79 in / 46 out)
Phase 2: Strip Retail Plaza – X = 25,000 square feet			
ITE Land Use 822 equation	$T=42.2(X) + 229.68$	$T=2.36(X)$	$T=6.59(X)$
Peak hour in/out split		60% / 40%	50% / 50%
Gross total trips	1,285	59 (35 in / 24 out)	165 (83 in / 82 out)
Less 10% internal + walk/bike	-128	-6 (4 in / 2 out)	-16 (8 in / 8 out)
Net trips	1,157	53 (31 in / 22 out)	149 (75 in, 74 out)
Combined net trips, both phases:	5,057	328 (101 in / 227 out)	494 (286 in / 208 out)

Source: Equations from ITE Trip Generation, 11th Edition.

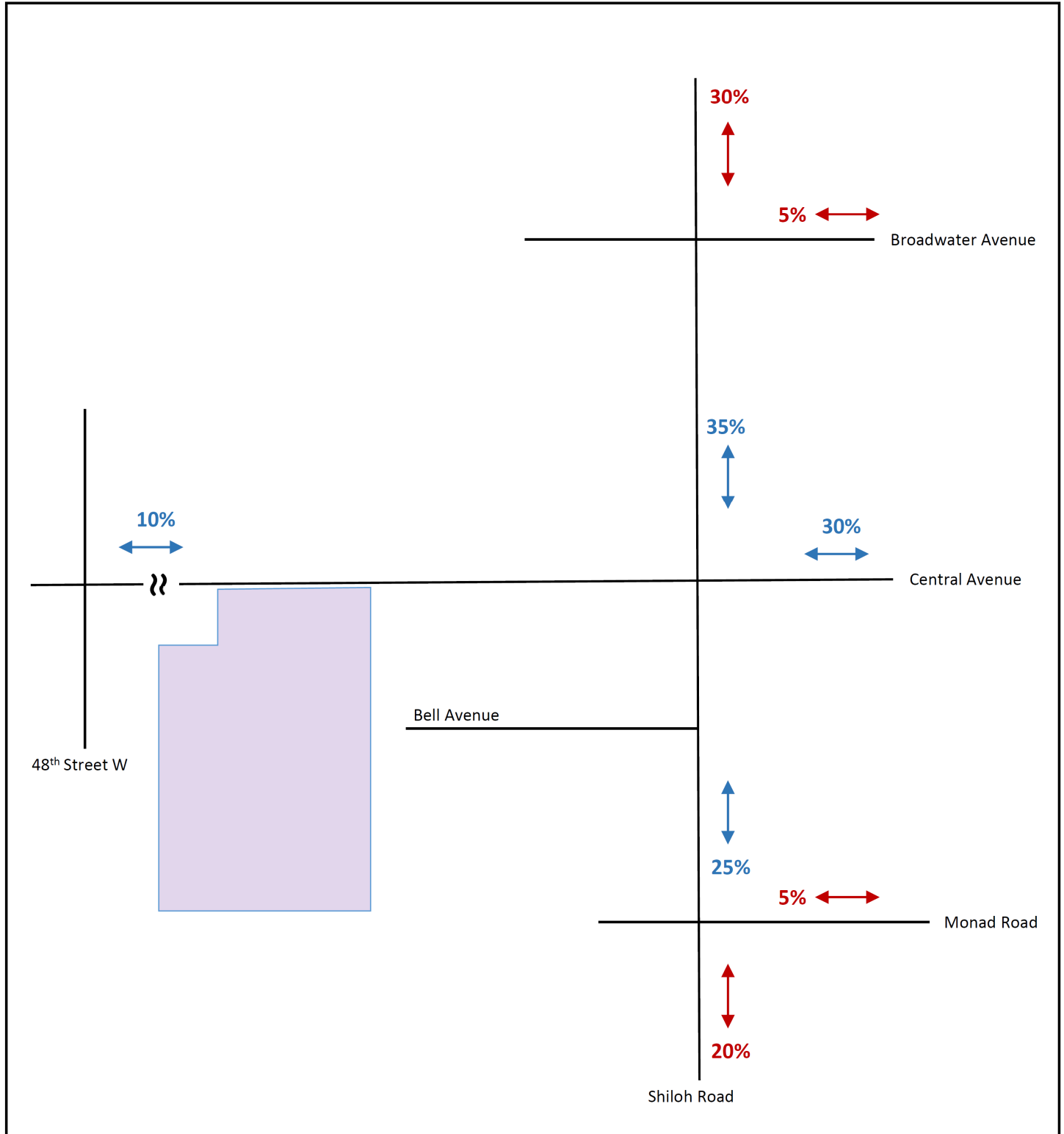
3.2 TRIP DISTRIBUTION AND ASSIGNMENT

Trip distribution has been estimated for the streets surrounding the project site in percentages that add to 100%. Farther from the site, traffic eventually disperses in smaller percentages to/from other routes. Because there is no new information regarding a future developer's plan to connect Bell Avenue and/or the similar connection in Phase 2 to the neighborhood to the west, no Clearwater traffic was assumed to use either such connection. Trip distribution and large-scale assignment percentages are shown in **Exhibit 11**. These percentages were assumed to be the same for both phases.

Phase 1 trips reflected as peak hour intersection turning movement volumes and selected daily link volumes are shown in **Exhibit 12**, and the total volumes after Phase 1 implementation and occupancy are shown in **Exhibit 13**. Similarly, new Phase 2 trips and total traffic are shown in **Exhibits 14** and **15**, respectively.

Note that the Shiloh median that blocks all left turns results in some differences in routing of in-out pairs. For example, many residents leaving the site bound for the Shiloh/Monad intersection can turn right at the Shiloh/Bell intersection, but when they return they must go north on Shiloh past Bell, then make a u-turn or left turn at the Shiloh/Central roundabout.

Exhibit 11. Trip Distribution Percentages for New Trips



Legend

- 30%** Primary Distribution (100%)
- 10%** Secondary Assignment

} of New Vehicle Trips to **Project Site**



Exhibit 12. Assignment of New Phase 1 Trips

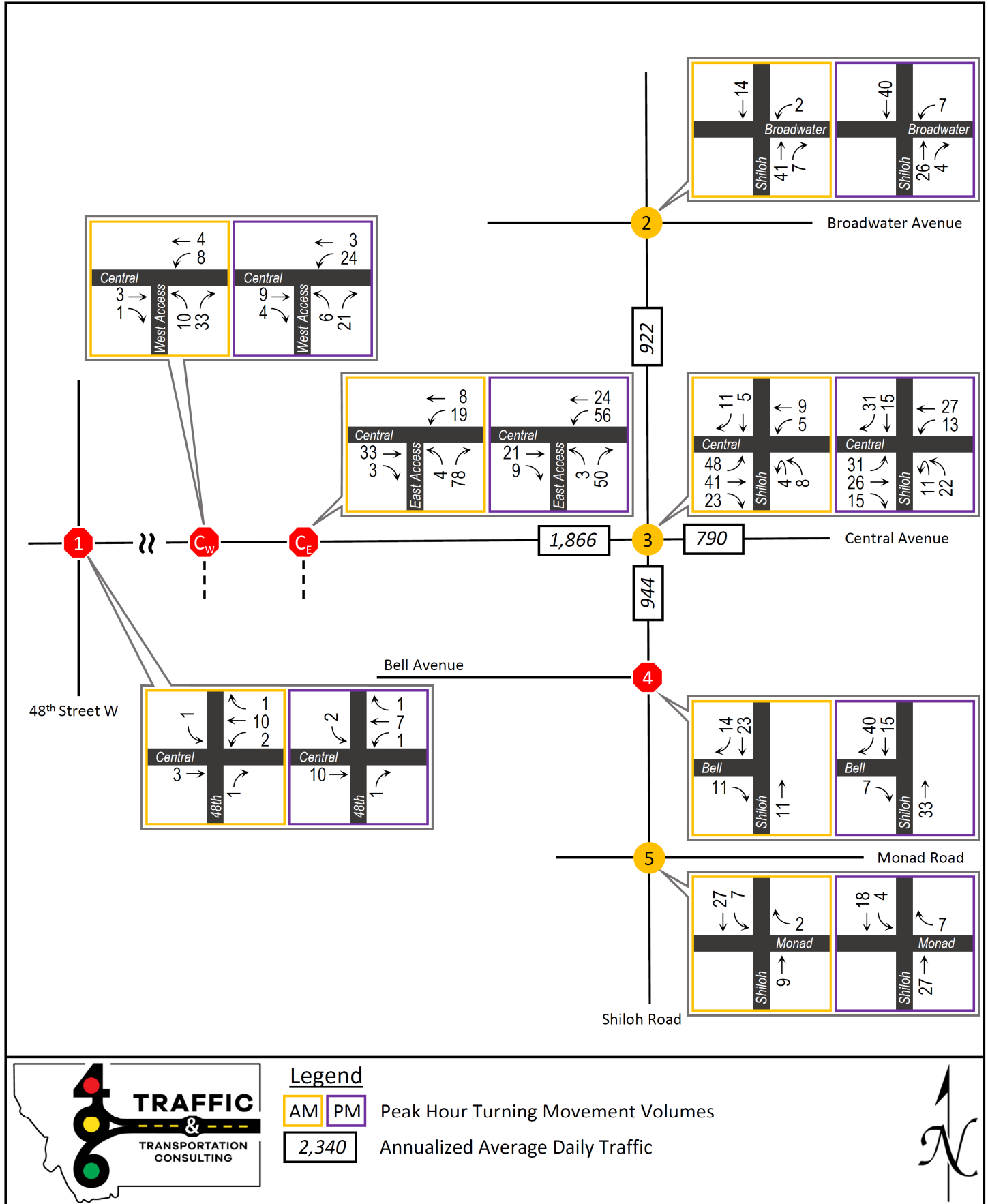


Exhibit 13. 2028 Total Traffic Volumes

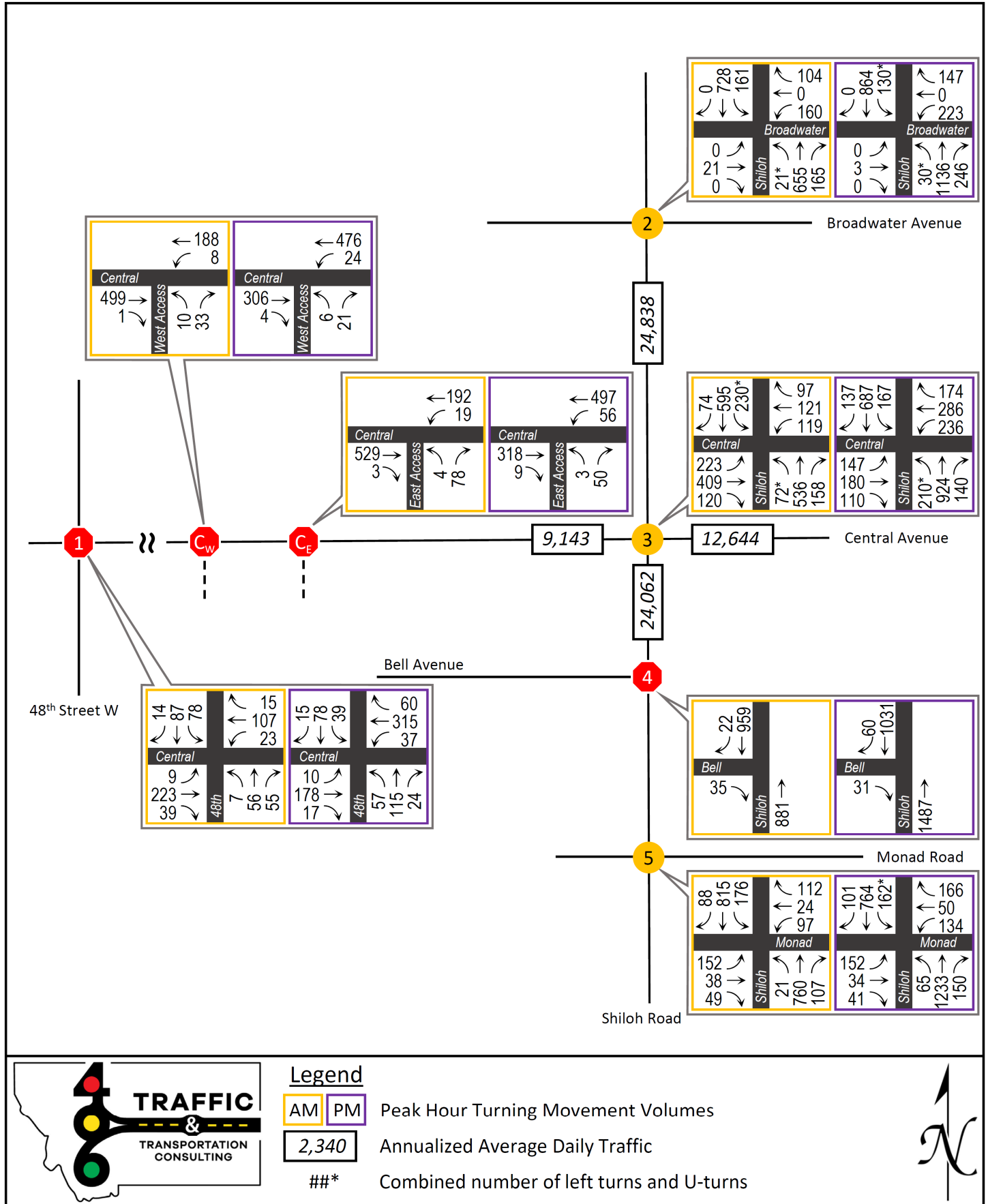


Exhibit 14. Assignment of New Phase 2 Trips

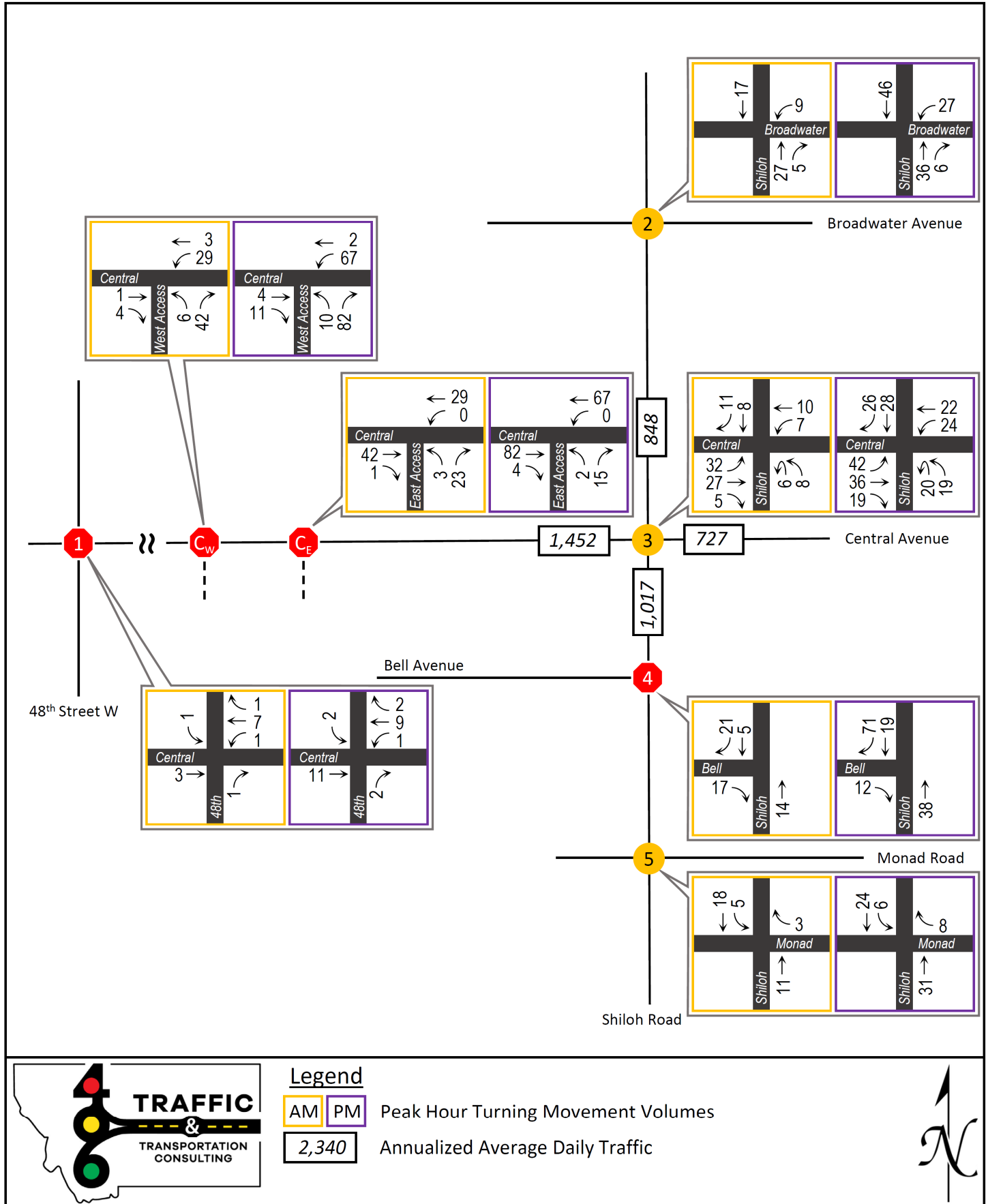
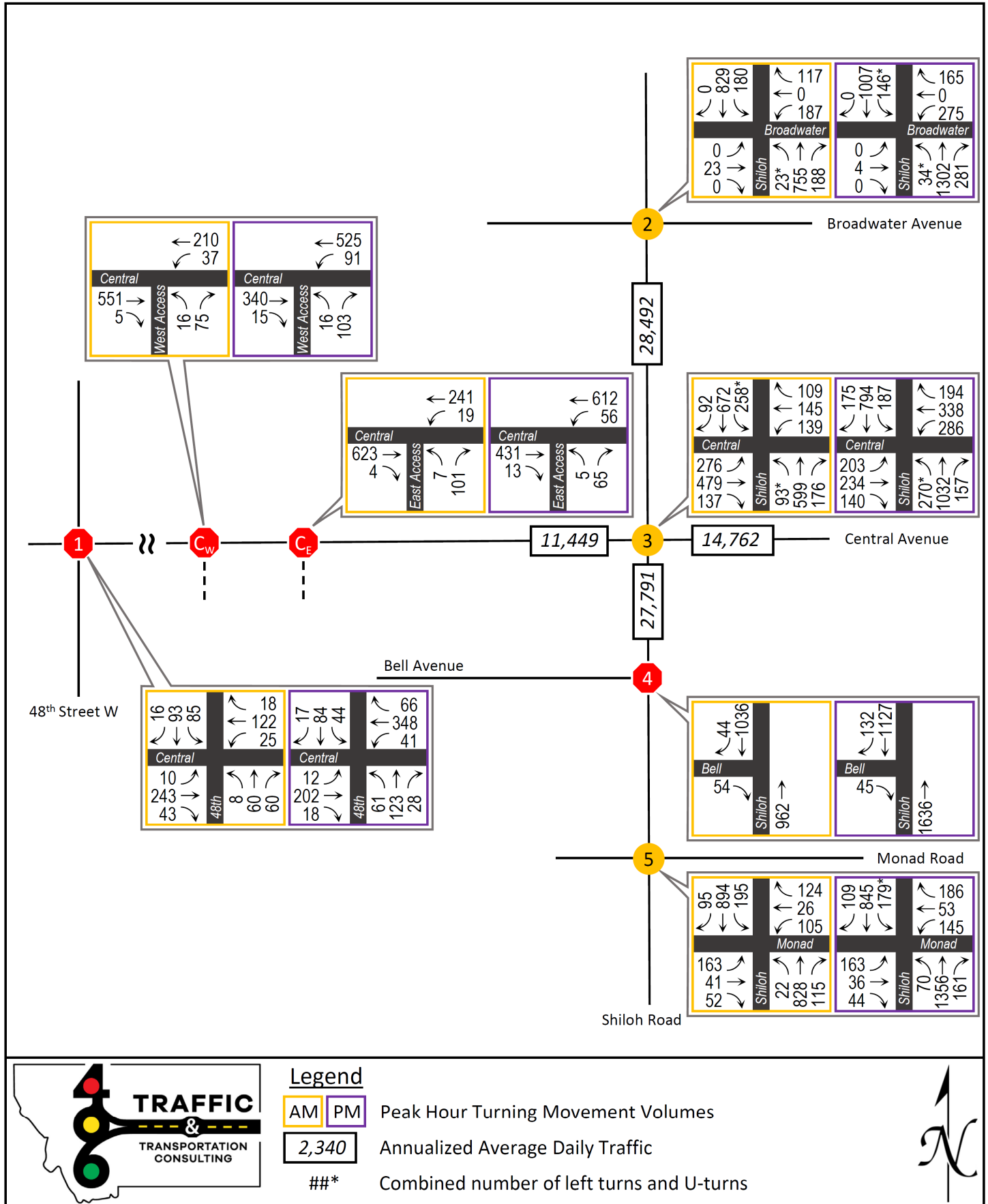


Exhibit 15. 2031 Total Traffic Volumes



4 INTERSECTION CAPACITY ANALYSIS

4.1 PHASE 1

The peak hour intersection Level of Service (LOS) and delay results in 2028 with and without Phase 1 are shown in **Exhibit 15**. Analysis software results are provided in Appendix B.

Exhibit 15. Projected 2028 Intersection LOS and Delay with and without Phase 1

Intersection	Traffic Control	LOS (delay, in seconds/vehicle)		
		2028 Background	With Phase 1	
AM Peak Hour	1. S. 48 th at Central	AWSC	B (10.6)	B (10.8)
	2. Shiloh at Broadwater	Roundabout	A (6.9)	A (7.1)
	3. Shiloh at Central	Roundabout	C (16.2)	C (21.4)
	4. Shiloh at Bell	TWSC*	B (12.6)	B (13.1)
	5. Shiloh at Monad	Roundabout	B (11.6)	B (12.0)
	Central, West Access	TWSC*	-	B (13.5)
	Central, East Access	TWSC*	-	B (14.0)
PM Peak Hour	1. S. 48 th at Central	AWSC	C (16.1)	C (17.4)
	2. Shiloh at Broadwater	Roundabout	B (11.8)	B (12.5)
	3. Shiloh at Central	Roundabout	C (21.9)	D (30.5)
	4. Shiloh at Bell	TWSC*	B (13.0)	B (13.6)
	5. Shiloh at Monad	Roundabout	B (13.7)	B (14.3)
	Central, West Access	TWSC*	-	B (12.2)
	Central, East Access	TWSC*	-	B (11.5)

* Worst lane group is Eastbound at Intersection 4 and Northbound at Intersections 6 and 7.

Both of the site accesses on Central and the Shiloh/Bell intersection would operate at LOS B in both 2028 peak hours. With respect to the peak hour LOS standard, Clearwater's Phase 1 traffic would only affect Intersection 3, the Shiloh at Central roundabout, and only in the PM peak hour. In this case, delay would increase beyond the LOS C/D threshold (25 seconds per vehicle) as a result of traffic generated by the subdivision. The detailed analysis results indicate that the longest delays (around 1 minute per vehicle) and queues (10 vehicles, at Synchro's 95th percentile design level) would be for the westbound approach. Given the limited range of mitigation options for this 2-lane roundabout and the projected LOS of D, testing of such options was deferred to the Phase 2 scenario, for which operations analysis results are described next.

4.2 PHASE 2

The peak hour intersection Level of Service (LOS) and delay results in 2031 with and without Phase 2 are shown in **Exhibit 16**. Analysis software results are provided in Appendix B.

Exhibit 16. Projected 2031 Intersection LOS and Delay with and without Phase 2

Intersection	Traffic Control	LOS (delay, in seconds/vehicle)		
		2031 Background	With Phase 2	
AM Peak Hour	1. S. 48 th at Central	AWSC	B (11.3)	B (11.6)
	2. Shiloh at Broadwater	Roundabout	A (7.8)	A (8.3)
	3. Shiloh at Central	Roundabout	D (25.6)	F (52.5)
	4. Shiloh at Bell	TWSC*	B (13.2)	B (14.4)
	5. Shiloh at Monad	Roundabout	B (13.7)	B (14.8)
	Central, West Access	TWSC*	-	C (16.0)
	Central, East Access	TWSC*	-	C (17.0)
PM Peak Hour	1. S. 48 th at Central	AWSC	C (20.0)	C (23.7)
	2. Shiloh at Broadwater	Roundabout	C (15.9)	C (20.6)
	3. Shiloh at Central	Roundabout	E (40.0)	F (95.7)
	4. Shiloh at Bell	TWSC*	B (13.6)	C (15.4)
	5. Shiloh at Monad	Roundabout	C (16.9)	C (19.1)
	Central, West Access	TWSC*	-	C (15.2)
	Central, East Access	TWSC*	-	B (13.8)

* Worst lane group is Eastbound at Intersection 4 and Northbound at Intersections 6 and 7.

As with 2028 conditions, all intersections and both new site accesses would operate within the City's LOS standard of C or better in both peak hours, with the exception of the Shiloh/Central roundabout. There, the additional traffic generated by Clearwater Estates would degrade the already-substandard LOS in both peak hours if no change is made to intersection capacity. In the context of examining intersection delays, it's important to note that the relationship between volume and delay is not linear; intersections operating near, at, or over capacity often have highly elastic delay responses to relatively small changes in volume.

To address future capacity deficiencies, the primary tool at roundabouts is the addition of a channelized right turn bypass lane on the approach(es) with the highest right-turning volume. They require widening and would lengthen pedestrian crossings, as with the addition of a turn lane at any intersection. Installing bypass lanes on the northbound and westbound approaches—that is, to and from the west, where Central is a 4/5-lane facility—would reduce projected PM peak hour average delay for the intersection by 25-30 seconds per vehicle, but LOS would still be F. The AM peak hour LOS would be expected to improve considerably, yet also still have higher delay than in the 2031 Background scenario. Bypass lanes are not logical for Central Avenue to and from the east, where Central currently has only a 2-lane cross section. The applicant team encourages the City to consider prioritizing, to the extent practicable, additional east-west connectivity between Shiloh and 48th with eventual functional extensions of Broadwater and/or Monad as additional land use changes occur along those logical alignments.

The short-term projection of substandard operations at Shiloh/Central, even without traffic from this particular subdivision, echoes similar findings for other major Shiloh roundabouts from recent studies. Some of this current and expected congestion stems from the scarcity of east-west street network connections other than the major arterials that are generally a mile apart. To that end, a secondary, "bigger-picture" part of the overall solution could involve the westward extension of the east-west streets a half-mile north and south of Central (Broadwater and Monad) to help relieve the traffic burden on Grand, Central, and King. Such extensions are outside the scope of Clearwater's mitigation analysis but still bear mentioning for general interest.

5 COST PARTICIPATION

The net new trips identified in this report are subject to examination under the City's cost participation program to the extent that they would travel through studied intersections. Critical traffic shares that drive cost participation are subject to waiver if they fall below 2%, but project trips from both phases are considered together when evaluating such a possibility. Right turns are not considered.

Intersection 4 was excluded from cost participation calculations because (a) Bell Avenue has been designed for local access only, which will keep volumes low, (b) Shiloh Road's access management features are considered permanent such that no traffic control changes are anticipated to be possible within the scope and timeframe of this project, and (c) as a right-in/right-out intersection there are, in effect, no critical pairs.

Exhibit 17 shows the incremental intersection cost participation for the new trips associated with each of the two project phases and the cost share calculation. As shown in the table, none of the four full-movement intersections qualify for the "sub-2%" waiver.

Exhibit 17. Intersection Cost Participation by Phase

Intersection*	Phase 1			Phase 2			Total
	AM	PM	Higher	AM	PM	Higher	
1. S. 48 th at Central	0.9%	1.1%	1.1%	0.7%	1.2%	1.2%	2.3%
2. Shiloh at Broadwater	1.9%	2.3%	2.3%	1.9%	4.2%	4.2%	6.5%
3. Shiloh at Central	5.3%	6.3%	6.3%	4.1%	7.2%	7.2%	13.5%
5. Shiloh at Monad	1.2%	1.5%	1.5%	0.9%	1.8%	1.8%	3.3%
Total Participation:			11.2%			14.4%	25.6%
x \$450,000			\$50,400			\$64,800	\$115,200

For all intersections in both phases, the PM peak hour critical-pair traffic volume would exceed that of the AM peak hour. The calculation summary shown here indicates that \$50,400 is associated with Phase 1 traffic and \$64,800 is associated with Phase 2. The details of these cost participation calculations are provided in Appendix C.

This concludes the Clearwater Subdivision TAS.

Appendix A: Original Raw Traffic Count Data for Intersections

Study Name Central and 48th

Start Date 8/8/2023

Start Time 7:30 AM

Type Road

Classification Totals

Start Time	48th Street Southbound				Central Avenue Westbound				48th Street Northbound				Central Avenue Eastbound			
	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U
7:00 AM																
7:15 AM																
7:30 AM	3	13	19	0	3	27	2	0	18	9	2	0	5	62	1	0
7:45 AM	3	26	21	0	3	24	5	0	9	10	1	0	12	48	1	0
8:00 AM	4	19	12	0	3	17	5	0	10	13	3	0	10	44	2	0
8:15 AM	2	15	13	0	3	14	5	0	8	14	0	0	6	31	4	0
8:30 AM																
8:45 AM																
4:00 PM																
4:15 PM																
4:30 PM																
4:45 PM																
5:00 PM	1	15	6	0	14	70	7	0	7	23	9	0	5	38	1	0
5:15 PM	3	19	12	0	17	60	12	0	5	30	19	0	5	40	2	0
5:30 PM	4	18	5	0	8	69	6	0	6	20	10	0	2	32	4	0
5:45 PM	5	14	8	0	10	60	5	0	1	23	9	0	2	31	2	0

Study Name Shiloh & Broadwater

Start Date 3/7/2024

Start Time 7:00 AM

Type Road

Classification Totals

Start Time	Shiloh Road Southbound				Broadwater Avenue Westbound				Shiloh Road Northbound				Eastbound Approach Eastbound			
	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U
7:00 AM	0	111	22	0	17	0	8	0	23	52	0	0	0	1	0	0
7:15 AM	0	147	52	0	21	0	25	0	35	102	0	6	0	3	0	0
7:30 AM	0	182	63	0	18	0	33	0	28	122	0	2	0	4	0	0
7:45 AM	0	170	34	0	23	0	39	0	38	140	0	4	0	4	0	0
8:00 AM	0	131	22	0	26	0	29	0	39	143	0	6	0	6	0	0
8:15 AM	0	139	21	0	24	0	36	0	32	130	0	6	0	4	0	0
8:30 AM	0	133	23	0	18	0	28	0	42	137	0	5	0	3	0	0
8:45 AM	0	150	49	0	18	0	28	0	34	124	0	3	0	4	0	0
4:00 PM	0	143	17	0	33	0	42	0	27	244	0	5	0	2	0	0
4:15 PM	0	151	25	0	20	0	46	0	36	226	0	2	0	0	1	0
4:30 PM	0	151	31	0	21	0	38	0	50	238	2	2	0	0	0	0
4:45 PM	0	177	21	0	24	0	37	0	35	201	1	3	0	0	0	0
5:00 PM	0	169	23	0	40	0	56	0	56	281	0	8	0	3	0	0
5:15 PM	0	193	32	1	44	0	52	0	63	283	4	8	0	0	0	0
5:30 PM	0	179	35	1	20	0	43	0	57	202	1	1	0	0	0	0
5:45 PM	0	160	33	2	20	1	35	0	43	200	0	0	0	0	0	0

Study Name Shiloh & Central

Start Date 3/21/2024

Start Time 7:00 AM

Type Road

Classification Totals

Start Time	Shiloh Road Southbound				Central Avenue Westbound				Shiloh Road Northbound				Central Avenue Eastbound			
	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U
7:00 AM	6	74	22	0	7	13	15	0	19	66	9	1	19	51	15	0
7:15 AM	8	118	48	0	7	18	28	0	32	84	14	0	25	90	17	0
7:30 AM	16	128	69	1	18	25	29	0	41	96	15	0	22	112	36	0
7:45 AM	17	135	67	0	26	19	34	0	36	130	19	0	20	91	42	0
8:00 AM	7	116	32	0	29	25	17	0	33	114	10	0	21	76	37	0
8:15 AM	15	135	31	1	12	29	19	0	27	127	9	0	22	41	38	0
8:30 AM	9	98	29	0	15	30	21	0	26	146	10	0	16	30	31	0
8:45 AM	10	102	31	1	20	22	24	0	17	119	20	0	22	40	30	0
4:00 PM	19	127	37	0	23	51	45	0	35	168	24	0	21	29	27	0
4:15 PM	20	100	34	0	35	41	58	0	26	156	45	0	20	39	25	0
4:30 PM	23	127	35	0	38	50	62	0	30	163	47	0	21	26	27	0
4:45 PM	19	153	33	0	41	45	49	0	26	174	41	0	15	36	23	0
5:00 PM	26	152	34	0	38	63	48	0	31	235	32	0	21	46	23	0
5:15 PM	24	154	43	0	35	67	35	0	35	233	35	0	26	26	28	0
5:30 PM	17	142	35	0	40	74	46	0	32	148	35	0	14	32	27	0
5:45 PM	21	148	30	0	31	46	41	0	32	162	26	0	24	22	30	0

Study Name Shiloh & Bell

Start Date 5/18/2023

Start Time 7:00 AM

Type Road

Classification Totals

Start Time	Shiloh Road Southbound				n/a Westbound				Shiloh Road Northbound				Bell Avenue Eastbound			
	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U
7:00 AM	1	126		0					103	0	0		1		0	0
7:15 AM	0	186		0					111	0	0		2		0	0
7:30 AM	2	181		0					228	0	0		7		0	0
7:45 AM	2	239		0					213	0	0		7		0	0
8:00 AM	1	184		0					169	0	0		7		0	0
8:15 AM	3	233		0					167	0	0		1		0	0
8:30 AM	2	163		0					180	0	0		3		0	0
8:45 AM	6	174		0					169	0	0		5		0	0
4:00 PM	2	225		0					272	0	0		6		0	0
4:15 PM	4	224		0					262	0	0		3		0	0
4:30 PM	3	212		0					311	0	0		2		0	0
4:45 PM	5	212		0					307	0	0		7		0	0
5:00 PM	4	241		0					357	0	0		8		0	0
5:15 PM	5	243		0					324	0	0		4		0	0
5:30 PM	6	213		0					263	0	0		7		0	0
5:45 PM	6	219		0					254	0	0		2		0	0

Study Name Shiloh & Monad

Start Date 10/24/2023

Start Time 7:00 AM

Type Road

Classification Totals

Start Time	Shiloh Road Southbound				Monad Road Westbound				Shiloh Road Northbound				Monad Road Eastbound			
	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U
7:00 AM	6	126	12	0	8	7	12	0	16	67	5	0	10	5	12	0
7:15 AM	12	129	36	0	11	9	15	0	22	113	1	0	13	3	25	0
7:30 AM	9	138	32	0	24	3	22	0	29	175	5	0	17	14	33	0
7:45 AM	16	215	49	0	29	8	21	0	21	190	8	0	12	7	36	0
8:00 AM	23	181	23	0	18	2	22	0	23	142	1	0	9	10	24	0
8:15 AM	26	128	38	0	22	7	17	0	17	123	3	0	2	1	34	0
8:30 AM	12	150	42	5	17	1	15	0	16	111	2	1	5	2	24	0
8:45 AM	10	135	20	0	20	5	9	0	14	109	1	0	10	3	16	0
4:00 PM	16	166	26	0	30	6	21	0	33	210	10	0	12	8	23	0
4:15 PM	15	162	23	0	25	10	20	0	30	203	7	0	6	15	23	0
4:30 PM	21	174	35	0	37	12	29	0	22	233	9	0	8	9	41	0
4:45 PM	18	154	27	1	29	8	32	0	28	236	18	0	6	0	35	0
5:00 PM	16	138	44	0	29	15	27	0	35	277	12	0	9	10	31	0
5:15 PM	30	160	25	0	38	6	25	0	40	266	16	0	11	9	20	0
5:30 PM	19	180	23	0	37	8	34	0	34	183	13	0	9	7	31	0
5:45 PM	24	156	28	0	37	10	16	0	25	176	13	0	11	12	21	0

Appendix B: Intersection Analysis Software Output

Scenario sequence:

Existing

2028 Background

2028 Phase 1

2031 Background

2031 Phase 2

Intersection	
Intersection Delay, s/veh	9.6
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	8	190	34	18	84	12	6	48	47	66	75	12
Future Vol, veh/h	8	190	34	18	84	12	6	48	47	66	75	12
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles, %	2	2	2	5	5	5	5	5	5	1	1	1
Mvmt Flow	9	213	38	20	94	13	7	54	53	74	84	13
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	10.2	9.1	8.9	9.7
HCM LOS	B	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	6%	3%	16%	43%
Vol Thru, %	48%	82%	74%	49%
Vol Right, %	47%	15%	11%	8%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	101	232	114	153
LT Vol	6	8	18	66
Through Vol	48	190	84	75
RT Vol	47	34	12	12
Lane Flow Rate	113	261	128	172
Geometry Grp	1	1	1	1
Degree of Util (X)	0.154	0.342	0.177	0.24
Departure Headway (Hd)	4.882	4.722	4.983	5.033
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	727	756	713	708
Service Time	2.959	2.783	3.056	3.104
HCM Lane V/C Ratio	0.155	0.345	0.18	0.243
HCM Control Delay, s/veh	8.9	10.2	9.1	9.7
HCM Lane LOS	A	B	A	A
HCM 95th-tile Q	0.5	1.5	0.6	0.9

Intersection									
Intersection Delay, s/veh	6.0								
Intersection LOS	A								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		1		1		
Adj Approach Flow, veh/h	19		241		728		803		
Demand Flow Rate, veh/h	19		243		742		811		
Vehicles Circulating, veh/h	957		594		168		165		
Vehicles Exiting, veh/h	19		316		808		672		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	3.1		6.1		5.9		6.1		
Approach LOS	A		A		A		A		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	R	LT	R	LT	TR	LT	TR	
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR	
RT Channelized									
Lane Util	1.000	0.000	0.601	0.399	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	1.000	2.535	2.667	2.535	2.535	2.535	2.535	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544	
A (Intercept)	3600	1420	1350	1420	1420	1420	1420	1420	
B (Slope)	1.151e-3	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4	
Entry Flow, veh/h	19	0	146	97	349	393	381	430	
Cap Entry Lane, veh/h	1196	629	782	857	1219	1219	1222	1222	
Entry HV Adj Factor	1.000	1.000	0.993	0.990	0.980	0.981	0.991	0.990	
Flow Entry, veh/h	19	0	145	96	342	386	378	426	
Cap Entry, veh/h	1196	629	776	848	1194	1196	1211	1210	
V/C Ratio	0.016	0.000	0.187	0.113	0.286	0.322	0.312	0.352	
Control Delay, s/veh	3.1	5.7	6.6	5.4	5.7	6.0	5.9	6.3	
LOS	A	A	A	A	A	A	A	A	
95th %tile Queue, veh	0	0	1	0	1	1	1	2	

Intersection									
Intersection Delay, s/veh	11.2								
Intersection LOS	B								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		2		2		
Adj Approach Flow, veh/h	620		310		730		857		
Demand Flow Rate, veh/h	632		319		753		866		
Vehicles Circulating, veh/h	917		768		762		282		
Vehicles Exiting, veh/h	231		747		787		805		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	14.6		7.9		13.7		7.6		
Approach LOS	B		A		B		A		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	TR	LT	TR	LT	TR	LT	TR	
Assumed Moves	LT	TR	LT	TR	LT	TR	LT	TR	
RT Channelized									
Lane Util	0.470	0.530	0.470	0.530	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.667	2.535	2.667	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.645	4.328	4.645	4.328	
A (Intercept)	1350	1420	1350	1420	1350	1420	1350	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	
Entry Flow, veh/h	297	335	150	169	354	399	407	459	
Cap Entry Lane, veh/h	581	651	666	739	670	743	1041	1117	
Entry HV Adj Factor	0.981	0.981	0.971	0.972	0.970	0.970	0.990	0.990	
Flow Entry, veh/h	291	329	146	164	343	387	403	454	
Cap Entry, veh/h	570	639	647	718	649	721	1031	1106	
V/C Ratio	0.511	0.514	0.225	0.229	0.529	0.537	0.391	0.411	
Control Delay, s/veh	15.3	14.0	8.3	7.6	14.2	13.3	7.7	7.6	
LOS	C	B	A	A	B	B	A	A	
95th %tile Queue, veh	3	3	1	1	3	3	2	2	

Intersection						
Int Delay, s/veh	0.2					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↗		↑↑	↑↑	
Traffic Vol, veh/h	0	21	0	750	807	7
Future Vol, veh/h	0	21	0	750	807	7
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	0	0	4	4	2	2
Mvmt Flow	0	24	0	843	907	8

Major/Minor	Minor2	Major1	Major2		
Conflicting Flow All	-	457	-	0	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-
Critical Hdwy	-	6.9	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-
Follow-up Hdwy	-	3.3	-	-	-
Pot Cap-1 Maneuver	0	556	0	-	-
Stage 1	0	-	0	-	-
Stage 2	0	-	0	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	-	556	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	11.76	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	556	-	-
HCM Lane V/C Ratio	-	0.042	-	-
HCM Ctrl Dly (s/v)	-	11.8	-	-
HCM Lane LOS	-	B	-	-
HCM 95th %tile Q(veh)	-	0.1	-	-

Intersection									
Intersection Delay, s/veh	9.0								
Intersection LOS	A								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		1		1		
Adj Approach Flow, veh/h	251		241		924		1100		
Demand Flow Rate, veh/h	259		248		933		1111		
Vehicles Circulating, veh/h	1119		985		386		151		
Vehicles Exiting, veh/h	143		334		992		1082		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	13.9		9.3		9.2		7.6		
Approach LOS	B		A		A		A		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	R	LT	R	LT	TR	LT	TR	
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR	
RT Channelized									
Lane Util	0.795	0.205	0.520	0.480	0.471	0.529	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544	
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4	
Entry Flow, veh/h	206	53	129	119	439	494	522	589	
Cap Entry Lane, veh/h	482	549	545	615	999	999	1238	1238	
Entry HV Adj Factor	0.970	0.962	0.971	0.975	0.989	0.991	0.990	0.990	
Flow Entry, veh/h	200	51	125	116	434	490	517	583	
Cap Entry, veh/h	468	528	529	599	989	991	1226	1225	
V/C Ratio	0.427	0.097	0.236	0.194	0.439	0.494	0.422	0.476	
Control Delay, s/veh	15.5	8.0	10.1	8.4	8.7	9.6	7.2	8.0	
LOS	C	A	B	A	A	A	A	A	
95th %tile Queue, veh	2	0	1	1	2	3	2	3	

Intersection	
Intersection Delay, s/veh	12.7
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	9	145	15	31	266	51	49	99	20	32	67	13
Future Vol, veh/h	9	145	15	31	266	51	49	99	20	32	67	13
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles, %	2	2	2	1	1	1	0	0	0	0	0	0
Mvmt Flow	10	169	17	36	309	59	57	115	23	37	78	15
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	10.8	14.9	11.3	10.5
HCM LOS	B	B	B	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	29%	5%	9%	29%
Vol Thru, %	59%	86%	76%	60%
Vol Right, %	12%	9%	15%	12%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	168	169	348	112
LT Vol	49	9	31	32
Through Vol	99	145	266	67
RT Vol	20	15	51	13
Lane Flow Rate	195	197	405	130
Geometry Grp	1	1	1	1
Degree of Util (X)	0.31	0.298	0.575	0.212
Departure Headway (Hd)	5.721	5.465	5.118	5.852
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	627	656	704	611
Service Time	3.772	3.515	3.159	3.907
HCM Lane V/C Ratio	0.311	0.3	0.575	0.213
HCM Control Delay, s/veh	11.3	10.8	14.9	10.5
HCM Lane LOS	B	B	B	B
HCM 95th-tile Q	1.3	1.2	3.7	0.8

Intersection									
Intersection Delay, s/veh	9.1								
Intersection LOS	A								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		1		1		
Adj Approach Flow, veh/h	3		360		1370		946		
Demand Flow Rate, veh/h	3		360		1370		955		
Vehicles Circulating, veh/h	1169		1130		133		244		
Vehicles Exiting, veh/h	30		373		1039		1246		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	7.9		13.6		9.0		7.6		
Approach LOS	A		B		A		A		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	R	LT	R	LT	TR	LT	TR	
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR	
RT Channelized									
Lane Util	1.000	0.000	0.594	0.406	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544	
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4	
Entry Flow, veh/h	3	0	214	146	644	726	449	506	
Cap Entry Lane, veh/h	461	526	477	543	1258	1258	1137	1137	
Entry HV Adj Factor	1.000	1.000	1.000	1.000	1.000	1.000	0.990	0.991	
Flow Entry, veh/h	3	0	214	146	644	726	445	501	
Cap Entry, veh/h	461	526	477	543	1258	1258	1126	1127	
V/C Ratio	0.007	0.000	0.448	0.269	0.512	0.577	0.395	0.445	
Control Delay, s/veh	7.9	6.8	15.8	10.4	8.4	9.6	7.2	8.0	
LOS	A	A	C	B	A	A	A	A	
95th %tile Queue, veh	0	0	2	1	3	4	2	2	

Intersection									
Intersection Delay, s/veh	13.6								
Intersection LOS	B								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		2		2		
Adj Approach Flow, veh/h	339		607		1152		877		
Demand Flow Rate, veh/h	339		607		1152		886		
Vehicles Circulating, veh/h	993		1130		408		611		
Vehicles Exiting, veh/h	504		430		924		1126		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	10.3		19.9		12.1		12.6		
Approach LOS	B		C		B		B		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	TR	LT	TR	LT	TR	LT	TR	
Assumed Moves	LT	TR	LT	TR	LT	TR	LT	TR	
RT Channelized									
Lane Util	0.469	0.531	0.470	0.530	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.667	2.535	2.667	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.645	4.328	4.645	4.328	
A (Intercept)	1350	1420	1350	1420	1350	1420	1350	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	
Entry Flow, veh/h	159	180	285	322	541	611	416	470	
Cap Entry Lane, veh/h	541	611	477	543	927	1004	769	845	
Entry HV Adj Factor	1.002	0.998	1.001	0.999	1.001	0.999	0.991	0.989	
Flow Entry, veh/h	159	180	285	322	541	611	412	465	
Cap Entry, veh/h	543	609	478	543	928	1003	762	835	
V/C Ratio	0.294	0.295	0.597	0.593	0.583	0.609	0.541	0.556	
Control Delay, s/veh	10.8	9.8	21.1	18.8	12.1	12.0	12.8	12.4	
LOS	B	A	C	C	B	B	B	B	
95th %tile Queue, veh	1	1	4	4	4	4	3	3	

Intersection						
Int Delay, s/veh	0.1					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↗		↑↑	↑↑	
Traffic Vol, veh/h	0	21	0	1254	876	17
Future Vol, veh/h	0	21	0	1254	876	17
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	2	2
Mvmt Flow	0	23	0	1363	952	18

Major/Minor	Minor2	Major1	Major2		
Conflicting Flow All	-	485	-	0	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-
Critical Hdwy	-	6.9	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-
Follow-up Hdwy	-	3.3	-	-	-
Pot Cap-1 Maneuver	0	533	0	-	-
Stage 1	0	-	0	-	-
Stage 2	0	-	0	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	-	533	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	12.05	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	533	-	-
HCM Lane V/C Ratio	-	0.043	-	-
HCM Ctrl Dly (s/v)	-	12.1	-	-
HCM Lane LOS	-	B	-	-
HCM 95th %tile Q(veh)	-	0.1	-	-

Intersection									
Intersection Delay, s/veh	10.0								
Intersection LOS	B								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		1		1		
Adj Approach Flow, veh/h	201		305		1263		893		
Demand Flow Rate, veh/h	206		305		1263		902		
Vehicles Circulating, veh/h	931		1268		310		222		
Vehicles Exiting, veh/h	193		305		827		1351		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	9.8		14.1		11.1		7.1		
Approach LOS	A		B		B		A		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	R	LT	R	LT	TR	LT	TR	
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR	
RT Channelized									
Lane Util	0.820	0.180	0.538	0.462	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544	
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4	
Entry Flow, veh/h	169	37	164	141	594	669	424	478	
Cap Entry Lane, veh/h	573	644	420	483	1071	1071	1160	1160	
Entry HV Adj Factor	0.979	0.973	1.000	1.000	0.999	1.001	0.990	0.991	
Flow Entry, veh/h	165	36	164	141	594	669	420	473	
Cap Entry, veh/h	561	626	420	483	1070	1072	1149	1149	
V/C Ratio	0.295	0.057	0.390	0.292	0.555	0.625	0.365	0.412	
Control Delay, s/veh	10.6	6.4	15.9	11.9	10.2	11.9	6.8	7.4	
LOS	B	A	C	B	B	B	A	A	
95th %tile Queue, veh	1	0	2	1	4	5	2	2	

Intersection	
Intersection Delay, s/veh	10.6
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	9	220	39	21	97	14	7	56	54	77	87	14
Future Vol, veh/h	9	220	39	21	97	14	7	56	54	77	87	14
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles, %	2	2	2	5	5	5	5	5	5	1	1	1
Mvmt Flow	10	247	44	24	109	16	8	63	61	87	98	16
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	11.6	9.8	9.5	10.6
HCM LOS	B	A	A	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	6%	3%	16%	43%
Vol Thru, %	48%	82%	73%	49%
Vol Right, %	46%	15%	11%	8%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	117	268	132	178
LT Vol	7	9	21	77
Through Vol	56	220	97	87
RT Vol	54	39	14	14
Lane Flow Rate	131	301	148	200
Geometry Grp	1	1	1	1
Degree of Util (X)	0.191	0.419	0.218	0.297
Departure Headway (Hd)	5.224	5.01	5.3	5.34
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	686	723	678	674
Service Time	3.259	3.01	3.332	3.371
HCM Lane V/C Ratio	0.191	0.416	0.218	0.297
HCM Control Delay, s/veh	9.5	11.6	9.8	10.6
HCM Lane LOS	A	B	A	B
HCM 95th-tile Q	0.7	2.1	0.8	1.2

Intersection									
Intersection Delay, s/veh	6.9								
Intersection LOS	A								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		1		1		
Adj Approach Flow, veh/h	22		279		843		931		
Demand Flow Rate, veh/h	22		282		859		941		
Vehicles Circulating, veh/h	1111		688		195		192		
Vehicles Exiting, veh/h	22		366		938		778		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	8.0		7.1		6.6		7.0		
Approach LOS	A		A		A		A		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	R	LT	R	LT	TR	LT	TR	
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR	
RT Channelized									
Lane Util	1.000	0.000	0.603	0.397	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544	
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4	
Entry Flow, veh/h	22	0	170	112	404	455	442	499	
Cap Entry Lane, veh/h	486	552	717	791	1189	1189	1192	1192	
Entry HV Adj Factor	1.000	1.000	0.988	0.991	0.981	0.982	0.990	0.989	
Flow Entry, veh/h	22	0	168	111	396	447	438	494	
Cap Entry, veh/h	486	552	708	784	1166	1168	1181	1180	
V/C Ratio	0.045	0.000	0.237	0.142	0.340	0.383	0.371	0.418	
Control Delay, s/veh	8.0	6.5	7.8	6.1	6.4	6.9	6.7	7.3	
LOS	A	A	A	A	A	A	A	A	
95th %tile Queue, veh	0	0	1	0	2	2	2	2	

Intersection									
Intersection Delay, s/veh	16.2								
Intersection LOS	C								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		2		2		
Adj Approach Flow, veh/h	719		363		847		992		
Demand Flow Rate, veh/h	733		374		872		1003		
Vehicles Circulating, veh/h	1063		890		883		331		
Vehicles Exiting, veh/h	271		865		913		933		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	23.2		9.8		21.1		9.2		
Approach LOS	C		A		C		A		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	TR	LT	TR	LT	TR	LT	TR	
Assumed Moves	LT	TR	LT	TR	LT	TR	LT	TR	
RT Channelized									
Lane Util	0.471	0.529	0.471	0.529	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.667	2.535	2.667	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.645	4.328	4.645	4.328	
A (Intercept)	1350	1420	1350	1420	1350	1420	1350	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	
Entry Flow, veh/h	345	388	176	198	410	462	471	532	
Cap Entry Lane, veh/h	508	575	595	666	599	670	996	1072	
Entry HV Adj Factor	0.979	0.982	0.970	0.972	0.971	0.972	0.990	0.989	
Flow Entry, veh/h	338	381	171	193	398	449	466	526	
Cap Entry, veh/h	497	565	577	648	582	651	986	1060	
V/C Ratio	0.680	0.674	0.296	0.297	0.684	0.689	0.473	0.496	
Control Delay, s/veh	24.6	21.9	10.3	9.4	22.0	20.3	9.3	9.2	
LOS	C	C	B	A	C	C	A	A	
95th %tile Queue, veh	5	5	1	1	5	5	3	3	

Intersection						
Int Delay, s/veh	0.2					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↗		↑↑	↑↑	
Traffic Vol, veh/h	0	24	0	870	936	8
Future Vol, veh/h	0	24	0	870	936	8
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	0	0	4	4	2	2
Mvmt Flow	0	27	0	978	1052	9

Major/Minor	Minor2	Major1	Major2		
Conflicting Flow All	-	530	-	0	0
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-
Critical Hdwy	-	6.9	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-
Follow-up Hdwy	-	3.3	-	-	-
Pot Cap-1 Maneuver	0	498	0	-	-
Stage 1	0	-	0	-	-
Stage 2	0	-	0	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	-	498	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	12.63	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	498	-	-
HCM Lane V/C Ratio	-	0.054	-	-
HCM Ctrl Dly (s/v)	-	12.6	-	-
HCM Lane LOS	-	B	-	-
HCM 95th %tile Q(veh)	-	0.2	-	-

Intersection									
Intersection Delay, s/veh	11.6								
Intersection LOS	B								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		1		1		
Adj Approach Flow, veh/h	291		281		1072		1274		
Demand Flow Rate, veh/h	300		290		1082		1287		
Vehicles Circulating, veh/h	1301		1142		446		178		
Vehicles Exiting, veh/h	164		386		1155		1254		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	21.1		11.9		11.8		9.1		
Approach LOS	C		B		B		A		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	R	LT	R	LT	TR	LT	TR	
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR	
RT Channelized									
Lane Util	0.793	0.207	0.524	0.476	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544	
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4	
Entry Flow, veh/h	238	62	152	138	509	573	605	682	
Cap Entry Lane, veh/h	408	470	472	538	946	946	1208	1208	
Entry HV Adj Factor	0.969	0.968	0.968	0.971	0.990	0.991	0.990	0.990	
Flow Entry, veh/h	231	60	147	134	504	568	599	675	
Cap Entry, veh/h	395	455	457	522	937	938	1196	1196	
V/C Ratio	0.583	0.132	0.322	0.257	0.538	0.606	0.501	0.565	
Control Delay, s/veh	24.0	9.8	13.2	10.5	10.9	12.6	8.5	9.7	
LOS	C	A	B	B	B	B	A	A	
95th %tile Queue, veh	4	0	1	1	3	4	3	4	

Intersection	
Intersection Delay, s/veh	16.1
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	10	168	17	36	308	59	57	115	23	37	78	15
Future Vol, veh/h	10	168	17	36	308	59	57	115	23	37	78	15
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles, %	2	2	2	1	1	1	0	0	0	0	0	0
Mvmt Flow	12	195	20	42	358	69	66	134	27	43	91	17
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	12.5	20.6	13.1	11.8
HCM LOS	B	C	B	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	29%	5%	9%	28%
Vol Thru, %	59%	86%	76%	60%
Vol Right, %	12%	9%	15%	12%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	195	195	403	130
LT Vol	57	10	36	37
Through Vol	115	168	308	78
RT Vol	23	17	59	15
Lane Flow Rate	227	227	469	151
Geometry Grp	1	1	1	1
Degree of Util (X)	0.386	0.376	0.706	0.269
Departure Headway (Hd)	6.244	5.964	5.425	6.413
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	580	608	661	562
Service Time	4.244	3.964	3.516	4.427
HCM Lane V/C Ratio	0.391	0.373	0.71	0.269
HCM Control Delay, s/veh	13.1	12.5	20.6	11.8
HCM Lane LOS	B	B	C	B
HCM 95th-tile Q	1.8	1.7	5.8	1.1

Intersection									
Intersection Delay, s/veh	11.8								
Intersection LOS	B								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		1		1		
Adj Approach Flow, veh/h	3		417		1588		1096		
Demand Flow Rate, veh/h	3		417		1588		1106		
Vehicles Circulating, veh/h	1354		1310		153		282		
Vehicles Exiting, veh/h	34		431		1204		1445		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	9.4		20.5		11.3		9.2		
Approach LOS	A		C		B		A		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	R	LT	R	LT	TR	LT	TR	
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR	
RT Channelized									
Lane Util	1.000	0.000	0.595	0.405	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544	
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4	
Entry Flow, veh/h	3	0	248	169	746	842	520	586	
Cap Entry Lane, veh/h	388	449	405	466	1236	1236	1099	1099	
Entry HV Adj Factor	1.000	1.000	1.000	1.000	1.000	1.000	0.990	0.991	
Flow Entry, veh/h	3	0	248	169	746	842	515	581	
Cap Entry, veh/h	388	449	405	466	1236	1235	1088	1089	
V/C Ratio	0.008	0.000	0.613	0.362	0.604	0.681	0.473	0.533	
Control Delay, s/veh	9.4	8.0	25.1	13.9	10.3	12.3	8.6	9.7	
LOS	A	A	D	B	B	B	A	A	
95th %tile Queue, veh	0	0	4	2	4	6	3	3	

Intersection									
Intersection Delay, s/veh	21.9								
Intersection LOS	C								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		2		2		
Adj Approach Flow, veh/h	393		705		1335		1017		
Demand Flow Rate, veh/h	393		705		1335		1027		
Vehicles Circulating, veh/h	1152		1309		473		708		
Vehicles Exiting, veh/h	583		499		1072		1306		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	13.7		39.1		17.6		18.7		
Approach LOS	B		E		C		C		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	TR	LT	TR	LT	TR	LT	TR	
Assumed Moves	LT	TR	LT	TR	LT	TR	LT	TR	
RT Channelized									
Lane Util	0.471	0.529	0.470	0.530	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.667	2.535	2.667	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.645	4.328	4.645	4.328	
A (Intercept)	1350	1420	1350	1420	1350	1420	1350	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	
Entry Flow, veh/h	185	208	331	374	627	708	483	544	
Cap Entry Lane, veh/h	468	533	405	467	874	950	704	778	
Entry HV Adj Factor	0.998	1.001	1.001	0.999	1.001	0.999	0.989	0.991	
Flow Entry, veh/h	185	208	331	374	627	708	478	539	
Cap Entry, veh/h	467	534	405	466	874	949	696	771	
V/C Ratio	0.395	0.390	0.817	0.801	0.718	0.745	0.686	0.699	
Control Delay, s/veh	14.6	12.9	42.3	36.2	17.4	17.7	19.1	18.3	
LOS	B	B	E	E	C	C	C	C	
95th %tile Queue, veh	2	2	7	7	6	7	5	6	

Intersection						
Int Delay, s/veh	0.1					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↗		↑↑	↑↑	
Traffic Vol, veh/h	0	24	0	1454	1016	20
Future Vol, veh/h	0	24	0	1454	1016	20
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	2	2
Mvmt Flow	0	26	0	1580	1104	22

Major/Minor	Minor2	Major1	Major2		
Conflicting Flow All	-	563	-	0	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-
Critical Hdwy	-	6.9	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-
Follow-up Hdwy	-	3.3	-	-	-
Pot Cap-1 Maneuver	0	475	0	-	-
Stage 1	0	-	0	-	-
Stage 2	0	-	0	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	-	475	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	13.03	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	475	-	-
HCM Lane V/C Ratio	-	0.055	-	-
HCM Ctrl Dly (s/v)	-	13	-	-
HCM Lane LOS	-	B	-	-
HCM 95th %tile Q(veh)	-	0.2	-	-

Intersection									
Intersection Delay, s/veh	13.7								
Intersection LOS	B								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		1		1		
Adj Approach Flow, veh/h	234		354		1465		1036		
Demand Flow Rate, veh/h	239		354		1465		1047		
Vehicles Circulating, veh/h	1080		1470		361		257		
Vehicles Exiting, veh/h	224		356		958		1567		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	12.8		21.0		15.8		8.4		
Approach LOS	B		C		C		A		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	R	LT	R	LT	TR	LT	TR	
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR	
RT Channelized									
Lane Util	0.820	0.180	0.537	0.463	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544	
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4	
Entry Flow, veh/h	196	43	190	164	689	776	492	555	
Cap Entry Lane, veh/h	500	567	349	407	1022	1022	1124	1124	
Entry HV Adj Factor	0.981	0.977	1.000	1.000	0.999	1.001	0.990	0.990	
Flow Entry, veh/h	192	42	190	164	689	776	487	549	
Cap Entry, veh/h	490	554	349	407	1022	1023	1113	1112	
V/C Ratio	0.392	0.076	0.544	0.403	0.674	0.759	0.438	0.494	
Control Delay, s/veh	14.0	7.4	24.7	16.7	13.8	17.4	7.9	8.8	
LOS	B	A	C	C	B	C	A	A	
95th %tile Queue, veh	2	0	3	2	5	8	2	3	

Intersection	
Intersection Delay, s/veh	10.8
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	9	223	39	23	107	15	7	56	55	78	87	14
Future Vol, veh/h	9	223	39	23	107	15	7	56	55	78	87	14
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles, %	2	2	2	5	5	5	5	5	5	1	1	1
Mvmt Flow	10	251	44	26	120	17	8	63	62	88	98	16
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	11.8	10.1	9.6	10.8
HCM LOS	B	B	A	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	6%	3%	16%	44%
Vol Thru, %	47%	82%	74%	49%
Vol Right, %	47%	14%	10%	8%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	118	271	145	179
LT Vol	7	9	23	78
Through Vol	56	223	107	87
RT Vol	55	39	15	14
Lane Flow Rate	133	304	163	201
Geometry Grp	1	1	1	1
Degree of Util (X)	0.195	0.427	0.241	0.302
Departure Headway (Hd)	5.284	5.054	5.325	5.4
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	679	716	674	666
Service Time	3.322	3.054	3.361	3.435
HCM Lane V/C Ratio	0.196	0.425	0.242	0.302
HCM Control Delay, s/veh	9.6	11.8	10.1	10.8
HCM Lane LOS	A	B	B	B
HCM 95th-tile Q	0.7	2.1	0.9	1.3

Intersection									
Intersection Delay, s/veh	7.1								
Intersection LOS	A								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		1		1		
Adj Approach Flow, veh/h	22		281		895		945		
Demand Flow Rate, veh/h	22		284		913		955		
Vehicles Circulating, veh/h	1127		733		195		194		
Vehicles Exiting, veh/h	22		375		954		823		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	8.1		7.5		6.9		7.1		
Approach LOS	A		A		A		A		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	R	LT	R	LT	TR	LT	TR	
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR	
RT Channelized									
Lane Util	1.000	0.000	0.606	0.394	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544	
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4	
Entry Flow, veh/h	22	0	172	112	429	484	449	506	
Cap Entry Lane, veh/h	479	545	688	762	1189	1189	1190	1190	
Entry HV Adj Factor	1.000	1.000	0.988	0.991	0.981	0.980	0.989	0.990	
Flow Entry, veh/h	22	0	170	111	421	474	444	501	
Cap Entry, veh/h	479	545	680	755	1166	1166	1178	1178	
V/C Ratio	0.046	0.000	0.250	0.147	0.361	0.407	0.377	0.425	
Control Delay, s/veh	8.1	6.6	8.3	6.3	6.6	7.2	6.8	7.4	
LOS	A	A	A	A	A	A	A	A	
95th %tile Queue, veh	0	0	1	1	2	2	2	2	

Intersection									
Intersection Delay, s/veh	21.4								
Intersection LOS	C								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		2		2		
Adj Approach Flow, veh/h	846		377		861		1007		
Demand Flow Rate, veh/h	863		388		886		1018		
Vehicles Circulating, veh/h	1075		959		986		359		
Vehicles Exiting, veh/h	302		913		952		988		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	33.5		10.9		28.0		9.7		
Approach LOS	D		B		D		A		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	TR	LT	TR	LT	TR	LT	TR	
Assumed Moves	LT	TR	LT	TR	LT	TR	LT	TR	
RT Channelized									
Lane Util	0.470	0.530	0.469	0.531	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.667	2.535	2.667	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.645	4.328	4.645	4.328	
A (Intercept)	1350	1420	1350	1420	1350	1420	1350	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	
Entry Flow, veh/h	406	457	182	206	416	470	478	540	
Cap Entry Lane, veh/h	502	569	559	628	545	614	970	1047	
Entry HV Adj Factor	0.979	0.981	0.974	0.970	0.973	0.971	0.990	0.989	
Flow Entry, veh/h	398	448	177	200	405	456	473	534	
Cap Entry, veh/h	492	559	544	610	530	596	961	1035	
V/C Ratio	0.809	0.803	0.326	0.328	0.763	0.765	0.493	0.516	
Control Delay, s/veh	35.5	31.6	11.4	10.4	29.2	26.8	9.8	9.7	
LOS	E	D	B	B	D	D	A	A	
95th %tile Queue, veh	8	8	1	1	7	7	3	3	

Intersection						
Int Delay, s/veh	0.2					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↗		↑↑	↑↑	
Traffic Vol, veh/h	0	35	0	881	959	22
Future Vol, veh/h	0	35	0	881	959	22
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	0	0	4	4	2	2
Mvmt Flow	0	39	0	990	1078	25

Major/Minor	Minor2	Major1	Major2		
Conflicting Flow All	-	551	-	0	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-
Critical Hdwy	-	6.9	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-
Follow-up Hdwy	-	3.3	-	-	-
Pot Cap-1 Maneuver	0	483	0	-	-
Stage 1	0	-	0	-	-
Stage 2	0	-	0	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	-	483	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	13.11	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	483	-	-
HCM Lane V/C Ratio	-	0.081	-	-
HCM Ctrl Dly (s/v)	-	13.1	-	-
HCM Lane LOS	-	B	-	-
HCM 95th %tile Q(veh)	-	0.3	-	-

Intersection									
Intersection Delay, s/veh	12.0								
Intersection LOS	B								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		1		1		
Adj Approach Flow, veh/h	291		284		1083		1316		
Demand Flow Rate, veh/h	300		293		1093		1329		
Vehicles Circulating, veh/h	1343		1153		455		178		
Vehicles Exiting, veh/h	164		395		1188		1268		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	22.8		12.1		12.1		9.4		
Approach LOS	C		B		B		A		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	R	LT	R	LT	TR	LT	TR	
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR	
RT Channelized									
Lane Util	0.793	0.207	0.519	0.481	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544	
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4	
Entry Flow, veh/h	238	62	152	141	514	579	625	704	
Cap Entry Lane, veh/h	392	453	467	533	939	939	1208	1208	
Entry HV Adj Factor	0.969	0.968	0.968	0.972	0.990	0.991	0.990	0.991	
Flow Entry, veh/h	231	60	147	137	509	574	619	698	
Cap Entry, veh/h	380	439	452	518	929	930	1195	1197	
V/C Ratio	0.606	0.137	0.325	0.265	0.548	0.617	0.518	0.583	
Control Delay, s/veh	26.1	10.2	13.4	10.8	11.2	13.0	8.8	10.0	
LOS	D	B	B	B	B	B	A	B	
95th %tile Queue, veh	4	0	1	1	3	4	3	4	

Intersection						
Int Delay, s/veh	0.9					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑			↑	↑	
Traffic Vol, veh/h	499	1	8	188	10	33
Future Vol, veh/h	499	1	8	188	10	33
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	561	1	9	211	11	37

Major/Minor	Major1	Major2	Minor1	Minor2	Minor3
Conflicting Flow All	0	0	562	0	790
Stage 1	-	-	-	-	561
Stage 2	-	-	-	-	229
Critical Hdwy	-	-	4.12	-	6.42
Critical Hdwy Stg 1	-	-	-	-	5.42
Critical Hdwy Stg 2	-	-	-	-	5.42
Follow-up Hdwy	-	-	2.218	-	3.518
Pot Cap-1 Maneuver	-	-	1010	-	359
Stage 1	-	-	-	-	571
Stage 2	-	-	-	-	809
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1010	-	355
Mov Cap-2 Maneuver	-	-	-	-	355
Stage 1	-	-	-	-	571
Stage 2	-	-	-	-	801

Approach	EB	WB	NB
HCM Ctrl Dly, s/v	0	0.35	13.46
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	474	-	-	73	-
HCM Lane V/C Ratio	0.102	-	-	0.009	-
HCM Ctrl Dly (s/v)	13.5	-	-	8.6	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.3	-	-	0	-

Intersection						
Int Delay, s/veh	1.6					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑			↑	↑	
Traffic Vol, veh/h	529	3	19	192	4	78
Future Vol, veh/h	529	3	19	192	4	78
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	594	3	21	216	4	88

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	0	598	0	854
Stage 1	-	-	-	-	596
Stage 2	-	-	-	-	258
Critical Hdwy	-	-	4.12	-	6.42
Critical Hdwy Stg 1	-	-	-	-	5.42
Critical Hdwy Stg 2	-	-	-	-	5.42
Follow-up Hdwy	-	-	2.218	-	3.518
Pot Cap-1 Maneuver	-	-	979	-	329
Stage 1	-	-	-	-	550
Stage 2	-	-	-	-	785
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	979	-	321
Mov Cap-2 Maneuver	-	-	-	-	321
Stage 1	-	-	-	-	550
Stage 2	-	-	-	-	765

Approach	EB	WB	NB
HCM Ctrl Dly, s/v	0	0.79	14.04
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	490	-	-	162	-
HCM Lane V/C Ratio	0.188	-	-	0.022	-
HCM Ctrl Dly (s/v)	14	-	-	8.8	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.7	-	-	0.1	-

Intersection	
Intersection Delay, s/veh	17.4
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	10	178	17	37	315	60	57	115	24	39	78	15
Future Vol, veh/h	10	178	17	37	315	60	57	115	24	39	78	15
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles, %	2	2	2	1	1	1	0	0	0	0	0	0
Mvmt Flow	12	207	20	43	366	70	66	134	28	45	91	17
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	13	23	13.6	12.1
HCM LOS	B	C	B	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	29%	5%	9%	30%
Vol Thru, %	59%	87%	76%	59%
Vol Right, %	12%	8%	15%	11%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	196	205	412	132
LT Vol	57	10	37	39
Through Vol	115	178	315	78
RT Vol	24	17	60	15
Lane Flow Rate	228	238	479	153
Geometry Grp	1	1	1	1
Degree of Util (X)	0.4	0.399	0.744	0.278
Departure Headway (Hd)	6.32	6.019	5.592	6.518
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	570	598	652	549
Service Time	4.369	4.065	3.592	4.572
HCM Lane V/C Ratio	0.4	0.398	0.735	0.279
HCM Control Delay, s/veh	13.6	13	23	12.1
HCM Lane LOS	B	B	C	B
HCM 95th-tile Q	1.9	1.9	6.6	1.1

Intersection									
Intersection Delay, s/veh	12.5								
Intersection LOS	B								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		1		1		
Adj Approach Flow, veh/h	3		425		1623		1142		
Demand Flow Rate, veh/h	3		425		1623		1153		
Vehicles Circulating, veh/h	1409		1340		153		290		
Vehicles Exiting, veh/h	34		436		1259		1475		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	9.9		22.5		11.7		9.7		
Approach LOS	A		C		B		A		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	R	LT	R	LT	TR	LT	TR	
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR	
RT Channelized									
Lane Util	1.000	0.000	0.602	0.398	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544	
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4	
Entry Flow, veh/h	3	0	256	169	763	860	542	611	
Cap Entry Lane, veh/h	369	429	394	455	1236	1236	1091	1091	
Entry HV Adj Factor	1.000	1.000	1.000	1.000	1.000	1.000	0.990	0.991	
Flow Entry, veh/h	3	0	256	169	763	860	537	605	
Cap Entry, veh/h	369	429	394	455	1235	1236	1080	1080	
V/C Ratio	0.008	0.000	0.651	0.372	0.618	0.696	0.497	0.560	
Control Delay, s/veh	9.9	8.4	27.9	14.4	10.6	12.8	9.1	10.3	
LOS	A	A	D	B	B	B	A	B	
95th %tile Queue, veh	0	0	4	2	5	6	3	4	

Intersection									
Intersection Delay, s/veh	30.5								
Intersection LOS	D								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		2		2		
Adj Approach Flow, veh/h	470		762		1371		1066		
Demand Flow Rate, veh/h	470		762		1371		1076		
Vehicles Circulating, veh/h	1182		1378		534		801		
Vehicles Exiting, veh/h	695		527		1118		1339		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	16.5		60.3		22.1		26.1		
Approach LOS	C		F		C		D		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	TR	LT	TR	LT	TR	LT	TR	
Assumed Moves	LT	TR	LT	TR	LT	TR	LT	TR	
RT Channelized									
Lane Util	0.470	0.530	0.470	0.530	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.667	2.535	2.667	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.645	4.328	4.645	4.328	
A (Intercept)	1350	1420	1350	1420	1350	1420	1350	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	
Entry Flow, veh/h	221	249	358	404	644	727	506	570	
Cap Entry Lane, veh/h	455	520	380	440	826	902	646	719	
Entry HV Adj Factor	1.000	1.000	1.000	1.000	1.001	0.999	0.990	0.991	
Flow Entry, veh/h	221	249	358	404	644	727	501	565	
Cap Entry, veh/h	455	520	380	440	826	901	639	712	
V/C Ratio	0.486	0.479	0.942	0.918	0.780	0.806	0.783	0.793	
Control Delay, s/veh	17.6	15.5	65.8	55.3	21.8	22.3	26.8	25.5	
LOS	C	C	F	F	C	C	D	D	
95th %tile Queue, veh	3	3	10	10	8	9	8	8	

Intersection						
Int Delay, s/veh	0.2					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↗		↑↑	↑↑	
Traffic Vol, veh/h	0	31	0	1487	1031	60
Future Vol, veh/h	0	31	0	1487	1031	60
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	2	2
Mvmt Flow	0	34	0	1616	1121	65

Major/Minor	Minor2	Major1	Major2		
Conflicting Flow All	-	593	-	0	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-
Critical Hdwy	-	6.9	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-
Follow-up Hdwy	-	3.3	-	-	-
Pot Cap-1 Maneuver	0	454	0	-	-
Stage 1	0	-	0	-	-
Stage 2	0	-	0	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	-	454	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	13.57	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	454	-	-
HCM Lane V/C Ratio	-	0.074	-	-
HCM Ctrl Dly (s/v)	-	13.6	-	-
HCM Lane LOS	-	B	-	-
HCM 95th %tile Q(veh)	-	0.2	-	-

Intersection									
Intersection Delay, s/veh	14.3								
Intersection LOS	B								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		1		1		
Adj Approach Flow, veh/h	234		361		1493		1059		
Demand Flow Rate, veh/h	239		361		1493		1070		
Vehicles Circulating, veh/h	1103		1498		365		257		
Vehicles Exiting, veh/h	224		360		977		1602		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	13.2		22.1		16.6		8.6		
Approach LOS	B		C		C		A		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	R	LT	R	LT	TR	LT	TR	
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR	
RT Channelized									
Lane Util	0.820	0.180	0.526	0.474	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544	
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4	
Entry Flow, veh/h	196	43	190	171	702	791	503	567	
Cap Entry Lane, veh/h	489	556	340	397	1019	1019	1124	1124	
Entry HV Adj Factor	0.981	0.977	1.000	1.000	1.000	1.000	0.990	0.990	
Flow Entry, veh/h	192	42	190	171	702	791	498	561	
Cap Entry, veh/h	480	543	340	397	1018	1019	1112	1113	
V/C Ratio	0.401	0.077	0.558	0.430	0.689	0.776	0.448	0.504	
Control Delay, s/veh	14.4	7.6	26.0	17.9	14.4	18.5	8.1	9.0	
LOS	B	A	D	C	B	C	A	A	
95th %tile Queue, veh	2	0	3	2	6	8	2	3	

Intersection						
Int Delay, s/veh	0.6					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑			↑	↑	
Traffic Vol, veh/h	306	4	24	476	6	21
Future Vol, veh/h	306	4	24	476	6	21
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	344	4	27	535	7	24

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	0	348	0	935 346
Stage 1	-	-	-	-	346 -
Stage 2	-	-	-	-	589 -
Critical Hdwy	-	-	4.12	-	6.42 6.22
Critical Hdwy Stg 1	-	-	-	-	5.42 -
Critical Hdwy Stg 2	-	-	-	-	5.42 -
Follow-up Hdwy	-	-	2.218	-	3.518 3.318
Pot Cap-1 Maneuver	-	-	1211	-	295 697
Stage 1	-	-	-	-	716 -
Stage 2	-	-	-	-	555 -
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1211	-	285 697
Mov Cap-2 Maneuver	-	-	-	-	285 -
Stage 1	-	-	-	-	716 -
Stage 2	-	-	-	-	537 -

Approach	EB	WB	NB
HCM Ctrl Dly, s/v	0	0.39	12.24
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	528	-	-	86	-
HCM Lane V/C Ratio	0.057	-	-	0.022	-
HCM Ctrl Dly (s/v)	12.2	-	-	8	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.2	-	-	0.1	-

Intersection						
Int Delay, s/veh	1.1					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑			↑	↑	
Traffic Vol, veh/h	318	9	56	497	3	50
Future Vol, veh/h	318	9	56	497	3	50
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	357	10	63	558	3	56

Major/Minor	Major1	Major2	Minor1	Minor2	Minor3
Conflicting Flow All	0	0	367	0	1047
Stage 1	-	-	-	-	362
Stage 2	-	-	-	-	684
Critical Hdwy	-	-	4.12	-	6.42
Critical Hdwy Stg 1	-	-	-	-	5.42
Critical Hdwy Stg 2	-	-	-	-	5.42
Follow-up Hdwy	-	-	2.218	-	3.518
Pot Cap-1 Maneuver	-	-	1191	-	253
Stage 1	-	-	-	-	704
Stage 2	-	-	-	-	501
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1191	-	233
Mov Cap-2 Maneuver	-	-	-	-	233
Stage 1	-	-	-	-	704
Stage 2	-	-	-	-	463

Approach	EB	WB	NB
HCM Ctrl Dly, s/v	0	0.83	11.48
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	615	-	-	182	-
HCM Lane V/C Ratio	0.097	-	-	0.053	-
HCM Ctrl Dly (s/v)	11.5	-	-	8.2	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.3	-	-	0.2	-

Intersection	
Intersection Delay, s/veh	11.3
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	10	237	43	22	105	16	8	60	58	83	93	16
Future Vol, veh/h	10	237	43	22	105	16	8	60	58	83	93	16
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles, %	2	2	2	5	5	5	5	5	5	1	1	1
Mvmt Flow	11	266	48	25	118	18	9	67	65	93	104	18
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	12.5	10.2	9.9	11.2
HCM LOS	B	B	A	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	6%	3%	15%	43%
Vol Thru, %	48%	82%	73%	48%
Vol Right, %	46%	15%	11%	8%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	126	290	143	192
LT Vol	8	10	22	83
Through Vol	60	237	105	93
RT Vol	58	43	16	16
Lane Flow Rate	142	326	161	216
Geometry Grp	1	1	1	1
Degree of Util (X)	0.212	0.462	0.243	0.329
Departure Headway (Hd)	5.392	5.106	5.446	5.485
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	664	704	659	656
Service Time	3.434	3.14	3.486	3.523
HCM Lane V/C Ratio	0.214	0.463	0.244	0.329
HCM Control Delay, s/veh	9.9	12.5	10.2	11.2
HCM Lane LOS	A	B	B	B
HCM 95th-tile Q	0.8	2.4	0.9	1.4

Intersection									
Intersection Delay, s/veh	7.8								
Intersection LOS	A								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		1		1		
Adj Approach Flow, veh/h	24		311		942		1040		
Demand Flow Rate, veh/h	24		314		961		1050		
Vehicles Circulating, veh/h	1239		770		217		213		
Vehicles Exiting, veh/h	24		408		1046		871		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	9.1		8.1		7.4		7.9		
Approach LOS	A		A		A		A		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	R	LT	R	LT	TR	LT	TR	
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR	
RT Channelized									
Lane Util	1.000	0.000	0.602	0.398	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544	
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4	
Entry Flow, veh/h	24	0	189	125	452	509	494	556	
Cap Entry Lane, veh/h	432	495	665	738	1166	1166	1170	1170	
Entry HV Adj Factor	1.000	1.000	0.989	0.992	0.980	0.981	0.989	0.991	
Flow Entry, veh/h	24	0	187	124	443	499	489	551	
Cap Entry, veh/h	432	495	658	732	1142	1144	1157	1159	
V/C Ratio	0.056	0.000	0.284	0.169	0.388	0.437	0.422	0.475	
Control Delay, s/veh	9.1	7.3	9.1	6.8	7.1	7.7	7.5	8.3	
LOS	A	A	A	A	A	A	A	A	
95th %tile Queue, veh	0	0	1	1	2	2	2	3	

Intersection									
Intersection Delay, s/veh	25.6								
Intersection LOS	D								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		2		2		
Adj Approach Flow, veh/h	804		407		946		1109		
Demand Flow Rate, veh/h	819		419		974		1120		
Vehicles Circulating, veh/h	1187		994		988		370		
Vehicles Exiting, veh/h	303		968		1018		1043		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	40.7		11.9		35.8		11.0		
Approach LOS	E		B		E		B		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	TR	LT	TR	LT	TR	LT	TR	
Assumed Moves	LT	TR	LT	TR	LT	TR	LT	TR	
RT Channelized									
Lane Util	0.470	0.530	0.470	0.530	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.667	2.535	2.667	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.645	4.328	4.645	4.328	
A (Intercept)	1350	1420	1350	1420	1350	1420	1350	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	
Entry Flow, veh/h	385	434	197	222	458	516	526	594	
Cap Entry Lane, veh/h	453	518	541	610	544	613	960	1037	
Entry HV Adj Factor	0.981	0.982	0.970	0.971	0.971	0.971	0.991	0.989	
Flow Entry, veh/h	378	426	191	216	445	501	521	588	
Cap Entry, veh/h	444	508	525	592	528	596	951	1026	
V/C Ratio	0.850	0.838	0.364	0.364	0.842	0.842	0.548	0.573	
Control Delay, s/veh	43.7	38.1	12.6	11.3	37.5	34.3	11.0	11.0	
LOS	E	E	B	B	E	D	B	B	
95th %tile Queue, veh	8	9	2	2	9	9	3	4	

Intersection						
Int Delay, s/veh	0.2					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↗		↑↑	↑↑	
Traffic Vol, veh/h	0	26	0	937	1008	9
Future Vol, veh/h	0	26	0	937	1008	9
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	0	0	4	4	2	2
Mvmt Flow	0	29	0	1053	1133	10

Major/Minor	Minor2	Major1	Major2		
Conflicting Flow All	-	571	-	0	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-
Critical Hdwy	-	6.9	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-
Follow-up Hdwy	-	3.3	-	-	-
Pot Cap-1 Maneuver	0	469	0	-	-
Stage 1	0	-	0	-	-
Stage 2	0	-	0	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	-	469	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	13.19	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	469	-	-
HCM Lane V/C Ratio	-	0.062	-	-
HCM Ctrl Dly (s/v)	-	13.2	-	-
HCM Lane LOS	-	B	-	-
HCM 95th %tile Q(veh)	-	0.2	-	-

Intersection									
Intersection Delay, s/veh	13.7								
Intersection LOS	B								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		1		1		
Adj Approach Flow, veh/h	312		305		1152		1374		
Demand Flow Rate, veh/h	321		314		1163		1387		
Vehicles Circulating, veh/h	1402		1227		481		192		
Vehicles Exiting, veh/h	177		417		1242		1349		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	28.4		13.8		13.9		10.2		
Approach LOS	D		B		B		B		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	R	LT	R	LT	TR	LT	TR	
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR	
RT Channelized									
Lane Util	0.798	0.202	0.525	0.475	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544	
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4	
Entry Flow, veh/h	256	65	165	149	547	616	652	735	
Cap Entry Lane, veh/h	372	431	437	500	917	917	1192	1192	
Entry HV Adj Factor	0.971	0.969	0.970	0.973	0.990	0.991	0.990	0.991	
Flow Entry, veh/h	249	63	160	145	542	611	646	728	
Cap Entry, veh/h	361	418	423	487	907	909	1181	1181	
V/C Ratio	0.689	0.151	0.378	0.298	0.597	0.672	0.547	0.616	
Control Delay, s/veh	32.8	10.9	15.5	12.0	12.6	15.0	9.4	10.9	
LOS	D	B	C	B	B	C	A	B	
95th %tile Queue, veh	5	1	2	1	4	5	3	4	

Intersection	
Intersection Delay, s/veh	20
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	12	181	18	39	332	63	61	123	25	40	84	17
Future Vol, veh/h	12	181	18	39	332	63	61	123	25	40	84	17
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles, %	2	2	2	1	1	1	0	0	0	0	0	0
Mvmt Flow	14	210	21	45	386	73	71	143	29	47	98	20
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	13.9	28	14.6	12.8
HCM LOS	B	D	B	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	29%	6%	9%	28%
Vol Thru, %	59%	86%	76%	60%
Vol Right, %	12%	9%	15%	12%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	209	211	434	141
LT Vol	61	12	39	40
Through Vol	123	181	332	84
RT Vol	25	18	63	17
Lane Flow Rate	243	245	505	164
Geometry Grp	1	1	1	1
Degree of Util (X)	0.44	0.425	0.802	0.307
Departure Headway (Hd)	6.523	6.243	5.722	6.74
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	552	574	631	531
Service Time	4.576	4.298	3.765	4.799
HCM Lane V/C Ratio	0.44	0.427	0.8	0.309
HCM Control Delay, s/veh	14.6	13.9	28	12.8
HCM Lane LOS	B	B	D	B
HCM 95th-tile Q	2.2	2.1	8	1.3

Intersection									
Intersection Delay, s/veh	15.9								
Intersection LOS	C								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		1		1		
Adj Approach Flow, veh/h	5		467		1775		1227		
Demand Flow Rate, veh/h	5		467		1775		1240		
Vehicles Circulating, veh/h	1517		1464		175		316		
Vehicles Exiting, veh/h	39		486		1347		1615		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	11.0		33.3		14.6		11.1		
Approach LOS	B		D		B		B		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	R	LT	R	LT	TR	LT	TR	
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR	
RT Channelized									
Lane Util	1.000	0.000	0.593	0.407	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544	
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4	
Entry Flow, veh/h	5	0	277	190	834	941	583	657	
Cap Entry Lane, veh/h	334	391	351	409	1211	1211	1065	1065	
Entry HV Adj Factor	1.000	1.000	1.000	1.000	1.000	1.000	0.990	0.990	
Flow Entry, veh/h	5	0	277	190	834	941	577	651	
Cap Entry, veh/h	334	391	351	409	1211	1211	1054	1055	
V/C Ratio	0.015	0.000	0.789	0.464	0.689	0.777	0.547	0.617	
Control Delay, s/veh	11.0	9.2	43.5	18.5	12.7	16.3	10.2	11.8	
LOS	B	A	E	C	B	C	B	B	
95th %tile Queue, veh	0	0	7	2	6	8	3	4	

Intersection									
Intersection Delay, s/veh	40.0								
Intersection LOS	E								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		2		2		
Adj Approach Flow, veh/h	439		788		1492		1136		
Demand Flow Rate, veh/h	439		788		1492		1147		
Vehicles Circulating, veh/h	1287		1463		528		792		
Vehicles Exiting, veh/h	652		557		1198		1459		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	18.2		89.6		27.8		30.2		
Approach LOS	C		F		D		D		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	TR	LT	TR	LT	TR	LT	TR	
Assumed Moves	LT	TR	LT	TR	LT	TR	LT	TR	
RT Channelized									
Lane Util	0.469	0.531	0.470	0.530	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.667	2.535	2.667	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.645	4.328	4.645	4.328	
A (Intercept)	1350	1420	1350	1420	1350	1420	1350	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	
Entry Flow, veh/h	206	233	370	418	701	791	539	608	
Cap Entry Lane, veh/h	413	475	351	409	831	907	651	724	
Entry HV Adj Factor	1.002	0.999	1.001	0.999	1.000	1.000	0.991	0.990	
Flow Entry, veh/h	206	233	370	418	701	791	534	602	
Cap Entry, veh/h	414	475	352	409	831	906	645	717	
V/C Ratio	0.499	0.490	1.053	1.021	0.844	0.873	0.827	0.839	
Control Delay, s/veh	19.5	17.1	97.8	82.3	27.1	28.5	30.8	29.7	
LOS	C	C	F	F	D	D	D	D	
95th %tile Queue, veh	3	3	13	13	10	11	9	9	

Intersection						
Int Delay, s/veh	0.1					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↗		↑↑	↑↑	
Traffic Vol, veh/h	0	26	0	1565	1093	21
Future Vol, veh/h	0	26	0	1565	1093	21
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	2	2
Mvmt Flow	0	28	0	1701	1188	23

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	-	605	-	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.9	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.3	-	-	-	-
Pot Cap-1 Maneuver	0	445	0	-	-	-
Stage 1	0	-	0	-	-	-
Stage 2	0	-	0	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	-	445	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	13.63	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	445	-	-
HCM Lane V/C Ratio	-	0.063	-	-
HCM Ctrl Dly (s/v)	-	13.6	-	-
HCM Lane LOS	-	B	-	-
HCM 95th %tile Q(veh)	-	0.2	-	-

Intersection									
Intersection Delay, s/veh	16.9								
Intersection LOS	C								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		1		1		
Adj Approach Flow, veh/h	250		380		1576		1114		
Demand Flow Rate, veh/h	255		380		1576		1125		
Vehicles Circulating, veh/h	1161		1581		385		276		
Vehicles Exiting, veh/h	240		380		1031		1685		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	15.0		27.5		20.0		9.3		
Approach LOS	B		D		C		A		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	R	LT	R	LT	TR	LT	TR	
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR	
RT Channelized									
Lane Util	0.820	0.180	0.537	0.463	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544	
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4	
Entry Flow, veh/h	209	46	204	176	741	835	529	596	
Cap Entry Lane, veh/h	464	529	315	370	1000	1000	1105	1105	
Entry HV Adj Factor	0.982	0.978	1.000	1.000	1.000	1.000	0.990	0.990	
Flow Entry, veh/h	205	45	204	176	741	835	523	590	
Cap Entry, veh/h	456	518	315	370	1000	1001	1093	1094	
V/C Ratio	0.450	0.087	0.647	0.475	0.741	0.835	0.479	0.540	
Control Delay, s/veh	16.5	8.0	33.4	20.6	16.8	22.9	8.7	9.8	
LOS	C	A	D	C	C	C	A	A	
95th %tile Queue, veh	2	0	4	2	7	10	3	3	

Intersection	
Intersection Delay, s/veh	11.6
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	10	243	43	25	122	18	8	60	60	85	93	16
Future Vol, veh/h	10	243	43	25	122	18	8	60	60	85	93	16
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles, %	2	2	2	5	5	5	5	5	5	1	1	1
Mvmt Flow	11	273	48	28	137	20	9	67	67	96	104	18
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	12.9	10.7	10.1	11.5
HCM LOS	B	B	B	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	6%	3%	15%	44%
Vol Thru, %	47%	82%	74%	48%
Vol Right, %	47%	15%	11%	8%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	128	296	165	194
LT Vol	8	10	25	85
Through Vol	60	243	122	93
RT Vol	60	43	18	16
Lane Flow Rate	144	333	185	218
Geometry Grp	1	1	1	1
Degree of Util (X)	0.22	0.479	0.283	0.339
Departure Headway (Hd)	5.501	5.181	5.497	5.594
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	650	695	653	641
Service Time	3.552	3.222	3.545	3.641
HCM Lane V/C Ratio	0.222	0.479	0.283	0.34
HCM Control Delay, s/veh	10.1	12.9	10.7	11.5
HCM Lane LOS	B	B	B	B
HCM 95th-tile Q	0.8	2.6	1.2	1.5

Intersection									
Intersection Delay, s/veh	8.3								
Intersection LOS	A								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		1		1		
Adj Approach Flow, veh/h	24		323		1027		1073		
Demand Flow Rate, veh/h	24		326		1047		1084		
Vehicles Circulating, veh/h	1285		843		217		225		
Vehicles Exiting, veh/h	24		421		1092		944		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	9.5		9.1		8.0		8.3		
Approach LOS	A		A		A		A		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	R	LT	R	LT	TR	LT	TR	
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR	
RT Channelized									
Lane Util	1.000	0.000	0.617	0.383	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544	
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4	
Entry Flow, veh/h	24	0	201	125	492	555	509	575	
Cap Entry Lane, veh/h	414	476	622	694	1166	1166	1157	1157	
Entry HV Adj Factor	1.000	1.000	0.990	0.992	0.981	0.981	0.991	0.989	
Flow Entry, veh/h	24	0	199	124	483	544	504	569	
Cap Entry, veh/h	414	476	615	688	1143	1143	1147	1145	
V/C Ratio	0.058	0.000	0.323	0.180	0.422	0.476	0.440	0.497	
Control Delay, s/veh	9.5	7.6	10.2	7.3	7.5	8.4	7.8	8.7	
LOS	A	A	B	A	A	A	A	A	
95th %tile Queue, veh	0	0	1	1	2	3	2	3	

Intersection									
Intersection Delay, s/veh	52.5								
Intersection LOS	F								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		2		2		
Adj Approach Flow, veh/h	1002		441		975		1148		
Demand Flow Rate, veh/h	1022		455		1004		1160		
Vehicles Circulating, veh/h	1217		1116		1158		436		
Vehicles Exiting, veh/h	379		1046		1081		1135		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	95.2		14.9		72.5		12.9		
Approach LOS	F		B		F		B		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	TR	LT	TR	LT	TR	LT	TR	
Assumed Moves	LT	TR	LT	TR	LT	TR	LT	TR	
RT Channelized									
Lane Util	0.470	0.530	0.470	0.530	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.667	2.535	2.667	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.645	4.328	4.645	4.328	
A (Intercept)	1350	1420	1350	1420	1350	1420	1350	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	
Entry Flow, veh/h	480	542	214	241	472	532	545	615	
Cap Entry Lane, veh/h	441	505	484	550	465	531	904	980	
Entry HV Adj Factor	0.981	0.980	0.969	0.970	0.971	0.971	0.990	0.990	
Flow Entry, veh/h	471	531	207	234	458	517	540	609	
Cap Entry, veh/h	432	495	468	533	452	515	895	970	
V/C Ratio	1.089	1.074	0.443	0.438	1.015	1.003	0.603	0.627	
Control Delay, s/veh	100.4	90.5	15.9	14.1	76.7	68.7	12.9	12.9	
LOS	F	F	C	B	F	F	B	B	
95th %tile Queue, veh	16	17	2	2	14	14	4	5	

Intersection						
Int Delay, s/veh	0.4					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↗		↑↑	↑↑	
Traffic Vol, veh/h	0	54	0	962	1036	44
Future Vol, veh/h	0	54	0	962	1036	44
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	0	0	4	4	2	2
Mvmt Flow	0	61	0	1081	1164	49

Major/Minor	Minor2	Major1	Major2		
Conflicting Flow All	-	607	-	0	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-
Critical Hdwy	-	6.9	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-
Follow-up Hdwy	-	3.3	-	-	-
Pot Cap-1 Maneuver	0	445	0	-	-
Stage 1	0	-	0	-	-
Stage 2	0	-	0	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	-	445	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	14.37	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	445	-	-
HCM Lane V/C Ratio	-	0.136	-	-
HCM Ctrl Dly (s/v)	-	14.4	-	-
HCM Lane LOS	-	B	-	-
HCM 95th %tile Q(veh)	-	0.5	-	-

Intersection									
Intersection Delay, s/veh	14.8								
Intersection LOS	B								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		1		1		
Adj Approach Flow, veh/h	312		311		1177		1444		
Demand Flow Rate, veh/h	321		321		1188		1458		
Vehicles Circulating, veh/h	1473		1252		496		192		
Vehicles Exiting, veh/h	177		432		1298		1381		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	33.4		14.4		14.9		10.9		
Approach LOS	D		B		B		B		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	R	LT	R	LT	TR	LT	TR	
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR	
RT Channelized									
Lane Util	0.798	0.202	0.514	0.486	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544	
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4	
Entry Flow, veh/h	256	65	165	156	558	630	685	773	
Cap Entry Lane, veh/h	348	406	427	490	904	904	1192	1192	
Entry HV Adj Factor	0.971	0.969	0.970	0.968	0.991	0.990	0.991	0.990	
Flow Entry, veh/h	249	63	160	151	553	624	679	765	
Cap Entry, veh/h	338	393	414	474	896	895	1182	1181	
V/C Ratio	0.735	0.160	0.387	0.318	0.617	0.697	0.574	0.648	
Control Delay, s/veh	38.9	11.7	16.0	12.7	13.3	16.2	9.9	11.7	
LOS	E	B	C	B	B	C	A	B	
95th %tile Queue, veh	6	1	2	1	4	6	4	5	

Intersection						
Int Delay, s/veh	2					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑			↑	↑	
Traffic Vol, veh/h	551	5	37	210	16	75
Future Vol, veh/h	551	5	37	210	16	75
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	619	6	42	236	18	84

Major/Minor	Major1	Major2	Minor1	Minor2	Minor3
Conflicting Flow All	0	0	625	0	941
Stage 1	-	-	-	-	622
Stage 2	-	-	-	-	319
Critical Hdwy	-	-	4.12	-	6.42
Critical Hdwy Stg 1	-	-	-	-	5.42
Critical Hdwy Stg 2	-	-	-	-	5.42
Follow-up Hdwy	-	-	2.218	-	3.518
Pot Cap-1 Maneuver	-	-	957	-	292
Stage 1	-	-	-	-	535
Stage 2	-	-	-	-	737
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	957	-	278
Mov Cap-2 Maneuver	-	-	-	-	278
Stage 1	-	-	-	-	535
Stage 2	-	-	-	-	700

Approach	EB	WB	NB
HCM Ctrl Dly, s/v	0	1.34	15.97
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	430	-	-	270	-
HCM Lane V/C Ratio	0.238	-	-	0.043	-
HCM Ctrl Dly (s/v)	16	-	-	8.9	0
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	0.9	-	-	0.1	-

Intersection						
Int Delay, s/veh	2					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	622	4	19	240	7	101
Future Vol, veh/h	622	4	19	240	7	101
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	699	4	21	270	8	113

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	0	703	0	1013 701
Stage 1	-	-	-	-	701 -
Stage 2	-	-	-	-	312 -
Critical Hdwy	-	-	4.12	-	6.42 6.22
Critical Hdwy Stg 1	-	-	-	-	5.42 -
Critical Hdwy Stg 2	-	-	-	-	5.42 -
Follow-up Hdwy	-	-	2.218	-	3.518 3.318
Pot Cap-1 Maneuver	-	-	894	-	265 439
Stage 1	-	-	-	-	492 -
Stage 2	-	-	-	-	742 -
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	894	-	257 439
Mov Cap-2 Maneuver	-	-	-	-	257 -
Stage 1	-	-	-	-	492 -
Stage 2	-	-	-	-	721 -

Approach	EB	WB	NB
HCM Ctrl Dly, s/v	0	0.67	17.04
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	419	-	-	132	-
HCM Lane V/C Ratio	0.289	-	-	0.024	-
HCM Ctrl Dly (s/v)	17	-	-	9.1	0
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	1.2	-	-	0.1	-

Intersection	
Intersection Delay, s/veh	23.7
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	12	202	18	41	348	66	61	123	28	44	84	17
Future Vol, veh/h	12	202	18	41	348	66	61	123	28	44	84	17
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles, %	2	2	2	1	1	1	0	0	0	0	0	0
Mvmt Flow	14	235	21	48	405	77	71	143	33	51	98	20
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	15.3	35.1	15.5	13.5
HCM LOS	C	E	C	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	29%	5%	9%	30%
Vol Thru, %	58%	87%	76%	58%
Vol Right, %	13%	8%	15%	12%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	212	232	455	145
LT Vol	61	12	41	44
Through Vol	123	202	348	84
RT Vol	28	18	66	17
Lane Flow Rate	247	270	529	169
Geometry Grp	1	1	1	1
Degree of Util (X)	0.462	0.48	0.863	0.328
Departure Headway (Hd)	6.747	6.41	5.87	6.995
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	532	558	614	511
Service Time	4.82	4.483	3.926	5.075
HCM Lane V/C Ratio	0.464	0.484	0.862	0.331
HCM Control Delay, s/veh	15.5	15.3	35.1	13.5
HCM Lane LOS	C	C	E	B
HCM 95th-tile Q	2.4	2.6	9.8	1.4

Intersection									
Intersection Delay, s/veh	20.6								
Intersection LOS	C								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		1		1		
Adj Approach Flow, veh/h	5		506		1859		1325		
Demand Flow Rate, veh/h	5		506		1859		1339		
Vehicles Circulating, veh/h	1655		1536		175		355		
Vehicles Exiting, veh/h	39		498		1485		1687		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	12.5		55.5		16.3		13.3		
Approach LOS	B		F		C		B		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	R	LT	R	LT	TR	LT	TR	
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR	
RT Channelized									
Lane Util	1.000	0.000	0.625	0.375	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544	
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4	
Entry Flow, veh/h	5	0	316	190	874	985	629	710	
Cap Entry Lane, veh/h	295	348	329	385	1211	1211	1028	1028	
Entry HV Adj Factor	1.000	1.000	1.000	1.000	1.000	1.000	0.990	0.989	
Flow Entry, veh/h	5	0	316	190	874	985	623	702	
Cap Entry, veh/h	295	348	329	385	1211	1211	1018	1017	
V/C Ratio	0.017	0.000	0.962	0.494	0.722	0.813	0.612	0.691	
Control Delay, s/veh	12.5	10.4	76.5	20.6	13.9	18.4	12.0	14.5	
LOS	B	B	F	C	B	C	B	B	
95th %tile Queue, veh	0	0	10	3	7	10	4	6	

Intersection									
Intersection Delay, s/veh	95.7								
Intersection LOS	F								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		2		2		
Adj Approach Flow, veh/h	621		897		1569		1243		
Demand Flow Rate, veh/h	621		897		1569		1256		
Vehicles Circulating, veh/h	1374		1618		673		978		
Vehicles Exiting, veh/h	860		624		1322		1537		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	35.0		208.7		62.8		85.8		
Approach LOS	D		F		F		F		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	TR	LT	TR	LT	TR	LT	TR	
Assumed Moves	LT	TR	LT	TR	LT	TR	LT	TR	
RT Channelized									
Lane Util	0.470	0.530	0.470	0.530	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.667	2.535	2.667	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.645	4.328	4.645	4.328	
A (Intercept)	1350	1420	1350	1420	1350	1420	1350	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	
Entry Flow, veh/h	292	329	422	475	737	832	590	666	
Cap Entry Lane, veh/h	381	442	305	359	727	801	549	618	
Entry HV Adj Factor	1.000	1.000	0.999	1.001	1.001	0.999	0.991	0.990	
Flow Entry, veh/h	292	329	422	475	737	832	584	659	
Cap Entry, veh/h	381	442	304	359	727	801	544	612	
V/C Ratio	0.766	0.745	1.385	1.324	1.014	1.038	1.075	1.077	
Control Delay, s/veh	38.2	32.1	225.4	194.0	60.7	64.7	87.4	84.4	
LOS	E	D	F	F	F	F	F	F	
95th %tile Queue, veh	6	6	22	22	17	20	18	19	

Intersection						
Int Delay, s/veh	0.2					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↗		↑↑	↑↑	
Traffic Vol, veh/h	0	45	0	1636	1127	132
Future Vol, veh/h	0	45	0	1636	1127	132
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	2	2
Mvmt Flow	0	49	0	1778	1225	143

Major/Minor	Minor2	Major1	Major2		
Conflicting Flow All	-	684	-	0	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-
Critical Hdwy	-	6.9	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-
Follow-up Hdwy	-	3.3	-	-	-
Pot Cap-1 Maneuver	0	396	0	-	-
Stage 1	0	-	0	-	-
Stage 2	0	-	0	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	-	396	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	15.38	0	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	396	-	-
HCM Lane V/C Ratio	-	0.124	-	-
HCM Ctrl Dly (s/v)	-	15.4	-	-
HCM Lane LOS	-	C	-	-
HCM 95th %tile Q(veh)	-	0.4	-	-

Intersection									
Intersection Delay, s/veh	19.1								
Intersection LOS	C								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		1		1		
Adj Approach Flow, veh/h	250		396		1636		1168		
Demand Flow Rate, veh/h	255		396		1636		1180		
Vehicles Circulating, veh/h	1216		1641		396		276		
Vehicles Exiting, veh/h	240		391		1075		1761		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	16.2		31.5		23.2		9.7		
Approach LOS	C		D		C		A		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	R	LT	R	LT	TR	LT	TR	
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR	
RT Channelized									
Lane Util	0.820	0.180	0.515	0.485	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544	
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4	
Entry Flow, veh/h	209	46	204	192	769	867	555	625	
Cap Entry Lane, veh/h	441	505	298	352	990	990	1105	1105	
Entry HV Adj Factor	0.982	0.978	1.000	1.000	1.000	1.000	0.989	0.991	
Flow Entry, veh/h	205	45	204	192	769	867	549	619	
Cap Entry, veh/h	433	494	298	352	990	990	1093	1094	
V/C Ratio	0.474	0.091	0.684	0.546	0.776	0.875	0.502	0.566	
Control Delay, s/veh	17.9	8.5	38.0	24.6	18.9	27.1	9.1	10.3	
LOS	C	A	E	C	C	D	A	B	
95th %tile Queue, veh	2	0	5	3	8	12	3	4	

Intersection						
Int Delay, s/veh	2.4					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑			↑	↑	
Traffic Vol, veh/h	340	15	91	525	16	103
Future Vol, veh/h	340	15	91	525	16	103
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	382	17	102	590	18	116

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	0	399	0	1185 390
Stage 1	-	-	-	-	390 -
Stage 2	-	-	-	-	794 -
Critical Hdwy	-	-	4.12	-	6.42 6.22
Critical Hdwy Stg 1	-	-	-	-	5.42 -
Critical Hdwy Stg 2	-	-	-	-	5.42 -
Follow-up Hdwy	-	-	2.218	-	3.518 3.318
Pot Cap-1 Maneuver	-	-	1160	-	209 658
Stage 1	-	-	-	-	684 -
Stage 2	-	-	-	-	445 -
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1160	-	181 658
Mov Cap-2 Maneuver	-	-	-	-	181 -
Stage 1	-	-	-	-	684 -
Stage 2	-	-	-	-	387 -

Approach	EB	WB	NB
HCM Ctrl Dly, s/v	0	1.24	15.19
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	486	-	-	266	-
HCM Lane V/C Ratio	0.275	-	-	0.088	-
HCM Ctrl Dly (s/v)	15.2	-	-	8.4	0
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	1.1	-	-	0.3	-

Intersection						
Int Delay, s/veh	1.2					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	430	13	56	611	5	65
Future Vol, veh/h	430	13	56	611	5	65
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	483	15	63	687	6	73

Major/Minor	Major1	Major2	Minor1	Minor2	Minor3
Conflicting Flow All	0	0	498	0	1303
Stage 1	-	-	-	-	490
Stage 2	-	-	-	-	812
Critical Hdwy	-	-	4.12	-	6.42
Critical Hdwy Stg 1	-	-	-	-	5.42
Critical Hdwy Stg 2	-	-	-	-	5.42
Follow-up Hdwy	-	-	2.218	-	3.518
Pot Cap-1 Maneuver	-	-	1066	-	177
Stage 1	-	-	-	-	616
Stage 2	-	-	-	-	436
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1066	-	160
Mov Cap-2 Maneuver	-	-	-	-	160
Stage 1	-	-	-	-	616
Stage 2	-	-	-	-	395

Approach	EB	WB	NB
HCM Ctrl Dly, s/v	0	0.72	13.81
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	487	-	-	151	-
HCM Lane V/C Ratio	0.161	-	-	0.059	-
HCM Ctrl Dly (s/v)	13.8	-	-	8.6	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.6	-	-	0.2	-

Appendix C: Intersection Cost Participation Calculations

City of Billings Cost Participation Worksheet: Clearwater Phase 1

Whether a movement pair is critical is based on Phase 1 site-generated traffic, as shown in Exhibit 12 of the report.

1: Central at 48th

Lane Group (critical)	Lanes	AM Peak Hour		PM Peak Hour	
		Vproject	Per Lane	Vproject	Per Lane
EB T	1	3	3	10	10
WB L	1	2	2	1	1
WB T	1	10	10	7	7
EB L	1	No project traffic			
NB T	1	No project traffic			
SB L	1	1	1	2	2
SB T	1	No project traffic			
NB L	1	No project traffic			
Project Critical Lane Volume		11		13	
Critical Lane Capacity		1200		1200	
% Increase		0.9%		1.1%	
Max % Increase		1.1%			

2: Shiloh at Broadwater

Lane Group (critical)	Lanes	AM Peak Hour		PM Peak Hour	
		Vproject	Per Lane	Vproject	Per Lane
EB T	1	No project traffic			
WB L	1	2	2	7	7
WB T	1	No project traffic			
EB L	1	No project traffic			
NB T	2	41	21	26	13
SB L	1	No project traffic			
SB T	2	14	7	40	20
NB L	1	No project traffic			
Project Critical Lane Volume		23		27	
Critical Lane Capacity		1200		1200	
% Increase		1.9%		2.3%	
Max % Increase		2.3%			

3: Shiloh at Central

Lane Group (critical)	Lanes	AM Peak Hour		PM Peak Hour	
		Vproject	Per Lane	Vproject	Per Lane
EB T	2	41	21	26	13
WB L	1	5	5	13	13
WB T	2	9	5	27	14
EB L	1	48	48	31	31
NB T	2	No project traffic			
SB L	1	No project traffic			
SB T	2	5	3	15	8
NB L	1	8	8	22	22
Project Critical Lane Volume		64		75	
Critical Lane Capacity		1200		1200	
% Increase		5.3%		6.3%	
Max % Increase		6.3%			

5: Shiloh at Monad

Lane Group (critical)	Lanes	AM Peak Hour		PM Peak Hour	
		Vproject	Per Lane	Vproject	Per Lane
EB T	1	No project traffic			
WB L	1	No project traffic			
WB T	1	No project traffic			
EB L	1	No project traffic			
NB T	2	9	5	27	14
SB L	1	7	7	4	4
SB T	2	27	14	18	9
NB L	1	No project traffic			
Project Critical Lane Volume		14		18	
Critical Lane Capacity		1200		1200	
% Increase		1.2%		1.5%	
Max % Increase		1.5%			

City of Billings Cost Participation Worksheet: Clearwater Phase 2

Whether a movement pair is critical is based on Phase 2 site-generated traffic, as shown in Exhibit 14 of the report.

1: Central at 48th

Lane Group (critical)	Lanes	AM Peak Hour		PM Peak Hour	
		Vproject	Per Lane	Vproject	Per Lane
EB T	1	3	3	11	11
WB L	1	1	1	1	1
WB T	1	7	7	9	9
EB L	1	No project traffic			
NB T	1	No project traffic			
SB L	1	1	1	2	2
SB T	1	No project traffic			
NB L	1	No project traffic			
Project Critical Lane Volume		8		14	
Critical Lane Capacity		1200		1200	
% Increase		0.7%		1.2%	
Max % Increase		1.2%			

2: Shiloh at Broadwater

Lane Group (critical)	Lanes	AM Peak Hour		PM Peak Hour	
		Vproject	Per Lane	Vproject	Per Lane
EB T	1	No project traffic			
WB L	1	9	9	27	27
WB T	1	No project traffic			
EB L	1	No project traffic			
NB T	2	27	14	36	18
SB L	1	No project traffic			
SB T	2	17	9	46	23
NB L	1	No project traffic			
Project Critical Lane Volume		23		50	
Critical Lane Capacity		1200		1200	
% Increase		1.9%		4.2%	
Max % Increase		4.2%			

3: Shiloh at Central

Lane Group (critical)	Lanes	AM Peak Hour		PM Peak Hour	
		Vproject	Per Lane	Vproject	Per Lane
EB T	2	27	14	36	18
WB L	1	7	7	24	24
WB T	2	10	5	22	11
EB L	1	32	32	42	42
NB T	2	No project traffic			
SB L	1	No project traffic			
SB T	2	8	4	28	14
NB L	1	8	8	19	19
Project Critical Lane Volume		49		86	
Critical Lane Capacity		1200		1200	
% Increase		4.1%		7.2%	
Max % Increase		7.2%			

5: Shiloh at Monad

Lane Group (critical)	Lanes	AM Peak Hour		PM Peak Hour	
		Vproject	Per Lane	Vproject	Per Lane
EB T	1	No project traffic			
WB L	1	No project traffic			
WB T	1	No project traffic			
EB L	1	No project traffic			
NB T	2	11	6	31	16
SB L	1	5	5	6	6
SB T	2	18	9	24	12
NB L	1	No project traffic			
Project Critical Lane Volume		11		22	
Critical Lane Capacity		1200		1200	
% Increase		0.9%		1.8%	
Max % Increase		1.8%			

Planning Board

Date: 05/28/2025
Title: 44 West Subdivision - Preliminary Major Plat - Public Hearing
Presented by: David Green
Department: Planning & Community Services
Presentation: Yes

Information

RECOMMENDATION

Staff recommends the Planning Board hear the staff presentation, conduct a public hearing, and make a recommend to City Council that the preliminary plat of 44 West Subdivision be conditionally approved and the Findings of Fact adopted as presented in the staff report.

BACKGROUND (Consistency with Adopted Plans and Policies, if applicable)

On April 1, 2025, Performance Engineering applied for preliminary minor plat approval for 44 West Subdivision. The proposed subdivision creates 62 lots for residential and commercial development. The proposed commercial area is 0.89 acres. The subject property is generally located south of Central Avenue, and west of Twin Pines Townhomes. The property is zoned NX2 -- Mixed Residential 2 (2 to 8 units) and NX1 Mixed Residential 1 (1 to 4 units).

VARIANCES REQUESTED

No variances from the City Subdivision Regulations have been requested.

PROPOSED CONDITIONS OF APPROVAL

Pursuant to Section 76-3-608(4), MCA, the following conditions are recommended to reasonably minimize potential adverse impacts identified within the Findings of Fact.

1. To minimize the effects on local service, prior to final plat approval, the applicant will coordinate with the USPS to determine what type of deliver system is preferred and to locate and provide the correct amount of space for safely delivering the mail to the residents and businesses.
2. To minimize the effects on local service, prior to final plat approval, the applicant shall provide a proportionate share contribution for improvements as indicated within the Traffic Impact Study and approved by City of Billings Engineering.
3. Minor changes may be made in the SIA and final documents, as requested by the Planning, Legal or Public Works Departments to clarify the documents and bring them into the standard acceptable format.
4. The final plat shall comply with all requirements of the City of Billings Subdivision regulations, rules, policies, and resolutions of the City of Billings, and the laws and Administrative Rules of the State of Montana.

PROCEDURAL HISTORY

- Pre-application meeting January 23, 2025
- Preliminary plat application submitted to Planning Division on April 1, 2025
- Departmental review meeting April 17, 2025
- Subdivision resubmittal April 24, 2025
- Planning Board plat review May 13, 2025
- Planning Board public hearing May 28, 2025
- Preliminary plat to City Council June 23, 2025
- 60 working-day preliminary plat review period ends June 26, 2025

PLAT INFORMATION

General location: South of Central Avenue, and west of Twin Pines Townhomes
Legal Description: Being Lots 4 and 5 of Clearwater Estates Subdivision
Owner/Subdivider: McCall Development, Inc.
Engineer and Surveyor: Performance Engineering

Existing Zoning: NX2 and NX1

Existing land use: Agricultural

Proposed land use: Residential / Commercial

Gross and Net area: 22.67 acres / 20.01 acres

Proposed number of lots: 62

Lot size: Max: 354,171 square feet / 8.13 acres
Min: 1,910 square feet

Parkland requirements: Parkland dedication requirement is 0.46 acres. The applicant is proposing to provide 0.50 acres of parkland.

TRAFFIC IMPACT STUDY OVERVIEW

A traffic accessibility study has been completed for the 44 West Subdivision. All required intersection improvement contributions identified therein shall be completed by the Subdivider at the Subdivider's expense. The percent of traffic contributions to the following intersections shall be in accordance with the traffic accessibility study:

- a. S. 48th and Central -- 0.27%
- b. Shiloh and Broadwater -- 0.56%
- c. Shiloh and Central -- 1.54%
- d. Shiloh and Monad -- 0.37%

The cash contributions shall be based on the percent of traffic contributions to the intersections is based on the total cost of an intersection determined by City Engineering for the year in which the contributions is made. This subdivision will pay its proportional share of the cost of the improvements to intersections studied in the traffic impact study. These cash contributions for the intersection improvement will be made prior to final plat approval.

PARKLAND OVERVIEW:

This subdivision is required to provide 0.46 acres of parkland. The applicant will be providing 0.50 acres of private parkland for this subdivision. The parkland will be maintained by the Homeowner Association. The Parks Department responded that it approved of the parkland being proposed for this subdivision.

STAKEHOLDERS

Planning Board Plat Hearing - May 13, 2025

Staff gave a presentation about the proposed 44 West Subdivision. At the end of the presentation there were comments and several questions from the board. The Board asked a series of questions on the traffic impacts, including: Providing more information regarding turning lane analysis, in general, for the TIS? When is a turning lane required? Are there certain speed limits? Who is typically on the hook for installation? The Board also asked about Bell Avenue: It wanted clarification on whether Bell would be upgraded to a different roadway classification, and what are the future plans for the roadway in this area? The Board also expressed concerns that the two connections for the subdivision both access Central Avenue and will increase the traffic circulation danger of this area. The Board asked if there any traffic-calming measures planned, and if, in future filings, will the City require either of these subdivisions to connect to Rocky Vista Way? Staff told the board the questions would be provided to the Engineering Division to get answers regarding specifics for turn lane requirements and traffic calming for the public hearing meeting. There were also inquiries made about one of the carriage lanes dead ending when it could be connected to a proposed future road. The board member was advised the applicant's agent would clarify this design aspect at the public hearing meeting.

ALTERNATIVES

In accordance with state law, the City Council has 60 working days to act upon this major preliminary plat. The 60 working day review period for the proposed plat ends on June 26, 2025. State and City subdivision regulations also require that preliminary plats be reviewed using specific criteria, as stated within this report. The City may not unreasonably restrict an owner's ability to develop land if the subdivider provides evidence that any identified adverse effects can be mitigated. Within the 60 working day review period, the City Council is required to:

1. Approve;
2. Conditionally Approve; or
3. Deny the Preliminary Plat

FISCAL EFFECTS

This plat will have no fiscal impacts on the City Planning Division.

SUMMARY

One of the purposes of the City's subdivision review process is to identify potential negative effects of property being subdivided. Negative effects that are identified become the subdivider's responsibility to mitigate. Various City departments, private service/utility providers and the affected school district/s, have reviewed this application and provided input on effects and mitigation. The Findings of Fact, which are presented as an attachment, discuss potential negative impacts of the subdivision and conditions of approval are recommended as measures to further mitigate any impacts. In this case, there were found to be minimal impacts from this proposed subdivision.

Attachments

Findings of Fact
Proposed Plat
Draft SIA
Traffic Study

FINDINGS OF FACT

The Planning staff has prepared the Findings of Fact for the preliminary plat of 44 West Subdivision. These findings are based on the preliminary plat application and supplemental documents and address the review criteria required by the Montana Subdivision and Platting Act (76-3-608, MCA) and the Billings Subdivision Regulations (Section 23-303(H), BMCC).

A. What are the effects on agriculture, local services, the natural environment, wildlife, wildlife habitat, and public health, safety and welfare? [MCA 76-3-608 (3) (a) and BMCC 23-302.H.2.]

1. Effect on agriculture and agricultural water user facilities

The subject property has been used for agricultural purposes in the past. The Monad Drain is to the south of this proposed subdivision and is not part of the proposed area to be subdivided. Perimeter ditches and drains shall remain in place and not be altered by the subdivider or subsequent owners. The subdivision should not affect agricultural water users' facilities. With farming activity wildlife habitat has not been maintained. Perimeter areas are good for birds to hide in and smaller ungulates, such as deer.

2. Effect on local services

- a. **Utilities** – Water service will be provided by the City of Billings. A 16-inch water main will be extended along Central Avenue for the proposed subdivision. 12-inch and 8-inch water lines will be provided within the proposed subdivision. 12-inch in the northern area and 8-inch throughout the majority of the subdivision. New individual services will be provided to all the lots, and new fire hydrants will be installed as required by the City Fire Department.

Sanitary sewer service to the subdivision will be by an existing 10-inch sanitary sewer main located within the alleyway along the western boundary at the south end of the Subdivision. The Subdivider is responsible for extending an 8-inch gravity sewer main to Central Avenue via South 44th Street West to allow for future connections to the north of the Subdivision. Sewer lines within the subdivision shall be no smaller than 8-inches in diameter.

The subdivider will install all new water lines and sewer lines in the local streets and individual services for each lot in accordance with design standards, specifications, rules, and regulations of the City of Billings Engineering/Public Works Department and MDEQ. This is outlined in the SIA under the heading VI Utilities.

Private Utilities will be provided from existing facilities to the subdivision. The private utilities will be installed within the Carriage Lane right-of-way and by easements included on the plat, as requested by the utility companies, to provide routes to the Carriage Lanes.

Stormwater – The storm drainage system for 44 West Subdivision, will consist of a curb and gutter surface collection and curb inlets that drain into storm drainage piping, as well as surface conveyance. The Subdivision will be allowed to discharge stormwater into the

Monad Drain as part of its stormwater management strategy. A complete stormwater management plan shall be submitted to the Engineering Division for review and approval at the time of development. This is outlined in the SIA under the heading V. Storm Drainage.

All drainage improvements shall satisfy the criteria set forth by the *City of Billings Stormwater Management Manual* and will be subject to review and approval by the City Engineering Department.

- b. **Solid Waste** – The City of Billings will provide solid waste collection and disposal. The City’s landfill has adequate capacity for this waste.
- c. **Streets** – All internal streets within the subdivision shall be built to grade with a satisfactory subbase, base course, curb and gutter, and asphalt surface. All public roads will be built to provide a 34-foot back-to-back curb street width.

All internal streets and carriage lanes will be built according to the standards of the City of Billings Public Works Department. Street improvements are included in the Waiver of Right to Protest Future Special Improvement Districts.

The sidewalks will be installed by the respective lot owners on a lot-by-lot basis, as lots develop. Sidewalks along the street frontage shall be minimum 5-foot-wide and separated with a boulevard width not less than five feet. The developer will also install all ADA required ramps at the intersections within the proposed subdivision. The developer shall construct the 5-foot-wide boulevard sidewalk adjacent to private parks. This information is all in the SIA under the heading Transportation.

Traffic Impact Study overview:

A traffic accessibility study update has been completed for 44 West Subdivision. All required intersection improvement contributions identified therein shall be completed by the Subdivider at the Subdivider’s expense.

This traffic study was done for both 44 West Subdivision and Clearwater Estates Subdivision 2nd Filing. The traffic study was for when all filings of the subdivisions is built out.

The studied intersections are anticipated to operate similarly to existing conditions at the time this subdivision is fully built out.

Intersection*	Phase 1			Phase 2			Total
	AM	PM	Higher	AM	PM	Higher	
1. S. 48th at Central	0.9%	1.1%	1.1%	0.7%	1.2%	1.2%	2.3%
2. Shiloh at Broadwater	1.9%	2.3%	2.3%	1.9%	4.2%	4.2%	6.5%
3. Shiloh at Central	5.3%	6.3%	6.3%	4.1%	7.2%	7.2%	13.5%
5. Shiloh at Monad	1.2%	1.5%	1.5%	0.9%	1.8%	1.8%	3.3%
Total Participation:			11.2%			14.4%	25.6%
x \$450,000			\$50,400			\$64,800	\$115,200

The cash contributions shall be based on the percent of traffic contributions to the intersections based on the total cost of an intersection as determined. The contributions will be made at the time of final plat. **(Condition #2)**

Street lighting is required for this subdivision. In the SIA the applicant has indicated that street lighting will be installed by private contract or SID. A Street Light Maintenance District will be created for operation and maintenance of the lighting at a future date and is included in the waiver of right to protest.

- d. **Emergency Services** – The Billings Police and Fire Departments will respond to emergencies within the proposed subdivision. The fire station that provides service for this area is Fire Station #7, is located at 1501 54th Street West. The subdivision is located within the ambulance service area of American Medical Response (AMR).
- e. **Schools** – School District #2 provides service to students within this subdivision for elementary through high school. Meadowlark for elementary school, Ben Steele for middle school and West for high school. At the time of the writing of this staff report School District #2 had not responded to requests for comments.
- f. **Parks and Recreation** – This subdivision is required to provide 0.46 acres of parkland. The applicant will be providing 0.50 acres of private parkland for this subdivision. The parkland will be maintained by the Homeowner Association. The Parks Department responded that they approved of the proposed parkland for the subdivision.
- g. **Mail Delivery** - The developer shall coordinate with the United States Postal Service to determine the preferred type and location of mail delivery system for this subdivision. **(Condition #1)**
- h. **Phasing of Development** – This subdivision will not be developed in phases.

3. Effect on the natural environment

The subject property is currently vacant with the proposed use of residential development with a small portion of commercial. The property is not located within a floodplain. During development, storm water pollution prevention best management practices are required to be used and monitored to prevent erosion on exposed ground. Overall, the effect on the natural environment should be minimal.

4. Effect on wildlife and wildlife habitat

There are no known endangered or threatened species on the property. There is a paragraph in the SIA that warns future lot owners of the presence of deer in the area, which may cause damage to their landscaping. This subdivision should have a minimal effect on wildlife and wildlife habitat.

5. Effect on public health, safety and welfare

There will be no significant impacts to public health, safety and welfare because of this subdivision.

B. Was an Environmental Assessment required? [(MCA 76-3-616 and BMCC 23-302.H.1.)]

The proposed subdivision is exempt from the requirement for an Environmental Assessment pursuant to Section 76-3-616, MCA.

C. Does the subdivision conform to the City of Billings 2016 Growth Policy, the 2014 Transportation Plan, and the Billings Area Bikeway and Trail Master Plan? [BMCC 23-302.H.4.]

1. City of Billings 2016 Growth Policy

The proposed subdivision is consistent with the following goals of the Growth Policy:

Strong Neighborhoods (livable, safe, sociable and resilient neighborhoods): Neighborhoods that are safe and attractive and provide essential services are much desired.

Home Base (healthy, safe and diverse housing options): Planning and construction of interconnected sidewalks and trails are important to the economy and livability of Billings.

Essential Investments (relating public and private expenditures to public values): Planning and construction of safe and affordable interconnected sidewalks and trails are important to the economy and livability of Billings.

Developed parks that provide recreation and active living opportunities are desirable for an attractive and healthy community.

3. 2023 Billings Urban Area Long Range Transportation Plan

The proposed subdivision adheres to the goals and objectives of the 2023 Transportation Plan and preserves the street network and street hierarchy specified in the plan.

4. Billings Area Bikeway and Trail Master Plan (BABTMP)

The proposed subdivision is within the Billings Area Bikeways and Trail Master Plan. There are no trails identified within the subdivision. There is a 10-foot-wide bike and pedestrian trail proposed along the south side of Central Avenue. This will be installed by private contract or SIA as outlined in the SIA. No additional improvements of this nature are anticipated.

D. Does the subdivision conform to the Montana Subdivision and Platting Act and to local subdivision regulations? [MCA 76-3-608 (3) (b) and BMCC 23-302.H.3.a.]

The proposed subdivision satisfies the requirements of the Montana Subdivision and Platting Act, and the design standards specified in the local subdivision regulations. The subdivider and the local government have complied with the subdivision review and approval procedures set forth in the local and state subdivision regulations.

E. Does the proposed subdivision conform to all requirements of the zoning in effect? [BMCC 23-302.H.3.e.]

The subject property is located within NX2 – Mixed Residential 2 (2 to 8 units) and NX1 Mixed Residential 1 (1 to 4 units). The lot frontages conform to the requirements of this zone. Other building setbacks and structure specific requirements will be reviewed for compliance at the time of building permit review.

F. Does the proposed plat provide easements for the location and installation of any utilities? [MCA 76-3-608 (3) (c) and BMCC 23-302.H.3.b.]

The subdivider will provide utility easements as requested by private utility companies on the face of the plat.

G. Does the proposed plat provide legal and physical access to each parcel within the subdivision and notation of that access on the plat? [MCA 76-3-608 (3) (d) and BMCC 23-302.H.3.c.]

Legal and physical access to the subdivision will be provided by Central Avenue, South 44th Street West and Tippet Trail. Carriage Lane access is also provided to residential lots within the subdivision.

CONCLUSIONS OF FINDINGS OF FACT

- The preliminary plat of 44 West Subdivision does not create any adverse impacts that warrant denial of the subdivision.
- The proposed subdivision conforms to several of the goals and policies of the 2016 Growth Policy and does not conflict with the Transportation or Bikeway/Trail Plans.
- The proposed subdivision complies with state and local subdivision regulations, local zoning, and sanitary requirements and provides legal and physical access to each lot.
- Any potential negative or adverse impacts will be mitigated with the proposed conditions of approval.

RECOMMENDATION

Staff proposes the Planning Board recommends to City Council that the preliminary plat of 44 West Subdivision, be conditionally approved and the Findings of Fact adopted as presented in the staff report.

**SUBDIVISION IMPROVEMENTS AGREEMENT
& WAIVER OF RIGHT TO PROTEST FUTURE SPECIAL IMPROVEMENT
DISTRICTS**

44 West Subdivision

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(City of Billings)**

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**SUBDIVISION IMPROVEMENTS AGREEMENT
& WAIVER OF RIGHT TO PROTEST FUTURE SPECIAL
IMPROVEMENT DISTRICTS**

44 West Subdivision

This agreement is made and entered into this ____ day of _____, 20__, by and between *44 West Development, LLC*, whose address for the purpose of this agreement is **1536 Mullooney Lane, Suite 100; Billings, Montana 59101**, hereinafter referred to as “Subdivider,” and **CITY OF BILLINGS**, Billings, Montana, hereinafter referred to as “City.”

WITNESSETH:

WHEREAS, the plat of *44 West Subdivision*, located in Yellowstone County, Montana was submitted to the Yellowstone County Board of Planning; and

WHEREAS, at a regular meeting conducted on ____ day of _____, 20__, the Board of Planning recommended conditional approval of a preliminary plat of *44 West Subdivision*; and

WHEREAS, at a regular meeting conducted on ____ day of _____, 20__, the City Council conditionally approved a preliminary plat of *44 West Subdivision*; and

WHEREAS, a Subdivision Improvements Agreement is required by the City prior to the approval of the final plat.

WHEREAS, the provisions of this agreement shall be effective and applicable to *44 West Subdivision* upon the filing of the final plat thereof in the office of the Clerk and Recorder of Yellowstone County, Montana. The Subdivision shall comply with all requirements of the City of Billings Subdivision Regulations, the rules, regulations, policies, and resolutions of the City of Billings, and the laws and administrative rules of the State of Montana.

THEREFORE, THE PARTIES TO THIS AGREEMENT, for and in consideration of the mutual promises herein contained and for other good and valuable consideration, do hereby agree as follows:

I. VARIANCES

A. Subdivider has requested, and the City hereby grants, the following variances by City Council from the strict interpretation of the City’s Subdivision Regulations (Section 23.1101, BMCC):

1. No variances are requested.

II. PROPERTY CONDITIONS AND INFORMATION FOR LOT PURCHASERS

- A.** Lot owners will be required to construct that segment of the required sidewalk that fronts their property at the time of lot development. If sidewalk is not constructed within 5 years, the City has the right to construct the sidewalk and assess the property owners.
- B.** Lot owners should be aware that this subdivision is being built in close proximity to prime deer and antelope habitat and it is likely that homeowners will experience problems with damage to landscaped shrubs, flowers, and gardens. The Montana Fish, Wildlife, and Parks Department does not provide damage assistance unless there is damage to commercial crops and/or a threat to public health and safety.
- C.** Lot owners should be aware that soil characteristics within the area of this subdivision, as described in the 1972 Yellowstone County Soil Survey, indicate that there could be potential limitations for proposed construction on the lots, which may require a geotechnical survey prior to construction.
- D.** No water rights have been transferred to the lot owners. Irrigation ditches that exist on the perimeter of this development are for the benefit of other properties. Perimeter ditches and drains shall remain in place and shall not be altered by the Subdivider or subsequent owners.
- E.** There is attached hereto a Waiver waiving the right to protest the creation of the special improvement district or districts which by this reference is expressly incorporated herein and made as much a part hereof as though fully and completely set forth herein at this point. The Waiver will be filed with the plat, shall run with the land, and shall constitute the guarantee by the Subdivider and property owner or owners of the developments described herein. Said Waiver is effective upon filing and is not conditioned on the completion of the conditions set forth in this Agreement. The Subdivider and owner specifically agree that they are waiving valuable rights and do so voluntarily.
- F.** The subdivider and subsequent contractors/builders acknowledge that there is a Stormwater Pollution and Prevention Plan (SWPPP) filed with the City and the Montana Department of Environmental Quality (MDEQ). This SWPPP shall be adhered to during all phases of construction and shall be updated as required by MDEQ under the General Permit for Stormwater Discharges Associated with Construction Activity, Chapter 28, BMCC and the Billings Stormwater Management Manual.
- G.** Individual lot owners should be aware that Best Management Practices for stormwater control shall be required for new construction on lots. Best Management Practices are defined within Section 28-201, BMCC and detailed in the Billings Stormwater Management Manual.

III. TRANSPORTATION

A. Streets

- All internal access roads and site improvements within the subdivision will be in accordance with the City of Billings Site Development Ordinance, City Zoning Ordinance, the Stormwater Management Manual, and other applicable City codes, rules, and regulations.
- Tippet Trail will be 34 feet back of curb to back of curb. The street improvements will be completed by private contract or SID.
- South 44th Street West will be 48 feet back of curb to back of curb to the intersection with Tippet Trail. The street improvements will be completed by private contract or SID.
- All internal streets to provide a 34-foot back of curb to back of curb street width. The street improvements will be completed by private contract or SID
- A traffic accessibility study has been completed for the *44 West Subdivision*. All required intersection improvement contributions identified therein shall be completed by the Subdivider at the Subdivider's expense. The percent of traffic contributions to the following intersections shall be in accordance with the traffic accessibility study:
 - a. S. 48th and Central – 0.27%
 - b. Shiloh and Broadwater – 0.56%
 - c. Shiloh and Central – 1.54%
 - d. Shiloh and Monad – 0.37%

The cash contributions shall be based on the percent of traffic contributions to the intersections based on the total cost of an intersection as determined by City Engineering for the year in which the contribution is made. These cash contributions for the intersection improvement will be made prior to final plat approval.

B. Carriage Lanes

- All carriage lanes within the subdivision shall be built to grade with a satisfactory subbase, base course, and asphalt surface or concrete surface. All carriage lane approaches constructed with asphalt shall be replaced with concrete by the Subdivider at the time when home construction is complete. In the event asphalt approaches within the subdivision are not replace with concrete within three years of the date of recording of the final plat, the City may construct the concrete approaches and assess the

Subdivider for the costs associated with the approach construction. Carriage Lane pavement widths shall be 12 feet. No trees are allowed to be planted in Carriage Lane rights-of-way. In addition, no shrubs taller than two (2) feet are allowed to be planted in Carriage Lane rights-of-way.

C. Sidewalks

- Individual lot owners will be responsible for the construction of the sidewalks within public right-of-way or easements adjacent to or through their lot at the time of lot construction and shall be included in each building permit. The Subdivider shall construct sidewalk adjacent to private parks at the time of private park development.
- Sidewalks shall be 5-foot wide with a minimum 5-foot boulevard planting strip between the sidewalk and the curb with handicap ramps and aprons installed where necessary.

D. Street Lighting

- Street lighting will be installed by private contract or SID. A Street Light Maintenance District will be created in the future and is included in the waiver of right to protest.

E. Traffic Control Devices

- Street name signs for streets within the subdivision, or located immediately adjacent thereto, shall be furnished and installed in accordance with the specifications of the City of Billings Public Works and Fire Departments.
- No traffic signals are required within this subdivision. Stop signs shall be installed at the intersection of South 44th Street West and Central Avenue.
- The Subdivider shall furnish and install all necessary traffic control devices in accordance with the Manual of Uniform Traffic Control Devices and approved by the City of Billings Public Works Department.

F. Access

- Access to the Subdivision will be provided by Central Avenue, South 44th Street West, Tippet Trail, Wildrye Road, Bluestem Lane, and Junegrass Avenue. Carriage Lane access is also provided to all residential lots within the subdivision.

G. Billings Area Bikeway and Trail Master Plan

- The Subdivision is within the Billings Area Bikeway and Trail Master Plan. A 10-foot-wide multi-use trail will be constructed along Central Avenue. The trail improvements will be completed by private contract or SID.

H. Public Transit

- MET Transit provides services along Central Avenue with the closest stop at the intersection of Central Avenue and Shiloh Road, approximately 0.5 miles east of the Subdivision. No improvements are required to ensure public transit service.

IV. EMERGENCY SERVICE

Construction of buildings made of combustible materials shall have adequate fire apparatus access roads and water supply (fire hydrants) in place to allow for fire suppression requirements. Prior to the issuance of a building permit for construction using combustible materials (i.e. lumber, plywood, wood trusses, etc.), fire apparatus access roads and water supply requirements shall be provided in accordance with the International Fire Code as adopted by the City of Billings.

At a minimum, the following is required:

- An unobstructed gravel road or gravel road base must be within 150 feet of the furthest portion of a building under construction as measured along the approved route.
- The access roads are required to support fire apparatus vehicle loading (40 tons) during all weather conditions and shall be a minimum of twenty (20) feet wide.
- An operational fire hydrant shall be located within 600 feet of the furthest portion of a residence under construction or within 400 feet of the furthest portion of a commercial building under construction as measured along the access roads to the site.
- The above requirements do not alter or effect the current minimum subdivision requirements for fire apparatus access and water supply.

V. STORM DRAINAGE

All drainage improvements shall comply with the provisions set forth in Chapter 28, BMCC, and the Stormwater Management Manual in place at the time of development. Additionally, a comprehensive drainage study has been completed for the Monad Drain with requirements that superseded the Stormwater Management Manual. The *Comprehensive Drainage Plan for the Monad Drain* is on-file at the City Engineering Department. A complete stormwater management plan shall be submitted to the Engineering Division for review and approval at the time of development.

Stormwater drainage will discharge east to Lot 5 or Clearwater Estates Subdivision, 1st Filing. A ditch will convey stormwater drainage south to a stormwater detention facility that is located within an off-site area on Tract 3, Certificate of Survey No. 3844. This detention facility will be sized to accept runoff generated from the *Clearwater Estates Subdivision, 2nd Filing*. The detention facility will outfall to the Monad Drain as described in the *Comprehensive Drainage Plan for the Monad Drain*.

Per the *Comprehensive Drainage Plan for the Monad Drain*, construction of a dike and control structure within the drain will be required as part of a future subdivision of Tract 3 of Certificate of Survey No. 3844, or as determined necessary by City Engineering. These improvements are included as part of the Waiver of Right to Protest a Special Improvement District.

VI. UTILITIES

The Subdivision Improvements Agreement does not constitute an approval for extension of or connection to water mains and sanitary sewers. The property owner shall make application for extension/connection of water mains and sanitary sewers to the Public Works Department – Engineering Division. The extension/connection of/to water mains and sanitary sewers is subject to the approval of the applications and the conditions of approval. Applications shall be submitted for processing prior to the start of any construction and prior to review and approval of any project plans and specifications.

The Developer/Owner acknowledges that the subdivision shall be subject to the applicable System Development Fees in effect at the time new water and/or sanitary sewer service connections are made.

The design/installation of sanitary sewers and appurtenances, and water mains and appurtenances (fire hydrants, etc.) shall be in accordance with design standards, specifications, rules, regulations of and as approved by the City of Billings Public Works Department, Fire Department and the Montana Department of Environmental Quality.

A. Water

- The Subdivision will be extending a 16-inch water main along Central Avenue. The City will reimburse the Subdivider for the cost of upsizing the water main from a 12-inch line to a 16-inch line. If requested by the Subdivider, City staff will forward a Compensation Agreement to City Council for approval of oversizing of the water main in accordance with the City’s Rules and Regulations Governing Water and Wastewater Service.
- A 12-inch water main will be installed along South 44th Street West and Tippet Trail.
- An 8-inch water main will be installed within Wildrye Road, Bluestem Lane, and Junegrass Avenue.

B. Sanitary Sewer

- The Subdivision will be served by an existing 10-inch sanitary sewer main located within the alleyway along the western boundary at the south end of the Subdivision. The Subdivider is responsible for extending an 8-inch gravity sewer main to Central Avenue via South 44th Street West to allow for future connections to the north of the Subdivision.
- Gravity sewer mains no less than 8 inches in diameter will be extended throughout the Subdivision. Mains shall be sized to accommodate future growth inside and outside of the Subdivision.

C. Power, Telephone, Gas, and Cable Television

- Private utility facilities currently exist to serve the subdivision. The private utility facilities will be installed within Carriage Lane right-of-way and by easements included on the plat, as requested by the utility companies, to provide routes to the Carriage Lanes.

VII. PARKS/OPEN SPACE

Section 76-3-621 of the Montana Code Annotated covers the park dedication requirement. Paragraph (1) calls for park area to be 11 percent of the land proposed to be subdivided into parcels of one-half acre or smaller. The required Parkland Dedication for the *44 West Subdivision* is 0.46 acres. Parkland dedications, in the amount of 0.50 acres, are depicted on the face of the plat as PRIVATE PARK.

Parks will be privately owned and maintained by a Private HOA created by the Subdivider.

VIII. POSTAL DELIVERY

The Subdivider shall provide centralized delivery boxes with sufficient pullout to accommodate a mail carrier vehicle. The location of the boxes shall be reviewed and approved by the United States Postal Service.

IX. IRRIGATION

No water rights have been transferred to the lot owners. Irrigation ditches that exist on the perimeter of this development are for the benefit of other properties. Perimeter ditches and drains shall remain in place and shall not be altered by the Subdivider or subsequent owners.

X. SOILS/GEOTECHNICAL STUDY

A soils/geotechnical study has been performed for the subdivision. A copy of this report is included as part of the infrastructure permitting documents and made public record through the Engineering Department. Lot owners and contractors/builders are encouraged to review the report and its recommendations or complete a site-specific geotechnical investigation.

XI. PHASING OF IMPROVEMENTS

The Subdivision is not proposed to be constructed in phases.

XII. FINANCIAL GUARANTEES

Except as otherwise provided, Subdivider shall install and construct said required improvements with cash or by utilizing the mechanics of a private contract secured by letters of credit or a letter of commitment to lend funds from a commercial lender, or by SID. All engineering and legal work in connection with such improvements shall be paid by the contracting parties pursuant to said private contract, and the improvements shall be installed as approved by the City Engineer and Utility Department Manager.

XIII. LEGAL PROVISIONS APPLYING TO SUBDIVIDER

- A.** Subdivider agrees to guarantee all public improvements for a period of two (2) years from the date of final acceptance by the City of Billings.
- B.** The owners of the properties involved in this proposed Subdivision by signature subscribed herein below agree, consent, and shall be bound by the provisions of this Agreement.
- C.** The covenants, agreements, and all statements in this Agreement run with the land and apply to and shall be binding on the heirs, personal representatives, successors, assigns and transferees of the respective parties.

- D.** In the event it becomes necessary for either party to this Agreement to retain an attorney to enforce any of the terms or conditions of this Agreement or to give any notice required herein, then the prevailing party or the party giving notice shall be entitled to reasonable attorney fees and costs.
- E.** Any amendments or modifications of this Agreement or any provisions herein shall be made in writing and executed in the same manner as this original document and shall after execution become a part of this Agreement.
- F.** Subdivider shall comply with all applicable federal, state, and local statutes, ordinances, and administrative regulations during the performance and discharge of its obligations. Subdivider acknowledges and agrees that nothing contained herein shall relieve or exempt it from such compliance.

This agreement is hereby approved and accepted by the City of Billings, this ____ day of _____, 20__.

“CITY”
CITY OF BILLINGS
MONTANA

By: _____
Mayor

Attest: _____
City Clerk

STATE OF MONTANA)
 : ss
County of Yellowstone)

On this ____ day of _____, 20__, before me, a Notary Public in and for the State of Montana, personally appeared _____ and _____, known to me to be the Mayor and City Clerk, respectively, of the City of Billings, Montana, whose names are subscribed to the foregoing instrument in such capacity and acknowledged to me that they executed the same on behalf of the City of Billings, Montana.

Notary Public in and for the State of Montana
Printed Name: _____
Residing at: _____
My commission expires: _____

Waiver of Right to Protest

FUTURE SPECIAL IMPROVEMENTS DISTRICTS

FOR VALUABLE CONSIDERATION, the undersigned, being the Subdivider and all of the owners of the hereinafter described real property, do hereby waive the right to protest the formation of one or more Special Improvement District(s) for a period of no more than twenty years from the recording of this waiver, for street light maintenance and energy, and for the construction of streets, street widening, sidewalks, survey monuments, street name signs, curb and gutter, street lights, driveways, traffic signals, and traffic control devices, parks and park maintenance, trails, sanitary sewer lines, water lines, storm drains (either within or outside the area), and other improvements which the City of Billings may require.

This Waiver and Agreement is independent from all other agreements and is supported by sufficient independent consideration to which the undersigned are parties, and shall run with the land and shall be binding upon the undersigned, their successors and assigns, and the same shall be recorded in the office of the County Clerk and Recorder of Yellowstone County, Montana.

This Waiver is in addition to any other recorded waiver related to the property described herein and is not intended to replace, supersede, or invalidate any such waiver.

The real property hereinabove mentioned is more particularly described as follows:

44 West Subdivision

Signed and dated this _____ day of _____, 20__.

44 West Development, LLC

By: _____

Title: _____

STATE OF MONTANA)
 : ss
County of Yellowstone)

On this ____ day of _____, 20__, before me, a Notary Public in and for the State of Montana, personally appeared _____, known to me to be the _____ of *44 West Development, LLC*, who executed the foregoing instrument and acknowledged to me that he/she executed the same.

Notary Public in and for the State of Montana
Printed Name: _____
Residing at: _____
My commission expires: _____

Clearwater Subdivision

Small/squarer photo here

Traffic Accessibility Study (DRAFT)

Prepared on behalf of:

Performance Engineering

February 2025

Larger/landscape image here – Consider Annafeld cottage view



Traffic Accessibility Study

Prepared for submittal to:



for the project:

Clearwater Subdivision

on behalf of:

Performance Engineering

608 N. 29th Street
Billings, MT 59101

by:

406 Traffic and Transportation Consulting

P.O. Box 249
Bozeman, MT 59771
406.922.7300

(signed stamp here when final)

February 2025

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C: Intersection Cost Participation Calculations

1 INTRODUCTION

This report documents the Traffic Accessibility Study (TAS) conducted for the Clearwater Estates subdivision project in northwest Billings. This is a working title for the project. Some parts of the site could be marketed under a different name before final occupancy.

1.1 PROJECT SITE AND STUDY AREA

The overall subdivision site is shown in **Exhibit 1** along with the intersections studied. The existing study intersections were identified during preapplication review with City of Billing staff as:

1. S. 48th Street West at Central Avenue
2. Shiloh Road at Broadwater Avenue
3. Shiloh Road at Central Avenue
4. Shiloh Road at Bell Avenue
5. Shiloh Road at Monad Road

From here forward in the body of this report, existing intersections are generally referred to only by their distinguishing street names (e.g., “Shiloh at Central”) for the sake of brevity. The two new subdivision access points on the south side of Central Avenue have been analyzed for both future scenarios that include project traffic. In this report, these are generally referred to as the West Access and the East Access. The West access has the working name Double Haul Lane and the East Access has the working name S. 44th Street West in part because it is situated approximately halfway between Shiloh Road and S. 48th Street West. The site’s third access will be to existing Bell Avenue, which will be extended west into the site and, while not fully continuous, terminate at the western property edge. The western terminus of Bell will be built to accommodate a future connection to the property west of this site, but no specific street connection has been planned there at the time of this study. The east-west Bell Avenue alignment generally separates the subdivision site into northern and southern parts of similar size.

1.2 LAND USE AND PHASING

The site is currently agricultural land. The subdivision’s proposed land use will be almost exclusively residential, with 194 single-family detached homes and 262 attached ones. The latter will include duplexes, attached multi-story row houses (townhomes), and “cottage” units that would be smaller units not directly classifiable as apartments. One commercial lot sized to support a 25,000 square-foot building will be situated at the northwest corner of the site, abutting Central Avenue and Double Haul Lane.

The project is divided into two logical phases. All 262 of the “attached” type of residential units are included in Phase 1 and are located on the northern part of the site. Phase 1 also includes about one third (66) of the total single-family detached units. Phase 2 includes the commercial parcel and all residential lots on the southern part of the site, which are for the remaining 128 single-family homes.

Because the site is self-contained and generally rural today, the types and locations of specific pathways or other facilities for pedestrians and bicycles have not yet been identified. A brief examination of potential traffic calming needs indicated that the absence of long streets without homes on them will strongly limit the need for such measures. On-street parking is expected to be allowed throughout the site wherever street width is sufficient for it.

Exhibit 2 shows the Clearwater Estates site plan on which the analysis here is based. It includes land use types, streets, alleys, access points, and park parcels.

Exhibit 1. Overall Site Location and Study Intersections



Exhibit 2. Clearwater Estates Subdivision Site Plan



Excerpted from: Performance Engineering drawing provided 1/31/2025

1.3 ANALYSIS METHODS AND REFERENCES

Raw field traffic counts were gathered from other recent traffic study work in the area by Sanbell and provided to the Clearwater applicant team. These raw counts were then adjusted slightly for this TAS based on both (a) recent traffic growth and (b) 2024 City of Billings annualization factors prior to their use in impact analysis.

Trip generation rates, or equations as applicable, are from the Institute of Transportation Engineers (ITE) Trip Generation suite’s 11th edition. ITE trip generation data, when aggregated across enough varied sites, produce both simple average rates and best-fit equations, either linear or logarithmic, to help the analyst derive proper estimates for their situation. Equations are generally preferred over rates, especially for larger sites where trip generation per unit of land use can diminish with increasing project size. General ITE guidance calls for the use of the fitted curve equation when the data set for the land use type in question is comprised of studies from 20 or more separate sites and when the equation produces a correlation coefficient (R²) of 0.75 or higher, with 1.0 being the best possible fit.

Operational performance was analyzed at the study intersections through the use of the industry-standard methods presented in the USDOT’s Highway Capacity Manual (HCM), published in its modern form as Transportation Research Board Special Report 209. Synchro Studio 12 was employed as both a data repository and a capacity analysis tool, with reports for each intersection generated using Synchro’s application of the assumptions of the HCM’s 7th edition, the most recent available at the time of this study.

The HCM methodology for intersection capacity analysis produces delay estimates for each turning movement (or “lane group”, when multiple turning movements operate from the same lane). These delay estimates are assigned Level of Service (LOS) grades that range from A (best) to F (worst), as indicated in **Exhibit 3**. It’s also important to note that for unsignalized intersections with only side-street Stop sign control, LOS for the intersection is represented by the LOS for the worst lane group. “T” intersections with side-street stop control also fall under this category. All stop-controlled intersections in this study area, including the two new proposed accesses to Central, are “T” intersections, where the approach on the stem of the T, rather than a main street turning movement, contains the worst lane group.

Operations impacts are determined by how peak hour LOS relates to acceptability standards. Billings employs a LOS standard of C or better. When LOS without the project is D or worse, an operations impact is defined when the project would increase delay.

Exhibit 3. LOS Definitions

LOS	Delay, seconds per vehicle
A	0 - 10.0
B	10.1 - 15.0
C	15.1 - 25.0
D	25.1 - 35.0
E	35.1 - 50.0
F	50.1 or more

Source: HCM 7th Edition

2 EXISTING AND BACKGROUND CONDITIONS

2.1 STREETS AND INTERSECTIONS

Shiloh Road, which also carries the designation of MT-302, is a north-south urban principal arterial with two travel lanes in each direction and a speed limit of 45 mph in the study area. Shiloh Road has been a key facilitator of the city’s westward expansion, with substantial residential and commercial growth having occurred adjacent to it in recent years. It is characterized by a series of roundabouts at intersections with several of western Billings’s east-west arterials and collectors. It also provides access to Interstate 90 via Zoo Drive to the south. A raised median prevents left turns at many two-way stop-controlled intersections, including the one at Bell Avenue. Exclusive left-turn lanes exist at a few select site accesses and local streets. A sidewalk runs along the east side of the road, and a shared-use path called Shiloh Road Trail runs along the west side, much of it separated from the road by a large ditch. There are also two MET Transit bus stops on its east side between the Broadwater and Central roundabouts. These are not considered to be close enough to the project to site to provide meaningful transit access.

Central Avenue is an east-west road that is classified as an urban collector to the west of Shiloh Road and as an urban principal arterial to the east of it. Accordingly, it has one travel lane in each direction to the west of Shiloh, and two travel lanes in each direction to the east of it. It has a speed limit of 45 mph on both sides of Shiloh Road, but it becomes 50 mph to the west of 48th St W. It connects residential neighborhoods to many of western Billings' commercial centers. Central currently has no exclusive turning lanes or parallel multimodal facilities to the west of Shiloh Road.

48th Street W is a north-south local road with one travel lane in each direction. It has a speed limit of 45 mph to the north of Central Avenue and 50 mph to the south of it. It links residences and agricultural properties on the western edges of Billings to the east-west routes that lead into the city, such as Central Avenue and King Avenue. No exclusive turning lanes or multimodal facilities currently exist on 48th in the study area.

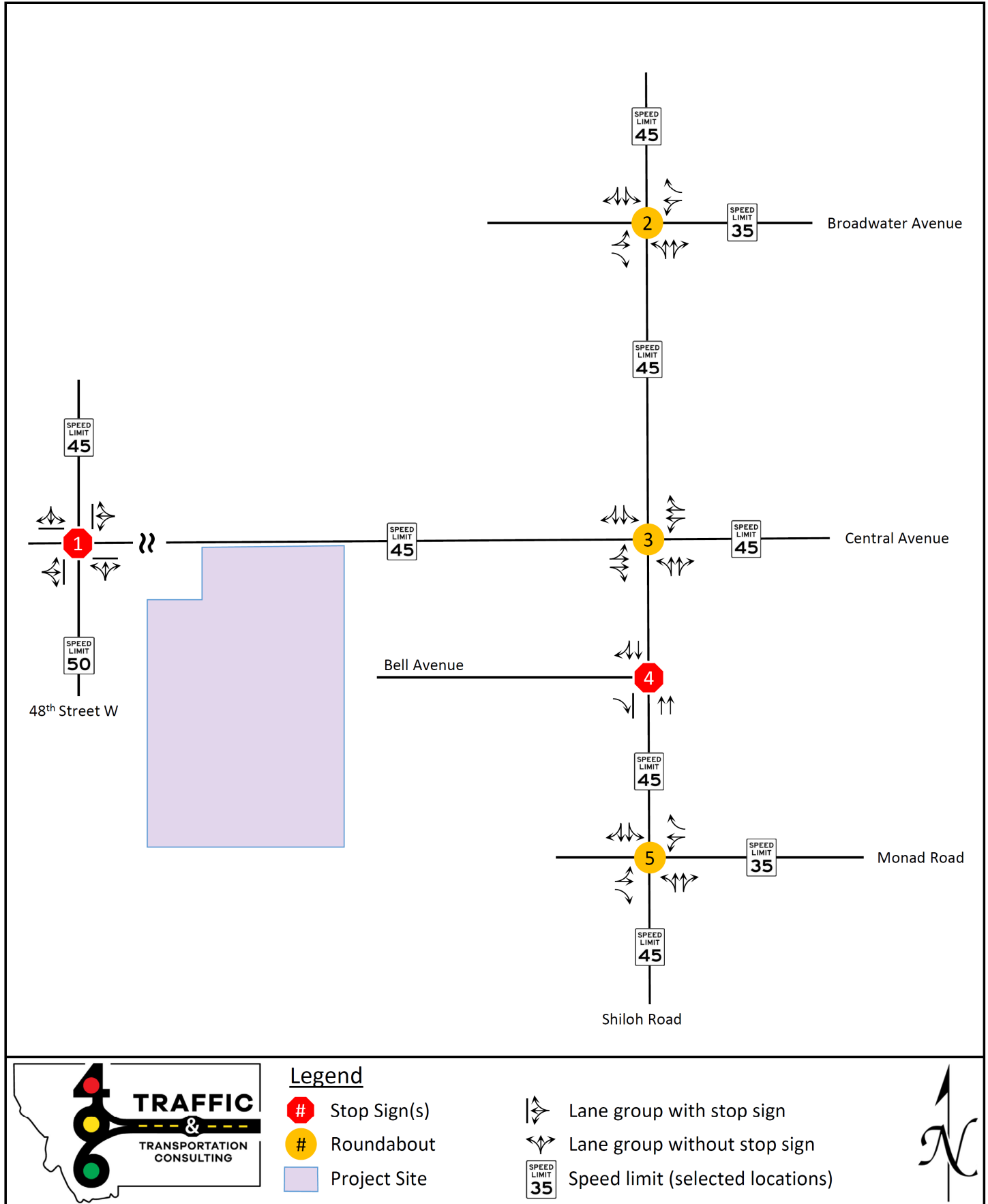
Bell Avenue is an east-west local street with one travel lane in each direction and no posted speed limit. Currently, it provides access to Shiloh Road for a private senior living community and a few other residences. Its eastern terminus is at its intersection with Shiloh Road, where left turns are prohibited. Its western terminus is at a dead-end approximately 2300 ft to the west of this intersection, just past Big Pine Court. While three other streets that intersect Bell Avenue also lead to Central Avenue, these streets traverse private property. As such, Bell Avenue has no outlet for non-residents. The street has no exclusive turning lanes or bike infrastructure, but there is a sidewalk along most of its northern side, starting from the Shiloh Road Trail.

Monad Road is an east-west road that is classified as an urban major collector to the east of Shiloh Road and as a local street to the west of it. West of Shiloh it has one travel lane in each direction, as well as a center left-turn lane. Its speed limit is 35 mph to the east of Shiloh, but it does not have a speed limit posted on the west side. It connects many of western Billings' residential neighborhoods to the industrial areas near the railroad tracks and to north-south routes such as 32nd St W and 24th St W that lead to large commercial centers. It has exclusive right-turn lanes on the east and west legs of the roundabout at Shiloh Road, as well as an exclusive left-turn lane at Henry Chapple Street. To the east of Shiloh Road, there are sidewalks, designated on-street parking, and unprotected bike lanes on both sides of the road. To the west of Shiloh, there is a shared-use path on much of the north side and a sidewalk on much of the south side of the street. There are also two nearby MET Transit bus stops on the south side of the road: one at Henry Chapple Street and the other at Hurdle Circle.

Broadwater Avenue is an east-west urban principal arterial with one travel lane in each direction and a speed limit of 35 mph in the study area. It serves as a link between residential neighborhoods in western Billings, some small commercial centers, and downtown Billings. Its eastern terminus is at its intersection with Division Street, 1st Ave N, and N 36th Street near downtown. Its western terminus is at a roundabout intersection with Shiloh Road. Currently, the roundabout's west leg only connects to two agricultural lots in active use, but the roundabout's infrastructure here has been built out in preparation for potential westward extension of the road. 48th St W also intersects a road called Broadwater Avenue, but this local road segment is currently disconnected from the rest of the arterial network and is only accessible via 48th St W. The arterial Broadwater Avenue has an exclusive westbound right-turn lane at the Shiloh roundabout. There is a shared-use path on the road's north side, and there is a sidewalk on the road's south side extending east.

Intersection traffic control comes in only two forms at the five existing study intersections: two-way stop control (TWSC) and roundabouts. Each leg of the three roundabouts has a crosswalk with a pedestrian refuge in the splitter island. Most of these crosswalks have two solar-powered rectangular rapidly flashing beacons. The intersection of Shiloh Road and Bell Avenue is considered two-way stop-controlled even though only one direction of traffic is stop-controlled. Only four movements are permitted at this intersection: northbound and southbound through movements and southbound and eastbound rights. Shiloh Road's center median prevents all left turns. The intersection of 48th Street and Central Avenue is all-way stop-controlled and is augmented with flashing red beacons facing all four directions. **Exhibit 4** shows traffic control and lane arrangements schematically at each existing intersection as well as posted speed limits on selected road segments.

Exhibit 4. Existing Road and Intersection Basics



Legend

- Stop Sign(s)
- Roundabout
- Project Site

- Lane group with stop sign
- Lane group without stop sign
- Speed limit (selected locations)



2.2 EXISTING TRAFFIC VOLUMES

Existing (2024) annualized volumes were estimated as described earlier in subsection 1.3 and are shown in **Exhibit 5**.

2.3 HISTORIC GROWTH AND BACKGROUND CONDITION TRAFFIC

The “Background Condition” described here is represented by the volumes and intersection performance after several years of traffic growth assumed to occur during the permitting, construction, and initial occupancy of Phase 1. This work is expected to take place in 2025, 2026, and 2027. Allowing for an additional year to ensure full/normal occupancy and for tripmaking behavior by residents to normalize, existing traffic at study intersections was grown to the year 2028. The resulting volumes and operating conditions form the basis for evaluating marginal delay effects of traffic generated by Phase 1 of the Clearwater Estates subdivision.

Phase 2 is currently projected by the applicant team to follow Phase 1 by approximately three years. As such, the study year for Phase 2 traffic is 2031, and traffic was grown in the same way to derive background volumes for that year.

In order to estimate traffic growth without the project, average daily traffic volumes were gathered from selected MDT periodic data collection locations in the study area. The best and most logical data set available was represented by the four legs of the Shiloh intersection at Central. Data were recorded or estimated by MDT annually on each leg dating back at least 20 years. This historical traffic information is shown in the chart in **Exhibit 6**.

Counts from the most recent 10 of these years were used to calculate the average annual growth rate in daily traffic for these four locations in aggregate, which was approximately 3.8% per year. This rate was then applied to the annualized peak hour intersection counts for the Phase 1 and Phase 2 study years. The resulting Background condition traffic volumes are shown for 2028 and 2031 in **Exhibits 7** and **8**, respectively.

Exhibit 5. Existing Traffic Volumes

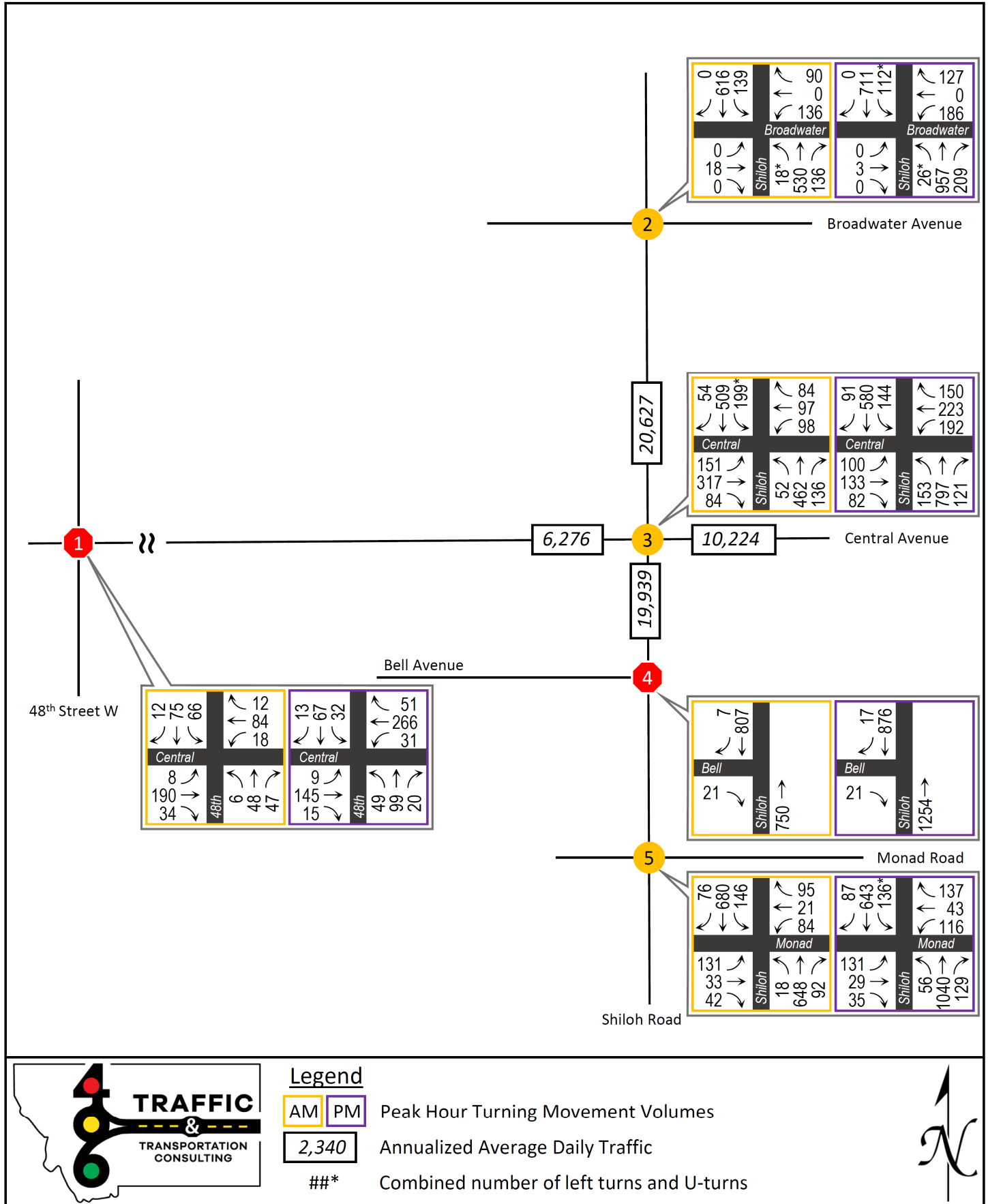


Exhibit 6. Historical Daily Traffic Volumes

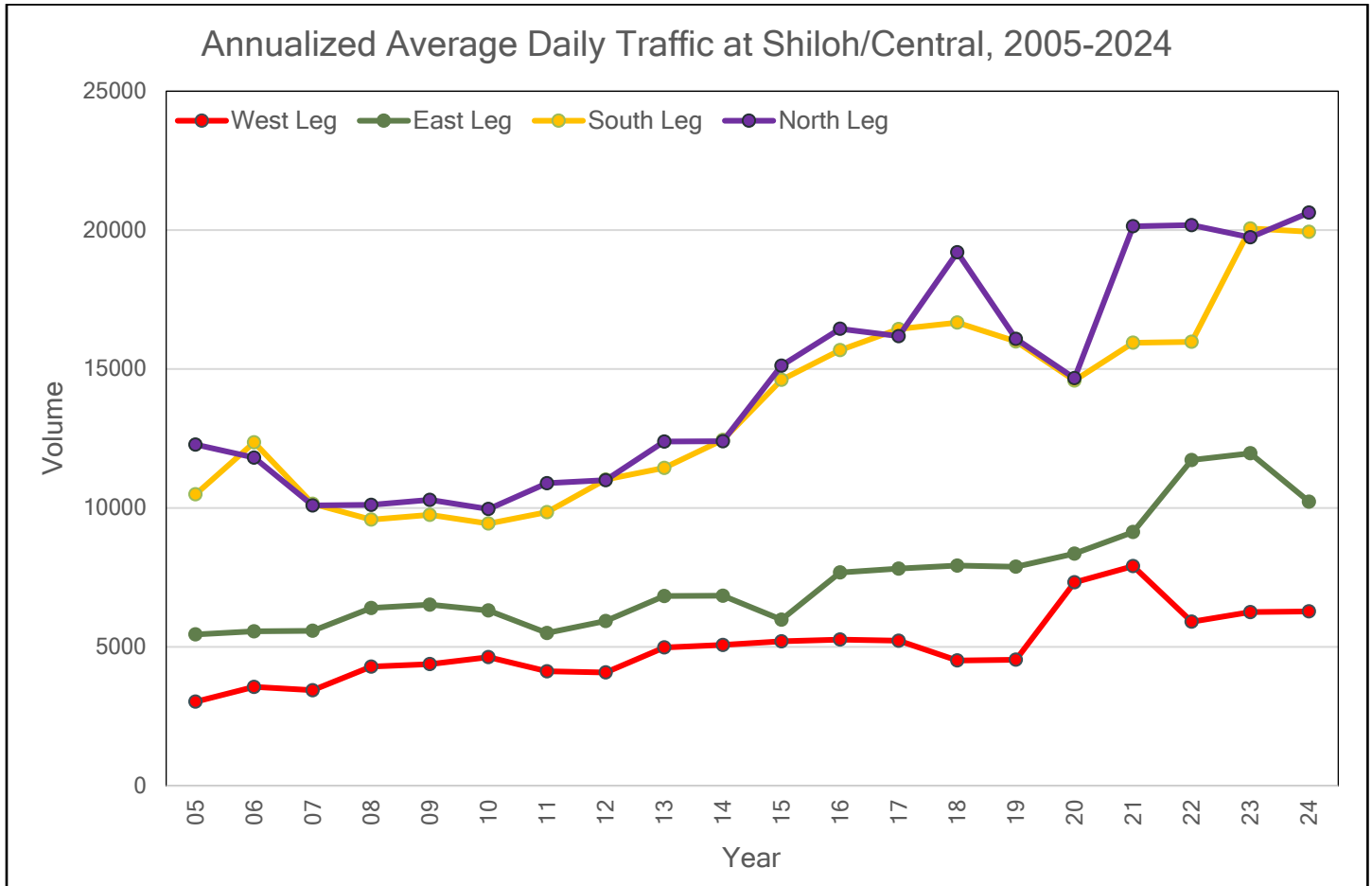


Exhibit 7. 2028 Background Traffic Volumes

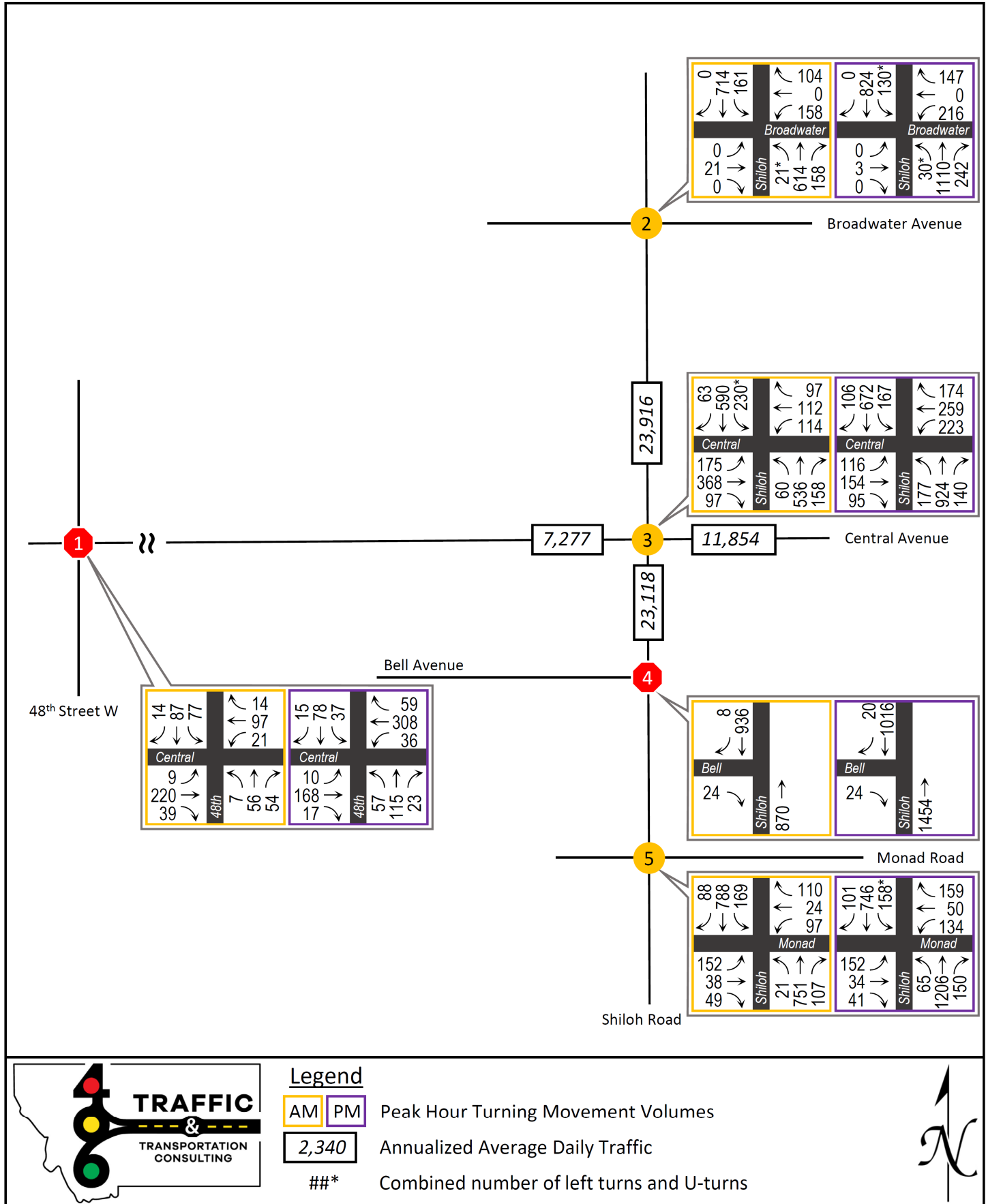
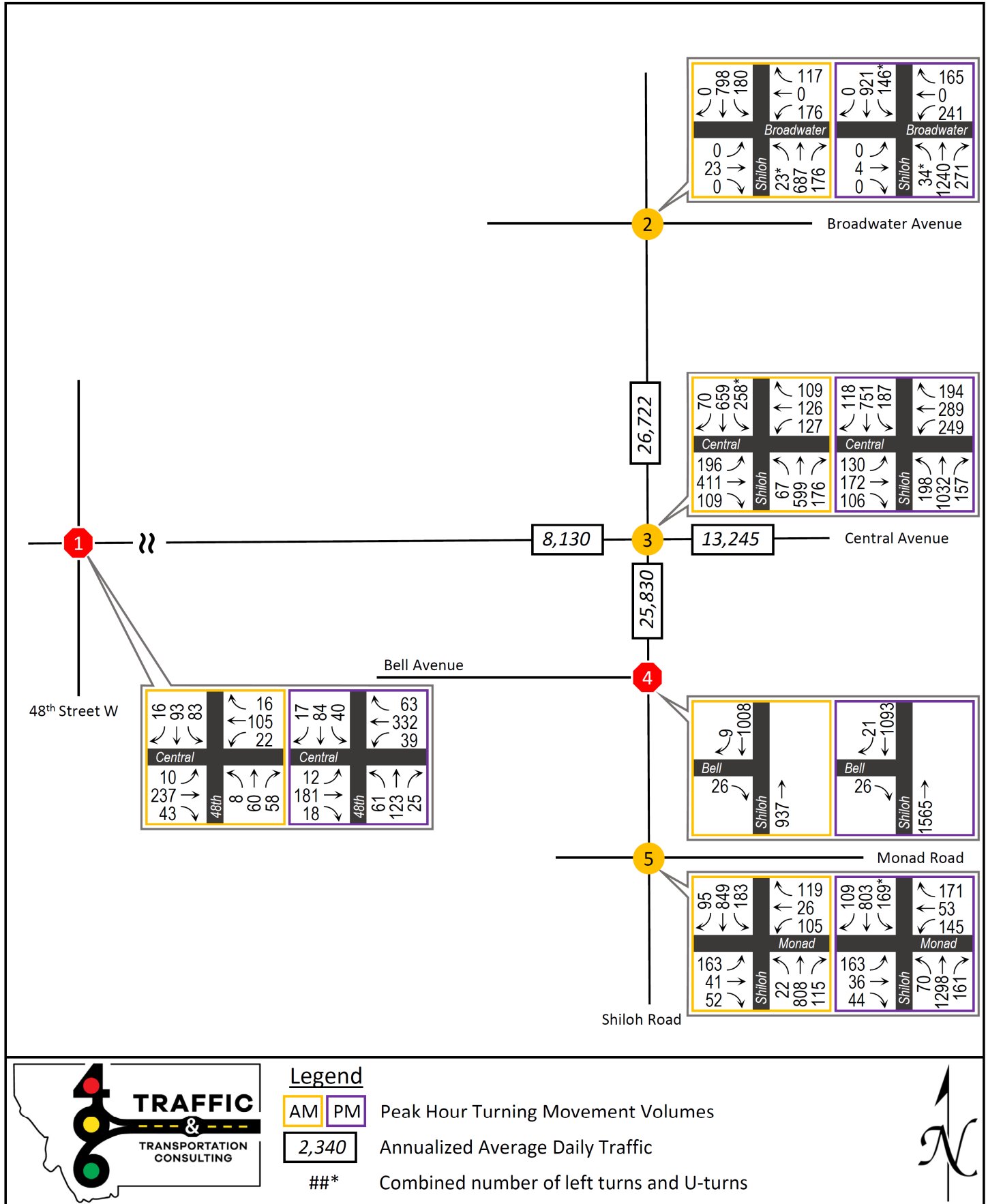


Exhibit 8. 2031 Background Traffic Volumes



2.4 INTERSECTION TRAFFIC OPERATIONS WITHOUT THE PROJECT

The existing and background peak hour intersection Level of Service (LOS) and delay results are shown in **Exhibit 9**. Analysis software results are provided in Appendix B.

Exhibit 9. Existing and Future Background Intersection LOS and Delay

	Intersection	Traffic Control	Peak Hour LOS (delay, in seconds/vehicle)		
			Existing	2028 Background	2031 Background
AM Peak Hour	1. 48 th at Central	AWSC	A (9.6)	B (10.6)	B (11.3)
	2. Shiloh at Broadwater	Roundabout	A (6.0)	A (6.9)	A (7.8)
	3. Shiloh at Central	Roundabout	B (11.2)	C (16.2)	D (25.6)
	4. Shiloh at Bell	TWSC*	B (11.8)	B (12.6)	B (13.2)
	5. Shiloh at Monad	Roundabout	A (9.0)	B (11.6)	B (13.7)
PM Peak Hour	1. 48 th at Central	AWSC	B (12.7)	C (16.1)	C (20.0)
	2. Shiloh at Broadwater	Roundabout	A (9.1)	B (11.8)	C (15.9)
	3. Shiloh at Central	Roundabout	B (13.6)	C (21.9)	E (40.0)
	4. Shiloh at Bell	TWSC*	B (12.1)	B (13.0)	B (13.6)
	5. Shiloh at Monad	Roundabout	B (10.0)	B (13.7)	C (16.9)

* Worst lane group is Eastbound at Intersection 4.

The results in the table indicate that in 2028, all intersections would meet the City's LOS standard of C or better. By 2031, background LOS at the Shiloh/Central roundabout is projected to degrade beyond that standard in both peak hours. Analysis details indicate that in the more severe peak (PM), the longest delays (around 1.5 minutes per vehicle) and queues (13 vehicles, at Synchro's 95th percentile design level) would be for the westbound approach. This background queue would be long enough to block the existing right-in/right-out access for the small mixed-use property on the northwest corner of the intersection, but not to block its $\frac{3}{4}$ access location farther east on Central.

3 PROJECT TRIP GENERATION AND DISTRIBUTION

3.1 TRIP GENERATION

Trip generation rates, or equations as applicable, are from the Institute of Transportation Engineers (ITE) Trip Generation package's 11th edition. ITE trip generation data, when aggregated across enough varied sites, produce both simple average rates and best-fit equations, either linear or logarithmic, to help the analyst derive proper estimates for their situation. Equations are generally preferred over rates, especially for larger sites where trip generation per unit of land use can diminish with increasing project size.

Clearwater Estates will consist almost entirely of residential land uses. Small park areas within the subdivision are designed and intended for use by residents and their guests, and will be similar to park spaces located in other residential areas around Billings. For that reason, they will not generate external traffic. The strip retail space in Phase 2, programmed for 25,000 square feet, has not had specific tenants or any sub-type(s) of retail use identified, but no drive-through activity is expected.

Three types of adjustments to trip generation were evaluated for this project. First, a discount is sometimes taken to reflect internal capture where multiple uses are present in a single project site. Second, a modal adjustment can be taken if a facility is clearly served by robust high-capacity transit and serves a clientele inclined to use transit to get there, or if the potential land use mix and walk/bike network are likely to lead to nonmotorized trips, either internal or external. Finally, some land uses such as gas stations or coffee shops attract trips that were already using the adjacent or nearby road network by virtue of improved convenience over a similar site that could have been used before. These are called "pass-by" and "diverted-linked" trips. Pass-by trips are those on streets bordering the site, while diverted-linked trips are those that might go slightly out of their way to stop at the establishment on their way to their destination.

The Phase 2 retail parcel is the only part of the site considered for these discounts. Due to its location, small size, and expected similarity to other sites along the Central Avenue corridor, only small discounts of the first two types were assumed here; it is not expected to support a use special enough or large enough to generate pass-by or diverted-linked trip activity. The estimate of combined reduction in vehicle trip use for the retail site due to (a) Clearwater residents' use and (b) nonmotorized trips applied here is 10%. **Exhibit 10** shows trip generation details for both phases of the project.

Exhibit 10. Clearwater Estates Trip Generation

	Daily	AM Peak Hour	PM Peak Hour
Phase 1: Single-Family Detached Housing – X = 66 dwelling units			
ITE Land Use 210 equation	$\text{Ln}(T)=0.92(X) + 2.68$	$\text{Ln}(T)=0.91(X) + 0.12$	$T=0.60(X) - 3.93$
Peak hour in/out split		25% / 75%	63% / 37%
Trips	688	51 (13 in / 38 out)	67 (42 in / 25 out)
Phase 1: Single-Family Attached Housing (combined townhome, duplex, and "cottage") – X = 262 dwelling units			
ITE Land Use 215 equation	$T=7.62(X) - 50.48$	$T=0.52(X) - 5.70$	$T=0.60(X) - 3.93$
Peak hour in/out split		25% / 75%	59% / 41%
Trips	1,946	131 (33 in / 98 out)	153 (90 in / 63 out)
Phase 1 Total Trips	2,634	182 (46 in / 136 out)	221 (133 in / 88 out)
Phase 2: Single-Family Detached Housing – X = 128 dwelling units			
ITE Land Use 210 equation	$\text{Ln}(T)=0.92(X) + 2.68$	$\text{Ln}(T)=0.91(X) + 0.12$	$T=0.60(X) - 3.93$
Peak hour in/out split		25% / 75%	63% / 37%
Trips	1,266	93 (23 in / 70 out)	125 (79 in / 46 out)
Phase 2: Strip Retail Plaza – X = 25,000 square feet			
ITE Land Use 822 equation	$T=42.2(X) + 229.68$	$T=2.36(X)$	$T=6.59(X)$
Peak hour in/out split		60% / 40%	50% / 50%
Gross total trips	1,285	59 (35 in / 24 out)	165 (83 in / 82 out)
Less 10% internal + walk/bike	-128	-6 (4 in / 2 out)	-16 (8 in / 8 out)
Net trips	1,157	53 (31 in / 22 out)	149 (75 in, 74 out)
Combined net trips, both phases:	5,057	328 (101 in / 227 out)	494 (286 in / 208 out)

Source: Equations from ITE Trip Generation, 11th Edition.

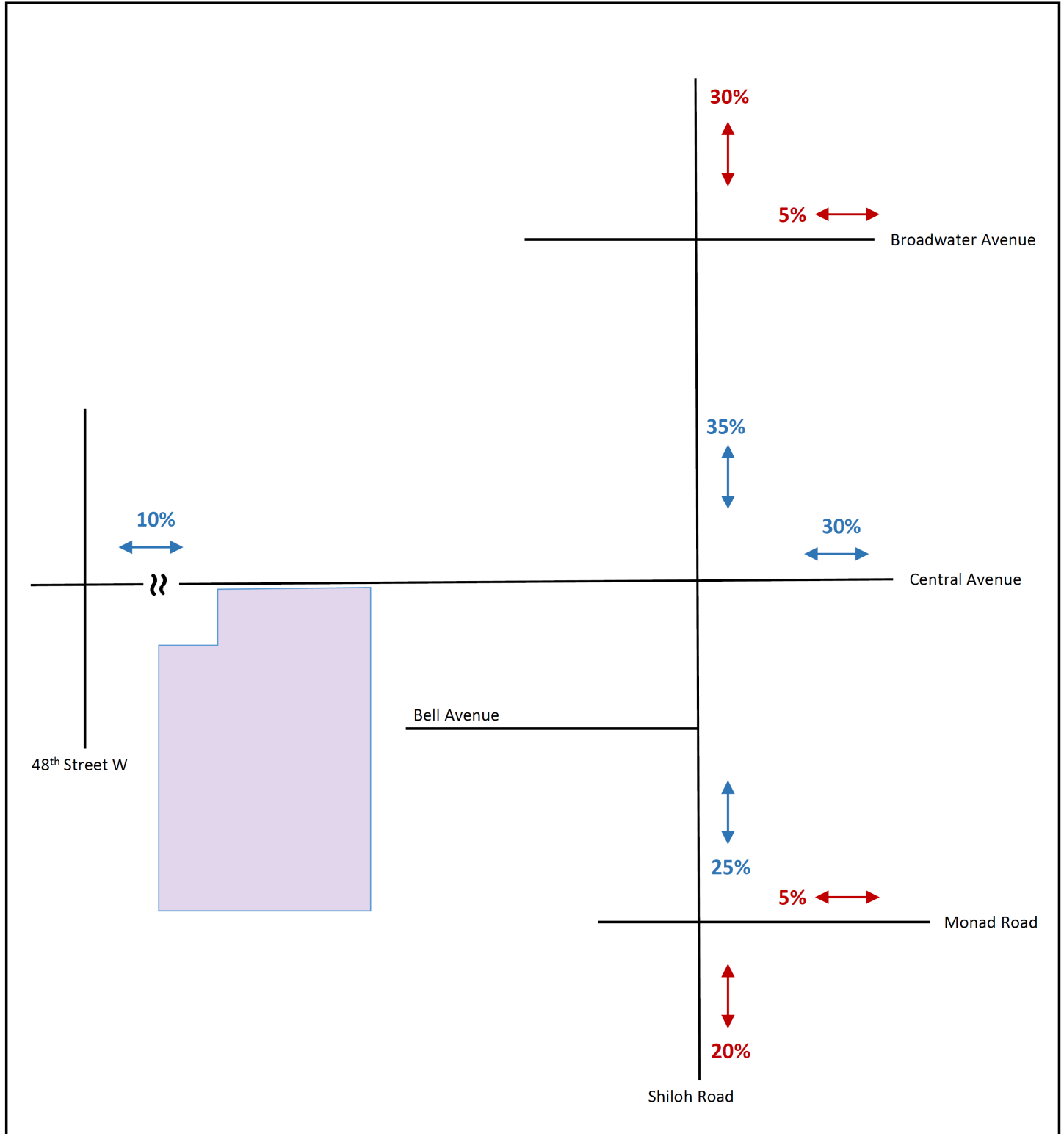
3.2 TRIP DISTRIBUTION AND ASSIGNMENT

Trip distribution has been estimated for the streets surrounding the project site in percentages that add to 100%. Farther from the site, traffic eventually disperses in smaller percentages to/from other routes. Because there is no new information regarding a future developer's plan to connect Bell Avenue and/or the similar connection in Phase 2 to the neighborhood to the west, no Clearwater traffic was assumed to use either such connection. Trip distribution and large-scale assignment percentages are shown in **Exhibit 11**. These percentages were assumed to be the same for both phases.

Phase 1 trips reflected as peak hour intersection turning movement volumes and selected daily link volumes are shown in **Exhibit 12**, and the total volumes after Phase 1 implementation and occupancy are shown in **Exhibit 13**. Similarly, new Phase 2 trips and total traffic are shown in **Exhibits 14** and **15**, respectively.

Note that the Shiloh median that blocks all left turns results in some differences in routing of in-out pairs. For example, many residents leaving the site bound for the Shiloh/Monad intersection can turn right at the Shiloh/Bell intersection, but when they return they must go north on Shiloh past Bell, then make a u-turn or left turn at the Shiloh/Central roundabout.

Exhibit 11. Trip Distribution Percentages for New Trips



Legend

- 30% Primary Distribution (100%)
- 10% Secondary Assignment

} of New Vehicle Trips to Project Site



Exhibit 12. Assignment of New Phase 1 Trips

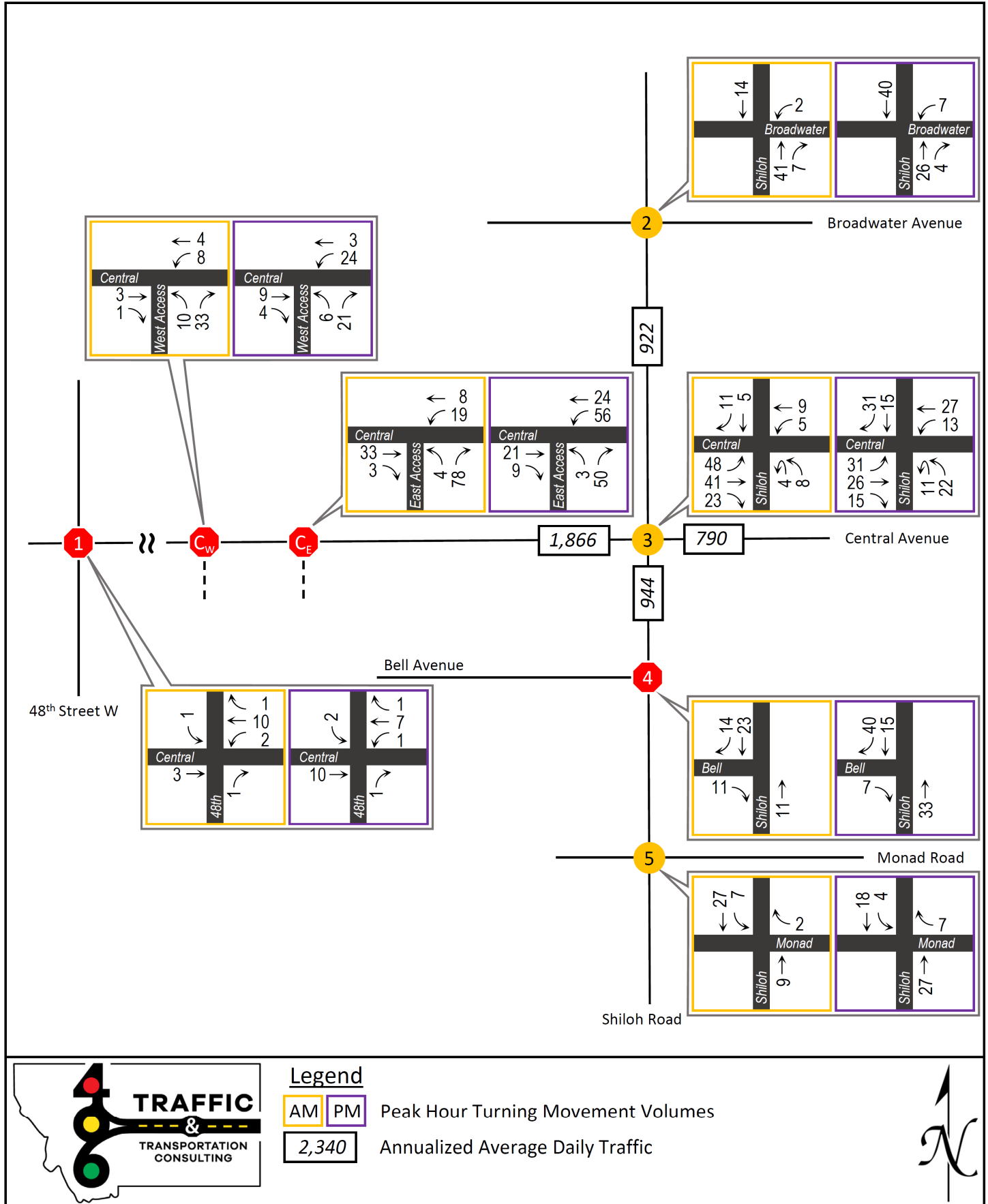


Exhibit 13. 2028 Total Traffic Volumes

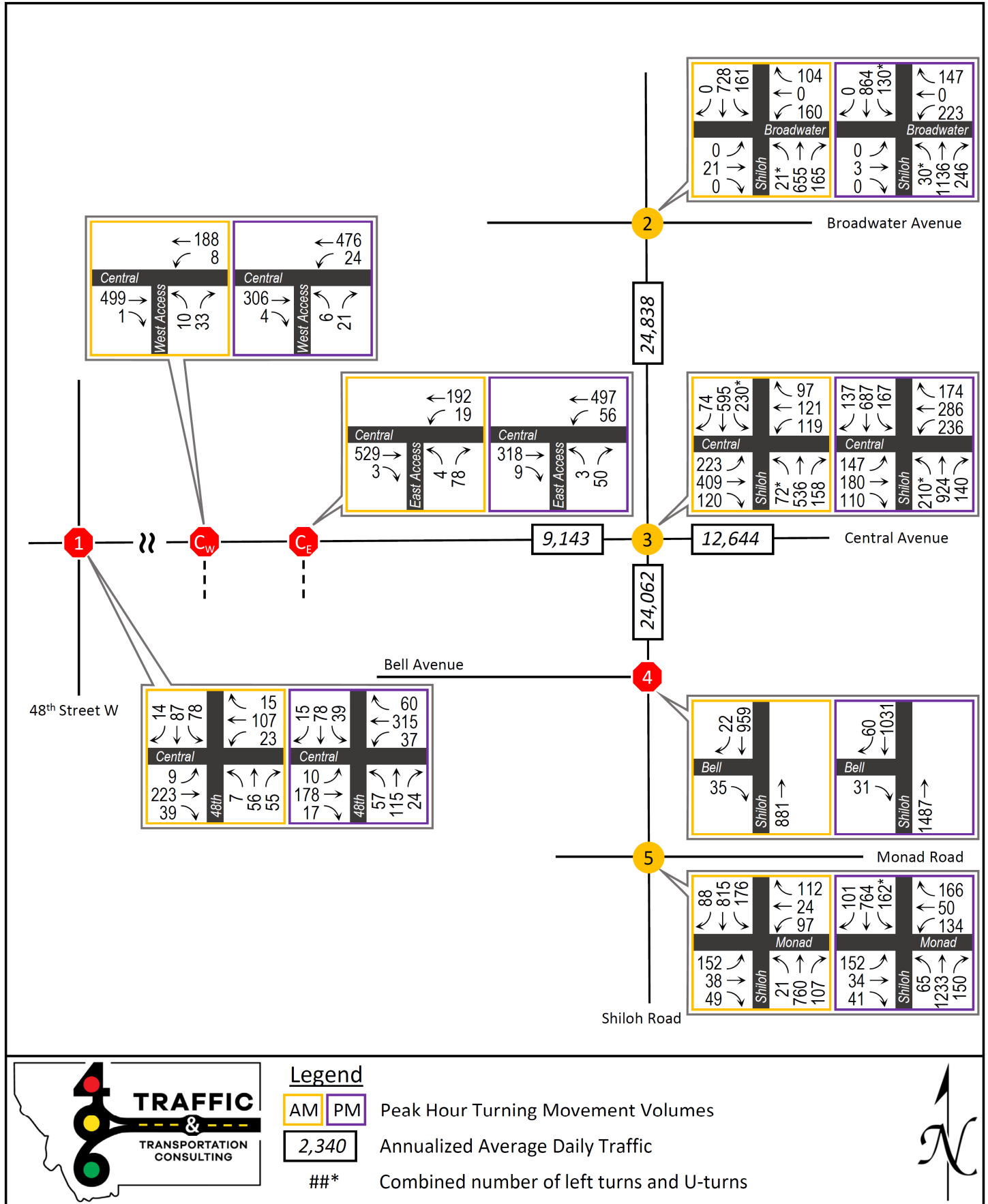


Exhibit 14. Assignment of New Phase 2 Trips

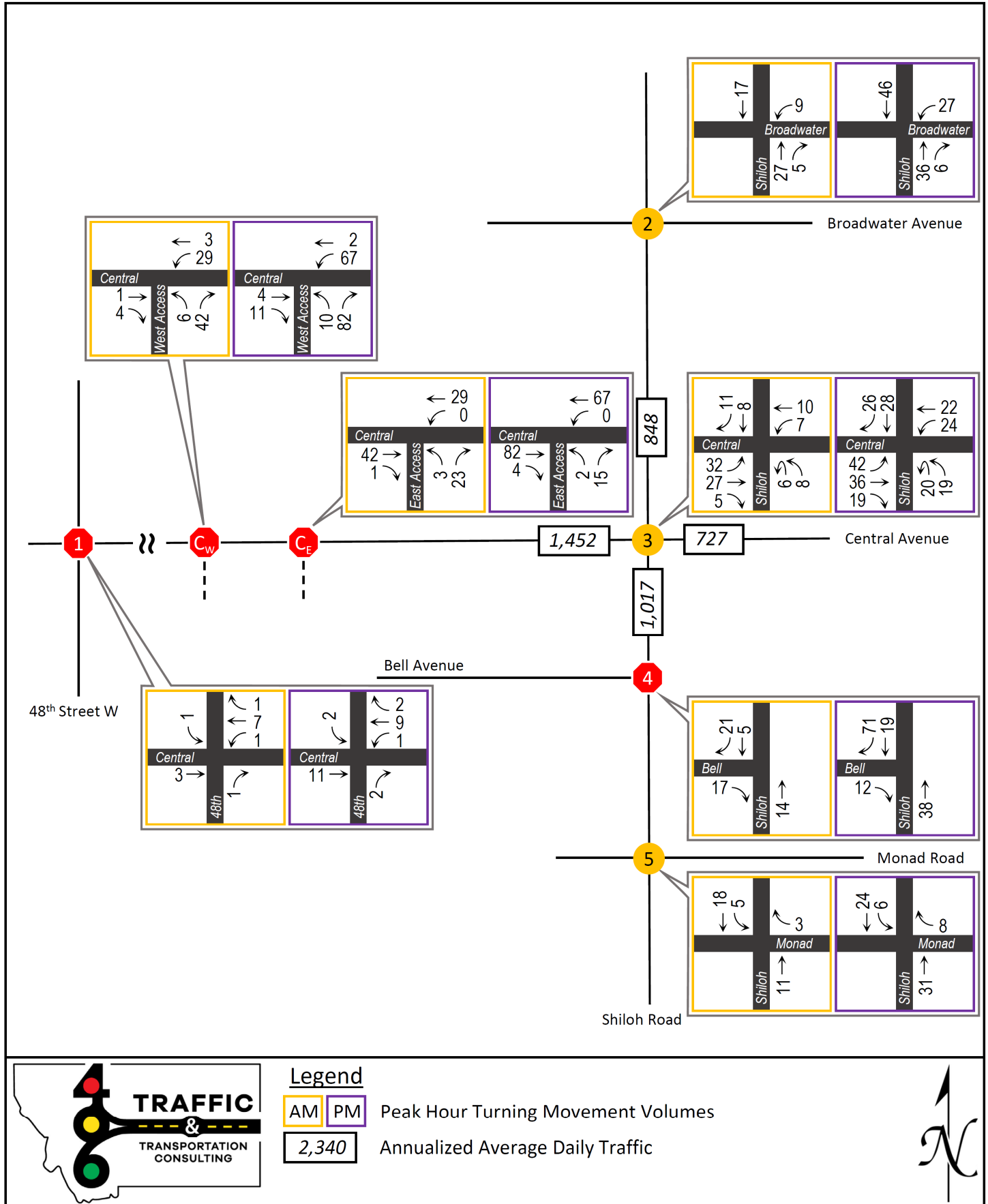
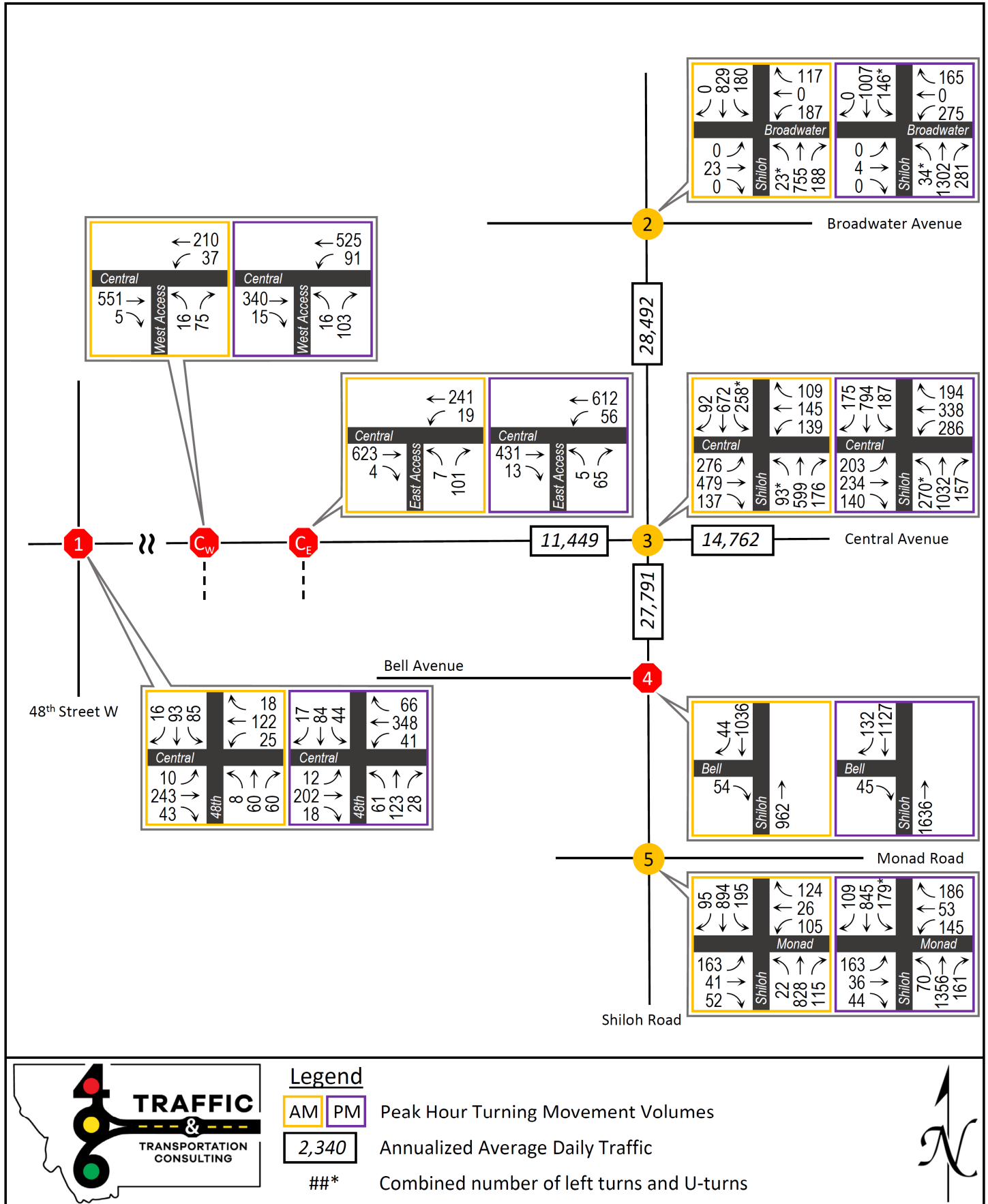


Exhibit 15. 2031 Total Traffic Volumes



4 INTERSECTION CAPACITY ANALYSIS

4.1 PHASE 1

The peak hour intersection Level of Service (LOS) and delay results in 2028 with and without Phase 1 are shown in **Exhibit 15**. Analysis software results are provided in Appendix B.

Exhibit 15. Projected 2028 Intersection LOS and Delay with and without Phase 1

Intersection	Traffic Control	LOS (delay, in seconds/vehicle)		
		2028 Background	With Phase 1	
AM Peak Hour	1. S. 48 th at Central	AWSC	B (10.6)	B (10.8)
	2. Shiloh at Broadwater	Roundabout	A (6.9)	A (7.1)
	3. Shiloh at Central	Roundabout	C (16.2)	C (21.4)
	4. Shiloh at Bell	TWSC*	B (12.6)	B (13.1)
	5. Shiloh at Monad	Roundabout	B (11.6)	B (12.0)
	Central, West Access	TWSC*	-	B (13.5)
	Central, East Access	TWSC*	-	B (14.0)
PM Peak Hour	1. S. 48 th at Central	AWSC	C (16.1)	C (17.4)
	2. Shiloh at Broadwater	Roundabout	B (11.8)	B (12.5)
	3. Shiloh at Central	Roundabout	C (21.9)	D (30.5)
	4. Shiloh at Bell	TWSC*	B (13.0)	B (13.6)
	5. Shiloh at Monad	Roundabout	B (13.7)	B (14.3)
	Central, West Access	TWSC*	-	B (12.2)
	Central, East Access	TWSC*	-	B (11.5)

* Worst lane group is Eastbound at Intersection 4 and Northbound at Intersections 6 and 7.

Both of the site accesses on Central and the Shiloh/Bell intersection would operate at LOS B in both 2028 peak hours. With respect to the peak hour LOS standard, Clearwater's Phase 1 traffic would only affect Intersection 3, the Shiloh at Central roundabout, and only in the PM peak hour. In this case, delay would increase beyond the LOS C/D threshold (25 seconds per vehicle) as a result of traffic generated by the subdivision. The detailed analysis results indicate that the longest delays (around 1 minute per vehicle) and queues (10 vehicles, at Synchro's 95th percentile design level) would be for the westbound approach. Given the limited range of mitigation options for this 2-lane roundabout and the projected LOS of D, testing of such options was deferred to the Phase 2 scenario, for which operations analysis results are described next.

4.2 PHASE 2

The peak hour intersection Level of Service (LOS) and delay results in 2031 with and without Phase 2 are shown in **Exhibit 16**. Analysis software results are provided in Appendix B.

Exhibit 16. Projected 2031 Intersection LOS and Delay with and without Phase 2

Intersection	Traffic Control	LOS (delay, in seconds/vehicle)		
		2031 Background	With Phase 2	
AM Peak Hour	1. S. 48 th at Central	AWSC	B (11.3)	B (11.6)
	2. Shiloh at Broadwater	Roundabout	A (7.8)	A (8.3)
	3. Shiloh at Central	Roundabout	D (25.6)	F (52.5)
	4. Shiloh at Bell	TWSC*	B (13.2)	B (14.4)
	5. Shiloh at Monad	Roundabout	B (13.7)	B (14.8)
	Central, West Access	TWSC*	-	C (16.0)
	Central, East Access	TWSC*	-	C (17.0)
PM Peak Hour	1. S. 48 th at Central	AWSC	C (20.0)	C (23.7)
	2. Shiloh at Broadwater	Roundabout	C (15.9)	C (20.6)
	3. Shiloh at Central	Roundabout	E (40.0)	F (95.7)
	4. Shiloh at Bell	TWSC*	B (13.6)	C (15.4)
	5. Shiloh at Monad	Roundabout	C (16.9)	C (19.1)
	Central, West Access	TWSC*	-	C (15.2)
	Central, East Access	TWSC*	-	B (13.8)

* Worst lane group is Eastbound at Intersection 4 and Northbound at Intersections 6 and 7.

As with 2028 conditions, all intersections and both new site accesses would operate within the City's LOS standard of C or better in both peak hours, with the exception of the Shiloh/Central roundabout. There, the additional traffic generated by Clearwater Estates would degrade the already-substandard LOS in both peak hours if no change is made to intersection capacity. In the context of examining intersection delays, it's important to note that the relationship between volume and delay is not linear; intersections operating near, at, or over capacity often have highly elastic delay responses to relatively small changes in volume.

To address future capacity deficiencies, the primary tool at roundabouts is the addition of a channelized right turn bypass lane on the approach(es) with the highest right-turning volume. They require widening and would lengthen pedestrian crossings, as with the addition of a turn lane at any intersection. Installing bypass lanes on the northbound and westbound approaches—that is, to and from the west, where Central is a 4/5-lane facility—would reduce projected PM peak hour average delay for the intersection by 25-30 seconds per vehicle, but LOS would still be F. The AM peak hour LOS would be expected to improve considerably, yet also still have higher delay than in the 2031 Background scenario. Bypass lanes are not logical for Central Avenue to and from the east, where Central currently has only a 2-lane cross section. The applicant team encourages the City to consider prioritizing, to the extent practicable, additional east-west connectivity between Shiloh and 48th with eventual functional extensions of Broadwater and/or Monad as additional land use changes occur along those logical alignments.

The short-term projection of substandard operations at Shiloh/Central, even without traffic from this particular subdivision, echoes similar findings for other major Shiloh roundabouts from recent studies. Some of this current and expected congestion stems from the scarcity of east-west street network connections other than the major arterials that are generally a mile apart. To that end, a secondary, "bigger-picture" part of the overall solution could involve the westward extension of the east-west streets a half-mile north and south of Central (Broadwater and Monad) to help relieve the traffic burden on Grand, Central, and King. Such extensions are outside the scope of Clearwater's mitigation analysis but still bear mentioning for general interest.

5 COST PARTICIPATION

The net new trips identified in this report are subject to examination under the City's cost participation program to the extent that they would travel through studied intersections. Critical traffic shares that drive cost participation are subject to waiver if they fall below 2%, but project trips from both phases are considered together when evaluating such a possibility. Right turns are not considered.

Intersection 4 was excluded from cost participation calculations because (a) Bell Avenue has been designed for local access only, which will keep volumes low, (b) Shiloh Road's access management features are considered permanent such that no traffic control changes are anticipated to be possible within the scope and timeframe of this project, and (c) as a right-in/right-out intersection there are, in effect, no critical pairs.

Exhibit 17 shows the incremental intersection cost participation for the new trips associated with each of the two project phases and the cost share calculation. As shown in the table, none of the four full-movement intersections qualify for the "sub-2%" waiver.

Exhibit 17. Intersection Cost Participation by Phase

Intersection*	Phase 1			Phase 2			Total
	AM	PM	Higher	AM	PM	Higher	
1. S. 48 th at Central	0.9%	1.1%	1.1%	0.7%	1.2%	1.2%	2.3%
2. Shiloh at Broadwater	1.9%	2.3%	2.3%	1.9%	4.2%	4.2%	6.5%
3. Shiloh at Central	5.3%	6.3%	6.3%	4.1%	7.2%	7.2%	13.5%
5. Shiloh at Monad	1.2%	1.5%	1.5%	0.9%	1.8%	1.8%	3.3%
Total Participation:			11.2%			14.4%	25.6%
x \$450,000			\$50,400			\$64,800	\$115,200

For all intersections in both phases, the PM peak hour critical-pair traffic volume would exceed that of the AM peak hour. The calculation summary shown here indicates that \$50,400 is associated with Phase 1 traffic and \$64,800 is associated with Phase 2. The details of these cost participation calculations are provided in Appendix C.

This concludes the Clearwater Subdivision TAS.

Appendix A: Original Raw Traffic Count Data for Intersections

Study Name Central and 48th

Start Date 8/8/2023

Start Time 7:30 AM

Type Road

Classification Totals

Start Time	48th Street Southbound				Central Avenue Westbound				48th Street Northbound				Central Avenue Eastbound			
	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U
7:00 AM																
7:15 AM																
7:30 AM	3	13	19	0	3	27	2	0	18	9	2	0	5	62	1	0
7:45 AM	3	26	21	0	3	24	5	0	9	10	1	0	12	48	1	0
8:00 AM	4	19	12	0	3	17	5	0	10	13	3	0	10	44	2	0
8:15 AM	2	15	13	0	3	14	5	0	8	14	0	0	6	31	4	0
8:30 AM																
8:45 AM																
4:00 PM																
4:15 PM																
4:30 PM																
4:45 PM																
5:00 PM	1	15	6	0	14	70	7	0	7	23	9	0	5	38	1	0
5:15 PM	3	19	12	0	17	60	12	0	5	30	19	0	5	40	2	0
5:30 PM	4	18	5	0	8	69	6	0	6	20	10	0	2	32	4	0
5:45 PM	5	14	8	0	10	60	5	0	1	23	9	0	2	31	2	0

Study Name Shiloh & Broadwater

Start Date 3/7/2024

Start Time 7:00 AM

Type Road

Classification Totals

Start Time	Shiloh Road Southbound				Broadwater Avenue Westbound				Shiloh Road Northbound				Eastbound Approach Eastbound			
	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U
7:00 AM	0	111	22	0	17	0	8	0	23	52	0	0	0	1	0	0
7:15 AM	0	147	52	0	21	0	25	0	35	102	0	6	0	3	0	0
7:30 AM	0	182	63	0	18	0	33	0	28	122	0	2	0	4	0	0
7:45 AM	0	170	34	0	23	0	39	0	38	140	0	4	0	4	0	0
8:00 AM	0	131	22	0	26	0	29	0	39	143	0	6	0	6	0	0
8:15 AM	0	139	21	0	24	0	36	0	32	130	0	6	0	4	0	0
8:30 AM	0	133	23	0	18	0	28	0	42	137	0	5	0	3	0	0
8:45 AM	0	150	49	0	18	0	28	0	34	124	0	3	0	4	0	0
4:00 PM	0	143	17	0	33	0	42	0	27	244	0	5	0	2	0	0
4:15 PM	0	151	25	0	20	0	46	0	36	226	0	2	0	0	1	0
4:30 PM	0	151	31	0	21	0	38	0	50	238	2	2	0	0	0	0
4:45 PM	0	177	21	0	24	0	37	0	35	201	1	3	0	0	0	0
5:00 PM	0	169	23	0	40	0	56	0	56	281	0	8	0	3	0	0
5:15 PM	0	193	32	1	44	0	52	0	63	283	4	8	0	0	0	0
5:30 PM	0	179	35	1	20	0	43	0	57	202	1	1	0	0	0	0
5:45 PM	0	160	33	2	20	1	35	0	43	200	0	0	0	0	0	0

Study Name Shiloh & Central

Start Date 3/21/2024

Start Time 7:00 AM

Type Road

Classification Totals

Start Time	Shiloh Road Southbound				Central Avenue Westbound				Shiloh Road Northbound				Central Avenue Eastbound			
	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U
7:00 AM	6	74	22	0	7	13	15	0	19	66	9	1	19	51	15	0
7:15 AM	8	118	48	0	7	18	28	0	32	84	14	0	25	90	17	0
7:30 AM	16	128	69	1	18	25	29	0	41	96	15	0	22	112	36	0
7:45 AM	17	135	67	0	26	19	34	0	36	130	19	0	20	91	42	0
8:00 AM	7	116	32	0	29	25	17	0	33	114	10	0	21	76	37	0
8:15 AM	15	135	31	1	12	29	19	0	27	127	9	0	22	41	38	0
8:30 AM	9	98	29	0	15	30	21	0	26	146	10	0	16	30	31	0
8:45 AM	10	102	31	1	20	22	24	0	17	119	20	0	22	40	30	0
4:00 PM	19	127	37	0	23	51	45	0	35	168	24	0	21	29	27	0
4:15 PM	20	100	34	0	35	41	58	0	26	156	45	0	20	39	25	0
4:30 PM	23	127	35	0	38	50	62	0	30	163	47	0	21	26	27	0
4:45 PM	19	153	33	0	41	45	49	0	26	174	41	0	15	36	23	0
5:00 PM	26	152	34	0	38	63	48	0	31	235	32	0	21	46	23	0
5:15 PM	24	154	43	0	35	67	35	0	35	233	35	0	26	26	28	0
5:30 PM	17	142	35	0	40	74	46	0	32	148	35	0	14	32	27	0
5:45 PM	21	148	30	0	31	46	41	0	32	162	26	0	24	22	30	0

Study Name Shiloh & Bell

Start Date 5/18/2023

Start Time 7:00 AM

Type Road

Classification Totals

Start Time	Shiloh Road Southbound				n/a Westbound				Shiloh Road Northbound				Bell Avenue Eastbound			
	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U
7:00 AM	1	126		0						103	0	0	1		0	0
7:15 AM	0	186		0						111	0	0	2		0	0
7:30 AM	2	181		0						228	0	0	7		0	0
7:45 AM	2	239		0						213	0	0	7		0	0
8:00 AM	1	184		0						169	0	0	7		0	0
8:15 AM	3	233		0						167	0	0	1		0	0
8:30 AM	2	163		0						180	0	0	3		0	0
8:45 AM	6	174		0						169	0	0	5		0	0
4:00 PM	2	225		0						272	0	0	6		0	0
4:15 PM	4	224		0						262	0	0	3		0	0
4:30 PM	3	212		0						311	0	0	2		0	0
4:45 PM	5	212		0						307	0	0	7		0	0
5:00 PM	4	241		0						357	0	0	8		0	0
5:15 PM	5	243		0						324	0	0	4		0	0
5:30 PM	6	213		0						263	0	0	7		0	0
5:45 PM	6	219		0						254	0	0	2		0	0

Study Name Shiloh & Monad

Start Date 10/24/2023

Start Time 7:00 AM

Type Road

Classification Totals

Start Time	Shiloh Road Southbound				Monad Road Westbound				Shiloh Road Northbound				Monad Road Eastbound			
	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U
7:00 AM	6	126	12	0	8	7	12	0	16	67	5	0	10	5	12	0
7:15 AM	12	129	36	0	11	9	15	0	22	113	1	0	13	3	25	0
7:30 AM	9	138	32	0	24	3	22	0	29	175	5	0	17	14	33	0
7:45 AM	16	215	49	0	29	8	21	0	21	190	8	0	12	7	36	0
8:00 AM	23	181	23	0	18	2	22	0	23	142	1	0	9	10	24	0
8:15 AM	26	128	38	0	22	7	17	0	17	123	3	0	2	1	34	0
8:30 AM	12	150	42	5	17	1	15	0	16	111	2	1	5	2	24	0
8:45 AM	10	135	20	0	20	5	9	0	14	109	1	0	10	3	16	0
4:00 PM	16	166	26	0	30	6	21	0	33	210	10	0	12	8	23	0
4:15 PM	15	162	23	0	25	10	20	0	30	203	7	0	6	15	23	0
4:30 PM	21	174	35	0	37	12	29	0	22	233	9	0	8	9	41	0
4:45 PM	18	154	27	1	29	8	32	0	28	236	18	0	6	0	35	0
5:00 PM	16	138	44	0	29	15	27	0	35	277	12	0	9	10	31	0
5:15 PM	30	160	25	0	38	6	25	0	40	266	16	0	11	9	20	0
5:30 PM	19	180	23	0	37	8	34	0	34	183	13	0	9	7	31	0
5:45 PM	24	156	28	0	37	10	16	0	25	176	13	0	11	12	21	0

Appendix B: Intersection Analysis Software Output

Scenario sequence:

Existing

2028 Background

2028 Phase 1

2031 Background

2031 Phase 2

Intersection	
Intersection Delay, s/veh	9.6
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	8	190	34	18	84	12	6	48	47	66	75	12
Future Vol, veh/h	8	190	34	18	84	12	6	48	47	66	75	12
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles, %	2	2	2	5	5	5	5	5	5	1	1	1
Mvmt Flow	9	213	38	20	94	13	7	54	53	74	84	13
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	10.2	9.1	8.9	9.7
HCM LOS	B	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	6%	3%	16%	43%
Vol Thru, %	48%	82%	74%	49%
Vol Right, %	47%	15%	11%	8%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	101	232	114	153
LT Vol	6	8	18	66
Through Vol	48	190	84	75
RT Vol	47	34	12	12
Lane Flow Rate	113	261	128	172
Geometry Grp	1	1	1	1
Degree of Util (X)	0.154	0.342	0.177	0.24
Departure Headway (Hd)	4.882	4.722	4.983	5.033
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	727	756	713	708
Service Time	2.959	2.783	3.056	3.104
HCM Lane V/C Ratio	0.155	0.345	0.18	0.243
HCM Control Delay, s/veh	8.9	10.2	9.1	9.7
HCM Lane LOS	A	B	A	A
HCM 95th-tile Q	0.5	1.5	0.6	0.9

Intersection									
Intersection Delay, s/veh	6.0								
Intersection LOS	A								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		1		1		
Adj Approach Flow, veh/h	19		241		728		803		
Demand Flow Rate, veh/h	19		243		742		811		
Vehicles Circulating, veh/h	957		594		168		165		
Vehicles Exiting, veh/h	19		316		808		672		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	3.1		6.1		5.9		6.1		
Approach LOS	A		A		A		A		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	R	LT	R	LT	TR	LT	TR	
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR	
RT Channelized									
Lane Util	1.000	0.000	0.601	0.399	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	1.000	2.535	2.667	2.535	2.535	2.535	2.535	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544	
A (Intercept)	3600	1420	1350	1420	1420	1420	1420	1420	
B (Slope)	1.151e-3	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4	
Entry Flow, veh/h	19	0	146	97	349	393	381	430	
Cap Entry Lane, veh/h	1196	629	782	857	1219	1219	1222	1222	
Entry HV Adj Factor	1.000	1.000	0.993	0.990	0.980	0.981	0.991	0.990	
Flow Entry, veh/h	19	0	145	96	342	386	378	426	
Cap Entry, veh/h	1196	629	776	848	1194	1196	1211	1210	
V/C Ratio	0.016	0.000	0.187	0.113	0.286	0.322	0.312	0.352	
Control Delay, s/veh	3.1	5.7	6.6	5.4	5.7	6.0	5.9	6.3	
LOS	A	A	A	A	A	A	A	A	
95th %tile Queue, veh	0	0	1	0	1	1	1	2	

Intersection									
Intersection Delay, s/veh	11.2								
Intersection LOS	B								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		2		2		
Adj Approach Flow, veh/h	620		310		730		857		
Demand Flow Rate, veh/h	632		319		753		866		
Vehicles Circulating, veh/h	917		768		762		282		
Vehicles Exiting, veh/h	231		747		787		805		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	14.6		7.9		13.7		7.6		
Approach LOS	B		A		B		A		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	TR	LT	TR	LT	TR	LT	TR	
Assumed Moves	LT	TR	LT	TR	LT	TR	LT	TR	
RT Channelized									
Lane Util	0.470	0.530	0.470	0.530	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.667	2.535	2.667	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.645	4.328	4.645	4.328	
A (Intercept)	1350	1420	1350	1420	1350	1420	1350	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	
Entry Flow, veh/h	297	335	150	169	354	399	407	459	
Cap Entry Lane, veh/h	581	651	666	739	670	743	1041	1117	
Entry HV Adj Factor	0.981	0.981	0.971	0.972	0.970	0.970	0.990	0.990	
Flow Entry, veh/h	291	329	146	164	343	387	403	454	
Cap Entry, veh/h	570	639	647	718	649	721	1031	1106	
V/C Ratio	0.511	0.514	0.225	0.229	0.529	0.537	0.391	0.411	
Control Delay, s/veh	15.3	14.0	8.3	7.6	14.2	13.3	7.7	7.6	
LOS	C	B	A	A	B	B	A	A	
95th %tile Queue, veh	3	3	1	1	3	3	2	2	

Intersection						
Int Delay, s/veh	0.2					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↗		↑↑	↑↑	
Traffic Vol, veh/h	0	21	0	750	807	7
Future Vol, veh/h	0	21	0	750	807	7
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	0	0	4	4	2	2
Mvmt Flow	0	24	0	843	907	8

Major/Minor	Minor2	Major1	Major2		
Conflicting Flow All	-	457	-	0	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-
Critical Hdwy	-	6.9	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-
Follow-up Hdwy	-	3.3	-	-	-
Pot Cap-1 Maneuver	0	556	0	-	-
Stage 1	0	-	0	-	-
Stage 2	0	-	0	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	-	556	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	11.76	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	556	-	-
HCM Lane V/C Ratio	-	0.042	-	-
HCM Ctrl Dly (s/v)	-	11.8	-	-
HCM Lane LOS	-	B	-	-
HCM 95th %tile Q(veh)	-	0.1	-	-

Intersection									
Intersection Delay, s/veh	9.0								
Intersection LOS	A								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		1		1		
Adj Approach Flow, veh/h	251		241		924		1100		
Demand Flow Rate, veh/h	259		248		933		1111		
Vehicles Circulating, veh/h	1119		985		386		151		
Vehicles Exiting, veh/h	143		334		992		1082		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	13.9		9.3		9.2		7.6		
Approach LOS	B		A		A		A		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	R	LT	R	LT	TR	LT	TR	
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR	
RT Channelized									
Lane Util	0.795	0.205	0.520	0.480	0.471	0.529	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544	
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4	
Entry Flow, veh/h	206	53	129	119	439	494	522	589	
Cap Entry Lane, veh/h	482	549	545	615	999	999	1238	1238	
Entry HV Adj Factor	0.970	0.962	0.971	0.975	0.989	0.991	0.990	0.990	
Flow Entry, veh/h	200	51	125	116	434	490	517	583	
Cap Entry, veh/h	468	528	529	599	989	991	1226	1225	
V/C Ratio	0.427	0.097	0.236	0.194	0.439	0.494	0.422	0.476	
Control Delay, s/veh	15.5	8.0	10.1	8.4	8.7	9.6	7.2	8.0	
LOS	C	A	B	A	A	A	A	A	
95th %tile Queue, veh	2	0	1	1	2	3	2	3	

Intersection	
Intersection Delay, s/veh	12.7
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	9	145	15	31	266	51	49	99	20	32	67	13
Future Vol, veh/h	9	145	15	31	266	51	49	99	20	32	67	13
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles, %	2	2	2	1	1	1	0	0	0	0	0	0
Mvmt Flow	10	169	17	36	309	59	57	115	23	37	78	15
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	10.8	14.9	11.3	10.5
HCM LOS	B	B	B	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	29%	5%	9%	29%
Vol Thru, %	59%	86%	76%	60%
Vol Right, %	12%	9%	15%	12%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	168	169	348	112
LT Vol	49	9	31	32
Through Vol	99	145	266	67
RT Vol	20	15	51	13
Lane Flow Rate	195	197	405	130
Geometry Grp	1	1	1	1
Degree of Util (X)	0.31	0.298	0.575	0.212
Departure Headway (Hd)	5.721	5.465	5.118	5.852
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	627	656	704	611
Service Time	3.772	3.515	3.159	3.907
HCM Lane V/C Ratio	0.311	0.3	0.575	0.213
HCM Control Delay, s/veh	11.3	10.8	14.9	10.5
HCM Lane LOS	B	B	B	B
HCM 95th-tile Q	1.3	1.2	3.7	0.8

Intersection									
Intersection Delay, s/veh	9.1								
Intersection LOS	A								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		1		1		
Adj Approach Flow, veh/h	3		360		1370		946		
Demand Flow Rate, veh/h	3		360		1370		955		
Vehicles Circulating, veh/h	1169		1130		133		244		
Vehicles Exiting, veh/h	30		373		1039		1246		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	7.9		13.6		9.0		7.6		
Approach LOS	A		B		A		A		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	R	LT	R	LT	TR	LT	TR	
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR	
RT Channelized									
Lane Util	1.000	0.000	0.594	0.406	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544	
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4	
Entry Flow, veh/h	3	0	214	146	644	726	449	506	
Cap Entry Lane, veh/h	461	526	477	543	1258	1258	1137	1137	
Entry HV Adj Factor	1.000	1.000	1.000	1.000	1.000	1.000	0.990	0.991	
Flow Entry, veh/h	3	0	214	146	644	726	445	501	
Cap Entry, veh/h	461	526	477	543	1258	1258	1126	1127	
V/C Ratio	0.007	0.000	0.448	0.269	0.512	0.577	0.395	0.445	
Control Delay, s/veh	7.9	6.8	15.8	10.4	8.4	9.6	7.2	8.0	
LOS	A	A	C	B	A	A	A	A	
95th %tile Queue, veh	0	0	2	1	3	4	2	2	

Intersection									
Intersection Delay, s/veh	13.6								
Intersection LOS	B								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		2		2		
Adj Approach Flow, veh/h	339		607		1152		877		
Demand Flow Rate, veh/h	339		607		1152		886		
Vehicles Circulating, veh/h	993		1130		408		611		
Vehicles Exiting, veh/h	504		430		924		1126		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	10.3		19.9		12.1		12.6		
Approach LOS	B		C		B		B		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	TR	LT	TR	LT	TR	LT	TR	
Assumed Moves	LT	TR	LT	TR	LT	TR	LT	TR	
RT Channelized									
Lane Util	0.469	0.531	0.470	0.530	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.667	2.535	2.667	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.645	4.328	4.645	4.328	
A (Intercept)	1350	1420	1350	1420	1350	1420	1350	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	
Entry Flow, veh/h	159	180	285	322	541	611	416	470	
Cap Entry Lane, veh/h	541	611	477	543	927	1004	769	845	
Entry HV Adj Factor	1.002	0.998	1.001	0.999	1.001	0.999	0.991	0.989	
Flow Entry, veh/h	159	180	285	322	541	611	412	465	
Cap Entry, veh/h	543	609	478	543	928	1003	762	835	
V/C Ratio	0.294	0.295	0.597	0.593	0.583	0.609	0.541	0.556	
Control Delay, s/veh	10.8	9.8	21.1	18.8	12.1	12.0	12.8	12.4	
LOS	B	A	C	C	B	B	B	B	
95th %tile Queue, veh	1	1	4	4	4	4	3	3	

Intersection						
Int Delay, s/veh	0.1					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↗		↑↑	↑↑	
Traffic Vol, veh/h	0	21	0	1254	876	17
Future Vol, veh/h	0	21	0	1254	876	17
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	2	2
Mvmt Flow	0	23	0	1363	952	18

Major/Minor	Minor2	Major1	Major2		
Conflicting Flow All	-	485	-	0	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-
Critical Hdwy	-	6.9	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-
Follow-up Hdwy	-	3.3	-	-	-
Pot Cap-1 Maneuver	0	533	0	-	-
Stage 1	0	-	0	-	-
Stage 2	0	-	0	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	-	533	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	12.05	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	533	-	-
HCM Lane V/C Ratio	-	0.043	-	-
HCM Ctrl Dly (s/v)	-	12.1	-	-
HCM Lane LOS	-	B	-	-
HCM 95th %tile Q(veh)	-	0.1	-	-

Intersection									
Intersection Delay, s/veh	10.0								
Intersection LOS	B								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		1		1		
Adj Approach Flow, veh/h	201		305		1263		893		
Demand Flow Rate, veh/h	206		305		1263		902		
Vehicles Circulating, veh/h	931		1268		310		222		
Vehicles Exiting, veh/h	193		305		827		1351		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	9.8		14.1		11.1		7.1		
Approach LOS	A		B		B		A		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	R	LT	R	LT	TR	LT	TR	
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR	
RT Channelized									
Lane Util	0.820	0.180	0.538	0.462	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544	
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4	
Entry Flow, veh/h	169	37	164	141	594	669	424	478	
Cap Entry Lane, veh/h	573	644	420	483	1071	1071	1160	1160	
Entry HV Adj Factor	0.979	0.973	1.000	1.000	0.999	1.001	0.990	0.991	
Flow Entry, veh/h	165	36	164	141	594	669	420	473	
Cap Entry, veh/h	561	626	420	483	1070	1072	1149	1149	
V/C Ratio	0.295	0.057	0.390	0.292	0.555	0.625	0.365	0.412	
Control Delay, s/veh	10.6	6.4	15.9	11.9	10.2	11.9	6.8	7.4	
LOS	B	A	C	B	B	B	A	A	
95th %tile Queue, veh	1	0	2	1	4	5	2	2	

Intersection	
Intersection Delay, s/veh	10.6
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	9	220	39	21	97	14	7	56	54	77	87	14
Future Vol, veh/h	9	220	39	21	97	14	7	56	54	77	87	14
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles, %	2	2	2	5	5	5	5	5	5	1	1	1
Mvmt Flow	10	247	44	24	109	16	8	63	61	87	98	16
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	11.6	9.8	9.5	10.6
HCM LOS	B	A	A	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	6%	3%	16%	43%
Vol Thru, %	48%	82%	73%	49%
Vol Right, %	46%	15%	11%	8%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	117	268	132	178
LT Vol	7	9	21	77
Through Vol	56	220	97	87
RT Vol	54	39	14	14
Lane Flow Rate	131	301	148	200
Geometry Grp	1	1	1	1
Degree of Util (X)	0.191	0.419	0.218	0.297
Departure Headway (Hd)	5.224	5.01	5.3	5.34
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	686	723	678	674
Service Time	3.259	3.01	3.332	3.371
HCM Lane V/C Ratio	0.191	0.416	0.218	0.297
HCM Control Delay, s/veh	9.5	11.6	9.8	10.6
HCM Lane LOS	A	B	A	B
HCM 95th-tile Q	0.7	2.1	0.8	1.2

Intersection									
Intersection Delay, s/veh	6.9								
Intersection LOS	A								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		1		1		
Adj Approach Flow, veh/h	22		279		843		931		
Demand Flow Rate, veh/h	22		282		859		941		
Vehicles Circulating, veh/h	1111		688		195		192		
Vehicles Exiting, veh/h	22		366		938		778		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	8.0		7.1		6.6		7.0		
Approach LOS	A		A		A		A		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	R	LT	R	LT	TR	LT	TR	
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR	
RT Channelized									
Lane Util	1.000	0.000	0.603	0.397	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544	
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4	
Entry Flow, veh/h	22	0	170	112	404	455	442	499	
Cap Entry Lane, veh/h	486	552	717	791	1189	1189	1192	1192	
Entry HV Adj Factor	1.000	1.000	0.988	0.991	0.981	0.982	0.990	0.989	
Flow Entry, veh/h	22	0	168	111	396	447	438	494	
Cap Entry, veh/h	486	552	708	784	1166	1168	1181	1180	
V/C Ratio	0.045	0.000	0.237	0.142	0.340	0.383	0.371	0.418	
Control Delay, s/veh	8.0	6.5	7.8	6.1	6.4	6.9	6.7	7.3	
LOS	A	A	A	A	A	A	A	A	
95th %tile Queue, veh	0	0	1	0	2	2	2	2	

Intersection									
Intersection Delay, s/veh	16.2								
Intersection LOS	C								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		2		2		
Adj Approach Flow, veh/h	719		363		847		992		
Demand Flow Rate, veh/h	733		374		872		1003		
Vehicles Circulating, veh/h	1063		890		883		331		
Vehicles Exiting, veh/h	271		865		913		933		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	23.2		9.8		21.1		9.2		
Approach LOS	C		A		C		A		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	TR	LT	TR	LT	TR	LT	TR	
Assumed Moves	LT	TR	LT	TR	LT	TR	LT	TR	
RT Channelized									
Lane Util	0.471	0.529	0.471	0.529	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.667	2.535	2.667	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.645	4.328	4.645	4.328	
A (Intercept)	1350	1420	1350	1420	1350	1420	1350	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	
Entry Flow, veh/h	345	388	176	198	410	462	471	532	
Cap Entry Lane, veh/h	508	575	595	666	599	670	996	1072	
Entry HV Adj Factor	0.979	0.982	0.970	0.972	0.971	0.972	0.990	0.989	
Flow Entry, veh/h	338	381	171	193	398	449	466	526	
Cap Entry, veh/h	497	565	577	648	582	651	986	1060	
V/C Ratio	0.680	0.674	0.296	0.297	0.684	0.689	0.473	0.496	
Control Delay, s/veh	24.6	21.9	10.3	9.4	22.0	20.3	9.3	9.2	
LOS	C	C	B	A	C	C	A	A	
95th %tile Queue, veh	5	5	1	1	5	5	3	3	

Intersection						
Int Delay, s/veh	0.2					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↗		↑↑	↑↑	
Traffic Vol, veh/h	0	24	0	870	936	8
Future Vol, veh/h	0	24	0	870	936	8
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	0	0	4	4	2	2
Mvmt Flow	0	27	0	978	1052	9

Major/Minor	Minor2	Major1	Major2		
Conflicting Flow All	-	530	-	0	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-
Critical Hdwy	-	6.9	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-
Follow-up Hdwy	-	3.3	-	-	-
Pot Cap-1 Maneuver	0	498	0	-	-
Stage 1	0	-	0	-	-
Stage 2	0	-	0	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	-	498	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	12.63	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	498	-	-
HCM Lane V/C Ratio	-	0.054	-	-
HCM Ctrl Dly (s/v)	-	12.6	-	-
HCM Lane LOS	-	B	-	-
HCM 95th %tile Q(veh)	-	0.2	-	-

Intersection									
Intersection Delay, s/veh	11.6								
Intersection LOS	B								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		1		1		
Adj Approach Flow, veh/h	291		281		1072		1274		
Demand Flow Rate, veh/h	300		290		1082		1287		
Vehicles Circulating, veh/h	1301		1142		446		178		
Vehicles Exiting, veh/h	164		386		1155		1254		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	21.1		11.9		11.8		9.1		
Approach LOS	C		B		B		A		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	R	LT	R	LT	TR	LT	TR	
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR	
RT Channelized									
Lane Util	0.793	0.207	0.524	0.476	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544	
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4	
Entry Flow, veh/h	238	62	152	138	509	573	605	682	
Cap Entry Lane, veh/h	408	470	472	538	946	946	1208	1208	
Entry HV Adj Factor	0.969	0.968	0.968	0.971	0.990	0.991	0.990	0.990	
Flow Entry, veh/h	231	60	147	134	504	568	599	675	
Cap Entry, veh/h	395	455	457	522	937	938	1196	1196	
V/C Ratio	0.583	0.132	0.322	0.257	0.538	0.606	0.501	0.565	
Control Delay, s/veh	24.0	9.8	13.2	10.5	10.9	12.6	8.5	9.7	
LOS	C	A	B	B	B	B	A	A	
95th %tile Queue, veh	4	0	1	1	3	4	3	4	

Intersection	
Intersection Delay, s/veh	16.1
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	10	168	17	36	308	59	57	115	23	37	78	15
Future Vol, veh/h	10	168	17	36	308	59	57	115	23	37	78	15
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles, %	2	2	2	1	1	1	0	0	0	0	0	0
Mvmt Flow	12	195	20	42	358	69	66	134	27	43	91	17
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	12.5	20.6	13.1	11.8
HCM LOS	B	C	B	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	29%	5%	9%	28%
Vol Thru, %	59%	86%	76%	60%
Vol Right, %	12%	9%	15%	12%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	195	195	403	130
LT Vol	57	10	36	37
Through Vol	115	168	308	78
RT Vol	23	17	59	15
Lane Flow Rate	227	227	469	151
Geometry Grp	1	1	1	1
Degree of Util (X)	0.386	0.376	0.706	0.269
Departure Headway (Hd)	6.244	5.964	5.425	6.413
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	580	608	661	562
Service Time	4.244	3.964	3.516	4.427
HCM Lane V/C Ratio	0.391	0.373	0.71	0.269
HCM Control Delay, s/veh	13.1	12.5	20.6	11.8
HCM Lane LOS	B	B	C	B
HCM 95th-tile Q	1.8	1.7	5.8	1.1

Intersection									
Intersection Delay, s/veh	11.8								
Intersection LOS	B								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		1		1		
Adj Approach Flow, veh/h	3		417		1588		1096		
Demand Flow Rate, veh/h	3		417		1588		1106		
Vehicles Circulating, veh/h	1354		1310		153		282		
Vehicles Exiting, veh/h	34		431		1204		1445		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	9.4		20.5		11.3		9.2		
Approach LOS	A		C		B		A		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	R	LT	R	LT	TR	LT	TR	
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR	
RT Channelized									
Lane Util	1.000	0.000	0.595	0.405	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544	
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4	
Entry Flow, veh/h	3	0	248	169	746	842	520	586	
Cap Entry Lane, veh/h	388	449	405	466	1236	1236	1099	1099	
Entry HV Adj Factor	1.000	1.000	1.000	1.000	1.000	1.000	0.990	0.991	
Flow Entry, veh/h	3	0	248	169	746	842	515	581	
Cap Entry, veh/h	388	449	405	466	1236	1235	1088	1089	
V/C Ratio	0.008	0.000	0.613	0.362	0.604	0.681	0.473	0.533	
Control Delay, s/veh	9.4	8.0	25.1	13.9	10.3	12.3	8.6	9.7	
LOS	A	A	D	B	B	B	A	A	
95th %tile Queue, veh	0	0	4	2	4	6	3	3	

Intersection									
Intersection Delay, s/veh	21.9								
Intersection LOS	C								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		2		2		
Adj Approach Flow, veh/h	393		705		1335		1017		
Demand Flow Rate, veh/h	393		705		1335		1027		
Vehicles Circulating, veh/h	1152		1309		473		708		
Vehicles Exiting, veh/h	583		499		1072		1306		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	13.7		39.1		17.6		18.7		
Approach LOS	B		E		C		C		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	TR	LT	TR	LT	TR	LT	TR	
Assumed Moves	LT	TR	LT	TR	LT	TR	LT	TR	
RT Channelized									
Lane Util	0.471	0.529	0.470	0.530	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.667	2.535	2.667	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.645	4.328	4.645	4.328	
A (Intercept)	1350	1420	1350	1420	1350	1420	1350	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	
Entry Flow, veh/h	185	208	331	374	627	708	483	544	
Cap Entry Lane, veh/h	468	533	405	467	874	950	704	778	
Entry HV Adj Factor	0.998	1.001	1.001	0.999	1.001	0.999	0.989	0.991	
Flow Entry, veh/h	185	208	331	374	627	708	478	539	
Cap Entry, veh/h	467	534	405	466	874	949	696	771	
V/C Ratio	0.395	0.390	0.817	0.801	0.718	0.745	0.686	0.699	
Control Delay, s/veh	14.6	12.9	42.3	36.2	17.4	17.7	19.1	18.3	
LOS	B	B	E	E	C	C	C	C	
95th %tile Queue, veh	2	2	7	7	6	7	5	6	

Intersection						
Int Delay, s/veh	0.1					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↗		↑↑	↑↑	
Traffic Vol, veh/h	0	24	0	1454	1016	20
Future Vol, veh/h	0	24	0	1454	1016	20
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	2	2
Mvmt Flow	0	26	0	1580	1104	22

Major/Minor	Minor2	Major1	Major2		
Conflicting Flow All	-	563	-	0	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-
Critical Hdwy	-	6.9	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-
Follow-up Hdwy	-	3.3	-	-	-
Pot Cap-1 Maneuver	0	475	0	-	-
Stage 1	0	-	0	-	-
Stage 2	0	-	0	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	-	475	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	13.03	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	475	-	-
HCM Lane V/C Ratio	-	0.055	-	-
HCM Ctrl Dly (s/v)	-	13	-	-
HCM Lane LOS	-	B	-	-
HCM 95th %tile Q(veh)	-	0.2	-	-

Intersection									
Intersection Delay, s/veh	13.7								
Intersection LOS	B								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		1		1		
Adj Approach Flow, veh/h	234		354		1465		1036		
Demand Flow Rate, veh/h	239		354		1465		1047		
Vehicles Circulating, veh/h	1080		1470		361		257		
Vehicles Exiting, veh/h	224		356		958		1567		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	12.8		21.0		15.8		8.4		
Approach LOS	B		C		C		A		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	R	LT	R	LT	TR	LT	TR	
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR	
RT Channelized									
Lane Util	0.820	0.180	0.537	0.463	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544	
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4	
Entry Flow, veh/h	196	43	190	164	689	776	492	555	
Cap Entry Lane, veh/h	500	567	349	407	1022	1022	1124	1124	
Entry HV Adj Factor	0.981	0.977	1.000	1.000	0.999	1.001	0.990	0.990	
Flow Entry, veh/h	192	42	190	164	689	776	487	549	
Cap Entry, veh/h	490	554	349	407	1022	1023	1113	1112	
V/C Ratio	0.392	0.076	0.544	0.403	0.674	0.759	0.438	0.494	
Control Delay, s/veh	14.0	7.4	24.7	16.7	13.8	17.4	7.9	8.8	
LOS	B	A	C	C	B	C	A	A	
95th %tile Queue, veh	2	0	3	2	5	8	2	3	

Intersection	
Intersection Delay, s/veh	10.8
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	9	223	39	23	107	15	7	56	55	78	87	14
Future Vol, veh/h	9	223	39	23	107	15	7	56	55	78	87	14
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles, %	2	2	2	5	5	5	5	5	5	1	1	1
Mvmt Flow	10	251	44	26	120	17	8	63	62	88	98	16
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	11.8	10.1	9.6	10.8
HCM LOS	B	B	A	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	6%	3%	16%	44%
Vol Thru, %	47%	82%	74%	49%
Vol Right, %	47%	14%	10%	8%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	118	271	145	179
LT Vol	7	9	23	78
Through Vol	56	223	107	87
RT Vol	55	39	15	14
Lane Flow Rate	133	304	163	201
Geometry Grp	1	1	1	1
Degree of Util (X)	0.195	0.427	0.241	0.302
Departure Headway (Hd)	5.284	5.054	5.325	5.4
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	679	716	674	666
Service Time	3.322	3.054	3.361	3.435
HCM Lane V/C Ratio	0.196	0.425	0.242	0.302
HCM Control Delay, s/veh	9.6	11.8	10.1	10.8
HCM Lane LOS	A	B	B	B
HCM 95th-tile Q	0.7	2.1	0.9	1.3

Intersection									
Intersection Delay, s/veh	7.1								
Intersection LOS	A								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		1		1		
Adj Approach Flow, veh/h	22		281		895		945		
Demand Flow Rate, veh/h	22		284		913		955		
Vehicles Circulating, veh/h	1127		733		195		194		
Vehicles Exiting, veh/h	22		375		954		823		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	8.1		7.5		6.9		7.1		
Approach LOS	A		A		A		A		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	R	LT	R	LT	TR	LT	TR	
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR	
RT Channelized									
Lane Util	1.000	0.000	0.606	0.394	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544	
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4	
Entry Flow, veh/h	22	0	172	112	429	484	449	506	
Cap Entry Lane, veh/h	479	545	688	762	1189	1189	1190	1190	
Entry HV Adj Factor	1.000	1.000	0.988	0.991	0.981	0.980	0.989	0.990	
Flow Entry, veh/h	22	0	170	111	421	474	444	501	
Cap Entry, veh/h	479	545	680	755	1166	1166	1178	1178	
V/C Ratio	0.046	0.000	0.250	0.147	0.361	0.407	0.377	0.425	
Control Delay, s/veh	8.1	6.6	8.3	6.3	6.6	7.2	6.8	7.4	
LOS	A	A	A	A	A	A	A	A	
95th %tile Queue, veh	0	0	1	1	2	2	2	2	

Intersection									
Intersection Delay, s/veh	21.4								
Intersection LOS	C								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		2		2		
Adj Approach Flow, veh/h	846		377		861		1007		
Demand Flow Rate, veh/h	863		388		886		1018		
Vehicles Circulating, veh/h	1075		959		986		359		
Vehicles Exiting, veh/h	302		913		952		988		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	33.5		10.9		28.0		9.7		
Approach LOS	D		B		D		A		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	TR	LT	TR	LT	TR	LT	TR	
Assumed Moves	LT	TR	LT	TR	LT	TR	LT	TR	
RT Channelized									
Lane Util	0.470	0.530	0.469	0.531	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.667	2.535	2.667	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.645	4.328	4.645	4.328	
A (Intercept)	1350	1420	1350	1420	1350	1420	1350	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	
Entry Flow, veh/h	406	457	182	206	416	470	478	540	
Cap Entry Lane, veh/h	502	569	559	628	545	614	970	1047	
Entry HV Adj Factor	0.979	0.981	0.974	0.970	0.973	0.971	0.990	0.989	
Flow Entry, veh/h	398	448	177	200	405	456	473	534	
Cap Entry, veh/h	492	559	544	610	530	596	961	1035	
V/C Ratio	0.809	0.803	0.326	0.328	0.763	0.765	0.493	0.516	
Control Delay, s/veh	35.5	31.6	11.4	10.4	29.2	26.8	9.8	9.7	
LOS	E	D	B	B	D	D	A	A	
95th %tile Queue, veh	8	8	1	1	7	7	3	3	

Intersection						
Int Delay, s/veh	0.2					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↗		↑↑	↑↑	
Traffic Vol, veh/h	0	35	0	881	959	22
Future Vol, veh/h	0	35	0	881	959	22
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	0	0	4	4	2	2
Mvmt Flow	0	39	0	990	1078	25

Major/Minor	Minor2	Major1	Major2		
Conflicting Flow All	-	551	-	0	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-
Critical Hdwy	-	6.9	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-
Follow-up Hdwy	-	3.3	-	-	-
Pot Cap-1 Maneuver	0	483	0	-	-
Stage 1	0	-	0	-	-
Stage 2	0	-	0	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	-	483	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	13.11	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	483	-	-
HCM Lane V/C Ratio	-	0.081	-	-
HCM Ctrl Dly (s/v)	-	13.1	-	-
HCM Lane LOS	-	B	-	-
HCM 95th %tile Q(veh)	-	0.3	-	-

Intersection									
Intersection Delay, s/veh	12.0								
Intersection LOS	B								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		1		1		
Adj Approach Flow, veh/h	291		284		1083		1316		
Demand Flow Rate, veh/h	300		293		1093		1329		
Vehicles Circulating, veh/h	1343		1153		455		178		
Vehicles Exiting, veh/h	164		395		1188		1268		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	22.8		12.1		12.1		9.4		
Approach LOS	C		B		B		A		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	R	LT	R	LT	TR	LT	TR	
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR	
RT Channelized									
Lane Util	0.793	0.207	0.519	0.481	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544	
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4	
Entry Flow, veh/h	238	62	152	141	514	579	625	704	
Cap Entry Lane, veh/h	392	453	467	533	939	939	1208	1208	
Entry HV Adj Factor	0.969	0.968	0.968	0.972	0.990	0.991	0.990	0.991	
Flow Entry, veh/h	231	60	147	137	509	574	619	698	
Cap Entry, veh/h	380	439	452	518	929	930	1195	1197	
V/C Ratio	0.606	0.137	0.325	0.265	0.548	0.617	0.518	0.583	
Control Delay, s/veh	26.1	10.2	13.4	10.8	11.2	13.0	8.8	10.0	
LOS	D	B	B	B	B	B	A	B	
95th %tile Queue, veh	4	0	1	1	3	4	3	4	

Intersection						
Int Delay, s/veh	0.9					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑			↑	↑	
Traffic Vol, veh/h	499	1	8	188	10	33
Future Vol, veh/h	499	1	8	188	10	33
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	561	1	9	211	11	37

Major/Minor	Major1	Major2	Minor1	Minor2	Minor3
Conflicting Flow All	0	0	562	0	790
Stage 1	-	-	-	-	561
Stage 2	-	-	-	-	229
Critical Hdwy	-	-	4.12	-	6.42
Critical Hdwy Stg 1	-	-	-	-	5.42
Critical Hdwy Stg 2	-	-	-	-	5.42
Follow-up Hdwy	-	-	2.218	-	3.518
Pot Cap-1 Maneuver	-	-	1010	-	359
Stage 1	-	-	-	-	571
Stage 2	-	-	-	-	809
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1010	-	355
Mov Cap-2 Maneuver	-	-	-	-	355
Stage 1	-	-	-	-	571
Stage 2	-	-	-	-	801

Approach	EB	WB	NB
HCM Ctrl Dly, s/v	0	0.35	13.46
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	474	-	-	73	-
HCM Lane V/C Ratio	0.102	-	-	0.009	-
HCM Ctrl Dly (s/v)	13.5	-	-	8.6	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.3	-	-	0	-

Intersection						
Int Delay, s/veh	1.6					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑			↑	↑	
Traffic Vol, veh/h	529	3	19	192	4	78
Future Vol, veh/h	529	3	19	192	4	78
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	594	3	21	216	4	88

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	0	598	0	854
Stage 1	-	-	-	-	596
Stage 2	-	-	-	-	258
Critical Hdwy	-	-	4.12	-	6.42
Critical Hdwy Stg 1	-	-	-	-	5.42
Critical Hdwy Stg 2	-	-	-	-	5.42
Follow-up Hdwy	-	-	2.218	-	3.518
Pot Cap-1 Maneuver	-	-	979	-	329
Stage 1	-	-	-	-	550
Stage 2	-	-	-	-	785
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	979	-	321
Mov Cap-2 Maneuver	-	-	-	-	321
Stage 1	-	-	-	-	550
Stage 2	-	-	-	-	765

Approach	EB	WB	NB
HCM Ctrl Dly, s/v	0	0.79	14.04
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	490	-	-	162	-
HCM Lane V/C Ratio	0.188	-	-	0.022	-
HCM Ctrl Dly (s/v)	14	-	-	8.8	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.7	-	-	0.1	-

Intersection	
Intersection Delay, s/veh	17.4
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	10	178	17	37	315	60	57	115	24	39	78	15
Future Vol, veh/h	10	178	17	37	315	60	57	115	24	39	78	15
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles, %	2	2	2	1	1	1	0	0	0	0	0	0
Mvmt Flow	12	207	20	43	366	70	66	134	28	45	91	17
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	13	23	13.6	12.1
HCM LOS	B	C	B	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	29%	5%	9%	30%
Vol Thru, %	59%	87%	76%	59%
Vol Right, %	12%	8%	15%	11%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	196	205	412	132
LT Vol	57	10	37	39
Through Vol	115	178	315	78
RT Vol	24	17	60	15
Lane Flow Rate	228	238	479	153
Geometry Grp	1	1	1	1
Degree of Util (X)	0.4	0.399	0.744	0.278
Departure Headway (Hd)	6.32	6.019	5.592	6.518
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	570	598	652	549
Service Time	4.369	4.065	3.592	4.572
HCM Lane V/C Ratio	0.4	0.398	0.735	0.279
HCM Control Delay, s/veh	13.6	13	23	12.1
HCM Lane LOS	B	B	C	B
HCM 95th-tile Q	1.9	1.9	6.6	1.1

Intersection									
Intersection Delay, s/veh	12.5								
Intersection LOS	B								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		1		1		
Adj Approach Flow, veh/h	3		425		1623		1142		
Demand Flow Rate, veh/h	3		425		1623		1153		
Vehicles Circulating, veh/h	1409		1340		153		290		
Vehicles Exiting, veh/h	34		436		1259		1475		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	9.9		22.5		11.7		9.7		
Approach LOS	A		C		B		A		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	R	LT	R	LT	TR	LT	TR	
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR	
RT Channelized									
Lane Util	1.000	0.000	0.602	0.398	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544	
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4	
Entry Flow, veh/h	3	0	256	169	763	860	542	611	
Cap Entry Lane, veh/h	369	429	394	455	1236	1236	1091	1091	
Entry HV Adj Factor	1.000	1.000	1.000	1.000	1.000	1.000	0.990	0.991	
Flow Entry, veh/h	3	0	256	169	763	860	537	605	
Cap Entry, veh/h	369	429	394	455	1235	1236	1080	1080	
V/C Ratio	0.008	0.000	0.651	0.372	0.618	0.696	0.497	0.560	
Control Delay, s/veh	9.9	8.4	27.9	14.4	10.6	12.8	9.1	10.3	
LOS	A	A	D	B	B	B	A	B	
95th %tile Queue, veh	0	0	4	2	5	6	3	4	

Intersection									
Intersection Delay, s/veh	30.5								
Intersection LOS	D								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		2		2		
Adj Approach Flow, veh/h	470		762		1371		1066		
Demand Flow Rate, veh/h	470		762		1371		1076		
Vehicles Circulating, veh/h	1182		1378		534		801		
Vehicles Exiting, veh/h	695		527		1118		1339		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	16.5		60.3		22.1		26.1		
Approach LOS	C		F		C		D		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	TR	LT	TR	LT	TR	LT	TR	
Assumed Moves	LT	TR	LT	TR	LT	TR	LT	TR	
RT Channelized									
Lane Util	0.470	0.530	0.470	0.530	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.667	2.535	2.667	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.645	4.328	4.645	4.328	
A (Intercept)	1350	1420	1350	1420	1350	1420	1350	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	
Entry Flow, veh/h	221	249	358	404	644	727	506	570	
Cap Entry Lane, veh/h	455	520	380	440	826	902	646	719	
Entry HV Adj Factor	1.000	1.000	1.000	1.000	1.001	0.999	0.990	0.991	
Flow Entry, veh/h	221	249	358	404	644	727	501	565	
Cap Entry, veh/h	455	520	380	440	826	901	639	712	
V/C Ratio	0.486	0.479	0.942	0.918	0.780	0.806	0.783	0.793	
Control Delay, s/veh	17.6	15.5	65.8	55.3	21.8	22.3	26.8	25.5	
LOS	C	C	F	F	C	C	D	D	
95th %tile Queue, veh	3	3	10	10	8	9	8	8	

Intersection						
Int Delay, s/veh	0.2					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↗		↑↑	↑↑	
Traffic Vol, veh/h	0	31	0	1487	1031	60
Future Vol, veh/h	0	31	0	1487	1031	60
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	2	2
Mvmt Flow	0	34	0	1616	1121	65

Major/Minor	Minor2	Major1	Major2		
Conflicting Flow All	-	593	-	0	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-
Critical Hdwy	-	6.9	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-
Follow-up Hdwy	-	3.3	-	-	-
Pot Cap-1 Maneuver	0	454	0	-	-
Stage 1	0	-	0	-	-
Stage 2	0	-	0	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	-	454	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	13.57	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	454	-	-
HCM Lane V/C Ratio	-	0.074	-	-
HCM Ctrl Dly (s/v)	-	13.6	-	-
HCM Lane LOS	-	B	-	-
HCM 95th %tile Q(veh)	-	0.2	-	-

Intersection									
Intersection Delay, s/veh	14.3								
Intersection LOS	B								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		1		1		
Adj Approach Flow, veh/h	234		361		1493		1059		
Demand Flow Rate, veh/h	239		361		1493		1070		
Vehicles Circulating, veh/h	1103		1498		365		257		
Vehicles Exiting, veh/h	224		360		977		1602		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	13.2		22.1		16.6		8.6		
Approach LOS	B		C		C		A		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	R	LT	R	LT	TR	LT	TR	
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR	
RT Channelized									
Lane Util	0.820	0.180	0.526	0.474	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544	
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4	
Entry Flow, veh/h	196	43	190	171	702	791	503	567	
Cap Entry Lane, veh/h	489	556	340	397	1019	1019	1124	1124	
Entry HV Adj Factor	0.981	0.977	1.000	1.000	1.000	1.000	0.990	0.990	
Flow Entry, veh/h	192	42	190	171	702	791	498	561	
Cap Entry, veh/h	480	543	340	397	1018	1019	1112	1113	
V/C Ratio	0.401	0.077	0.558	0.430	0.689	0.776	0.448	0.504	
Control Delay, s/veh	14.4	7.6	26.0	17.9	14.4	18.5	8.1	9.0	
LOS	B	A	D	C	B	C	A	A	
95th %tile Queue, veh	2	0	3	2	6	8	2	3	

Intersection						
Int Delay, s/veh	0.6					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑			↑	↑	
Traffic Vol, veh/h	306	4	24	476	6	21
Future Vol, veh/h	306	4	24	476	6	21
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	344	4	27	535	7	24

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	0	348	0	935 346
Stage 1	-	-	-	-	346 -
Stage 2	-	-	-	-	589 -
Critical Hdwy	-	-	4.12	-	6.42 6.22
Critical Hdwy Stg 1	-	-	-	-	5.42 -
Critical Hdwy Stg 2	-	-	-	-	5.42 -
Follow-up Hdwy	-	-	2.218	-	3.518 3.318
Pot Cap-1 Maneuver	-	-	1211	-	295 697
Stage 1	-	-	-	-	716 -
Stage 2	-	-	-	-	555 -
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1211	-	285 697
Mov Cap-2 Maneuver	-	-	-	-	285 -
Stage 1	-	-	-	-	716 -
Stage 2	-	-	-	-	537 -

Approach	EB	WB	NB
HCM Ctrl Dly, s/v	0	0.39	12.24
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	528	-	-	86	-
HCM Lane V/C Ratio	0.057	-	-	0.022	-
HCM Ctrl Dly (s/v)	12.2	-	-	8	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.2	-	-	0.1	-

Intersection						
Int Delay, s/veh	1.1					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑			↑	↑	
Traffic Vol, veh/h	318	9	56	497	3	50
Future Vol, veh/h	318	9	56	497	3	50
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	357	10	63	558	3	56

Major/Minor	Major1	Major2	Minor1	Minor2	Minor3
Conflicting Flow All	0	0	367	0	1047 362
Stage 1	-	-	-	-	362 -
Stage 2	-	-	-	-	684 -
Critical Hdwy	-	-	4.12	-	6.42 6.22
Critical Hdwy Stg 1	-	-	-	-	5.42 -
Critical Hdwy Stg 2	-	-	-	-	5.42 -
Follow-up Hdwy	-	-	2.218	-	3.518 3.318
Pot Cap-1 Maneuver	-	-	1191	-	253 682
Stage 1	-	-	-	-	704 -
Stage 2	-	-	-	-	501 -
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1191	-	233 682
Mov Cap-2 Maneuver	-	-	-	-	233 -
Stage 1	-	-	-	-	704 -
Stage 2	-	-	-	-	463 -

Approach	EB	WB	NB
HCM Ctrl Dly, s/v	0	0.83	11.48
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	615	-	-	182	-
HCM Lane V/C Ratio	0.097	-	-	0.053	-
HCM Ctrl Dly (s/v)	11.5	-	-	8.2	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.3	-	-	0.2	-

Intersection	
Intersection Delay, s/veh	11.3
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	10	237	43	22	105	16	8	60	58	83	93	16
Future Vol, veh/h	10	237	43	22	105	16	8	60	58	83	93	16
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles, %	2	2	2	5	5	5	5	5	5	1	1	1
Mvmt Flow	11	266	48	25	118	18	9	67	65	93	104	18
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	12.5	10.2	9.9	11.2
HCM LOS	B	B	A	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	6%	3%	15%	43%
Vol Thru, %	48%	82%	73%	48%
Vol Right, %	46%	15%	11%	8%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	126	290	143	192
LT Vol	8	10	22	83
Through Vol	60	237	105	93
RT Vol	58	43	16	16
Lane Flow Rate	142	326	161	216
Geometry Grp	1	1	1	1
Degree of Util (X)	0.212	0.462	0.243	0.329
Departure Headway (Hd)	5.392	5.106	5.446	5.485
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	664	704	659	656
Service Time	3.434	3.14	3.486	3.523
HCM Lane V/C Ratio	0.214	0.463	0.244	0.329
HCM Control Delay, s/veh	9.9	12.5	10.2	11.2
HCM Lane LOS	A	B	B	B
HCM 95th-tile Q	0.8	2.4	0.9	1.4

Intersection									
Intersection Delay, s/veh	7.8								
Intersection LOS	A								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		1		1		
Adj Approach Flow, veh/h	24		311		942		1040		
Demand Flow Rate, veh/h	24		314		961		1050		
Vehicles Circulating, veh/h	1239		770		217		213		
Vehicles Exiting, veh/h	24		408		1046		871		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	9.1		8.1		7.4		7.9		
Approach LOS	A		A		A		A		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	R	LT	R	LT	TR	LT	TR	
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR	
RT Channelized									
Lane Util	1.000	0.000	0.602	0.398	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544	
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4	
Entry Flow, veh/h	24	0	189	125	452	509	494	556	
Cap Entry Lane, veh/h	432	495	665	738	1166	1166	1170	1170	
Entry HV Adj Factor	1.000	1.000	0.989	0.992	0.980	0.981	0.989	0.991	
Flow Entry, veh/h	24	0	187	124	443	499	489	551	
Cap Entry, veh/h	432	495	658	732	1142	1144	1157	1159	
V/C Ratio	0.056	0.000	0.284	0.169	0.388	0.437	0.422	0.475	
Control Delay, s/veh	9.1	7.3	9.1	6.8	7.1	7.7	7.5	8.3	
LOS	A	A	A	A	A	A	A	A	
95th %tile Queue, veh	0	0	1	1	2	2	2	3	

Intersection									
Intersection Delay, s/veh	25.6								
Intersection LOS	D								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		2		2		
Adj Approach Flow, veh/h	804		407		946		1109		
Demand Flow Rate, veh/h	819		419		974		1120		
Vehicles Circulating, veh/h	1187		994		988		370		
Vehicles Exiting, veh/h	303		968		1018		1043		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	40.7		11.9		35.8		11.0		
Approach LOS	E		B		E		B		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	TR	LT	TR	LT	TR	LT	TR	
Assumed Moves	LT	TR	LT	TR	LT	TR	LT	TR	
RT Channelized									
Lane Util	0.470	0.530	0.470	0.530	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.667	2.535	2.667	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.645	4.328	4.645	4.328	
A (Intercept)	1350	1420	1350	1420	1350	1420	1350	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	
Entry Flow, veh/h	385	434	197	222	458	516	526	594	
Cap Entry Lane, veh/h	453	518	541	610	544	613	960	1037	
Entry HV Adj Factor	0.981	0.982	0.970	0.971	0.971	0.971	0.991	0.989	
Flow Entry, veh/h	378	426	191	216	445	501	521	588	
Cap Entry, veh/h	444	508	525	592	528	596	951	1026	
V/C Ratio	0.850	0.838	0.364	0.364	0.842	0.842	0.548	0.573	
Control Delay, s/veh	43.7	38.1	12.6	11.3	37.5	34.3	11.0	11.0	
LOS	E	E	B	B	E	D	B	B	
95th %tile Queue, veh	8	9	2	2	9	9	3	4	

Intersection						
Int Delay, s/veh	0.2					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↗		↑↑	↑↑	
Traffic Vol, veh/h	0	26	0	937	1008	9
Future Vol, veh/h	0	26	0	937	1008	9
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	0	0	4	4	2	2
Mvmt Flow	0	29	0	1053	1133	10

Major/Minor	Minor2	Major1	Major2		
Conflicting Flow All	-	571	-	0	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-
Critical Hdwy	-	6.9	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-
Follow-up Hdwy	-	3.3	-	-	-
Pot Cap-1 Maneuver	0	469	0	-	-
Stage 1	0	-	0	-	-
Stage 2	0	-	0	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	-	469	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	13.19	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	469	-	-
HCM Lane V/C Ratio	-	0.062	-	-
HCM Ctrl Dly (s/v)	-	13.2	-	-
HCM Lane LOS	-	B	-	-
HCM 95th %tile Q(veh)	-	0.2	-	-

Intersection									
Intersection Delay, s/veh	13.7								
Intersection LOS	B								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		1		1		
Adj Approach Flow, veh/h	312		305		1152		1374		
Demand Flow Rate, veh/h	321		314		1163		1387		
Vehicles Circulating, veh/h	1402		1227		481		192		
Vehicles Exiting, veh/h	177		417		1242		1349		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	28.4		13.8		13.9		10.2		
Approach LOS	D		B		B		B		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	R	LT	R	LT	TR	LT	TR	
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR	
RT Channelized									
Lane Util	0.798	0.202	0.525	0.475	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544	
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4	
Entry Flow, veh/h	256	65	165	149	547	616	652	735	
Cap Entry Lane, veh/h	372	431	437	500	917	917	1192	1192	
Entry HV Adj Factor	0.971	0.969	0.970	0.973	0.990	0.991	0.990	0.991	
Flow Entry, veh/h	249	63	160	145	542	611	646	728	
Cap Entry, veh/h	361	418	423	487	907	909	1181	1181	
V/C Ratio	0.689	0.151	0.378	0.298	0.597	0.672	0.547	0.616	
Control Delay, s/veh	32.8	10.9	15.5	12.0	12.6	15.0	9.4	10.9	
LOS	D	B	C	B	B	C	A	B	
95th %tile Queue, veh	5	1	2	1	4	5	3	4	

Intersection	
Intersection Delay, s/veh	20
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	12	181	18	39	332	63	61	123	25	40	84	17
Future Vol, veh/h	12	181	18	39	332	63	61	123	25	40	84	17
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles, %	2	2	2	1	1	1	0	0	0	0	0	0
Mvmt Flow	14	210	21	45	386	73	71	143	29	47	98	20
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	13.9	28	14.6	12.8
HCM LOS	B	D	B	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	29%	6%	9%	28%
Vol Thru, %	59%	86%	76%	60%
Vol Right, %	12%	9%	15%	12%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	209	211	434	141
LT Vol	61	12	39	40
Through Vol	123	181	332	84
RT Vol	25	18	63	17
Lane Flow Rate	243	245	505	164
Geometry Grp	1	1	1	1
Degree of Util (X)	0.44	0.425	0.802	0.307
Departure Headway (Hd)	6.523	6.243	5.722	6.74
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	552	574	631	531
Service Time	4.576	4.298	3.765	4.799
HCM Lane V/C Ratio	0.44	0.427	0.8	0.309
HCM Control Delay, s/veh	14.6	13.9	28	12.8
HCM Lane LOS	B	B	D	B
HCM 95th-tile Q	2.2	2.1	8	1.3

Intersection									
Intersection Delay, s/veh	15.9								
Intersection LOS	C								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		1		1		
Adj Approach Flow, veh/h	5		467		1775		1227		
Demand Flow Rate, veh/h	5		467		1775		1240		
Vehicles Circulating, veh/h	1517		1464		175		316		
Vehicles Exiting, veh/h	39		486		1347		1615		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	11.0		33.3		14.6		11.1		
Approach LOS	B		D		B		B		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	R	LT	R	LT	TR	LT	TR	
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR	
RT Channelized									
Lane Util	1.000	0.000	0.593	0.407	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544	
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4	
Entry Flow, veh/h	5	0	277	190	834	941	583	657	
Cap Entry Lane, veh/h	334	391	351	409	1211	1211	1065	1065	
Entry HV Adj Factor	1.000	1.000	1.000	1.000	1.000	1.000	0.990	0.990	
Flow Entry, veh/h	5	0	277	190	834	941	577	651	
Cap Entry, veh/h	334	391	351	409	1211	1211	1054	1055	
V/C Ratio	0.015	0.000	0.789	0.464	0.689	0.777	0.547	0.617	
Control Delay, s/veh	11.0	9.2	43.5	18.5	12.7	16.3	10.2	11.8	
LOS	B	A	E	C	B	C	B	B	
95th %tile Queue, veh	0	0	7	2	6	8	3	4	

Intersection									
Intersection Delay, s/veh	40.0								
Intersection LOS	E								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		2		2		
Adj Approach Flow, veh/h	439		788		1492		1136		
Demand Flow Rate, veh/h	439		788		1492		1147		
Vehicles Circulating, veh/h	1287		1463		528		792		
Vehicles Exiting, veh/h	652		557		1198		1459		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	18.2		89.6		27.8		30.2		
Approach LOS	C		F		D		D		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	TR	LT	TR	LT	TR	LT	TR	
Assumed Moves	LT	TR	LT	TR	LT	TR	LT	TR	
RT Channelized									
Lane Util	0.469	0.531	0.470	0.530	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.667	2.535	2.667	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.645	4.328	4.645	4.328	
A (Intercept)	1350	1420	1350	1420	1350	1420	1350	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	
Entry Flow, veh/h	206	233	370	418	701	791	539	608	
Cap Entry Lane, veh/h	413	475	351	409	831	907	651	724	
Entry HV Adj Factor	1.002	0.999	1.001	0.999	1.000	1.000	0.991	0.990	
Flow Entry, veh/h	206	233	370	418	701	791	534	602	
Cap Entry, veh/h	414	475	352	409	831	906	645	717	
V/C Ratio	0.499	0.490	1.053	1.021	0.844	0.873	0.827	0.839	
Control Delay, s/veh	19.5	17.1	97.8	82.3	27.1	28.5	30.8	29.7	
LOS	C	C	F	F	D	D	D	D	
95th %tile Queue, veh	3	3	13	13	10	11	9	9	

Intersection						
Int Delay, s/veh	0.1					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↗		↑↑	↑↑	
Traffic Vol, veh/h	0	26	0	1565	1093	21
Future Vol, veh/h	0	26	0	1565	1093	21
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	2	2
Mvmt Flow	0	28	0	1701	1188	23

Major/Minor	Minor2	Major1	Major2		
Conflicting Flow All	-	605	-	0	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-
Critical Hdwy	-	6.9	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-
Follow-up Hdwy	-	3.3	-	-	-
Pot Cap-1 Maneuver	0	445	0	-	-
Stage 1	0	-	0	-	-
Stage 2	0	-	0	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	-	445	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	13.63	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	445	-	-
HCM Lane V/C Ratio	-	0.063	-	-
HCM Ctrl Dly (s/v)	-	13.6	-	-
HCM Lane LOS	-	B	-	-
HCM 95th %tile Q(veh)	-	0.2	-	-

Intersection									
Intersection Delay, s/veh	16.9								
Intersection LOS	C								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		1		1		
Adj Approach Flow, veh/h	250		380		1576		1114		
Demand Flow Rate, veh/h	255		380		1576		1125		
Vehicles Circulating, veh/h	1161		1581		385		276		
Vehicles Exiting, veh/h	240		380		1031		1685		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	15.0		27.5		20.0		9.3		
Approach LOS	B		D		C		A		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	R	LT	R	LT	TR	LT	TR	
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR	
RT Channelized									
Lane Util	0.820	0.180	0.537	0.463	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544	
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4	
Entry Flow, veh/h	209	46	204	176	741	835	529	596	
Cap Entry Lane, veh/h	464	529	315	370	1000	1000	1105	1105	
Entry HV Adj Factor	0.982	0.978	1.000	1.000	1.000	1.000	0.990	0.990	
Flow Entry, veh/h	205	45	204	176	741	835	523	590	
Cap Entry, veh/h	456	518	315	370	1000	1001	1093	1094	
V/C Ratio	0.450	0.087	0.647	0.475	0.741	0.835	0.479	0.540	
Control Delay, s/veh	16.5	8.0	33.4	20.6	16.8	22.9	8.7	9.8	
LOS	C	A	D	C	C	C	A	A	
95th %tile Queue, veh	2	0	4	2	7	10	3	3	

Intersection	
Intersection Delay, s/veh	11.6
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	10	243	43	25	122	18	8	60	60	85	93	16
Future Vol, veh/h	10	243	43	25	122	18	8	60	60	85	93	16
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles, %	2	2	2	5	5	5	5	5	5	1	1	1
Mvmt Flow	11	273	48	28	137	20	9	67	67	96	104	18
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	12.9	10.7	10.1	11.5
HCM LOS	B	B	B	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	6%	3%	15%	44%
Vol Thru, %	47%	82%	74%	48%
Vol Right, %	47%	15%	11%	8%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	128	296	165	194
LT Vol	8	10	25	85
Through Vol	60	243	122	93
RT Vol	60	43	18	16
Lane Flow Rate	144	333	185	218
Geometry Grp	1	1	1	1
Degree of Util (X)	0.22	0.479	0.283	0.339
Departure Headway (Hd)	5.501	5.181	5.497	5.594
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	650	695	653	641
Service Time	3.552	3.222	3.545	3.641
HCM Lane V/C Ratio	0.222	0.479	0.283	0.34
HCM Control Delay, s/veh	10.1	12.9	10.7	11.5
HCM Lane LOS	B	B	B	B
HCM 95th-tile Q	0.8	2.6	1.2	1.5

Intersection									
Intersection Delay, s/veh	8.3								
Intersection LOS	A								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		1		1		
Adj Approach Flow, veh/h	24		323		1027		1073		
Demand Flow Rate, veh/h	24		326		1047		1084		
Vehicles Circulating, veh/h	1285		843		217		225		
Vehicles Exiting, veh/h	24		421		1092		944		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	9.5		9.1		8.0		8.3		
Approach LOS	A		A		A		A		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	R	LT	R	LT	TR	LT	TR	
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR	
RT Channelized									
Lane Util	1.000	0.000	0.617	0.383	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544	
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4	
Entry Flow, veh/h	24	0	201	125	492	555	509	575	
Cap Entry Lane, veh/h	414	476	622	694	1166	1166	1157	1157	
Entry HV Adj Factor	1.000	1.000	0.990	0.992	0.981	0.981	0.991	0.989	
Flow Entry, veh/h	24	0	199	124	483	544	504	569	
Cap Entry, veh/h	414	476	615	688	1143	1143	1147	1145	
V/C Ratio	0.058	0.000	0.323	0.180	0.422	0.476	0.440	0.497	
Control Delay, s/veh	9.5	7.6	10.2	7.3	7.5	8.4	7.8	8.7	
LOS	A	A	B	A	A	A	A	A	
95th %tile Queue, veh	0	0	1	1	2	3	2	3	

Intersection									
Intersection Delay, s/veh	52.5								
Intersection LOS	F								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		2		2		
Adj Approach Flow, veh/h	1002		441		975		1148		
Demand Flow Rate, veh/h	1022		455		1004		1160		
Vehicles Circulating, veh/h	1217		1116		1158		436		
Vehicles Exiting, veh/h	379		1046		1081		1135		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	95.2		14.9		72.5		12.9		
Approach LOS	F		B		F		B		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	TR	LT	TR	LT	TR	LT	TR	
Assumed Moves	LT	TR	LT	TR	LT	TR	LT	TR	
RT Channelized									
Lane Util	0.470	0.530	0.470	0.530	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.667	2.535	2.667	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.645	4.328	4.645	4.328	
A (Intercept)	1350	1420	1350	1420	1350	1420	1350	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	
Entry Flow, veh/h	480	542	214	241	472	532	545	615	
Cap Entry Lane, veh/h	441	505	484	550	465	531	904	980	
Entry HV Adj Factor	0.981	0.980	0.969	0.970	0.971	0.971	0.990	0.990	
Flow Entry, veh/h	471	531	207	234	458	517	540	609	
Cap Entry, veh/h	432	495	468	533	452	515	895	970	
V/C Ratio	1.089	1.074	0.443	0.438	1.015	1.003	0.603	0.627	
Control Delay, s/veh	100.4	90.5	15.9	14.1	76.7	68.7	12.9	12.9	
LOS	F	F	C	B	F	F	B	B	
95th %tile Queue, veh	16	17	2	2	14	14	4	5	

Intersection						
Int Delay, s/veh	0.4					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↗		↑↑	↑↑	
Traffic Vol, veh/h	0	54	0	962	1036	44
Future Vol, veh/h	0	54	0	962	1036	44
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	0	0	4	4	2	2
Mvmt Flow	0	61	0	1081	1164	49

Major/Minor	Minor2	Major1	Major2		
Conflicting Flow All	-	607	-	0	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-
Critical Hdwy	-	6.9	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-
Follow-up Hdwy	-	3.3	-	-	-
Pot Cap-1 Maneuver	0	445	0	-	-
Stage 1	0	-	0	-	-
Stage 2	0	-	0	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	-	445	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	14.37	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	445	-	-
HCM Lane V/C Ratio	-	0.136	-	-
HCM Ctrl Dly (s/v)	-	14.4	-	-
HCM Lane LOS	-	B	-	-
HCM 95th %tile Q(veh)	-	0.5	-	-

Intersection									
Intersection Delay, s/veh	14.8								
Intersection LOS	B								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		1		1		
Adj Approach Flow, veh/h	312		311		1177		1444		
Demand Flow Rate, veh/h	321		321		1188		1458		
Vehicles Circulating, veh/h	1473		1252		496		192		
Vehicles Exiting, veh/h	177		432		1298		1381		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	33.4		14.4		14.9		10.9		
Approach LOS	D		B		B		B		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	R	LT	R	LT	TR	LT	TR	
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR	
RT Channelized									
Lane Util	0.798	0.202	0.514	0.486	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544	
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4	
Entry Flow, veh/h	256	65	165	156	558	630	685	773	
Cap Entry Lane, veh/h	348	406	427	490	904	904	1192	1192	
Entry HV Adj Factor	0.971	0.969	0.970	0.968	0.991	0.990	0.991	0.990	
Flow Entry, veh/h	249	63	160	151	553	624	679	765	
Cap Entry, veh/h	338	393	414	474	896	895	1182	1181	
V/C Ratio	0.735	0.160	0.387	0.318	0.617	0.697	0.574	0.648	
Control Delay, s/veh	38.9	11.7	16.0	12.7	13.3	16.2	9.9	11.7	
LOS	E	B	C	B	B	C	A	B	
95th %tile Queue, veh	6	1	2	1	4	6	4	5	

Intersection						
Int Delay, s/veh	2					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑			↑	↑	
Traffic Vol, veh/h	551	5	37	210	16	75
Future Vol, veh/h	551	5	37	210	16	75
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	619	6	42	236	18	84

Major/Minor	Major1	Major2	Minor1	Minor2	Minor3
Conflicting Flow All	0	0	625	0	941
Stage 1	-	-	-	-	622
Stage 2	-	-	-	-	319
Critical Hdwy	-	-	4.12	-	6.42
Critical Hdwy Stg 1	-	-	-	-	5.42
Critical Hdwy Stg 2	-	-	-	-	5.42
Follow-up Hdwy	-	-	2.218	-	3.518
Pot Cap-1 Maneuver	-	-	957	-	292
Stage 1	-	-	-	-	535
Stage 2	-	-	-	-	737
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	957	-	278
Mov Cap-2 Maneuver	-	-	-	-	278
Stage 1	-	-	-	-	535
Stage 2	-	-	-	-	700

Approach	EB	WB	NB
HCM Ctrl Dly, s/v	0	1.34	15.97
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	430	-	-	270	-
HCM Lane V/C Ratio	0.238	-	-	0.043	-
HCM Ctrl Dly (s/v)	16	-	-	8.9	0
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	0.9	-	-	0.1	-

Intersection						
Int Delay, s/veh	2					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑			↑	↑	
Traffic Vol, veh/h	622	4	19	240	7	101
Future Vol, veh/h	622	4	19	240	7	101
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	699	4	21	270	8	113

Major/Minor	Major1	Major2	Minor1	Minor2	Minor3
Conflicting Flow All	0	0	703	0	1013
Stage 1	-	-	-	-	701
Stage 2	-	-	-	-	312
Critical Hdwy	-	-	4.12	-	6.42
Critical Hdwy Stg 1	-	-	-	-	5.42
Critical Hdwy Stg 2	-	-	-	-	5.42
Follow-up Hdwy	-	-	2.218	-	3.518
Pot Cap-1 Maneuver	-	-	894	-	265
Stage 1	-	-	-	-	492
Stage 2	-	-	-	-	742
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	894	-	257
Mov Cap-2 Maneuver	-	-	-	-	257
Stage 1	-	-	-	-	492
Stage 2	-	-	-	-	721

Approach	EB	WB	NB
HCM Ctrl Dly, s/v	0	0.67	17.04
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	419	-	-	132	-
HCM Lane V/C Ratio	0.289	-	-	0.024	-
HCM Ctrl Dly (s/v)	17	-	-	9.1	0
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	1.2	-	-	0.1	-

Intersection	
Intersection Delay, s/veh	23.7
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	12	202	18	41	348	66	61	123	28	44	84	17
Future Vol, veh/h	12	202	18	41	348	66	61	123	28	44	84	17
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles, %	2	2	2	1	1	1	0	0	0	0	0	0
Mvmt Flow	14	235	21	48	405	77	71	143	33	51	98	20
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	15.3	35.1	15.5	13.5
HCM LOS	C	E	C	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	29%	5%	9%	30%
Vol Thru, %	58%	87%	76%	58%
Vol Right, %	13%	8%	15%	12%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	212	232	455	145
LT Vol	61	12	41	44
Through Vol	123	202	348	84
RT Vol	28	18	66	17
Lane Flow Rate	247	270	529	169
Geometry Grp	1	1	1	1
Degree of Util (X)	0.462	0.48	0.863	0.328
Departure Headway (Hd)	6.747	6.41	5.87	6.995
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	532	558	614	511
Service Time	4.82	4.483	3.926	5.075
HCM Lane V/C Ratio	0.464	0.484	0.862	0.331
HCM Control Delay, s/veh	15.5	15.3	35.1	13.5
HCM Lane LOS	C	C	E	B
HCM 95th-tile Q	2.4	2.6	9.8	1.4

Intersection									
Intersection Delay, s/veh	20.6								
Intersection LOS	C								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		1		1		
Adj Approach Flow, veh/h	5		506		1859		1325		
Demand Flow Rate, veh/h	5		506		1859		1339		
Vehicles Circulating, veh/h	1655		1536		175		355		
Vehicles Exiting, veh/h	39		498		1485		1687		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	12.5		55.5		16.3		13.3		
Approach LOS	B		F		C		B		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	R	LT	R	LT	TR	LT	TR	
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR	
RT Channelized									
Lane Util	1.000	0.000	0.625	0.375	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544	
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4	
Entry Flow, veh/h	5	0	316	190	874	985	629	710	
Cap Entry Lane, veh/h	295	348	329	385	1211	1211	1028	1028	
Entry HV Adj Factor	1.000	1.000	1.000	1.000	1.000	1.000	0.990	0.989	
Flow Entry, veh/h	5	0	316	190	874	985	623	702	
Cap Entry, veh/h	295	348	329	385	1211	1211	1018	1017	
V/C Ratio	0.017	0.000	0.962	0.494	0.722	0.813	0.612	0.691	
Control Delay, s/veh	12.5	10.4	76.5	20.6	13.9	18.4	12.0	14.5	
LOS	B	B	F	C	B	C	B	B	
95th %tile Queue, veh	0	0	10	3	7	10	4	6	

Intersection									
Intersection Delay, s/veh	95.7								
Intersection LOS	F								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		2		2		
Adj Approach Flow, veh/h	621		897		1569		1243		
Demand Flow Rate, veh/h	621		897		1569		1256		
Vehicles Circulating, veh/h	1374		1618		673		978		
Vehicles Exiting, veh/h	860		624		1322		1537		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	35.0		208.7		62.8		85.8		
Approach LOS	D		F		F		F		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	TR	LT	TR	LT	TR	LT	TR	
Assumed Moves	LT	TR	LT	TR	LT	TR	LT	TR	
RT Channelized									
Lane Util	0.470	0.530	0.470	0.530	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.667	2.535	2.667	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.645	4.328	4.645	4.328	
A (Intercept)	1350	1420	1350	1420	1350	1420	1350	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	
Entry Flow, veh/h	292	329	422	475	737	832	590	666	
Cap Entry Lane, veh/h	381	442	305	359	727	801	549	618	
Entry HV Adj Factor	1.000	1.000	0.999	1.001	1.001	0.999	0.991	0.990	
Flow Entry, veh/h	292	329	422	475	737	832	584	659	
Cap Entry, veh/h	381	442	304	359	727	801	544	612	
V/C Ratio	0.766	0.745	1.385	1.324	1.014	1.038	1.075	1.077	
Control Delay, s/veh	38.2	32.1	225.4	194.0	60.7	64.7	87.4	84.4	
LOS	E	D	F	F	F	F	F	F	
95th %tile Queue, veh	6	6	22	22	17	20	18	19	

Intersection						
Int Delay, s/veh	0.2					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↗		↑↑	↑↑	
Traffic Vol, veh/h	0	45	0	1636	1127	132
Future Vol, veh/h	0	45	0	1636	1127	132
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	2	2
Mvmt Flow	0	49	0	1778	1225	143

Major/Minor	Minor2	Major1	Major2		
Conflicting Flow All	-	684	-	0	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-
Critical Hdwy	-	6.9	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-
Follow-up Hdwy	-	3.3	-	-	-
Pot Cap-1 Maneuver	0	396	0	-	-
Stage 1	0	-	0	-	-
Stage 2	0	-	0	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	-	396	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	15.38	0	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBT EBLn1	SBT	SBR
Capacity (veh/h)	- 396	-	-
HCM Lane V/C Ratio	- 0.124	-	-
HCM Ctrl Dly (s/v)	- 15.4	-	-
HCM Lane LOS	- C	-	-
HCM 95th %tile Q(veh)	- 0.4	-	-

Intersection									
Intersection Delay, s/veh	19.1								
Intersection LOS	C								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		1		1		
Adj Approach Flow, veh/h	250		396		1636		1168		
Demand Flow Rate, veh/h	255		396		1636		1180		
Vehicles Circulating, veh/h	1216		1641		396		276		
Vehicles Exiting, veh/h	240		391		1075		1761		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	16.2		31.5		23.2		9.7		
Approach LOS	C		D		C		A		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LT	R	LT	R	LT	TR	LT	TR	
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR	
RT Channelized									
Lane Util	0.820	0.180	0.515	0.485	0.470	0.530	0.470	0.530	
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535	
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544	
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420	
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4	
Entry Flow, veh/h	209	46	204	192	769	867	555	625	
Cap Entry Lane, veh/h	441	505	298	352	990	990	1105	1105	
Entry HV Adj Factor	0.982	0.978	1.000	1.000	1.000	1.000	0.989	0.991	
Flow Entry, veh/h	205	45	204	192	769	867	549	619	
Cap Entry, veh/h	433	494	298	352	990	990	1093	1094	
V/C Ratio	0.474	0.091	0.684	0.546	0.776	0.875	0.502	0.566	
Control Delay, s/veh	17.9	8.5	38.0	24.6	18.9	27.1	9.1	10.3	
LOS	C	A	E	C	C	D	A	B	
95th %tile Queue, veh	2	0	5	3	8	12	3	4	

Intersection						
Int Delay, s/veh	2.4					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑			↑	↑	
Traffic Vol, veh/h	340	15	91	525	16	103
Future Vol, veh/h	340	15	91	525	16	103
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	382	17	102	590	18	116

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	0	399	0	1185 390
Stage 1	-	-	-	-	390 -
Stage 2	-	-	-	-	794 -
Critical Hdwy	-	-	4.12	-	6.42 6.22
Critical Hdwy Stg 1	-	-	-	-	5.42 -
Critical Hdwy Stg 2	-	-	-	-	5.42 -
Follow-up Hdwy	-	-	2.218	-	3.518 3.318
Pot Cap-1 Maneuver	-	-	1160	-	209 658
Stage 1	-	-	-	-	684 -
Stage 2	-	-	-	-	445 -
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1160	-	181 658
Mov Cap-2 Maneuver	-	-	-	-	181 -
Stage 1	-	-	-	-	684 -
Stage 2	-	-	-	-	387 -

Approach	EB	WB	NB
HCM Ctrl Dly, s/v	0	1.24	15.19
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	486	-	-	266	-
HCM Lane V/C Ratio	0.275	-	-	0.088	-
HCM Ctrl Dly (s/v)	15.2	-	-	8.4	0
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	1.1	-	-	0.3	-

Intersection						
Int Delay, s/veh	1.2					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑			↑	↑	
Traffic Vol, veh/h	430	13	56	611	5	65
Future Vol, veh/h	430	13	56	611	5	65
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	483	15	63	687	6	73

Major/Minor	Major1	Major2	Minor1	Minor2	Minor3
Conflicting Flow All	0	0	498	0	1303
Stage 1	-	-	-	-	490
Stage 2	-	-	-	-	812
Critical Hdwy	-	-	4.12	-	6.42
Critical Hdwy Stg 1	-	-	-	-	5.42
Critical Hdwy Stg 2	-	-	-	-	5.42
Follow-up Hdwy	-	-	2.218	-	3.518
Pot Cap-1 Maneuver	-	-	1066	-	177
Stage 1	-	-	-	-	616
Stage 2	-	-	-	-	436
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1066	-	160
Mov Cap-2 Maneuver	-	-	-	-	160
Stage 1	-	-	-	-	616
Stage 2	-	-	-	-	395

Approach	EB	WB	NB
HCM Ctrl Dly, s/v	0	0.72	13.81
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	487	-	-	151	-
HCM Lane V/C Ratio	0.161	-	-	0.059	-
HCM Ctrl Dly (s/v)	13.8	-	-	8.6	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.6	-	-	0.2	-

Appendix C: Intersection Cost Participation Calculations

City of Billings Cost Participation Worksheet: Clearwater Phase 1

Whether a movement pair is critical is based on Phase 1 site-generated traffic, as shown in Exhibit 12 of the report.

1: Central at 48th

Lane Group (critical)	Lanes	AM Peak Hour		PM Peak Hour	
		Vproject	Per Lane	Vproject	Per Lane
EB T	1	3	3	10	10
WB L	1	2	2	1	1
WB T	1	10	10	7	7
EB L	1	No project traffic			
NB T	1	No project traffic			
SB L	1	1	1	2	2
SB T	1	No project traffic			
NB L	1	No project traffic			
Project Critical Lane Volume		11		13	
Critical Lane Capacity		1200		1200	
% Increase		0.9%		1.1%	
Max % Increase		1.1%			

2: Shiloh at Broadwater

Lane Group (critical)	Lanes	AM Peak Hour		PM Peak Hour	
		Vproject	Per Lane	Vproject	Per Lane
EB T	1	No project traffic			
WB L	1	2	2	7	7
WB T	1	No project traffic			
EB L	1	No project traffic			
NB T	2	41	21	26	13
SB L	1	No project traffic			
SB T	2	14	7	40	20
NB L	1	No project traffic			
Project Critical Lane Volume		23		27	
Critical Lane Capacity		1200		1200	
% Increase		1.9%		2.3%	
Max % Increase		2.3%			

3: Shiloh at Central

Lane Group (critical)	Lanes	AM Peak Hour		PM Peak Hour	
		Vproject	Per Lane	Vproject	Per Lane
EB T	2	41	21	26	13
WB L	1	5	5	13	13
WB T	2	9	5	27	14
EB L	1	48	48	31	31
NB T	2	No project traffic			
SB L	1	No project traffic			
SB T	2	5	3	15	8
NB L	1	8	8	22	22
Project Critical Lane Volume		64		75	
Critical Lane Capacity		1200		1200	
% Increase		5.3%		6.3%	
Max % Increase		6.3%			

5: Shiloh at Monad

Lane Group (critical)	Lanes	AM Peak Hour		PM Peak Hour	
		Vproject	Per Lane	Vproject	Per Lane
EB T	1	No project traffic			
WB L	1	No project traffic			
WB T	1	No project traffic			
EB L	1	No project traffic			
NB T	2	9	5	27	14
SB L	1	7	7	4	4
SB T	2	27	14	18	9
NB L	1	No project traffic			
Project Critical Lane Volume		14		18	
Critical Lane Capacity		1200		1200	
% Increase		1.2%		1.5%	
Max % Increase		1.5%			

City of Billings Cost Participation Worksheet: Clearwater Phase 2

Whether a movement pair is critical is based on Phase 2 site-generated traffic, as shown in Exhibit 14 of the report.

1: Central at 48th

Lane Group (critical)	Lanes	AM Peak Hour		PM Peak Hour	
		Vproject	Per Lane	Vproject	Per Lane
EB T	1	3	3	11	11
WB L	1	1	1	1	1
WB T	1	7	7	9	9
EB L	1	No project traffic			
NB T	1	No project traffic			
SB L	1	1	1	2	2
SB T	1	No project traffic			
NB L	1	No project traffic			
Project Critical Lane Volume		8		14	
Critical Lane Capacity		1200		1200	
% Increase		0.7%		1.2%	
Max % Increase		1.2%			

2: Shiloh at Broadwater

Lane Group (critical)	Lanes	AM Peak Hour		PM Peak Hour	
		Vproject	Per Lane	Vproject	Per Lane
EB T	1	No project traffic			
WB L	1	9	9	27	27
WB T	1	No project traffic			
EB L	1	No project traffic			
NB T	2	27	14	36	18
SB L	1	No project traffic			
SB T	2	17	9	46	23
NB L	1	No project traffic			
Project Critical Lane Volume		23		50	
Critical Lane Capacity		1200		1200	
% Increase		1.9%		4.2%	
Max % Increase		4.2%			

3: Shiloh at Central

Lane Group (critical)	Lanes	AM Peak Hour		PM Peak Hour	
		Vproject	Per Lane	Vproject	Per Lane
EB T	2	27	14	36	18
WB L	1	7	7	24	24
WB T	2	10	5	22	11
EB L	1	32	32	42	42
NB T	2	No project traffic			
SB L	1	No project traffic			
SB T	2	8	4	28	14
NB L	1	8	8	19	19
Project Critical Lane Volume		49		86	
Critical Lane Capacity		1200		1200	
% Increase		4.1%		7.2%	
Max % Increase		7.2%			

5: Shiloh at Monad

Lane Group (critical)	Lanes	AM Peak Hour		PM Peak Hour	
		Vproject	Per Lane	Vproject	Per Lane
EB T	1	No project traffic			
WB L	1	No project traffic			
WB T	1	No project traffic			
EB L	1	No project traffic			
NB T	2	11	6	31	16
SB L	1	5	5	6	6
SB T	2	18	9	24	12
NB L	1	No project traffic			
Project Critical Lane Volume		11		22	
Critical Lane Capacity		1200		1200	
% Increase		0.9%		1.8%	
Max % Increase		1.8%			

Planning Board

Date: 05/28/2025
Title: Bicycle and Pedestrian Advisory Committee Annual Presentation
Presented by: Elyse Monat
Department: Planning & Community Services
Presentation: Yes

Information

RECOMMENDATION

Staff recommends the Planning Board receive the annual presentation from the Bicycle and Pedestrian Advisory Committee.

BACKGROUND (Consistency with Adopted Plans and Policies, if applicable)

The Bicycle and Pedestrian Advisory Committee (BPAC) is providing its annual report to the Planning Board at this meeting. BPAC is composed of seven volunteer members, three appointed by the County, three appointed by the City, and one appointed by the Planning Board. Two County seats are currently unfilled at the time of writing this memo. The purpose of the Bicycle and Pedestrian Advisory Committee is to advise the City Council, Mayor, County Commissioners, Planning Board, and all departments and boards of the City and County with regard to non-motorized transportation matters. The presentation will cover what BPAC does, an analysis of crash data involving people biking and walking, and more.

STAKEHOLDERS

Residents of the City of Billings and Yellowstone County are all stakeholders in making the transportation system for the greater urban area safe for all users. The BPAC is a volunteer citizen advisory committee that hears from the public, provides recommendations, and participates in safety programs, projects and studies related to multi-modal transportation in Yellowstone County.

ALTERNATIVES

This item is a presentation only. No action is needed on the item.

FISCAL EFFECTS

There are no fiscal effects. This item is an informational presentation only.

Attachments

No file(s) attached.