



YELLOWSTONE COUNTY BOARD OF PLANNING

CITY OF BILLINGS AND
YELLOWSTONE COUNTY, MONTANA



AGENDA

MARCH 10, 2026 MEETING TIME: 4:30 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 of 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. **MEETING MINUTES:**
 - a. Approval of Meeting Minutes - January 13, 2026
Attachments
Minutes of January 13, 2026
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).
8. **NEW BUSINESS** (Agenda items new to this meeting).
 - a. Trailhead Major Subdivision - Preliminary Plat. Board Presentation. Dave Green, Planner II
Attachments
Findings of Fact
Proposed Plat
Draft SIA
Traffic Study

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

Date: 03/10/2026
Title:
Presented by:
Department: Planning & Community Services
Presentation:

Information

RECOMMENDATION

Approval of the January 13, 2026 Meeting Minutes

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

ALTERNATIVES

City Council may:

- Approve; or,
- Not Approve

FISCAL EFFECTS

Attachments

Minutes of January 13, 2026



CITY/COUNTY PLANNING BOARD

TUESDAY, JANUARY 13, 2025 at 4:30pm

Members	Position	01/13/2026	01/27/2026	02/10/2026	02/24/2026	03/10/2026	03/24/2026	04/14/2026	04/28/2026	05/12/2026	05/26/2026	06/09/2026	06/23/2026	07/14/2026	07/28/2026	08/11/2026	08/25/2026	09/08/2026	09/22/2026	10/13/2026	10/27/2026	11/10/2026	11/24/2026	12/08/2026	12/22/2026
		Jim Ronquillo	Billings Ward I	1																					
Roger Gravgaard	Billings Ward II	1																							
Dennie Stephenson	Billings Ward III	1																							
John Staley PRESIDENT	Billings Ward IV	1																							
David Nordel	Billings Ward V	V																							
Troy Boucher	YC District 1	1																							
Dennis Cook, VICE PRESIDENT	YC District 2	1																							
Vacant	YC District 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vacant	YC District 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vacant	YC District 5	-																							
Alexis Bonogofsky	YC District 6	1																							
Vacant	YC District 7	-																							
Scott Reiter Megan Trevino	Ex-Officio SD2	1																							

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 Staley called the meeting to order at 4:30 PM

Introduction of Planning Board Members and Planning Department Staff

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

Attending Staff: Wyeth Friday, PCSD Director; Anna Vickers, Planning Division Manager; Lora Mattox, Transportation Planning Coordinator; Mike Hayes, Multi-Modal Transportation Planner; Brenda Berns, Planning Clerk

1. Others in Attendance: there were no others in attendance.

2. Approval of Agenda

Motion

Motion by Board member Stephenson to approve the agenda as submitted, second by Board member Cook. Motion passed unanimously.

3. Approval of Minutes: December 23, 2025

President Staley read into the record, a correction to the December 23, 2025 meeting minutes:

The minutes state; “the motion to accept the staff recommendation of Denial for the Variance from Section 4.6.A.3 to Not allow a connection from the subdivision to the south.”

The actual motion was to; Approve the request for a Variance to Not allow a connection from the subdivision from the south.

Motion

Motion by Board member Ronquillo to approve the December 23, 2025 meeting minutes with the correction as read, second by Board Member Cook. 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.

5. Disclosure of Outside (Ex-Parte) Communication – There were no Ex-Parte Communications.

6. Disclosure of Conflicts of Interest – There were no Conflicts of Interests.

7. Old Business – There was no Old Business.

8. New Business

- a. **Proposed Amendment to the 2023 Long Range Transportation Plan (LRTP) and Metropolitan Planning Organization (MPO) Planning Boundary** – Presentation. Public Hearing and Recommendation. Lora Mattox, Transportation Planning Coordinator.

Staff recommends that the Planning Board receive a presentation on, and hold a public hearing for, a proposed amendment to the 2023 Long Range Transportation Plan (LRTP) and the Metropolitan Planning Organization (MPO) Planning Boundary. The amendment responds to findings from a 2024 Federal Highway Administration (FHWA) and Montana Department of Transportation (MDT) review, which determined that the Billings MPO is substantially compliant with federal regulations but identified two required technical corrections: redesigning the LRTP project list and updating the MPO's urban planning boundary to reflect 2020 Census data.

Addressing these findings will ensure continued compliance with federal and state requirements, improve clarity and transparency of the LRTP, and may expand eligibility for federal transportation funding. Completing the updates now will also position MPO staff to complete much of the next required LRTP update in 2028 in-house, with limited external support.

City Council approved a consulting contract with Kittelson & Associates in March 2025 to assist with the technical corrections. The scope of work includes auditing and redesigning the LRTP project list for accuracy and consistency, updating the MPO urban planning boundary using 2020 Census data and GIS mapping, modifying the LRTP accordingly, and conducting required public outreach to document community input.

Public Hearing

President Staley opened the Public Hearing. There were no speakers. The Public Hearing was closed.

Motion

Motion by Planning Board member Stephenson to recommend approval of the Amendment to the 2023 Long Range Transportation Plan and the Metropolitan Planning Organization Planning Boundary, and to forward that recommendation to the Policy Coordinating Committee through the Planning Board representative, second by Planning Board member Ronquillo. Motion passed unanimously.

Board Discussion

The Board discussed the importance of ensuring adequate funding to support proposed plans and the need to clearly demonstrate financial backing to build public confidence. Staff explained that the Metropolitan Planning Organization (MPO) process is ongoing and federally required, requiring plans to be kept current and well documented as conditions change. Clarification was provided regarding county and city service areas, including where municipal services currently extend. Staff also noted that potential annexation areas were considered in the planning effort to proactively address transportation needs as growth expands.

Other Business

Wyeth Friday reported on two ongoing public surveys. One survey supports the Safe Routes to School and Safe Streets for All grant programs and includes required public outreach, with questions designed to gather input from people of all ages and mobility levels. A second community survey relates to the 21st Street Underpass study and presents design alternatives developed by the consultant team and city staff, including options to improve emergency vehicle access.

It was announced that Planning Board President John Staley will represent the Board on the Policy Coordinating Committee (PCC). The next PCC meeting is scheduled for February 17, 2026.

Staff also noted that the upcoming Interim Planning Commission meeting will include a review of information gathered during Planning Week, as well as discussion of the Montana Land Use Planning Act (MLUPA) housing criteria, which requires jurisdictions to demonstrate compliance with at least five of the fourteen statutory criteria.

Adjournment: 5:04PM

Brenda J Berns, Planning Clerk

Planning Board

Date: 03/10/2026
Title: Trailhead Subdivision - Preliminary Major Plat
Presented by: David Green
Department: Planning & Community Services
Presentation: Yes

Information

RECOMMENDATION

Staff recommends the Planning Board review and make a recommendation of conditional approval to City Council for the preliminary plat of Trailhead Subdivision and adopt the Findings of Fact as presented in the staff report.

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

On February 2, 2026, Performance Engineering, applied for preliminary major plat approval for Trailhead Subdivision. The proposed subdivision creates seven (7) lots for future commercial development. There is one structure on the property that historically was used as a convention center. The subject property is generally located south of Midland Road and east of Mullowney Lane. The property is zoned CMU-2 -- Corridor Mixed Use 2.

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 requirements of intersection contributions and for traffic safety, prior to final plat approval, the applicant will have MDT determination, based on the TIS the agent provides to MDT, on any contributions required for the intersection of Midland Road and Mullowney Lane.
2. To provide locations and safe delivery and retrieval of individual mail, prior to final plat approval, the applicant will coordinate with the USPS to determine location of Central Box Units and provide the correct amount of space for safely delivering the mail to the businesses.
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 October 2, 2025
- Preliminary plat application submitted to Planning Division on February 2, 2026
- Departmental review meeting February 12, 2026
- Subdivision resubmittal February 19, 2026
- Planning Board plat review March 10, 2026
- Planning Board public hearing March 24, 2026
- Preliminary plat to City Council April 27, 2026
- 60 working-day preliminary plat review period ends April 28, 2026

PLAT INFORMATION

General location: South of Midland Road and east of Mullowney Lane
Legal Description: Parcel 5A of Amended Certificate of Survey 1091
Owner/Subdivider: Tropicana Inn-Vestments 2.0 LLC
Engineer and Surveyor: Performance Engineering

Existing Zoning: CMU - 2

Existing land use: Old parking lot and one existing building

Proposed land use: Commercial

Gross and Net area: 11.12 acres / 11.12 acres

Proposed number of lots: 7

Lot size: Max: 3.32 acres
Min: 0.85 acres

Parkland requirements: Parkland dedication is not required for a commercial subdivision

Traffic Impact Study overview:

The applicant has provided a traffic study for the proposed commercial development. There were four (4) intersections studied as required by City of Billings Engineering.

- 1 - King Ave, W, and Laurel Rd
- 2 - I-90 and the nearby two exits
- 3 - Midland Rd and Mullowney Ln.
- 4 - Midland Rd and S Billings Blvd.

Exhibit 11. Intersection LOS and Delay with and without the Project

Intersection	Control	LOS (delay, in seconds/vehicle)	
		Background (without project)	Total Traffic (with project)
AM Peak Hour			
1. King Ave. W. at Laurel Rd	Signal	A (3.7)	A (3.9)
2. Mullowney at I-90 Ramps	Signal	C (28.0)	C (32.2)
3. Mullowney at Midland	Signal	B (12.9)	B (14.7)
4. South Billings Blvd at Midland	Signal	B (17.1)	B (17.9)
5. West Site Driveway Access	TWSC*	N/A	C (22.2)*
6. East Site Driveway Access	TWSC*	N/A	B (14.6)*

Intersection	Control	LOS (delay, in seconds/vehicle)	
		Background (without project)	Total Traffic (with project)
PM Peak Hour			
1. King at Laurel Road	Signal	A (5.1)	A (5.6)
2. Mullowney at I-90 Ramps	Signal	C (24.1)	C (30.8)
3. Mullowney at Midland	Signal	B (17.6)	B (19.7)
4. South Billings Blvd at Midland	Signal	B (19.7)	C (20.7)
5. West Site Driveway Access	TWSC*	N/A	E (42.4)*
6. East Site Driveway Access	TWSC*	N/A	C (19.0)*

* TWSC LOS reported only for the worst lane group, which is the northbound (exit) left at both site driveways.

New project trips identified in this report are subject to examination under the City's cost participation program to the extent that they would travel through the two studied intersections on Midland. At Intersections 1 and 2, the need, scope, and timing of capacity improvements are controlled by MDT, so they are not covered here. Critical traffic shares that drive cost participation are subject to waiver if they fall below 2%. Right turns are not considered.

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, neither of the intersections examined would qualify for the "sub-2%" waiver.

Intersection	Critical Volume %		
	AM	PM	Highest
3. Mullowney at Midland	9.8%	19.2%	19.2%
4. South Billings Blvd at Midland	2.1%	3.1%	3.1%
	Total:	22.3%	

x \$450,000 \$100,350

Intersections 1 and 2 did not change enough with the anticipated increase to meet the minimum 2% threshold requiring contributions. Intersections 3 and 4 did go over the 2% threshold requiring the applicant to make contributions at those two intersections. Contributions will be made at final plat at the current cost of the intersection improvements. As of right now, the current cost of intersection of improvements is \$450,000 per intersection.

STAKEHOLDERS

A public hearing is not scheduled for this Planning Board meeting. However, at the Planning Board meeting scheduled for March 24, 2026, this is a public hearing and stakeholders will have the opportunity to provide comments.

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 April 28, 2026. 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/County 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 districts, 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 Trailhead 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 not been used for agricultural purposes for quite some time. Most recently it has been used for a hotel and convention center. The hotel has been owned by a few different firms over the past 10 years. The convention center has not been actively used for a few years now. There are no ditches that run through this project. The subdivision should have no effect on agricultural water users' facilities. There is a paragraph in the SIA under the heading Property Conditions and Information for Lot Purchasers alerting property owners of the potential for wildlife in the area.

2. Effect on local services

Utilities – Water service will be provided by the City of Billings. Service to the subdivision will be provided from a 12-inch water main stub located at Midland Road. There is an existing connection for the existing building on lot 7. Additional connections will be coordinated with the developments and the City of Billings Engineering department.

Any additional fire hydrants needed, will be installed as required by the City Fire Department.

Sanitary sewer service to the subdivision will be from the existing 8-inch and 10-inch Sanitary sewer stub located in Midland Road.

The subdivider will install all new water lines and sewer lines 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 are available to the proposed subdivision as they go past the frontage to other developments along Midland Road. Extension of the private utilities will be the responsibility of each development as they build in the subdivision. The private utilities will be installed in easements, created when they are determined for the development being proposed for each lot, and as requested by the utility companies.

Stormwater – 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. A complete stormwater management plan 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. **Solid Waste** – The City of Billings will provide solid waste collection and disposal. The City’s landfill has adequate capacity for this subdivision.
- b. **Streets** – This subdivision will not be creating any new streets. The subdivision is designed as a commercial development with internal circulation through the parking lot.

The development has frontage on Midland Road. Midland Road has the correct dedication for the road and is developed at this time with curb and gutter. There is a 5-foot-wide boulevard and sidewalk on the north side of the road. On the south side there is a multi-use trail with a boulevard separating the road and the trail. No additional improvements will be required by the subdivider.

Traffic Impact Study overview:

The applicant has provided a traffic study for the proposed commercial development. There were 4 intersections studied as required by City of Billings Engineering; 1 - King and Laurel Road, 2 - I-90 and the two exits, 3 - Midland Road and Mallowney and 4 - Midland Road and South Billings Boulevard.

Exhibit 11. Intersection LOS and Delay with and without the Project

Intersection	Traffic Control	LOS (delay, in seconds/vehicle)	
		Background	Total Traffic
AM Peak Hour			
1. King at Laurel Road	Signal	A (3.7)	A (3.9)
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6. East Site Driveway Access	TWSC*	N/A	C (19.0) *

* TWSC LOS reported only for the worst lane group, which is the northbound (exit) left at both site driveways.

Intersections 1 and 2 did not change enough with the anticipated increase to meet the minimum 2% threshold requiring contributions. Intersections 3 and 4 did go over the 2% threshold requiring the applicant to make contributions at those two intersections. Contributions will be made at final plat at the current cost of the intersection improvements.

Exhibit 13 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, neither of the intersections examined would qualify for the “sub-2%” waiver.

Exhibit 13. Intersection Cost Participation

Intersection	Critical Volume %		
	AM	PM	Highest
3. Muldowney at Midland	9.8%	19.2%	19.2%
4. South Billings Blvd at Midland	2.1%	3.1%	3.1%
	Total: 22.3%		
	x \$450,000 \$100,350		

The traffic study also has to be reviewed by MDT. During their review process they will be determining any contribution that needs to be made, if any, at the intersection of Muldowney Lane and Midland Road. Should MDT determine a need for a contribution or no contribution, this will be determined before final plat. **(Condition #1)**

Street lighting is not required for commercial subdivision. Street lights do exist within the public right-of-way adjacent to the subdivision along Midland Road. The existing parcel is part of the Street Light District, number 324. No additional street lighting is proposed for the development.

- c. **Emergency Services** – The Billings Police and Fire Departments will respond to emergencies within the proposed subdivision. The police department comments that continued annexation and development without commensurate resources has adversely affected our ability to deliver service. The fire station that provides service for this area is Fire Station #5, it is located at 605 S 24th Street West. The subdivision is located within the ambulance service area of American Medical Response (AMR).
- d. **Schools** – Schools will not be affected by the proposed subdivision because it is a commercial subdivision and will not have any homes with children needing school services.
- e. **Parks and Recreation** – This subdivision is not required to provide parkland. Commercial subdivisions are not required to provide any parkland.
- f. **Mail Delivery** - The developer shall coordinate with the United States Postal Service to determine the location of the Central Box Units for mail delivery within this subdivision. **(Condition #2)**

g. **Phasing of Development** – This subdivision will not be developed in phases.

3. Effect on the natural environment

The subject property is currently vacant former convention center and hotel parking lot. 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 2023 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.

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.

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

Mobility and Access (transportation choices in places where goods and services are accessible to all):

Planning and construction of interconnected sidewalks and trails are important to the economy and livability of Billings

Prosperity (promoting equal opportunity and economic advancement)

Community investments that attract and retain a strong, skilled and diverse workforce also attracts businesses

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 has an existing 10-foot-wide multi-use trail along the frontage of Midland Road. No additional trails are required with this subdivision.

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 CMU-2 – Corridor Mixed Use 2. 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 from Midland Road. All internal parking lot circulation streets will provide access to individual lots.

CONCLUSIONS OF FINDINGS OF FACT

- The preliminary plat of Trailhead 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 Trailhead Subdivision, be conditionally approved and the Findings of Fact adopted as presented in the staff report.

PRELIMINARY PLAT OF
TRAILHEAD SUBDIVISION
 BEING LOTS 4A & 5A OF THE AMENDED TRACTS 4 & 5 OF CERTIFICATE OF SURVEY NO. 1091
 LOCATED IN THE S 1/2 OF THE NW 1/4 OF SECTION 17, TOWNSHIP 01 SOUTH, RANGE 26 EAST, P.M.M.,
 CITY OF BILLINGS, YELLOWSTONE COUNTY, MONTANA

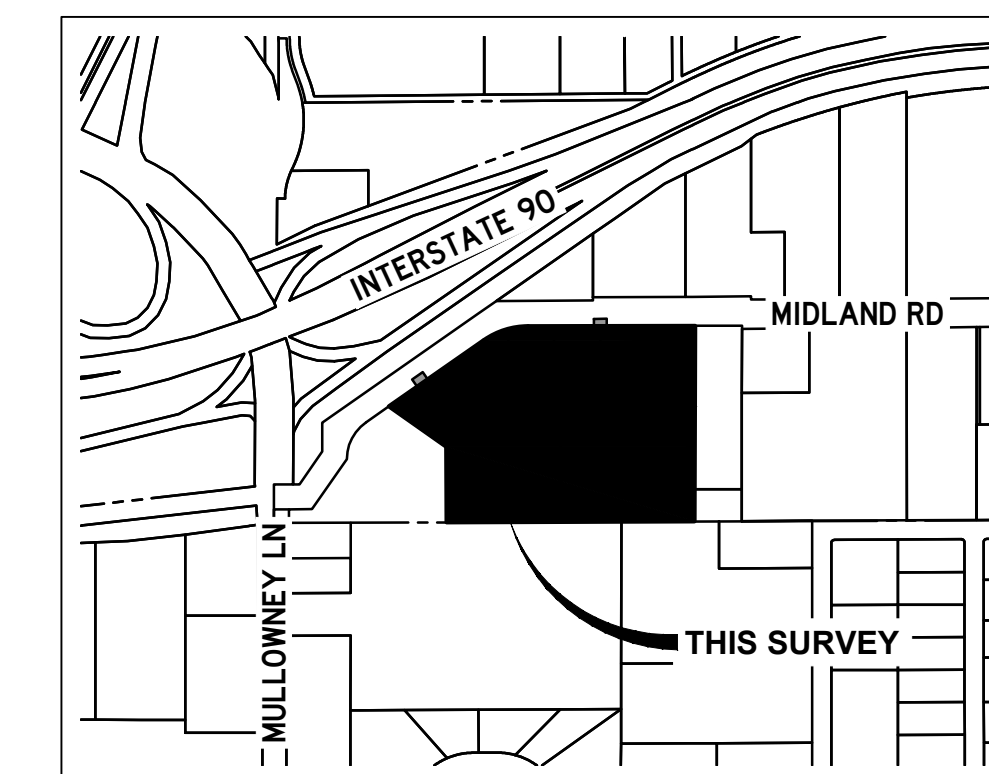
PREPARED FOR : TROPICANA INN-VESTMENTS 2.0, LLC



PREPARED BY : PERFORMANCE ENGINEERING, LLC

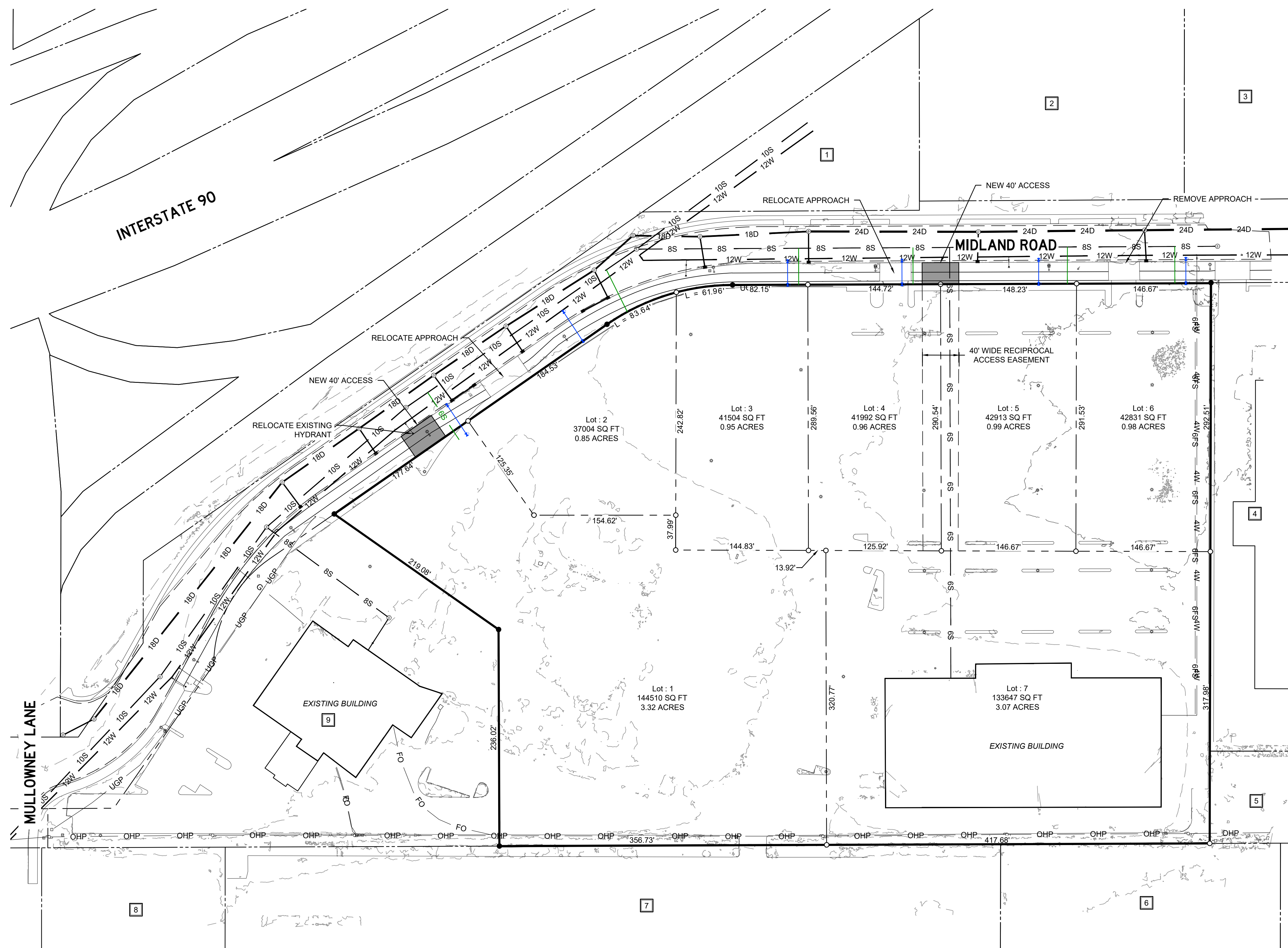
TOTAL AREA OF SUBDIVISION : ± 11.12 ACRES

LEGEND	
●	PROPERTY CORNER, FOUND AS DESCRIBED
○	PROPERTY CORNER, SET 5/8" REBAR W/ CAP MARKED "51414LS"
—	SURVEY BOUNDARY
- - -	EXISTING PROPERTY LINE
—	PROPOSED PROPERTY LINE
- - -	RIGHT-OF-WAY LINE



VICINITY MAP
 NOT TO SCALE

SITE DATA	
GROSS AREA	11.12 ACRES
NET AREA	11.12 ACRES
LOT COUNT	7
MAX. LOT AREA	3.32 ACRES
MIN. LOT AREA	0.85 ACRES
ZONING	CMU 2 - CORRIDOR MIXED USE 2
PARKLAND REQUIRED	NONE



ADJOINING PROPERTY OWNER INFORMATION

- 1 MAGGA, LLC
 5435 MIDLAND ROAD
 BILLINGS, MT 59101
- 2 BIG SKY HOTELS, LLC
 C/O STEPHEN CRANSTON, CPA
 1345 MALLOWNEY LANE
 BILLINGS, MT 59101
- 3 STEVEN A KENNEY & DEAN A LUPTAK
 2237 S 45TH STREET W
 BILLINGS, MT 59106
- 4 RELIANSE MT, LLC
 400 REDHEAD COURT
 MCKINNEY, TX 75072
- 5 CHARLES W LOVERIDGE & MEGAN CLANCY-LOVERIDGE
 1206 CORDOVA STREET
 BILLINGS, MT 59101
- 6 LOVE PROPERTIES, LLP
 PO BOX 31234
 BILLINGS, MT 59107
- 7 BHCC II, INC.
 C/O RON & JEFF MURI
 1223 MALLOWNEY LANE
 BILLINGS, MT 59101
- 8 APPLE FRITTER, LLC
 10771 US HIGHWAY 287
 THREE FORKS, MT 59752
- 9 TROPICANA INN-VESTMENTS 2.0, LLC
 16114 E INDIANA AVENUE
 SPOKANE VALLEY, WA 99216

BASIS OF BEARINGS

Bearings shown on this plat are derived from a low distortion Lambert Conformal Conic single parallel projection with parameters as follows:

Latitude of Origin: 45° 47' 00" N
 Longitude of Origin: 108° 25' 00" W
 Mapping Scale Factor: 1.0001515

Distances are ground.



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

Trailhead Subdivision

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(City of Billings)**

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

Trailhead Subdivision

This agreement is made and entered into this ____ day of _____, 20__, by and between *Tropicana Inn-Vestments 2.0, LLC*, whose address for the purpose of this agreement is **16114 E. Indiana Ave, Suite 200, Spokane Valley, WA 99216**, hereinafter referred to as “Subdivider,” and **CITY OF BILLINGS**, Billings, Montana, hereinafter referred to as “City.”

WITNESSETH:

WHEREAS, the plat of *Trailhead 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 *Trailhead Subdivision*; and

WHEREAS, at a regular meeting conducted on ____ day of _____, 20__, the City Council conditionally approved a preliminary plat of *Trailhead 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 *Trailhead 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 public right-of-way for surrounding streets has been dedicated. No additional right-of-way dedication is required.
- All public roadways adjacent to the Subdivision have been completed as part of previous projects. No additional public street improvements are required by the Subdivider.
- All private 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 Uniform Building Code, and the City of Billings Stormwater Management Manual.
- A traffic accessibility study has been completed for the *Trailhead Subdivision*. All required intersection improvement contributions are identified herein shall be completed by the Lot Owners at the Owner's expense at the time of lot development. The percentage of traffic contributions to the following intersections shall be in accordance with the traffic accessibility study:

Intersection	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5	Lot 6	Lot 7	Total
Muldowney and Midland	9.22%	1.07%	1.07%	1.07%	1.07%	1.07%	4.63%	19.2%
South Billings Blvd and Midland	1.50%	0.17%	0.17%	0.17%	0.17%	0.17%	0.75%	3.1%
Subtotal	10.71%	1.24%	1.24%	1.24%	1.24%	1.24%	5.38%	22.3%

The cash contributions shall be based on the percentage 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.

B. Sidewalks

- The 10-foot-wide multi-use path located within the public right-of-way adjacent to the Subdivision has been constructed as part of previous projects. No additional sidewalks are required by the Subdivider.

- Subdivision is responsible for maintaining the 10-foot multi-use path adjacent to the development.

C. Street Lighting

- Streetlights exist within the public right-of-way adjacent to the Subdivision along Midland Road. The existing parcel is part of Street Light District Number 324. No additional street lighting is proposed for the development.

D. Traffic Control Devices

- 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

- The Subdivision will be accessed off Midland Road. Access off Midland Road will be provided via two (2) 40-foot-wide shared accesses at the locations identified on the plat.
- A site vision analysis shall be completed for the western approach at the time of lot development.

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 was previously constructed within the public right-of-way adjacent to the Subdivision. No additional improvements are required.

G. Public Transit

- MET Transit provides services along Midland Road with a stop located along the frontage 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. A complete stormwater management plan shall be submitted to the Engineering Division for review and approval at the time of development.

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.

Service connections to the existing public water and sanitary sewer mains within Midland Road shall be completed at the time of lot development for Lots 1 – 6. Water and sanitary sewer services exist for Lot 7.

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 serviced by an existing 12-inch water main located in Midland Road.

B. Sanitary Sewer

- The Subdivision will be serviced by existing 8-inch and 10-inch sanitary sewer mains located in Midland Road.

C. Power, Telephone, Gas, and Cable Television

- Private utility facilities currently exist to serve the subdivision. The private utility facilities will be installed within the right-of-way and utility easements shown on the plat.

VII. PARKS/OPEN SPACE

There is no parkland requirement for proposed *Trailhead Subdivision* as all parcels in the subdivision are nonresidential [MCA 76-3-621(3)(b)].

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:

Trailhead Subdivision

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

Traffic Impact Study

Prepared for submittal to:

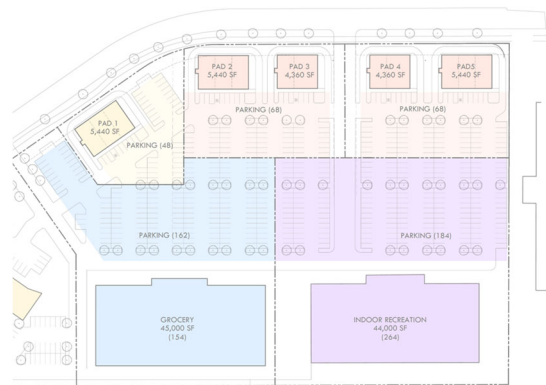


for the project:

Trailhead Commercial Subdivision

on behalf of:

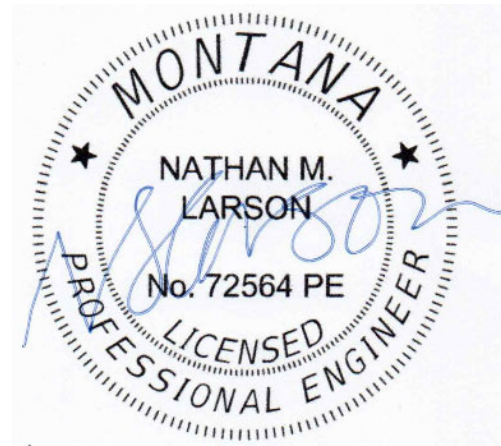
Performance Engineering
3412 Colton Blvd., Suite 202
Billings, MT 59102



by:



406 Traffic & Transportation Consulting
P.O. Box 249
Bozeman, MT 59771
406.922.7300



PTOE #1185, certified in 2003

December 2025

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 - 1.2 Land Uses and Phasing 1
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- A: Raw Traffic Count Data for Intersections
- B: Intersection Analysis Software Output
- C: Intersection Cost Participation Calculations

1 INTRODUCTION

This report documents the Traffic Impact Study (TIS) conducted for the Trailhead Commercial Subdivision project in south central Billings. This is a working title for the project, and it could change before final occupancy. The TIS documented here was conducted in accord with the guidelines indicated in the City of Billings Code of Ordinances Section 23-406, subsection (b), part (4) as updated May 19, 2025. This report also documents other study elements specified in the City's TIS checklist as well as intersection improvement cost-share calculations.

The need for a traffic study is met by this project's trip generation characteristics. This study has been prepared by a professional engineer licensed in good standing in Montana with experience and training in the field of traffic and transportation engineering. This study's author and signatory is also a professional traffic operations engineer.

1.1 PROJECT SITE AND STUDY AREA

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

1. Mallowney Lane/King Avenue at I-90 Business/Laurel Road
2. Mallowney Lane at I-90 Ramps
3. Mallowney Lane at Midland Road
4. South Billings Boulevard at Midland Road

For the sake of brevity from here forward in the body of this report, existing intersections are generally referred to only by their distinguishing street names (e.g., "Mallowney at Midland"). There is one existing driveway and one new/consolidated driveway that will be used by project traffic. These have been examined for the future "Total Traffic" scenario. In this report, these are referred to as the West access and the East access. Both were analyzed for future conditions with the project (the Total Traffic scenario), but because they are simple driveways they were not considered in cost share calculations.

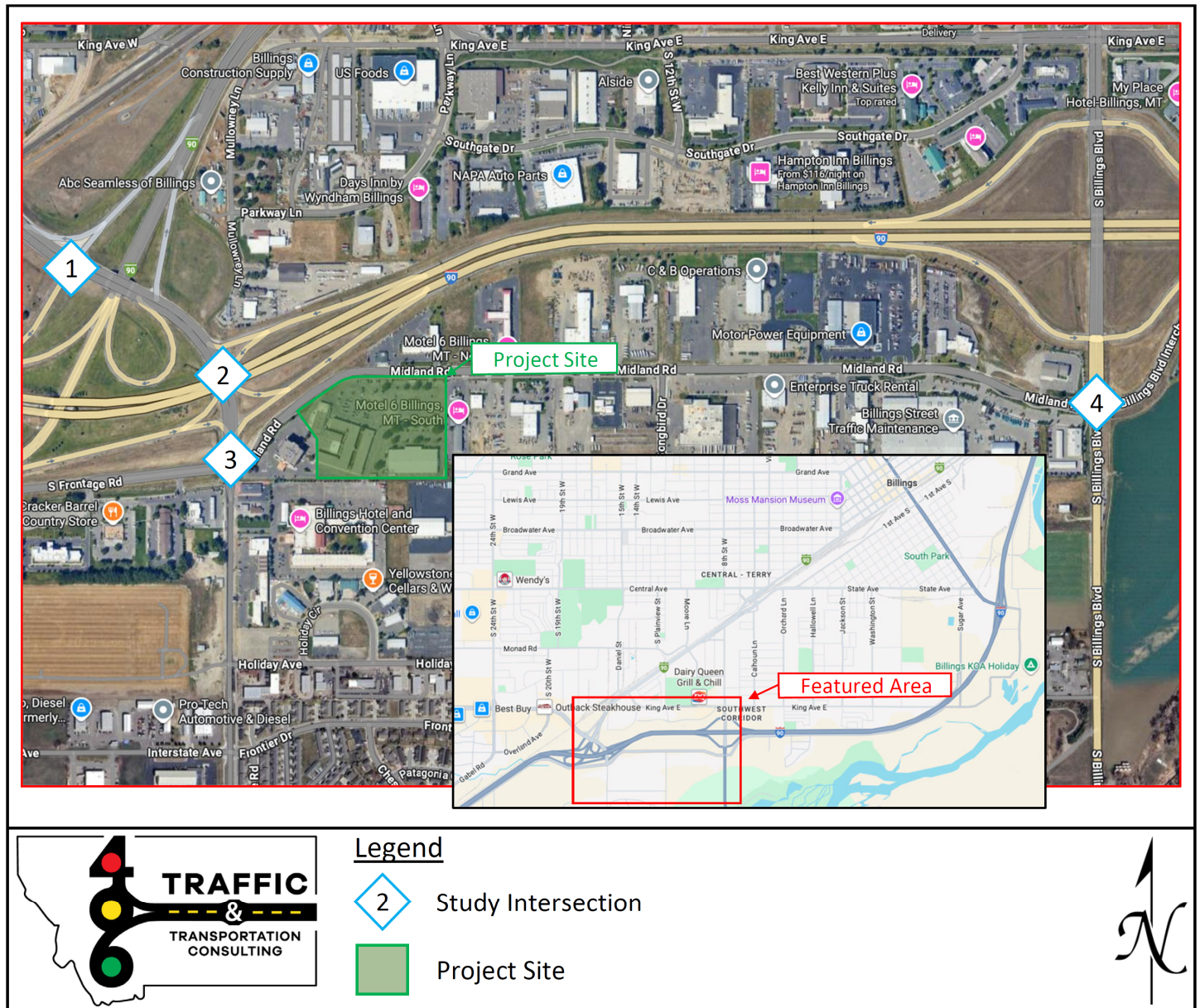
Midland is considered to be oriented east-west for the purpose of this report despite a prominent curve on the east leg of its intersection with Mallowney. The West access to the project site is on this curve, but with Midland considered east-west, the access is described here as a north-south facility.

1.2 LAND USES AND PHASING

The site was unused when this study began. The project will cover the whole site and will consist of seven commercial structures (6 new and one existing building not in use): two larger buildings and five outparcel pad sites. The two larger buildings are proposed to be a newly-constructed grocery store of 44,000 square feet (SF) and a re-used existing building that will house an indoor multi-purpose recreation center of similar size. Each of the five pad sites are expected to have 2-3 tenants and are being designed to include a simple drive-through lane/window that wraps around the building. Only the complete buildout of both uses is considered, so there is only one phase of the project for traffic impact analysis purposes.

Exhibit 2 shows the Trailhead Commercial Subdivision site plan on which the analysis here is based. It includes the proposed building footprints, adjacent street, access points, on-site circulation, drive-through lanes, parking, and limited landscaping features. Note that this site plan should be considered illustrative for the purpose of this traffic study, and a more detailed and/or higher-resolution one has been (or will be) provided separately by the applicant. The existing hotel west of this commercial site is not part of the project.

Exhibit 1. Overall Site Location and Study Intersections

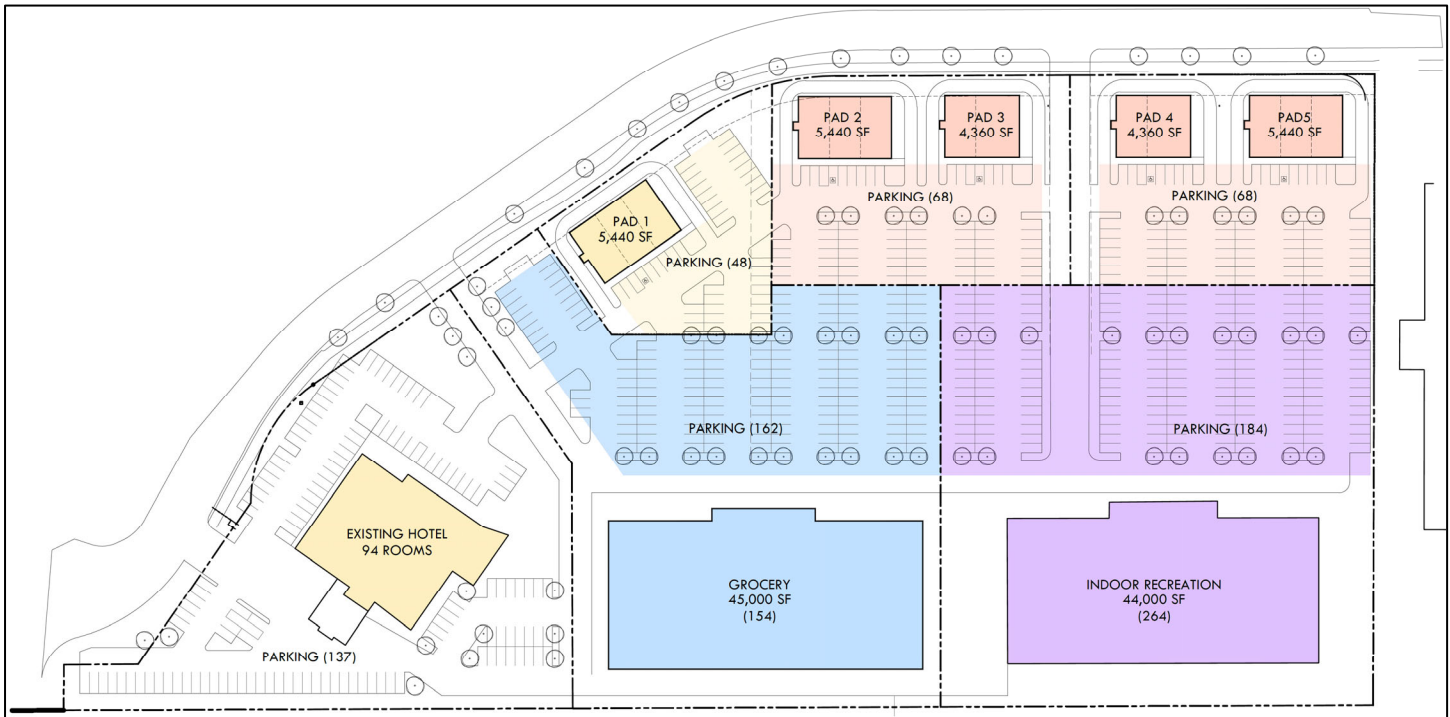


1.3 ANALYSIS METHODS AND REFERENCES

Raw field traffic counts were gathered by 406 Traffic. These raw counts were then adjusted slightly for this TIS based on 2025 City of Billings annualization factors prior to their use in impact analysis. Existing signal phasing and timing information was provided by MDT and City of Billings staff.

Trip generation rates, or equations as applicable, are from the Institute of Transportation Engineers (ITE) Trip Generation suite's 12th 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 (R^2) of 0.75 or higher, with 1.0 being the best possible fit. More information about trip generation is provided in Chapter 3.

Exhibit 2. Site Plan



Excerpted from: Performance Engineering/Collaborative Design Architects, 9/15/2025

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 under Stop sign control, LOS for the intersection is often represented by the LOS for the worst lane group. The Trailhead site’s access points fall under this category.

Exhibit 3. Intersection LOS Criteria

LOS	Delay Range (seconds/vehicle) by Control Type		Description
	Unsignalized	Signalized	
A	0 to 10.0	0 - 10.0	Free flow
B	10.1 to 15.0	10.1 to 20.0	Stable flow (slight delays)
C	15.1 to 25.0	20.1 to 35.1	Stable flow (acceptable delays)
D	25.1 to 35.0	35.1 to 55.0	Approaching unstable flow
E	35.1 to 50.0	55.1 to 80.0	Unstable flow
F	50.1 or more	80.1 or more	Forced flow (congested, queues fail to clear)

Source: HCM 7th Edition

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

MDT auxiliary turn lane analysis was not conducted for this project for the following reasons:

- All four existing study intersections are already signalized;
- Midland is a lower-speed collector, rather than the type of rural highway for which the MDT process was developed;
- Midland already has a continuous center turn lane to serve traffic entering the site; and
- The site driveways are located somewhat close together.

2 EXISTING AND BACKGROUND CONDITIONS

2.1 STREETS AND INTERSECTIONS

Note that for the purpose of this traffic study report, the dividing line between Mallowney Lane and King Avenue is the I-90 SPUI intersection (Intersection 2). There are currently no dedicated bicycle facilities in the study area.

Mallowney Lane is a north-south Collector in the Billings 2023 Long Range Transportation Plan (LRTP) with a speed limit of 35 mph. It has two travel lanes in each direction in the study area with a single left turn lane in each direction (a 5-lane section) at the Midland intersection. About 400-500 feet south of the Midland intersection, Mallowney transitions down to a three-lane section, with one lane in each direction and a center turn lane. There is a sidewalk along the east side of Mallowney from the Midland intersection to the north.

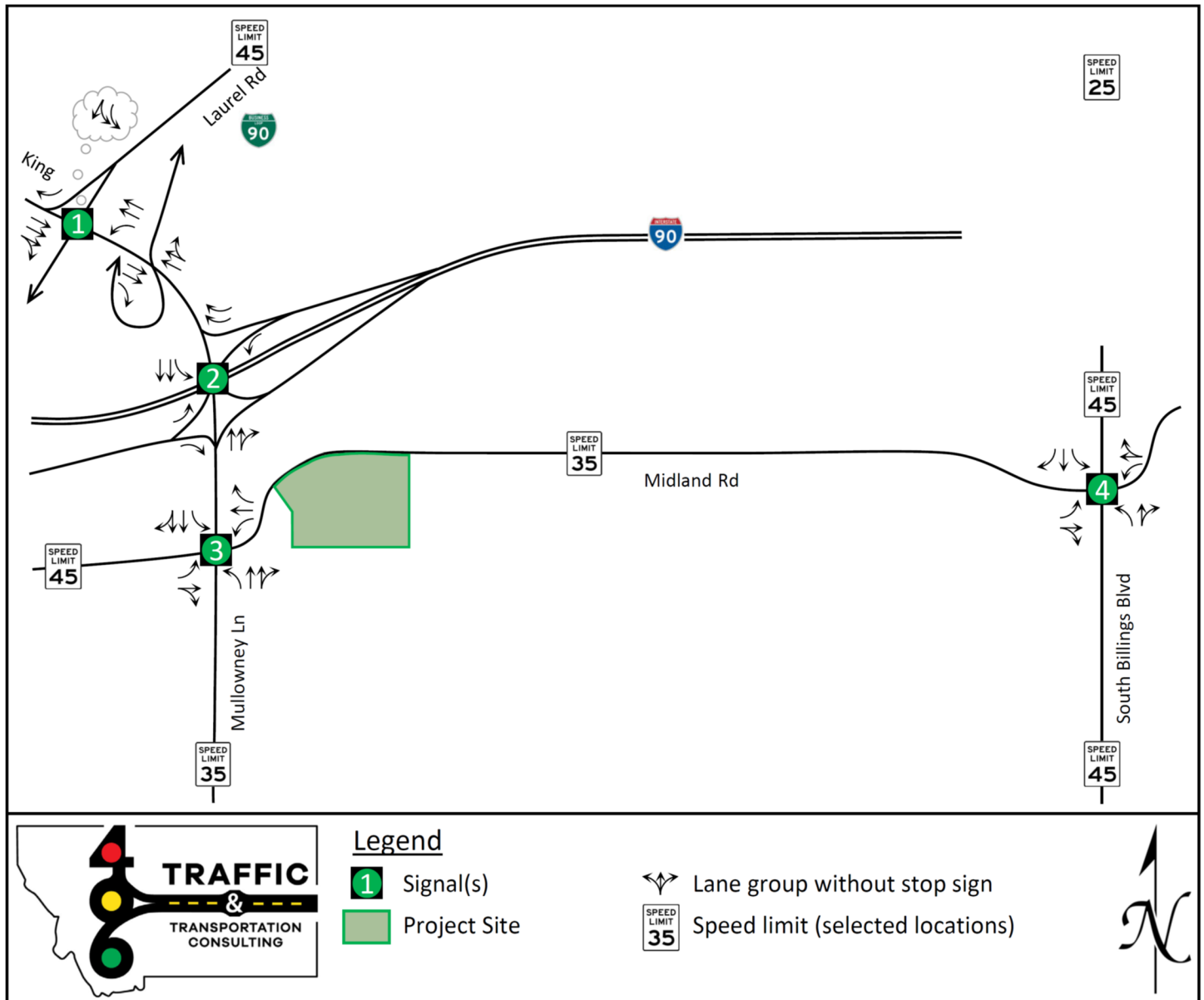
King Avenue is a northwest-southeast principal arterial in the study area with two through travel lanes northbound, two or three travel lanes southbound, and a speed limit of 35 mph. King Avenue's primary function in the study area is to connect ramps to and from both I-90 and Laurel Road to the major commercial corridor to the northwest. There is a sidewalk on the east (northeast) side of King in the study area.

Midland Road is an east-west Minor Arterial with one travel lane in each direction, a continuous center turn lane, and a speed limit of 35 mph. Midland connects a mix of low-density commercial and municipal uses to two of southern Billings' major north-south routes. Sidewalks run along both sides of the street between Mallowney and South Billings Boulevard. MET Transit runs its *Route 19 – Midtown* buses along Mallowney and Midland with hourly service on weekdays. In the study area, this route serves four fixed bus stop locations on Midland in each direction, with one of these near the proposed project's east access. East of South Billings Boulevard and west of Mallowney Lane, this facility is an MDT one simply signed as "Frontage Road", but those parts are only relevant in the context of intersection analysis, and so are not described separately here.

South Billings Boulevard is a north-south Principal Arterial with one travel lane in each direction approaching its Midland Road intersection and a speed limit of 45 mph. North of Midland it connects travelers to I-90 and the neighborhoods of south Billings. South of Midland it provides access to limited low-density commercial and municipal uses and crosses the Yellowstone River. South Billings Boulevard has a sidewalk along its west side south of the Midland intersection.

All four study existing intersections are signalized. **Exhibit 4** shows traffic control and lane arrangements schematically at each existing intersection, as well as posted speed limits on selected road segments.

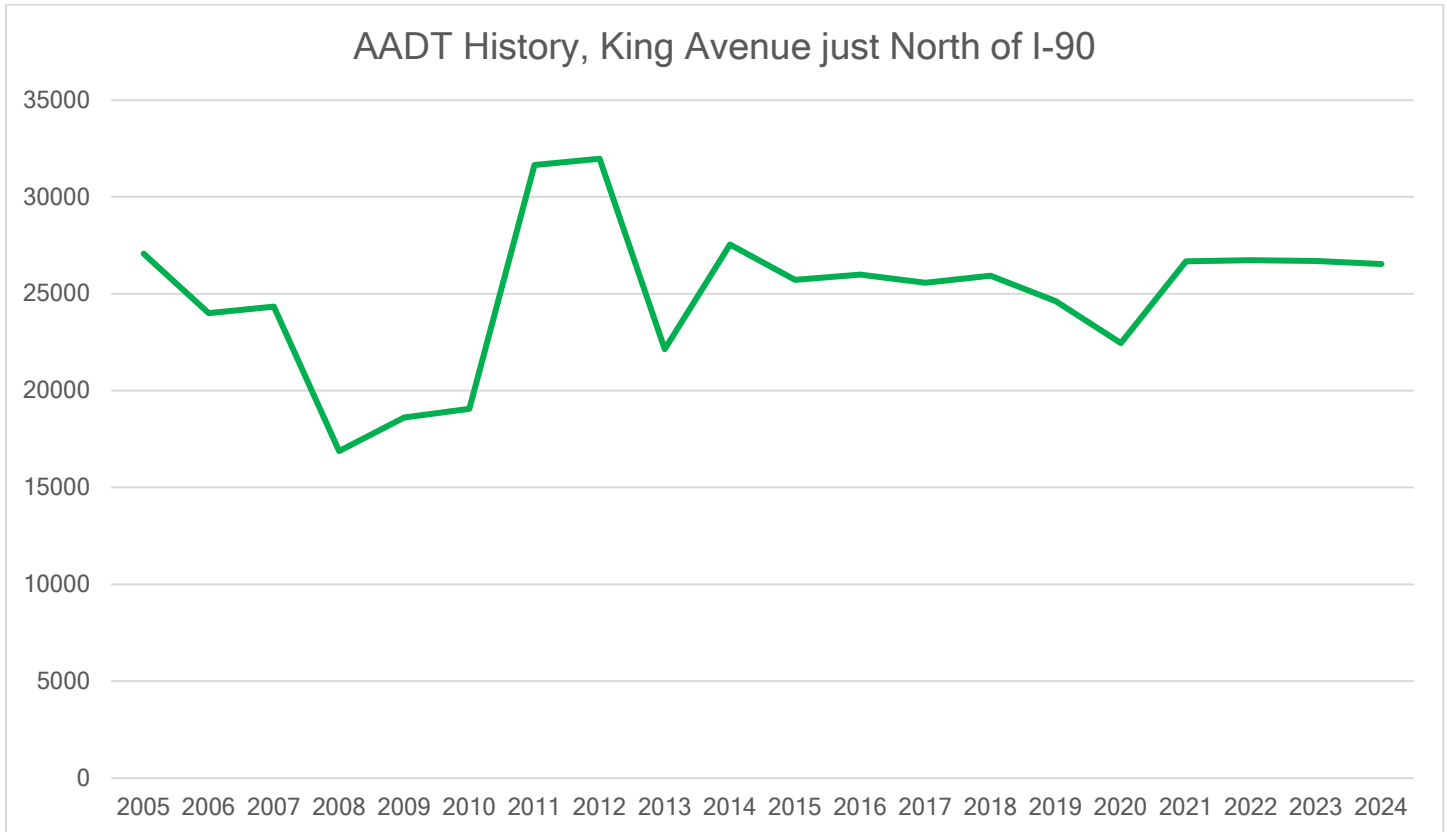
Exhibit 4. Existing Road and Intersection Basics



2.2 HISTORICAL TRAFFIC VOLUMES

Daily traffic information was gathered from the Montana Department of Transportation’s (MDT) public-facing data resource, the Traffic Count Database System, which compiles data from thousands of counting stations across Montana. At these stations, the MDT either collects or estimates traffic counts from which annualized average daily traffic (AADT) is computed. For this report, AADT data from the counting station on Mullooney/King between I-90 and Laurel Road was used. Of the MDT count stations in the study area, this station’s location would be used by the most project traffic. These data were examined over the past 20 years for a historical perspective. The historical AADT volumes are shown in **Exhibit 5**.

Exhibit 5. Historical Daily Traffic Volumes



The COVID-19 pandemic appears to have strongly influenced traffic volumes in 2020, but volume recovered quickly in the following year. Traffic volume on King has largely plateaued and even saw a slight decrease in 2024, unrelated to the pandemic. Based on the historical growth trend, it was assumed that there will be no growth in background traffic volumes between 2025 and this project’s buildout year of 2028.

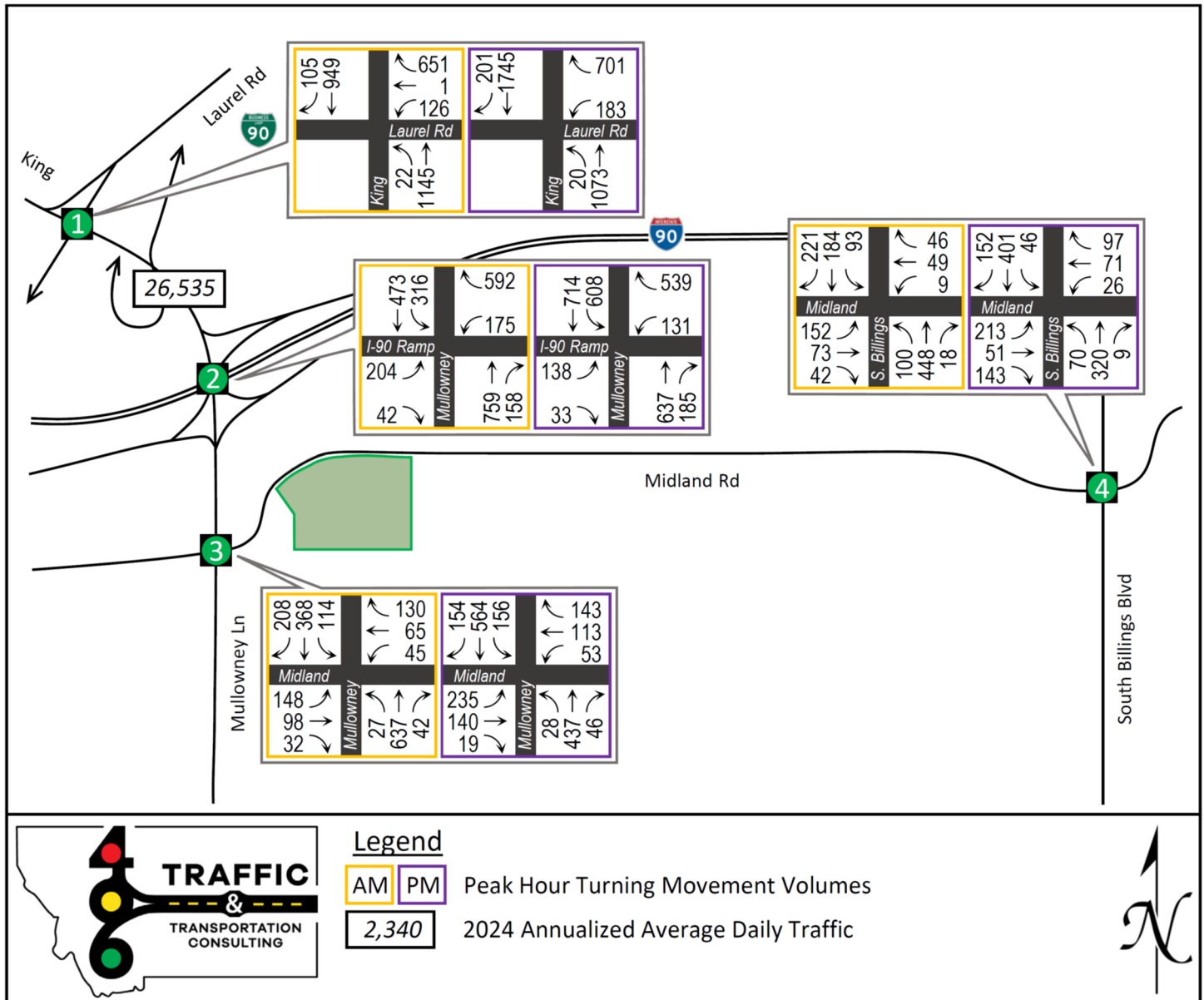
2.3 RECENT TRAFFIC COUNTS

Three of the four study intersections were studied between 4-6 p.m. and between 7-9 a.m. on November 3 and 4, 2025, respectively. At Intersection 1, Laurel Road at King, volumes were adapted from a TIS conducted in 2023 for a nearby site, provided by City of Billings staff. To estimate volumes there, peak-hour turning movement ratios from the previous study were applied to 2025 field volumes counted on the north leg at intersection 2. These volumes also reflect the ramps between Intersections 1 and 2 that send traffic on to Laurel Road.

All of the new counts were conducted using StreetLogic CountCam4 cameras, and they were summarized for analysis in 15-minute increments. Based on total entering volume (TEV), the study area’s AM peak hour was identified from these counts as starting at 7:15 a.m. The PM peak hour was estimated to have started at 4:30 p.m. along Mullowney/King and at 4:45 at Intersection 4. The existing count information at each of the four existing study intersections is provided in **Appendix A**.

Counts at the four study intersections were adjusted for seasonal variation using the City’s seasonal adjustment factors, or annualization factors, last updated in February 2025. These factors vary by month and day of the week, but not by functional classification as the MDT seasonal adjustment factors do. All of the raw counts were multiplied by Billings’ annualization factor for a Tuesday or Wednesday in November, which is 1.01. Existing annualized traffic volumes based on the traffic counts are shown in **Exhibit 6**. Note that because traffic growth has been flat (zero) as documented in the previous subsection, these are also the Background scenario traffic volumes against which project traffic impacts were measured.

Exhibit 6. Existing (Background) Traffic Volumes



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 suite’s 12th 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 often diminishes with increasing project size.

The proposed grocery store, ITE 850, is a common use with solid data. The other co-anchor for the site, the indoor recreation center, is similar to the ITE land use Multipurpose Recreation Center (code 435). ITE’s description indicates that based on the sites studied, a facility to which its rates can apply should contain at least two of the following six elements:

- Mini-golf
- Driving range
- Batting cages
- Video arcade
- Bumper boats
- Go-kart track

ITE also indicates that such facilities customarily have a snack bar or limited restaurant, and that the sites studied range in size from about 20,000 to 60,000 square feet. Such facilities typically attract scheduled family parties and co-worker events. While no specific tenant for this use has been revealed to the design team at the time of this TIS, the nature of the building and a potential model location in another state indicates that the recreation center will have a primary focus on a broad range of arcade, tavern-style, and prize games, with space expected to be dedicated to additional similar and more modern activities such as axe-throwing. A key feature of such facilities is that they are not open during the morning peak, and ITE does not have AM peak data for this land use.

Land use for the site's five outparcels was divided into three types. Because each of the five buildings would contain a wraparound drive-through element, two of them were assumed to have part of their space dedicated to coffee/donut shops (or similar) and the other three were assumed to be food establishments. Coffee/donut establishments could be those that are primarily for coffee, primarily for baked items, or something else such as specialty soda beverages. All of these were assumed to have the trip generation patterns covered by ITE land use 937. The restaurant uses are expected to be most consistent with ITE's description for 934 – Fast Food Restaurant with Drive-Through Window, though they will be smaller than most such sites included by ITE and more likely to be occupied by specialized tenants. Content/theme examples from potential model sites located elsewhere include sandwiches, pizza, and fried chicken.

After the coffee/donut and fast food uses associated with drive-through space, the remaining eight spaces with considerably less projected tenant information were grouped into a more standard retail/shopping center use. These tenants could include many types of small stores, service businesses (e.g., mobile phone, nail salon, or insurance office), and a small specialty restaurant, bakery, or coffee shop without a drive-through lane.

Three types of adjustments to trip generation were considered for this project, per guidance in ITE's Trip Generation Handbook. Each is described separately.

First, a discount is sometimes taken to reflect internal capture where multiple uses are present in a single project site. This discount reflects the tendency for a user to visit more than one part of the site in a single trip. Examples of this could include a patron of both a store and a restaurant located on the site, or an employee on one part of the site who commutes by car visiting a coffee shop on another part of the site on the way to or from their car. Due to both the large number of separate tenants on the site and the scarcity of similar commercial sites in this part of South Billings, the potential for internal capture is expected to be relatively high. An internal capture discount of 20% was applied for this project.

Second, a modal adjustment can be taken if a site is clearly served by robust high-capacity transit and one or more of its land uses by their nature serve a customer base 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. No modal discount was applied for the following three reasons: (a) no such transit network is present near this site, (b) facilities for nonmotorized access are limited in and around the study area are limited, and (c) few land uses such as offices and residences that would produce potential walk trips are close to the project site. The only prominent potential sources of such trips are lodging properties east and west of the site along Midland.

Finally, some land uses 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. ITE has compiled pass-by data from studies of over two dozen land uses. All but the Indoor Recreation Center have ITE pass-by data that yield average percentages used in this study. Diverted-linked trips were not estimated for

this study, in part because ITE has no studies of this type for the land uses proposed. Note that pass-by trips still turn into and out of the site driveways, but they are part of background traffic at other intersections. Pass-by reductions are applied after the internal capture discount mentioned above. **Exhibit 7** shows trip generation details for the project.

Exhibit 7. Trip Generation

	Daily	AM Peak Hour	PM Peak Hour
Multipurpose Recreational Facility – X = 45,000 square feet (45.0 ksf)			
ITE Land Use 435 rate:	T = 29.78 (X) ¹	N/A	T = 3.44 (X)
Peak hour in/out split			56% / 44%
Gross trips	1,310		151
Net after internal capture (20%)	1,048		121 (68 in / 53 out)
Pass-by reduction (none)			
Net primary trips	1,048		121 (68 in / 53 out)
Strip Retail Plaza (under 40,000 square feet) – X = 16,100 square feet (16.1 ksf)			
ITE Land Use 822 rate:	T = 54.45 (X)	T = 3.93 (X)	T = 6.29 (X)
Peak hour in/out split		55% / 45%	50% / 50%
Gross trips	877	63	101
Net after internal capture (20%)	702	50 (28 in / 22 out)	81 (41 in / 40 out)
Pass-by reduction (40%)	- 281	- 20	- 32
Net primary trips	421	30 (17 in / 13 out)	49 (25 in / 24 out)
Supermarket – X = 44,000 square feet (44.0 ksf)			
ITE Land Use 850 rate:	T = 92.29 (X)	T = 2.95 (X)	T = 8.79 (X)
Peak hour in/out split		59% / 41%	50% / 50%
Gross trips	4,153	133	396
Net after internal capture (20%)	3,322	106 (63 in / 43 out)	317 (159 in / 158 out)
Pass-by reduction	- 797	- 27	- 76
Net primary trips	2,525	81 (47 in / 33 out)	241 (121 in / 120 out)
Fast-Food Restaurant with Drive-Through Window – X = 5,370 square feet (5.37 ksf)			
ITE Land Use 934 rate:	T = 467.48 (X)	T = 44.61 (X)	T = 33.03 (X)
Peak hour in/out split		51% / 49%	52% / 48%
Gross trips	2,511	240	177
Net after internal capture (20%)	2,009	192 (98 in / 94 out)	142 (74 in, 68 out)
Pass-by reduction (50%)	- 1004	- 96	- 71
Net primary trips	1005	96 (49 in / 47 out)	71 (37 in / 34 out)
Coffee/Donut Shop with Drive-Through Window – X = 3,560 square feet (3.56 ksf)			
ITE Land Use 937 rate:	T = 600.50 (X)	T = 85.41 (X)	T = 39.00 (X)
Peak hour in/out split		51% / 49%	50% / 50%
Gross trips	2,136	304	139
Net after internal capture (20%)	1,709	243 (124 in / 119 out)	111 (56 in / 55 out)
Pass-by reduction (82%)	- 1,401	- 199	- 91
Net primary trips	308	44 (22 in / 22 out)	20 (10 in / 10 out)
Net after internal capture, all uses²	8,790	591 (313 in / 278 out)	772 (398 in / 374 out)
Net primary trips, all uses³	5,307	251 (136 in / 115 out)	502 (261 in / 241 out)

Source: ITE Trip Generation, 12th Edition.

1. Daily rate, not present in ITE data, was assumed based on Daily-to-PM ratio for Strip Retail
2. Total project-generated traffic assigned at site driveway locations
3. Total project-generated traffic assigned at external street intersections

3.2 TRIP DISTRIBUTION AND ASSIGNMENT

Trip distribution was 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. Most project-generated traffic is expected to be oriented west of the site. Trip distribution and assignment percentages are shown in **Exhibit 8**. These percentages were assumed to be the same for all uses. Trips reflected as peak hour intersection and site driveway turning movement volumes and the daily link volume on King are shown in **Exhibit 9**, and the total volumes are shown in **Exhibit 10**.

Exhibit 8. Trip Distribution Percentages for Site Trips

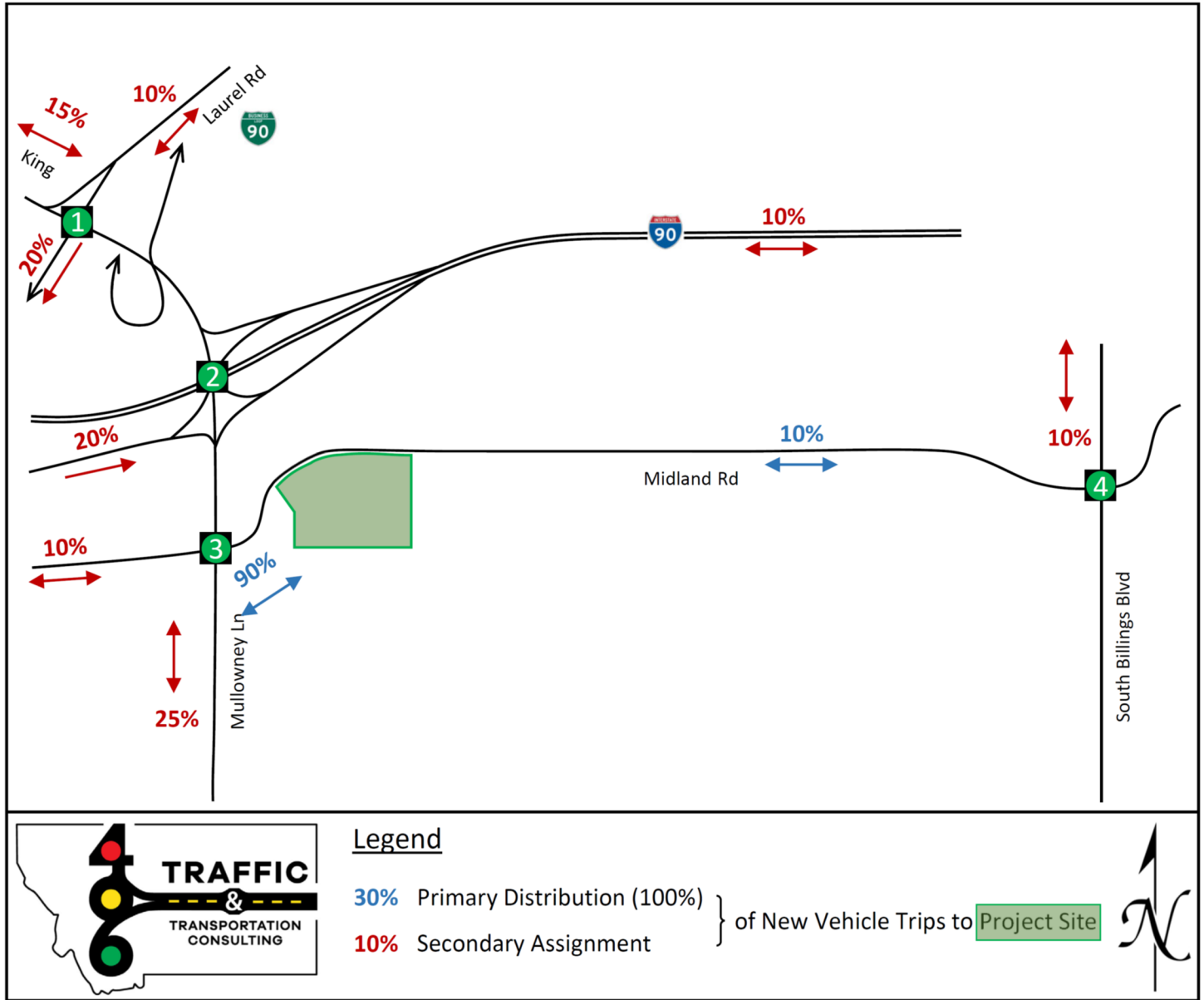


Exhibit 9. Assignment of Site Trips

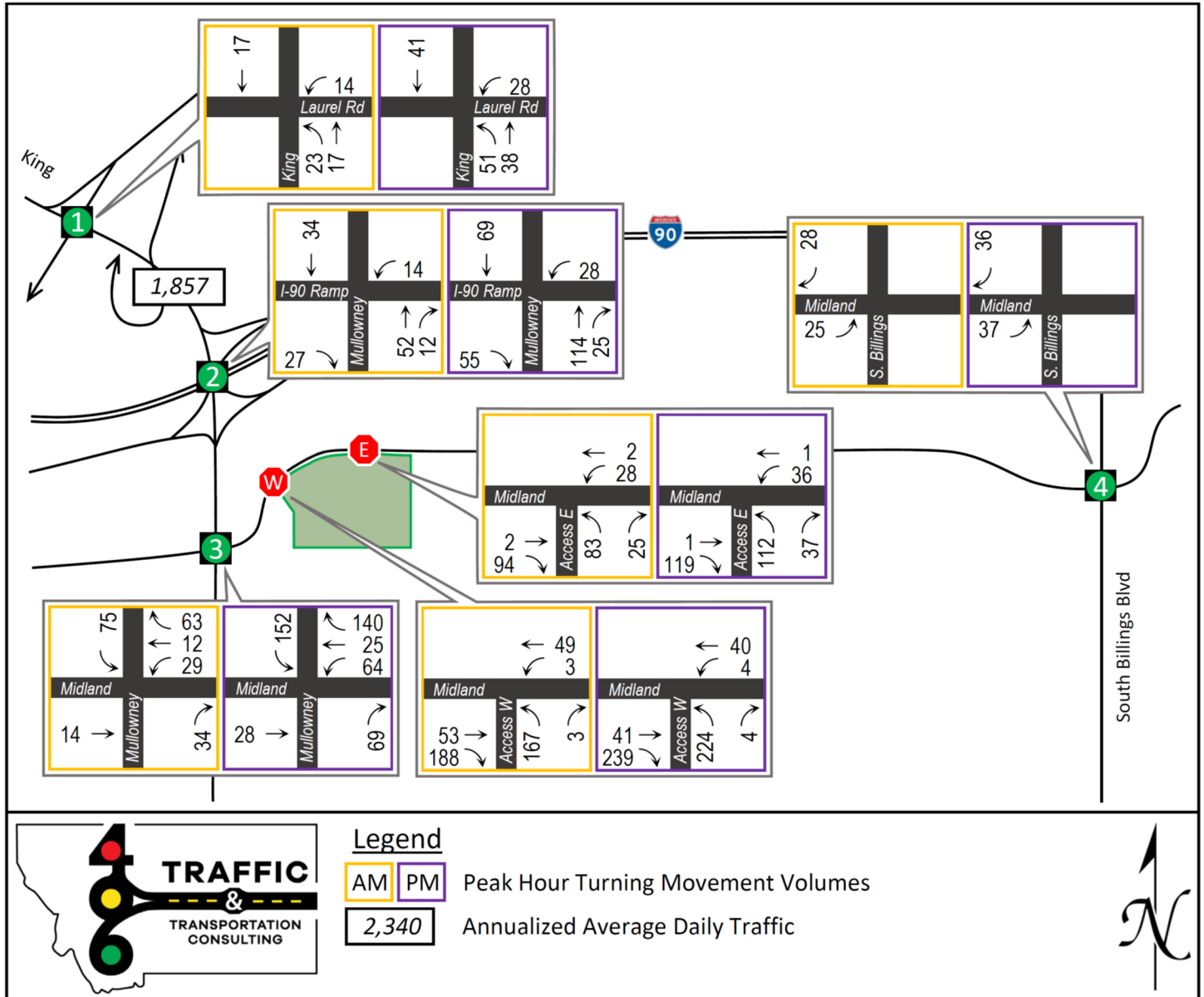
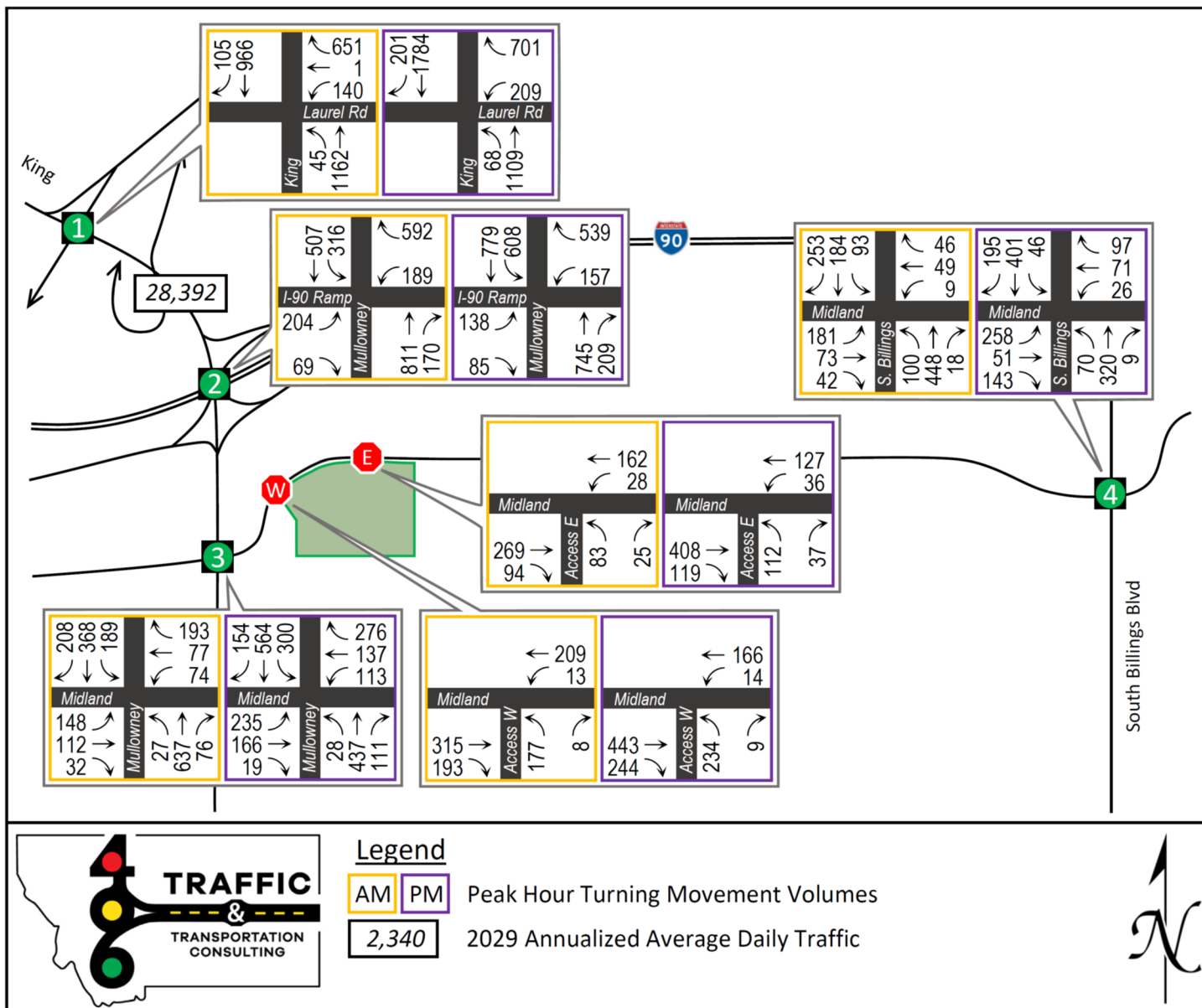


Exhibit 10. Total Traffic Volumes



4 CAPACITY ANALYSIS

4.1 INTERSECTIONS

The project driveways were not subject to analysis under the background condition because they handle only a very small amount of turning traffic for existing land uses. Peak hour volumes are low for two reasons: (a) the Trailhead Inn’s other access to Midland Road is closer to the Mallowney intersection where the strong majority of traffic is oriented and (b) hotels and casinos tend to have low amounts of traffic spread throughout the day. The peak hour intersection Level of Service (LOS) and delay results with and without the project are shown in **Exhibit 11**. Analysis software results are provided in Appendix B.

Exhibit 11. Intersection LOS and Delay with and without the Project

	Intersection	Traffic Control	LOS (delay, in seconds/vehicle)	
			Background	Total Traffic
AM Peak Hour	1. King at Laurel Road	Signal	A (3.7)	A (3.9)
	2. Mullooney at I-90 Ramps	Signal	C (28.0)	C (32.2)
	3. Mullooney at Midland	Signal	B (12.9)	B (14.7)
	4. South Billings Blvd at Midland	Signal	B (17.1)	B (17.9)
	5. West Site Driveway Access	TWSC*	N/A	C (22.2)*
	6. East Site Driveway Access	TWSC*	N/A	B (14.6)*
PM Peak Hour	1. King at Laurel Road	Signal	A (5.1)	A (5.6)
	2. Mullooney at I-90 Ramps	Signal	C (24.1)	C (30.8)
	3. Mullooney at Midland	Signal	B (17.6)	B (19.7)
	4. South Billings Blvd at Midland	Signal	B (19.7)	C (20.7)
	5. West Site Driveway Access	TWSC*	N/A	E (42.4)*
	6. East Site Driveway Access	TWSC*	N/A	C (19.0)*

* TWSC LOS reported only for the worst lane group, which is the northbound (exit) left at both site driveways.

All signalized intersections would operate at LOS C or better in both peaks with or without the project with the data and assumptions documented in this study. At the driveways only delay for the northbound approach is shown. The northbound King Avenue left turn at Intersection 1 (traffic getting on to I-90 westbound) would continue to operate at LOS A, with or without the project. The only LOS challenge for the study area is that with 90% of traffic leaving the site destined to the west on Midland, much of that traffic would turn left at the West Driveway, which results in sufficient delay for that one movement to exceed the LOS C standard in the PM peak hour. The movement would operate at LOS E, with Synchro reporting a 95th-percentile queue length of just under 6 vehicles (approximately 130-140 feet). This queue would extend back into the site but would not affect street operations and is not expected to affect internal site circulation for most of the peak hour. Analysis software results are provided in Appendix B. No impact mitigation is recommended at this time.

4.2 DRIVE-THROUGH LANE ANALYSIS

The drive-through lanes for the five outparcels were analyzed for queue storage sufficiency based on fundamental traffic flow principles, limited information from studies and inquiries at other restaurants and coffee shops, and field-based assumptions about vehicle mix and driver behavior.

Assumptions

Quantitative analysis of queuing relies on the assumption that arrivals are generally random. Average rates reflect the fact that despite the nearby signal on Midland leading to some potential platooning, traffic could arrive from any direction. The arrival and service rates for drive-through queue lane operation were gathered separately for the two outparcel uses (fast-food and coffee/donut shop), and an adjustment factor was applied to reflect that based on the example and model indicated by the applicant, the style of building proposed here, with multiple tenants, is not typically occupied by food/beverage companies with very high-volume drive-through activity. Arrival rates from the AM peak hour condition was used for this analysis because it has the higher traffic generation quantities for the food/beverage uses.

The service rate represents the amount of time spent at the pick-up window, which will also be used for in-person payments, and is also sometimes called the "window time." An advance order menu board/microphone is expected to be available on the east side of the buildings for drive-through patrons. Orders are also expected to be taken in advance via online/mobile apps. App-based pickup, through such services as DoorDash and Uber Eats, have not been directly predicted as a proportion of orders, but increasing use of such services in the restaurant/coffee shop industry, along with a strong trend of lower use of cash and physical card transactions, is believed to provide support for the use of a window time assumption of 2 minutes for food businesses and 0.8 minutes for the coffee/donut shop-based ones.

For storage capacity, the amount of space available for queued vehicles, including the one being served at the pick-up window, is estimated to be about 230 feet. This distance is measured along the center of the drive-through lane from (a) several feet ahead of the pick-up window location such that the driver is positioned at the window to (b) the beginning of the drive-through lane. Factors that govern how many vehicles fit in this space include vehicle mix (especially as it relates to light trucks), vehicle length, and separation of stopped vehicles in queue. Most passenger vehicles and pickup trucks are nominally 15-18 feet long, and bumper spacing for stopped vehicles in a drive-through lane is often in the 3- to 5-foot range (slightly shorter than for vehicles stopped in traffic). The analysis documented here is based on these assumptions, which indicate that 230 feet is enough space to store 12 vehicles. This assumption also accounts for the fact that the last vehicle in the queue doesn't need separation space behind it before encroaching on the crosswalk.

Finally, the definition of adequacy used here is a minimum probability of 95% that the vehicle queue, at any given time that peak-hour arrival rates exist, will fit within the available storage. In other words, the success threshold is when the probability of 12 or fewer vehicles being queued is 95% or greater.

Methodology

Foundational traffic flow theory has a well-developed set of mathematical relationships that allow the estimation of queue characteristics, similar to the estimation of average intersection delay. To apply these here, relevant information is adapted from the text *Traffic Flow Fundamentals* (Adolf D. May, Simon & Schuster, 1990), where Chapter 12, section 3 covers Stochastic Queuing Analysis.

In the context of queuing analysis, traffic intensity is directly analogous to the commonly computed parameter "volume/capacity ratio." This variable is assigned the letter ρ (rho), and it is the only one necessary, other than the number of vehicles that can fit in the space available, to analyze the drive-through lane in question. Importantly, as with arrivals, the service time for queued vehicles at the window can also be considered random for the purposes of this analysis. These rates in simple queueing are commonly assumed to follow a Poisson distribution, not a Normal distribution.

The applicable mathematical relationship here is the probability of a specific number of vehicles in queue (or fewer). The equation for this probability is:

$$P(n) = \rho^n(1 - \rho)$$

where $P(n)$ = probability of exactly n vehicles in the drive-through lane, and
 ρ = traffic intensity (arrival rate/service rate)

The traffic intensity (ρ) value here is arrival rate divided by the service rate. The addition of successive probabilities for specific numbers of vehicles results in the cumulative probability that a queue will be equal to or less than the highest of those values at any given time.

Application

The results of the drive-through lane's relevant cumulative queue probability calculations are shown in **Exhibit 12**.

Exhibit 12. Drive-Through Queue Analysis

ρ (arrival / service rate): Probability of n vehicles:	Fast Food (ITE 934) $22.1 \text{ vph} / 30 \text{ vph} = 0.74$		Coffee/Donut (ITE 937) $58.1 \text{ vph} / 75 \text{ vph} = 0.78$	
	Exactly	At Least	Exactly	At Least
$n = 0$	26.3%	26.3%	22.5%	22.5%
$n = 1$	19.4%	45.7%	17.4%	39.9%
$n = 2$	14.3%	60.0%	13.5%	53.4%
$n = 3$	10.5%	70.5%	10.5%	63.9%
$n = 4$	7.8%	78.3%	8.1%	72.0%
$n = 5$	5.7%	84.0%	6.3%	78.3%
$n = 6$	4.2%	88.2%	4.9%	83.2%
$n = 7$	3.1%	91.3%	3.8%	87.0%
$n = 8$	2.3%	93.6%	2.9%	89.9%
$n = 9$	1.7%	95.3%	2.3%	92.2%
$n = 10$	1.2%	96.5%	1.8%	94.0%
$n = 11$	0.9%	97.4%	1.4%	95.4%
$n = 12$	0.7%	98.1%	1.1%	96.5%

The accepted design confidence level, or cumulative probability threshold, is 95%. For both types of land uses examined the expected traffic would be storable in the drive-through space available under the estimated peak traffic arrival rate at this confidence level.

5 COST PARTICIPATION

New project trips identified in this report are subject to examination under the City's cost participation program to the extent that they would travel through the two studied intersections on Midland. At Intersections 1 and 2, the need, scope, and timing of capacity improvements are controlled by MDT, so they are not covered here. Critical traffic shares that drive cost participation are subject to waiver if they fall below 2%. Right turns are not considered.

Exhibit 13 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, neither of the intersections examined would qualify for the "sub-2%" waiver.

Exhibit 13. Intersection Cost Participation

Intersection	Critical Volume %		
	AM	PM	Highest
3. Mullowney at Midland	9.8%	19.2%	19.2%
4. South Billings Blvd at Midland	2.1%	3.1%	3.1%
	Total:		22.3%
	x \$450,000		\$100,350

For both intersections, the PM peak hour critical-pair traffic volume would exceed that of the AM peak hour. The details of these cost calculations are provided in Appendix C.

This concludes the Trailhead Commercial Subdivision TIS.

Appendix A: Raw Traffic Count Data for Intersections

Project Trailhead Commercial Subdivision

Intersection 1. King Avenue at Laurel Road/I-90 Business WB

AM Count Adapted/Factored from adjacent intersection (see report text)

PM Count Adapted/Factored from adjacent intersection (see report text)

Start Time	King Avenue Southbound				Laurel Road/Business 90 Westbound				King Avenue Northbound				N/A Eastbound			
	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U
7:15 AM	15	188		0	142	1	28		240	3	0					
7:30 AM	22	257		0	169	0	30		284	5	0					
7:45 AM	23	275		0	197	0	40		365	9	1					
8:00 AM	27	220		0	137	0	27		245	5	0					
4:30 PM	44	396		0	171	0	20		279	10	0					
4:45 PM	54	410		0	168	0	43		260	8	0					
5:00 PM	56	489		0	169	0	68		265	1	2					
5:15 PM	45	433		0	186	0	50		258	1	0					

Project Trailhead Commercial Subdivision

Intersection 2. King Avenue/Mullowney Lane at I-90 Ramps (SPUI)

AM Count November 4, 2025; 7-9 a.m.

PM Count November 3, 2025, 4-6 p.m.

Start Time	King Avenue Southbound				I-90 Off Westbound				Mullowney Lane Northbound				I-90 Off Eastbound			
	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U
7:00 AM		74	57	0	88		32	0	31	136		0	10			35
7:15 AM		98	75	0	141		42	0	48	171		0	12			44
7:30 AM		130	78	1	147		48	0	36	207		0	4			54
7:45 AM		138	83	0	179		55	0	44	203		0	19			57
8:00 AM		102	77	0	119		28	0	28	170		0	7			47
8:15 AM		112	87	0	99		31	0	37	111		0	8			39
8:30 AM		104	67	0	107		24	0	15	130		0	5			27
8:45 AM		99	67	0	93		16	0	27	116		0	10			35
4:00 PM		145	148	0	113		27	1	30	165		0	6			38
4:15 PM		151	144	1	119		24	0	26	140		0	11			36
4:30 PM		167	139	0	123		28	0	48	180		0	12			37
4:45 PM		194	142	0	130		31	0	51	137		0	8			32
5:00 PM		173	165	0	143		37	0	47	165		0	4			40
5:15 PM		173	156	0	138		34	0	37	149		0	9			28
5:30 PM		169	116	0	116		29	0	25	120		0	6			46
5:45 PM		122	107	0	118		31	0	20	110		0	4			47

Project Trailhead Commercial Subdivision

Intersection 3. Mullowney Lane at Midland Road

AM Count November 4, 2025; 7-9 a.m.

PM Count November 3, 2025, 4-6 p.m.

Start Time	Mullowney Lane Southbound				Midland Road Westbound				Mullowney Lane Northbound				Frontage Road Eastbound			
	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U
7:00 AM	27	73	16	0	24	18	10	0	9	131	8	0	2	12	12	0
7:15 AM	47	76	29	0	33	16	8	0	13	159	6	0	7	19	27	1
7:30 AM	59	98	25	0	32	22	13	0	8	179	10	0	10	19	32	0
7:45 AM	74	100	38	0	35	16	11	0	8	167	2	0	9	24	45	0
8:00 AM	26	90	21	0	29	10	13	0	13	126	9	0	6	35	43	0
8:15 AM	33	84	34	0	17	18	4	0	7	107	6	0	3	35	24	0
8:30 AM	45	62	26	0	25	16	7	0	11	93	4	0	3	14	27	0
8:45 AM	30	71	23	1	34	16	11	0	13	80	7	0	1	16	28	0
4:00 PM	26	109	42	1	34	17	9	0	19	116	8	0	6	31	44	0
4:15 PM	27	124	34	1	24	32	7	0	9	98	4	0	2	33	43	0
4:30 PM	35	136	35	1	44	29	12	0	18	119	11	0	5	32	64	0
4:45 PM	36	143	51	3	25	22	16	0	11	115	6	0	3	32	45	0
5:00 PM	47	130	36	1	45	33	11	0	9	96	6	0	6	41	70	0
5:15 PM	34	149	32	1	28	28	13	0	8	103	5	0	5	34	54	0
5:30 PM	29	152	22	1	25	16	12	0	7	87	5	0	5	18	32	0
5:45 PM	23	111	22	1	16	16	14	0	4	87	6	0	10	10	26	0

Project Trailhead Commercial Subdivision

Intersection 4. Midland Road at South Billings Boulevard

Start Time November 4, 2025; 7-9 a.m.

Site Code November 3, 2025, 4-6 p.m.

Start Time	South Billings Blvd Southbound				Frontage Road Westbound				South Billings Blvd Northbound				Midland Road Eastbound			
	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U
7:00 AM	36	31	19	0	4	12	3	0	6	93	20	0	6	13	29	0
7:15 AM	44	34	31	1	16	17	2	0	5	117	26	0	8	18	36	0
7:30 AM	71	36	19	0	11	12	2	0	4	148	32	0	10	10	33	0
7:45 AM	74	53	25	0	9	11	2	0	5	102	30	0	11	17	42	0
8:00 AM	30	59	17	0	10	9	3	0	4	77	11	0	13	27	39	0
8:15 AM	29	73	20	0	14	10	3	0	5	52	13	0	14	21	36	0
8:30 AM	20	55	9	0	13	13	1	0	5	97	15	0	20	19	41	0
8:45 AM	36	54	11	0	17	18	3	0	4	101	26	1	14	9	38	0
4:00 PM	38	102	10	0	26	15	10	0	3	74	17	0	29	21	65	0
4:15 PM	39	85	12	1	22	16	6	0	2	88	12	0	29	28	60	0
4:30 PM	29	97	14	0	17	12	4	0	2	79	16	0	27	30	71	0
4:45 PM	42	90	14	0	18	20	6	0	4	79	12	0	37	17	54	0
5:00 PM	27	92	10	0	37	21	9	0	2	79	24	0	51	16	73	0
5:15 PM	44	109	12	0	31	17	9	0	1	90	22	0	30	7	51	0
5:30 PM	37	106	10	0	10	12	2	0	2	69	11	0	24	10	33	0
5:45 PM	23	86	8	0	10	5	2	0	2	50	14	0	15	5	30	0

Appendix B: Intersection Analysis Software Output

Scenario sequence:

Background AM




















Background PM

Total Traffic AM

Total Traffic PM

HCM 7th Signalized Intersection Summary
 1: Mullowney/King & I-90 WB On/Laurel Road WB

Trailhead Commercial
 12/23/2025

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	126	1	0	22	1145	0	0	949	105
Future Volume (veh/h)	0	0	0	126	1	0	22	1145	0	0	949	105
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Lane Width Adj.				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach				No			No			No		
Adj Sat Flow, veh/h/ln				1709	1709	0	1709	1709	0	0	1709	1709
Adj Flow Rate, veh/h				155	0	0	27	1396	0	0	1157	128
Peak Hour Factor				0.82	0.82	0.82	0.82	0.82	0.82	0.92	0.82	0.82
Percent Heavy Veh, %				3	3	0	3	3	0	0	3	3
Cap, veh/h				244	128		399	2594	0	0	3405	377
Arrive On Green				0.08	0.00	0.00	1.00	1.00	0.00	0.00	0.80	0.80
Sat Flow, veh/h				3255	1709	0	427	3333	0	0	4417	471
Grp Volume(v), veh/h				155	0	0	27	1396	0	0	844	441
Grp Sat Flow(s),veh/h/ln				1628	1709	0	427	1624	0	0	1555	1624
Q Serve(g_s), s				3.7	0.0	0.0	0.5	0.0	0.0	0.0	6.0	6.0
Cycle Q Clear(g_c), s				3.7	0.0	0.0	6.5	0.0	0.0	0.0	6.0	6.0
Prop In Lane				1.00		0.00	1.00		0.00	0.00		0.29
Lane Grp Cap(c), veh/h				244	128		399	2594	0	0	2484	1297
V/C Ratio(X)				0.63	0.00		0.07	0.54	0.00	0.00	0.34	0.34
Avail Cap(c_a), veh/h				1420	746		399	2594	0	0	2484	1297
HCM Platoon Ratio				1.00	1.00	1.00	1.33	1.33	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh				35.9	0.0	0.0	0.3	0.0	0.0	0.0	2.2	2.2
Incr Delay (d2), s/veh				2.7	0.0	0.0	0.3	0.8	0.0	0.0	0.4	0.7
Initial Q Delay(d3), s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				1.5	0.0	0.0	0.0	0.3	0.0	0.0	0.9	1.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh				38.7	0.0	0.0	0.6	0.8	0.0	0.0	2.6	2.9
LnGrp LOS				D			A	A			A	A
Approach Vol, veh/h					155			1423			1285	
Approach Delay, s/veh					38.7			0.8			2.7	
Approach LOS					D			A			A	
Timer - Assigned Phs		2				6		8				
Phs Duration (G+Y+Rc), s		68.9				68.9		11.1				
Change Period (Y+Rc), s		5.0				5.0		5.1				
Max Green Setting (Gmax), s		35.0				35.0		34.9				
Max Q Clear Time (g_c+I1), s		8.5				8.0		5.7				
Green Ext Time (p_c), s		12.6				10.0		0.5				
Intersection Summary												
HCM 7th Control Delay, s/veh				3.7								
HCM 7th LOS				A								
Notes												
User approved volume balancing among the lanes for turning movement.												
Unsignalized Delay for [WBR] is excluded from calculations of the approach delay and intersection delay.												

Lanes, Volumes, Timings
2: Mullowney & I-90 EB Ramps+WB Off

Trailhead Commercial
12/23/2025

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	204	0	0	175	0	592	0	759	0	316	473	0
Future Volume (vph)	204	0	0	175	0	592	0	759	0	316	473	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Storage Length (ft)	0		0	300		0	0		0	550		0
Storage Lanes	1		0	1		2	0		0	1		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	1583	0	0	1599	0	2517	0	3228	0	1614	3228	0
Flt Permitted	0.950			0.950						0.138		
Satd. Flow (perm)	1583	0	0	1599	0	2517	0	3228	0	234	3228	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						426						
Link Speed (mph)		35			35			35				35
Link Distance (ft)		500			500			550				656
Travel Time (s)		9.7			9.7			10.7				12.8
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Heavy Vehicles (%)	5%	2%	2%	4%	2%	4%	2%	3%	2%	3%	3%	2%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	234	0	0	201	0	680	0	872	0	363	544	0
Turn Type	Prot			Prot		Over		NA		pm+pt	NA	
Protected Phases	7			3		1		2		1	6	
Permitted Phases										6		
Detector Phase	7			3		1		2		1	6	
Switch Phase												
Minimum Initial (s)	5.0			5.0		5.0		5.0		5.0	5.0	
Minimum Split (s)	14.6			14.6		10.7		23.7		10.7	23.7	
Total Split (s)	35.0			35.0		20.0		25.0		20.0	45.0	
Total Split (%)	43.8%			43.8%		25.0%		31.3%		25.0%	56.3%	
Maximum Green (s)	25.4			25.4		14.4		19.4		14.4	39.4	
Yellow Time (s)	3.6			3.6		3.6		3.6		3.6	3.6	
All-Red Time (s)	6.0			6.0		2.0		2.0		2.0	2.0	
Lost Time Adjust (s)	0.0			0.0		0.0		0.0		0.0	0.0	
Total Lost Time (s)	9.6			9.6		5.6		5.6		5.6	5.6	
Lead/Lag						Lead		Lag		Lead		
Lead-Lag Optimize?						Yes		Yes		Yes		
Vehicle Extension (s)	3.0			3.0		3.0		3.0		3.0	3.0	
Recall Mode	None			None		None		C-Max		None	C-Max	
Walk Time (s)								7.0			7.0	
Flash Don't Walk (s)								11.0			11.0	
Pedestrian Calls (#/hr)								0			0	
Act Effct Green (s)	17.1			17.1		18.8		23.3		47.7	47.7	
Actuated g/C Ratio	0.21			0.21		0.24		0.29		0.60	0.60	
v/c Ratio	0.69			0.59		0.74		0.93		0.78	0.28	
Control Delay (s/veh)	39.4			34.7		16.2		43.0		29.5	10.1	
Queue Delay	0.0			0.0		0.0		0.0		0.0	0.0	
Total Delay (s/veh)	39.4			34.7		16.2		43.0		29.5	10.1	
LOS	D			C		B		D		C	B	
Approach Delay (s/veh)		39.4			20.4			43.0			17.8	
Approach LOS		D			C			D			B	

Lanes, Volumes, Timings
 2: Mullowney & I-90 EB Ramps+WB Off

Trailhead Commercial
 12/23/2025

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 50th (ft)	109			91		57		~271		121	73	
Queue Length 95th (ft)	158			136		127		#348		#280	128	
Internal Link Dist (ft)		420			420			470			576	
Turn Bay Length (ft)				300						550		
Base Capacity (vph)	502			507		918		939		464	1926	
Starvation Cap Reductn	0			0		0		0		0	0	
Spillback Cap Reductn	0			0		0		0		0	0	
Storage Cap Reductn	0			0		0		0		0	0	
Reduced v/c Ratio	0.47			0.40		0.74		0.93		0.78	0.28	

Intersection Summary

Area Type: Other

Cycle Length: 80

Actuated Cycle Length: 80

Offset: 3 (4%), Referenced to phase 2:NBT and 6:SBTL, Start of Green

Natural Cycle: 90

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.93

Intersection Signal Delay (s/veh): 28.0 Intersection LOS: C

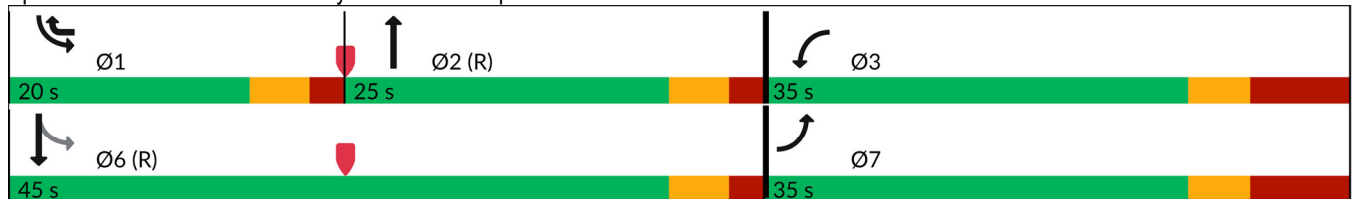
Intersection Capacity Utilization 71.4% ICU Level of Service C

Analysis Period (min) 15

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
























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

Splits and Phases: 2: Mullowney & I-90 EB Ramps+WB Off
























HCM 7th Signalized Intersection Summary
3: Mullowney & Midland

Trailhead Commercial
12/23/2025

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	148	98	32	45	65	130	27	637	42	114	368	208
Future Volume (veh/h)	148	98	32	45	65	130	27	637	42	114	368	208
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1641	1641	1641	1668	1668	1668	1723	1723	1723	1709	1709	1709
Adj Flow Rate, veh/h	164	109	36	50	72	144	30	708	47	127	409	231
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	8	8	8	6	6	6	2	2	2	3	3	3
Cap, veh/h	293	257	85	257	364	308	525	1719	114	481	1317	736
Arrive On Green	0.22	0.22	0.22	0.22	0.22	0.22	0.55	0.55	0.55	0.12	1.00	1.00
Sat Flow, veh/h	1110	1181	390	1204	1668	1414	789	3115	207	1628	2009	1122
Grp Volume(v), veh/h	164	0	145	50	72	144	30	372	383	127	330	310
Grp Sat Flow(s),veh/h/ln	1110	0	1571	1204	1668	1414	789	1637	1685	1628	1624	1507
Q Serve(g_s), s	11.3	0.0	6.4	3.0	2.8	7.1	1.4	10.5	10.5	2.5	0.0	0.0
Cycle Q Clear(g_c), s	14.2	0.0	6.4	9.3	2.8	7.1	1.4	10.5	10.5	2.5	0.0	0.0
Prop In Lane	1.00		0.25	1.00		1.00	1.00		0.12	1.00		0.74
Lane Grp Cap(c), veh/h	293	0	342	257	364	308	525	903	930	481	1065	988
V/C Ratio(X)	0.56	0.00	0.42	0.19	0.20	0.47	0.06	0.41	0.41	0.26	0.31	0.31
Avail Cap(c_a), veh/h	535	0	685	519	728	617	525	903	930	617	1065	988
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.94	0.94	0.94
Uniform Delay (d), s/veh	31.3	0.0	26.9	31.0	25.6	27.2	8.3	10.4	10.4	6.5	0.0	0.0
Incr Delay (d2), s/veh	1.7	0.0	0.8	0.4	0.3	1.1	0.2	1.4	1.3	0.3	0.7	0.8
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.9	0.0	2.3	0.9	1.1	2.4	0.2	3.6	3.7	0.7	0.2	0.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	33.0	0.0	27.8	31.3	25.8	28.3	8.6	11.8	11.7	6.8	0.7	0.8
LnGrp LOS	C		C	C	C	C	A	B	B	A	A	A
Approach Vol, veh/h		309			266			785			767	
Approach Delay, s/veh		30.6			28.2			11.6			1.7	
Approach LOS		C			C			B			A	
Timer - Assigned Phs	1	2		4		6		8				
Phs Duration (G+Y+Rc), s	8.3	49.2		22.5		57.5		22.5				
Change Period (Y+Rc), s	3.6	5.0		5.1		5.0		5.1				
Max Green Setting (Gmax), s	11.4	20.0		34.9		35.0		34.9				
Max Q Clear Time (g_c+I1), s	4.5	12.5		16.2		2.0		11.3				
Green Ext Time (p_c), s	0.2	2.8		1.3		4.4		1.0				
Intersection Summary												
HCM 7th Control Delay, s/veh			12.9									
HCM 7th LOS			B									




















HCM 7th Signalized Intersection Summary
4: S. Billings Blvd. & Midland

Trailhead Commercial
12/23/2025

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	152	73	42	9	49	46	100	448	18	93	184	221
Future Volume (veh/h)	152	73	42	9	49	46	100	448	18	93	184	221
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1559	1559	1559	1532	1532	1532	1695	1695	1695	1668	1668	1668
Adj Flow Rate, veh/h	165	79	46	10	53	50	109	487	20	101	200	240
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	14	14	14	16	16	16	4	4	4	6	6	6
Cap, veh/h	294	217	126	274	170	160	552	800	33	418	1024	868
Arrive On Green	0.23	0.23	0.23	0.23	0.23	0.23	0.49	0.49	0.49	0.06	0.61	0.61
Sat Flow, veh/h	1169	924	538	1125	725	684	934	1617	66	1589	1668	1414
Grp Volume(v), veh/h	165	0	125	10	0	103	109	0	507	101	200	240
Grp Sat Flow(s),veh/h/ln	1169	0	1462	1125	0	1409	934	0	1683	1589	1668	1414
Q Serve(g_s), s	10.9	0.0	5.7	0.6	0.0	4.8	5.3	0.0	17.4	2.3	4.2	6.3
Cycle Q Clear(g_c), s	15.7	0.0	5.7	6.3	0.0	4.8	5.3	0.0	17.4	2.3	4.2	6.3
Prop In Lane	1.00		0.37	1.00		0.49	1.00		0.04	1.00		1.00
Lane Grp Cap(c), veh/h	294	0	343	274	0	331	552	0	832	418	1024	868
V/C Ratio(X)	0.56	0.00	0.36	0.04	0.00	0.31	0.20	0.00	0.61	0.24	0.20	0.28
Avail Cap(c_a), veh/h	510	0	614	482	0	592	552	0	832	526	1024	868
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	31.8	0.0	25.6	28.3	0.0	25.3	11.6	0.0	14.6	10.4	6.8	7.2
Incr Delay (d2), s/veh	1.7	0.0	0.6	0.1	0.0	0.5	0.8	0.0	3.3	0.3	0.4	0.8
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.0	0.0	1.9	0.2	0.0	1.5	1.1	0.0	6.3	0.7	1.3	1.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	33.4	0.0	26.3	28.3	0.0	25.8	12.4	0.0	17.9	10.7	7.2	8.0
LnGrp LOS	C		C	C		C	B		B	B	A	A
Approach Vol, veh/h		290			113			616			541	
Approach Delay, s/veh		30.3			26.0			17.0			8.2	
Approach LOS		C			C			B			A	
Timer - Assigned Phs	1	2		4		6		8				
Phs Duration (G+Y+Rc), s	9.6	45.3		25.2		54.8		25.2				
Change Period (Y+Rc), s	5.1	5.7		6.4		5.7		6.4				
Max Green Setting (Gmax), s	9.9	19.3		33.6		34.3		33.6				
Max Q Clear Time (g_c+I1), s	4.3	19.4		17.7		8.3		8.3				
Green Ext Time (p_c), s	0.1	0.0		1.1		1.8		0.5				
Intersection Summary												
HCM 7th Control Delay, s/veh				17.1								
HCM 7th LOS				B								






















HCM 7th Signalized Intersection Summary
 1: Mullowney/King & I-90 WB On/Laurel Road WB

Trailhead Commercial
 12/23/2025

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	183	0	0	20	1073	0	0	1745	201
Future Volume (veh/h)	0	0	0	183	0	0	20	1073	0	0	1745	201
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Lane Width Adj.				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach				No			No			No		
Adj Sat Flow, veh/h/ln				1736	1736	0	1736	1736	0	0	1736	1736
Adj Flow Rate, veh/h				197	0	0	22	1154	0	0	1876	216
Peak Hour Factor				0.93	0.93	0.93	0.93	0.93	0.92	0.92	0.93	0.93
Percent Heavy Veh, %				1	1	0	1	1	0	0	1	1
Cap, veh/h				297	156		212	2587	0	0	3383	387
Arrive On Green				0.09	0.00	0.00	1.00	1.00	0.00	0.00	0.78	0.78
Sat Flow, veh/h				3307	1736	0	198	3386	0	0	4471	493
Grp Volume(v), veh/h				197	0	0	22	1154	0	0	1371	721
Grp Sat Flow(s),veh/h/ln				1654	1736	0	198	1650	0	0	1580	1648
Q Serve(g_s), s				4.6	0.0	0.0	2.2	0.0	0.0	0.0	13.2	13.5
Cycle Q Clear(g_c), s				4.6	0.0	0.0	15.7	0.0	0.0	0.0	13.2	13.5
Prop In Lane				1.00		0.00	1.00		0.00	0.00		0.30
Lane Grp Cap(c), veh/h				297	156		212	2587	0	0	2478	1292
V/C Ratio(X)				0.66	0.00		0.10	0.45	0.00	0.00	0.55	0.56
Avail Cap(c_a), veh/h				1443	757		212	2587	0	0	2478	1292
HCM Platoon Ratio				1.00	1.00	1.00	2.00	2.00	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh				35.2	0.0	0.0	1.7	0.0	0.0	0.0	3.3	3.3
Incr Delay (d2), s/veh				2.6	0.0	0.0	1.0	0.6	0.0	0.0	0.9	1.7
Initial Q Delay(d3), s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				1.9	0.0	0.0	0.1	0.2	0.0	0.0	2.3	2.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh				37.8	0.0	0.0	2.7	0.6	0.0	0.0	4.2	5.1
LnGrp LOS				D			A	A			A	A
Approach Vol, veh/h					197			1176			2092	
Approach Delay, s/veh					37.8			0.6			4.5	
Approach LOS					D			A			A	
Timer - Assigned Phs		2				6		8				
Phs Duration (G+Y+Rc), s		67.7				67.7		12.3				
Change Period (Y+Rc), s		5.0				5.0		5.1				
Max Green Setting (Gmax), s		35.0				35.0		34.9				
Max Q Clear Time (g_c+I1), s		17.7				15.5		6.6				
Green Ext Time (p_c), s		8.4				14.4		0.7				
Intersection Summary												
HCM 7th Control Delay, s/veh					5.1							
HCM 7th LOS					A							
Notes												
User approved volume balancing among the lanes for turning movement.												
Unsignalized Delay for [WBR] is excluded from calculations of the approach delay and intersection delay.												

Lanes, Volumes, Timings
2: Mullowney & I-90 EB Ramps+WB Off

Trailhead Commercial
12/23/2025

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations						 		 			 	
Traffic Volume (vph)	138	0	0	131	0	539	0	637	0	608	714	0
Future Volume (vph)	138	0	0	131	0	539	0	637	0	608	714	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Storage Length (ft)	0		0	300		0	0		0	550		0
Storage Lanes	1		0	1		2	0		0	1		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	1583	0	0	1599	0	2517	0	3292	0	1646	3292	0
Flt Permitted	0.950			0.950						0.166		
Satd. Flow (perm)	1583	0	0	1599	0	2517	0	3292	0	288	3292	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						561						
Link Speed (mph)		35			35			35				35
Link Distance (ft)		500			500			550				656
Travel Time (s)		9.7			9.7			10.7				12.8
Peak Hour Factor	0.96	0.92	0.92	0.96	0.92	0.96	0.92	0.96	0.92	0.96	0.96	0.92
Heavy Vehicles (%)	5%	2%	2%	4%	2%	4%	2%	1%	2%	1%	1%	2%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	144	0	0	136	0	561	0	664	0	633	744	0
Turn Type	Prot			Prot		Over		NA		pm+pt	NA	
Protected Phases	7			3		1		2		1	6	
Permitted Phases										6		
Detector Phase	7			3		1		2		1	6	
Switch Phase												
Minimum Initial (s)	5.0			5.0		5.0		5.0		5.0	5.0	
Minimum Split (s)	14.6			27.6		10.7		25.0		10.7	25.0	
Total Split (s)	35.0			35.0		20.0		25.0		20.0	45.0	
Total Split (%)	43.8%			43.8%		25.0%		31.3%		25.0%	56.3%	
Maximum Green (s)	25.4			25.4		14.4		19.4		14.4	39.4	
Yellow Time (s)	3.6			3.6		3.6		3.6		3.6	3.6	
All-Red Time (s)	6.0			6.0		2.0		2.0		2.0	2.0	
Lost Time Adjust (s)	0.0			0.0		0.0		0.0		0.0	0.0	
Total Lost Time (s)	9.6			9.6		5.6		5.6		5.6	5.6	
Lead/Lag						Lead		Lag		Lead		
Lead-Lag Optimize?						Yes		Yes		Yes		
Vehicle Extension (s)	3.0			3.0		3.0		3.0		3.0	3.0	
Recall Mode	None			None		None		C-Max		None	C-Max	
Walk Time (s)				7.0				7.0			7.0	
Flash Don't Walk (s)				11.0				11.0			11.0	
Pedestrian Calls (#/hr)				0				0			0	
Act Effct Green (s)	12.6			12.6		27.2		19.4		52.2	52.2	
Actuated g/C Ratio	0.16			0.16		0.34		0.24		0.65	0.65	
v/c Ratio	0.58			0.54		0.46		0.83		0.98	0.35	
Control Delay (s/veh)	39.8			38.3		3.5		32.8		46.9	7.0	
Queue Delay	0.0			0.0		0.0		0.0		0.0	0.0	
Total Delay (s/veh)	39.8			38.3		3.5		32.8		46.9	7.0	
LOS	D			D		A		C		D	A	
Approach Delay (s/veh)		39.8			10.3			32.8			25.3	
Approach LOS		D			B			C			C	

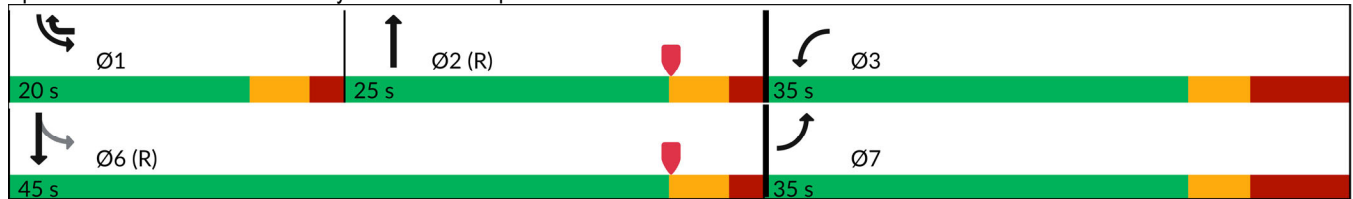
Lanes, Volumes, Timings
 2: Mullowney & I-90 EB Ramps+WB Off

Trailhead Commercial
 12/23/2025

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 50th (ft)	68			63		0		175		260	104	
Queue Length 95th (ft)	115			110		39		#258		#539	136	
Internal Link Dist (ft)		420			420			470			576	
Turn Bay Length (ft)				300						550		
Base Capacity (vph)	502			507		1226		798		649	2148	
Starvation Cap Reductn	0			0		0		0		0	0	
Spillback Cap Reductn	0			0		0		0		0	0	
Storage Cap Reductn	0			0		0		0		0	0	
Reduced v/c Ratio	0.29			0.27		0.46		0.83		0.98	0.35	
























Intersection Summary
 Area Type: Other
 Cycle Length: 80
 Actuated Cycle Length: 80
 Offset: 26.4 (33%), Referenced to phase 2:NBT and 6:SBTL, Start of Yellow
 Natural Cycle: 90
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.98
 Intersection Signal Delay (s/veh): 24.1 Intersection LOS: C
 Intersection Capacity Utilization 81.3% ICU Level of Service D
 Analysis Period (min) 15
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Splits and Phases: 2: Mullowney & I-90 EB Ramps+WB Off



HCM 7th Signalized Intersection Summary
3: Mullowney & Midland

Trailhead Commercial
12/23/2025






















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	235	140	19	53	113	143	28	437	46	156	564	154
Future Volume (veh/h)	235	140	19	53	113	143	28	437	46	156	564	154
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1682	1682	1682	1709	1709	1709	1750	1750	1750	1709	1709	1709
Adj Flow Rate, veh/h	245	146	20	55	118	149	29	455	48	162	588	160
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	5	5	5	3	3	3	0	0	0	3	3	3
Cap, veh/h	371	449	62	372	530	449	271	759	80	580	1422	386
Arrive On Green	0.31	0.31	0.31	0.31	0.31	0.31	0.25	0.25	0.25	0.50	1.00	1.00
Sat Flow, veh/h	1086	1448	198	1210	1709	1448	725	3036	319	1628	2524	685
Grp Volume(v), veh/h	245	0	166	55	118	149	29	248	255	162	378	370
Grp Sat Flow(s),veh/h/ln	1086	0	1646	1210	1709	1448	725	1663	1693	1628	1624	1586
Q Serve(g_s), s	17.3	0.0	6.2	2.9	4.1	6.3	2.5	10.5	10.6	0.0	0.0	0.0
Cycle Q Clear(g_c), s	21.4	0.0	6.2	9.1	4.1	6.3	2.5	10.5	10.6	0.0	0.0	0.0
Prop In Lane	1.00		0.12	1.00		1.00	1.00		0.19	1.00		0.43
Lane Grp Cap(c), veh/h	371	0	511	372	530	449	271	416	423	580	915	894
V/C Ratio(X)	0.66	0.00	0.33	0.15	0.22	0.33	0.11	0.60	0.60	0.28	0.41	0.41
Avail Cap(c_a), veh/h	508	0	718	524	746	632	271	416	423	580	915	894
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.93	0.93	0.93
Uniform Delay (d), s/veh	28.4	0.0	21.2	24.7	20.4	21.2	23.4	26.5	26.5	13.1	0.0	0.0
Incr Delay (d2), s/veh	2.0	0.0	0.4	0.2	0.2	0.4	0.8	6.2	6.2	0.2	1.3	1.3
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.3	0.0	2.2	0.8	1.6	2.1	0.5	4.7	4.8	1.4	0.3	0.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	30.4	0.0	21.5	24.8	20.7	21.6	24.2	32.7	32.7	13.3	1.3	1.3
LnGrp LOS	C		C	C	C	C	C	C	C	B	A	A
Approach Vol, veh/h		411			322			532			910	
Approach Delay, s/veh		26.8			21.8			32.2			3.4	
Approach LOS		C			C			C			A	
Timer - Assigned Phs	1	2		4		6		8				
Phs Duration (G+Y+Rc), s	25.1	25.0		29.9		50.1		29.9				
Change Period (Y+Rc), s	5.0	* 5		5.1		5.0		5.1				
Max Green Setting (Gmax), s	12.0	* 20		34.9		35.0		34.9				
Max Q Clear Time (g_c+I1), s	2.0	12.6		23.4		2.0		11.1				
Green Ext Time (p_c), s	0.3	1.8		1.5		5.2		1.3				

Intersection Summary												
HCM 7th Control Delay, s/veh				17.6								
HCM 7th LOS				B								

Notes
* HCM 7th computational engine requires equal clearance times for the phases crossing the barrier.




















HCM 7th Signalized Intersection Summary
4: S. Billings Blvd. & Midland

Trailhead Commercial
12/23/2025

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	213	51	143	26	71	97	70	320	9	46	401	152
Future Volume (veh/h)	213	51	143	26	71	97	70	320	9	46	401	152
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1723	1723	1723	1709	1709	1709	1709	1709	1709	1723	1723	1723
Adj Flow Rate, veh/h	237	57	159	29	79	108	78	356	10	51	446	169
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	3	3	3	3	3	3	2	2	2
Cap, veh/h	368	130	364	337	213	291	367	678	19	412	887	752
Arrive On Green	0.33	0.33	0.33	0.33	0.33	0.33	0.41	0.41	0.41	0.04	0.51	0.51
Sat Flow, veh/h	1196	401	1120	1156	654	894	801	1654	46	1641	1723	1460
Grp Volume(v), veh/h	237	0	216	29	0	187	78	0	366	51	446	169
Grp Sat Flow(s),veh/h/ln	1196	0	1521	1156	0	1548	801	0	1701	1641	1723	1460
Q Serve(g_s), s	15.2	0.0	8.9	1.6	0.0	7.4	5.6	0.0	12.9	1.3	13.6	5.1
Cycle Q Clear(g_c), s	22.6	0.0	8.9	10.6	0.0	7.4	10.8	0.0	12.9	1.3	13.6	5.1
Prop In Lane	1.00		0.74	1.00		0.58	1.00		0.03	1.00		1.00
Lane Grp Cap(c), veh/h	368	0	495	337	0	503	367	0	697	412	887	752
V/C Ratio(X)	0.64	0.00	0.44	0.09	0.00	0.37	0.21	0.00	0.52	0.12	0.50	0.22
Avail Cap(c_a), veh/h	482	0	639	446	0	650	367	0	697	547	887	752
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	29.4	0.0	21.2	25.4	0.0	20.7	19.0	0.0	17.7	12.7	12.7	10.6
Incr Delay (d2), s/veh	1.9	0.0	0.6	0.1	0.0	0.5	1.3	0.0	2.8	0.1	2.0	0.7
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.2	0.0	3.0	0.4	0.0	2.5	1.1	0.0	5.0	0.4	4.9	1.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	31.3	0.0	21.8	25.5	0.0	21.2	20.3	0.0	20.6	12.9	14.7	11.3
LnGrp LOS	C		C	C		C	C		C	B	B	B
Approach Vol, veh/h		453			216			444			666	
Approach Delay, s/veh		26.8			21.8			20.5			13.7	
Approach LOS		C			C			C			B	
Timer - Assigned Phs		2		4	5	6		8				
Phs Duration (G+Y+Rc), s		47.6		32.4	8.4	39.2		32.4				
Change Period (Y+Rc), s		6.4		6.4	5.0	6.4		6.4				
Max Green Setting (Gmax), s		33.6		33.6	10.0	18.6		33.6				
Max Q Clear Time (g_c+I1), s		15.6		24.6	3.3	14.9		12.6				
Green Ext Time (p_c), s		2.9		1.4	0.0	0.9		1.0				
Intersection Summary												
HCM 7th Control Delay, s/veh				19.7								
HCM 7th LOS				B								

HCM 7th Signalized Intersection Summary
 1: Mullowney/King & I-90 WB On/Laurel Road WB

Trailhead Commercial
 12/28/2025

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	140	1	0	45	1162	0	0	966	105
Future Volume (veh/h)	0	0	0	140	1	0	45	1162	0	0	966	105
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Lane Width Adj.				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach				No			No			No		
Adj Sat Flow, veh/h/ln				1709	1709	0	1709	1709	0	0	1709	1709
Adj Flow Rate, veh/h				172	0	0	55	1417	0	0	1178	128
Peak Hour Factor				0.82	0.82	0.82	0.82	0.82	0.82	0.92	0.82	0.82
Percent Heavy Veh, %				3	3	0	3	3	0	0	3	3
Cap, veh/h				265	139		388	2573	0	0	3385	368
Arrive On Green				0.08	0.00	0.00	1.00	1.00	0.00	0.00	0.79	0.79
Sat Flow, veh/h				3255	1709	0	418	3333	0	0	4426	464
Grp Volume(v), veh/h				172	0	0	55	1417	0	0	858	448
Grp Sat Flow(s),veh/h/ln				1628	1709	0	418	1624	0	0	1555	1626
Q Serve(g_s), s				4.1	0.0	0.0	1.3	0.0	0.0	0.0	6.3	6.3
Cycle Q Clear(g_c), s				4.1	0.0	0.0	7.6	0.0	0.0	0.0	6.3	6.3
Prop In Lane				1.00		0.00	1.00		0.00	0.00		0.29
Lane Grp Cap(c), veh/h				265	139		388	2573	0	0	2464	1288
V/C Ratio(X)				0.65	0.00		0.14	0.55	0.00	0.00	0.35	0.35
Avail Cap(c_a), veh/h				1420	746		388	2573	0	0	2464	1288
HCM Platoon Ratio				1.00	1.00	1.00	1.33	1.33	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh				35.6	0.0	0.0	0.4	0.0	0.0	0.0	2.4	2.4
Incr Delay (d2), s/veh				2.7	0.0	0.0	0.8	0.9	0.0	0.0	0.4	0.7
Initial Q Delay(d3), s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				1.7	0.0	0.0	0.1	0.3	0.0	0.0	1.0	1.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh				38.3	0.0	0.0	1.1	0.9	0.0	0.0	2.8	3.1
LnGrp LOS				D			A	A			A	A
Approach Vol, veh/h					172			1472			1306	
Approach Delay, s/veh					38.3			0.9			2.9	
Approach LOS					D			A			A	
Timer - Assigned Phs		2				6		8				
Phs Duration (G+Y+Rc), s		68.4				68.4		11.6				
Change Period (Y+Rc), s		5.0				5.0		5.1				
Max Green Setting (Gmax), s		35.0				35.0		34.9				
Max Q Clear Time (g_c+I1), s		9.6				8.3		6.1				
Green Ext Time (p_c), s		13.1				10.2		0.6				
Intersection Summary												
HCM 7th Control Delay, s/veh											3.9	
HCM 7th LOS											A	
Notes												
User approved volume balancing among the lanes for turning movement.												
Unsignalized Delay for [WBR] is excluded from calculations of the approach delay and intersection delay.												

Lanes, Volumes, Timings
2: Mullowney & I-90 EB Ramps+WB Off

Trailhead Commercial
12/28/2025

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	204	0	0	189	0	592	0	811	0	316	507	0
Future Volume (vph)	204	0	0	189	0	592	0	811	0	316	507	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Storage Length (ft)	0		0	300		0	0		0	550		0
Storage Lanes	1		0	1		2	0		0	1		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	1583	0	0	1599	0	2517	0	3228	0	1614	3228	0
Flt Permitted	0.950			0.950						0.138		
Satd. Flow (perm)	1583	0	0	1599	0	2517	0	3228	0	234	3228	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						424						
Link Speed (mph)		35			35			35				35
Link Distance (ft)		500			500			550				656
Travel Time (s)		9.7			9.7			10.7				12.8
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Heavy Vehicles (%)	5%	2%	2%	4%	2%	4%	2%	3%	2%	3%	3%	2%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	234	0	0	217	0	680	0	932	0	363	583	0
Turn Type	Prot			Prot		Over		NA		pm+pt		NA
Protected Phases	7			3		1		2		1		6
Permitted Phases										6		
Detector Phase	7			3		1		2		1		6
Switch Phase												
Minimum Initial (s)	5.0			5.0		5.0		5.0		5.0		5.0
Minimum Split (s)	14.6			14.6		10.7		23.7		10.7		23.7
Total Split (s)	35.0			35.0		20.0		25.0		20.0		45.0
Total Split (%)	43.8%			43.8%		25.0%		31.3%		25.0%		56.3%
Maximum Green (s)	25.4			25.4		14.4		19.4		14.4		39.4
Yellow Time (s)	3.6			3.6		3.6		3.6		3.6		3.6
All-Red Time (s)	6.0			6.0		2.0		2.0		2.0		2.0
Lost Time Adjust (s)	0.0			0.0		0.0		0.0		0.0		0.0
Total Lost Time (s)	9.6			9.6		5.6		5.6		5.6		5.6
Lead/Lag						Lead		Lag		Lead		
Lead-Lag Optimize?						Yes		Yes		Yes		
Vehicle Extension (s)	3.0			3.0		3.0		3.0		3.0		3.0
Recall Mode	None			None		None		C-Max		None		C-Max
Walk Time (s)								7.0				7.0
Flash Don't Walk (s)								11.0				11.0
Pedestrian Calls (#/hr)								0				0
Act Effct Green (s)	17.1			17.1		18.8		23.3		47.7		47.7
Actuated g/C Ratio	0.21			0.21		0.24		0.29		0.60		0.60
v/c Ratio	0.69			0.64		0.74		0.99		0.78		0.30
Control Delay (s/veh)	39.4			36.6		16.3		55.8		29.8		10.1
Queue Delay	0.0			0.0		0.0		0.0		0.0		0.0
Total Delay (s/veh)	39.4			36.6		16.3		55.8		29.8		10.1
LOS	D			D		B		E		C		B
Approach Delay (s/veh)		39.4			21.2			55.8				17.7
Approach LOS		D			C			E				B

Lanes, Volumes, Timings
2: Mullowney & I-90 EB Ramps+WB Off

Trailhead Commercial
12/28/2025

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 50th (ft)	109			99		57		~305		122	79	
Queue Length 95th (ft)	158			147		127		#383		#278	138	
Internal Link Dist (ft)		420			420			470			576	
Turn Bay Length (ft)				300						550		
Base Capacity (vph)	502			507		916		939		464	1926	
Starvation Cap Reductn	0			0		0		0		0	0	
Spillback Cap Reductn	0			0		0		0		0	0	
Storage Cap Reductn	0			0		0		0		0	0	
Reduced v/c Ratio	0.47			0.43		0.74		0.99		0.78	0.30	

Intersection Summary

Area Type: Other

Cycle Length: 80

Actuated Cycle Length: 80

Offset: 3 (4%), Referenced to phase 2:NBT and 6:SBTL, Start of Green

Natural Cycle: 90

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.99

Intersection Signal Delay (s/veh): 32.2 Intersection LOS: C

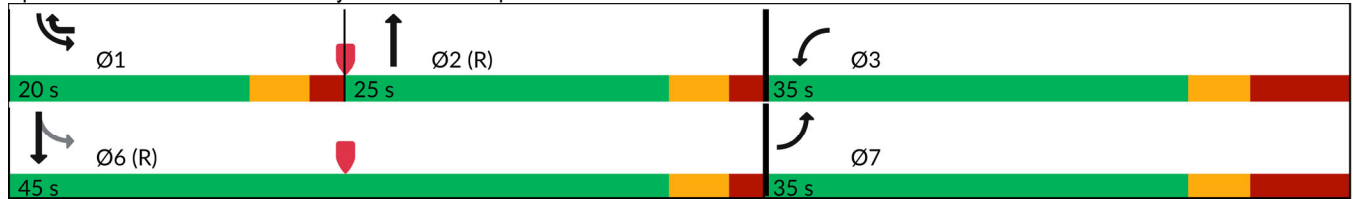
Intersection Capacity Utilization 73.0% ICU Level of Service C

Analysis Period (min) 15

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

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

Splits and Phases: 2: Mullowney & I-90 EB Ramps+WB Off



HCM 7th Signalized Intersection Summary
3: Mullowney & Midland

Trailhead Commercial
12/28/2025



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	148	112	32	74	77	193	27	637	76	189	368	208
Future Volume (veh/h)	148	112	32	74	77	193	27	637	76	189	368	208
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1641	1641	1641	1668	1668	1668	1723	1723	1723	1709	1709	1709
Adj Flow Rate, veh/h	164	124	36	82	86	214	30	708	84	210	409	231
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	8	8	8	6	6	6	2	2	2	3	3	3
Cap, veh/h	291	289	84	269	395	335	489	1490	177	468	1279	715
Arrive On Green	0.24	0.24	0.24	0.24	0.24	0.24	0.51	0.51	0.51	0.14	1.00	1.00
Sat Flow, veh/h	1028	1222	355	1187	1668	1414	789	2947	349	1628	2009	1122
Grp Volume(v), veh/h	164	0	160	82	86	214	30	393	399	210	330	310
Grp Sat Flow(s),veh/h/ln	1028	0	1577	1187	1668	1414	789	1637	1660	1628	1624	1507
Q Serve(g_s), s	12.2	0.0	6.9	5.0	3.3	10.9	1.6	12.5	12.5	4.7	0.0	0.0
Cycle Q Clear(g_c), s	15.5	0.0	6.9	11.9	3.3	10.9	1.6	12.5	12.5	4.7	0.0	0.0
Prop In Lane	1.00		0.22	1.00		1.00	1.00		0.21	1.00		0.74
Lane Grp Cap(c), veh/h	291	0	373	269	395	335	489	828	839	468	1034	960
V/C Ratio(X)	0.56	0.00	0.43	0.30	0.22	0.64	0.06	0.47	0.48	0.45	0.32	0.32
Avail Cap(c_a), veh/h	496	0	688	506	728	617	489	828	839	559	1034	960
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.67	1.67	1.67
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.93	0.93	0.93
Uniform Delay (d), s/veh	30.8	0.0	25.9	31.0	24.6	27.5	10.2	12.9	12.9	8.1	0.0	0.0
Incr Delay (d2), s/veh	1.7	0.0	0.8	0.6	0.3	2.0	0.2	1.9	1.9	0.6	0.8	0.8
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.9	0.0	2.5	1.4	1.3	3.7	0.3	4.5	4.6	1.3	0.2	0.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	32.5	0.0	26.7	31.6	24.8	29.5	10.4	14.8	14.8	8.7	0.8	0.8
LnGrp LOS	C		C	C	C	C	B	B	B	A	A	A
Approach Vol, veh/h		324			382			822			850	
Approach Delay, s/veh		29.7			28.9			14.6			2.7	
Approach LOS		C			C			B			A	
Timer - Assigned Phs	1	2		4		6		8				
Phs Duration (G+Y+Rc), s	30.5	45.5		24.0		56.0		24.0				
Change Period (Y+Rc), s	3.6	5.0		5.1		5.0		5.1				
Max Green Setting (Gmax), s	1.4	20.0		34.9		35.0		34.9				
Max Q Clear Time (g_c+10), s	1.4	14.5		17.5		2.0		13.9				
Green Ext Time (p_c), s	0.2	2.4		1.4		4.4		1.4				
Intersection Summary												
HCM 7th Control Delay, s/veh			14.7									
HCM 7th LOS			B									

HCM 7th Signalized Intersection Summary
4: S. Billings Blvd. & Midland

Trailhead Commercial
12/28/2025



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	177	73	42	9	49	46	100	448	18	93	184	249
Future Volume (veh/h)	177	73	42	9	49	46	100	448	18	93	184	249
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No		No		No		No		No		No
Adj Sat Flow, veh/h/ln	1559	1559	1559	1532	1532	1532	1695	1695	1695	1668	1668	1668
Adj Flow Rate, veh/h	192	79	46	10	53	50	109	487	20	101	200	271
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	14	14	14	16	16	16	4	4	4	6	6	6
Cap, veh/h	320	236	138	300	185	175	520	765	31	392	989	838
Arrive On Green	0.26	0.26	0.26	0.26	0.26	0.26	0.47	0.47	0.47	0.06	0.59	0.59
Sat Flow, veh/h	1169	924	538	1125	725	684	908	1617	66	1589	1668	1414
Grp Volume(v), veh/h	192	0	125	10	0	103	109	0	507	101	200	271
Grp Sat Flow(s),veh/h/ln	169	0	1462	1125	0	1409	908	0	1683	1589	1668	1414
Q Serve(g_s), s	12.6	0.0	5.6	0.6	0.0	4.7	5.7	0.0	18.2	2.4	4.4	7.7
Cycle Q Clear(g_c), s	17.3	0.0	5.6	6.1	0.0	4.7	5.7	0.0	18.2	2.4	4.4	7.7
Prop In Lane	1.00		0.37	1.00		0.49	1.00		0.04	1.00		1.00
Lane Grp Cap(c), veh/h	320	0	374	300	0	360	520	0	797	392	989	838
V/C Ratio(X)	0.60	0.00	0.33	0.03	0.00	0.29	0.21	0.00	0.64	0.26	0.20	0.32
Avail Cap(c_a), veh/h	512	0	614	484	0	592	520	0	797	499	989	838
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	30.9	0.0	24.2	26.7	0.0	23.9	12.6	0.0	15.9	11.4	7.5	8.2
Incr Delay (d2), s/veh	1.8	0.0	0.5	0.0	0.0	0.4	0.9	0.0	3.9	0.3	0.5	1.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.4	0.0	1.8	0.2	0.0	1.5	1.1	0.0	6.8	0.7	1.4	2.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	32.7	0.0	24.7	26.8	0.0	24.3	13.5	0.0	19.7	11.7	8.0	9.2
LnGrp LOS	C		C	C		C	B		B	B	A	A
Approach Vol, veh/h		317			113			616			572	
Approach Delay, s/veh		29.5			24.5			18.6			9.2	
Approach LOS		C			C			B			A	
Timer - Assigned Phs	1	2		4		6		8				
Phs Duration (G+Y+Rc), s	9.6	43.6		26.9		53.1		26.9				
Change Period (Y+Rc), s	5.1	5.7		6.4		5.7		6.4				
Max Green Setting (Gmax), s	9.9	19.3		33.6		34.3		33.6				
Max Q Clear Time (g_c+1), s	14.4	20.2		19.3		9.7		8.1				
Green Ext Time (p_c), s	0.1	0.0		1.1		1.9		0.5				
Intersection Summary												
HCM 7th Control Delay, s/veh			17.9									
HCM 7th LOS			B									

Intersection						
Int Delay, s/veh	4.5					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↔		↔	↔	↔	↔
Traffic Vol, veh/h	315	193	13	209	177	8
Future Vol, veh/h	315	193	13	209	177	8
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	300	-	0	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	342	210	14	227	192	9

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	0	552	0	703 447
Stage 1	-	-	-	-	447 -
Stage 2	-	-	-	-	255 -
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	-	-	1018	-	404 611
Stage 1	-	-	-	-	644 -
Stage 2	-	-	-	-	787 -
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1018	-	398 611
Mov Cap-2 Maneuver	-	-	-	-	398 -
Stage 1	-	-	-	-	644 -
Stage 2	-	-	-	-	776 -

Approach	EB	WB	NB
HCM Ctrl Dly, s/v	0	0.5	21.71
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	398	611	-	-	1018	-
HCM Lane V/C Ratio	0.483	0.014	-	-	0.014	-
HCM Ctrl Dly (s/v)	22.2	11	-	-	8.6	-
HCM Lane LOS	C	B	-	-	A	-
HCM 95th %tile Q(veh)	2.5	0	-	-	0	-

Intersection						
Int Delay, s/veh	2.6					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑		↑	↑	↑	↑
Traffic Vol, veh/h	269	94	28	162	83	25
Future Vol, veh/h	269	94	28	162	83	25
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	300	-	0	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	292	102	30	176	90	27

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	0	395	0	580 343
Stage 1	-	-	-	-	343 -
Stage 2	-	-	-	-	237 -
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	-	-	1164	-	476 699
Stage 1	-	-	-	-	718 -
Stage 2	-	-	-	-	802 -
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1164	-	464 699
Mov Cap-2 Maneuver	-	-	-	-	464 -
Stage 1	-	-	-	-	718 -
Stage 2	-	-	-	-	781 -

Approach	EB	WB	NB
HCM Ctrl Dly, s/v	0	1.2	13.64
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	464	699	-	-	1164	-
HCM Lane V/C Ratio	0.195	0.039	-	-	0.026	-
HCM Ctrl Dly (s/v)	14.6	10.4	-	-	8.2	-
HCM Lane LOS	B	B	-	-	A	-
HCM 95th %tile Q(veh)	0.7	0.1	-	-	0.1	-

HCM 7th Signalized Intersection Summary
 1: Mullowney/King & I-90 WB On/Laurel Road WB

Trailhead Commercial
 12/28/2025



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↘		↙	↘			↗	↘
Traffic Volume (veh/h)	0	0	0	209	0	0	68	1109	0	0	1784	201
Future Volume (veh/h)	0	0	0	209	0	0	68	1109	0	0	1784	201
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Lane Width Adj.				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach				No			No			No		
Adj Sat Flow, veh/h/ln				1736	1736	0	1736	1736	0	0	1736	1736
Adj Flow Rate, veh/h				225	0	0	73	1192	0	0	1918	216
Peak Hour Factor				0.93	0.93	0.93	0.93	0.93	0.92	0.92	0.93	0.93
Percent Heavy Veh, %				1	1	0	1	1	0	0	1	1
Cap, veh/h				329	173		203	2554	0	0	3350	374
Arrive On Green				0.10	0.00	0.00	1.00	1.00	0.00	0.00	0.77	0.77
Sat Flow, veh/h				3307	1736	0	190	3386	0	0	4482	483
Grp Volume(v), veh/h				225	0	0	73	1192	0	0	1397	737
Grp Sat Flow(s),veh/h/ln				1654	1736	0	190	1650	0	0	1580	1649
Q Serve(g_s), s				5.3	0.0	0.0	14.3	0.0	0.0	0.0	14.3	14.6
Cycle Q Clear(g_c), s				5.3	0.0	0.0	28.9	0.0	0.0	0.0	14.3	14.6
Prop In Lane				1.00		0.00	1.00		0.00	0.00		0.29
Lane Grp Cap(c), veh/h				329	173		203	2554	0	0	2447	1277
V/C Ratio(X)				0.68	0.00		0.36	0.47	0.00	0.00	0.57	0.58
Avail Cap(c_a), veh/h				1443	757		203	2554	0	0	2447	1277
HCM Platoon Ratio				1.00	1.00	1.00	1.33	1.33	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh				34.8	0.0	0.0	3.4	0.0	0.0	0.0	3.7	3.7
Incr Delay (d2), s/veh				2.5	0.0	0.0	4.9	0.6	0.0	0.0	1.0	1.9
Initial Q Delay(d3), s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				2.2	0.0	0.0	0.5	0.2	0.0	0.0	2.7	3.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh				37.3	0.0	0.0	8.3	0.6	0.0	0.0	4.6	5.6
LnGrp LOS				D			A	A			A	A
Approach Vol, veh/h					225			1265			2134	
Approach Delay, s/veh					37.3			1.1			5.0	
Approach LOS					D			A			A	
Timer - Assigned Phs		2				6		8				
Phs Duration (G+Y+Rc), s		66.9				66.9		13.1				
Change Period (Y+Rc), s		5.0				5.0		5.1				
Max Green Setting (Gmax), s		35.0				35.0		34.9				
Max Q Clear Time (g_c+I1), s		30.9				16.6		7.3				
Green Ext Time (p_c), s		3.1				13.9		0.8				
Intersection Summary												
HCM 7th Control Delay, s/veh											5.6	
HCM 7th LOS											A	
Notes												
User approved volume balancing among the lanes for turning movement.												
Unsignalized Delay for [WBR] is excluded from calculations of the approach delay and intersection delay.												

Lanes, Volumes, Timings
2: Mullowney & I-90 EB Ramps+WB Off

Trailhead Commercial
12/28/2025

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	138	0	0	157	0	539	0	745	0	608	779	0
Future Volume (vph)	138	0	0	157	0	539	0	745	0	608	779	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Storage Length (ft)	0		0	300		0	0		0	550		0
Storage Lanes	1		0	1		2	0		0	1		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	1583	0	0	1599	0	2517	0	3292	0	1646	3292	0
Flt Permitted	0.950			0.950						0.160		
Satd. Flow (perm)	1583	0	0	1599	0	2517	0	3292	0	277	3292	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						561						
Link Speed (mph)		35			35			35				35
Link Distance (ft)		500			500			550				656
Travel Time (s)		9.7			9.7			10.7				12.8
Peak Hour Factor	0.96	0.92	0.92	0.96	0.92	0.96	0.92	0.96	0.92	0.96	0.96	0.92
Heavy Vehicles (%)	5%	2%	2%	4%	2%	4%	2%	1%	2%	1%	1%	2%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	144	0	0	164	0	561	0	776	0	633	811	0
Turn Type	Prot			Prot		Over		NA		pm+pt		NA
Protected Phases	7			3		1		2		1		6
Permitted Phases										6		
Detector Phase	7			3		1		2		1		6
Switch Phase												
Minimum Initial (s)	5.0			5.0		5.0		5.0		5.0		5.0
Minimum Split (s)	14.6			27.6		10.7		25.0		10.7		25.0
Total Split (s)	35.0			35.0		20.0		25.0		20.0		45.0
Total Split (%)	43.8%			43.8%		25.0%		31.3%		25.0%		56.3%
Maximum Green (s)	25.4			25.4		14.4		19.4		14.4		39.4
Yellow Time (s)	3.6			3.6		3.6		3.6		3.6		3.6
All-Red Time (s)	6.0			6.0		2.0		2.0		2.0		2.0
Lost Time Adjust (s)	0.0			0.0		0.0		0.0		0.0		0.0
Total Lost Time (s)	9.6			9.6		5.6		5.6		5.6		5.6
Lead/Lag						Lead		Lag		Lead		
Lead-Lag Optimize?						Yes		Yes		Yes		
Vehicle Extension (s)	3.0			3.0		3.0		3.0		3.0		3.0
Recall Mode	None			None		None		C-Max		None		C-Max
Walk Time (s)				7.0				7.0				7.0
Flash Don't Walk (s)				11.0				11.0				11.0
Pedestrian Calls (#/hr)				0				0				0
Act Effct Green (s)	13.5			13.5		26.3		19.4		51.3		51.3
Actuated g/C Ratio	0.17			0.17		0.33		0.24		0.64		0.64
v/c Ratio	0.54			0.61		0.47		0.97		1.01		0.38
Control Delay (s/veh)	37.1			39.9		3.7		51.5		55.4		7.7
Queue Delay	0.0			0.0		0.0		0.0		0.0		0.0
Total Delay (s/veh)	37.1			39.9		3.7		51.5		55.4		7.7
LOS	D			D		A		D		E		A
Approach Delay (s/veh)		37.1			11.9			51.5				28.6
Approach LOS		D			B			D				C

Lanes, Volumes, Timings
 2: Mullowney & I-90 EB Ramps+WB Off

Trailhead Commercial
 12/28/2025

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 50th (ft)	67			77		0		210		~275	123	
Queue Length 95th (ft)	113			127		40		#327		#557	159	
Internal Link Dist (ft)		420			420			470				576
Turn Bay Length (ft)				300						550		
Base Capacity (vph)	502			507		1204		798		627	2110	
Starvation Cap Reductn	0			0		0		0		0	0	
Spillback Cap Reductn	0			0		0		0		0	0	
Storage Cap Reductn	0			0		0		0		0	0	
Reduced v/c Ratio	0.29			0.32		0.47		0.97		1.01	0.38	

Intersection Summary

Area Type: Other

Cycle Length: 80

Actuated Cycle Length: 80

Offset: 26.4 (33%), Referenced to phase 2:NBT and 6:SBTL, Start of Yellow

Natural Cycle: 90

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.01

Intersection Signal Delay (s/veh): 30.8 Intersection LOS: C

Intersection Capacity Utilization 85.7% ICU Level of Service E

Analysis Period (min) 15

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

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

Splits and Phases: 2: Mullowney & I-90 EB Ramps+WB Off



HCM 7th Signalized Intersection Summary
3: Mullowney & Midland

Trailhead Commercial
12/28/2025



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	235	166	19	113	137	276	28	437	111	300	564	154
Future Volume (veh/h)	235	166	19	113	137	276	28	437	111	300	564	154
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No		No		No		No		No		No
Adj Sat Flow, veh/h/ln	1682	1682	1682	1709	1709	1709	1750	1750	1750	1709	1709	1709
Adj Flow Rate, veh/h	245	173	20	118	143	288	29	455	116	312	588	160
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	5	5	5	3	3	3	0	0	0	3	3	3
Cap, veh/h	365	523	60	406	604	511	271	657	166	484	1314	357
Arrive On Green	0.35	0.35	0.35	0.35	0.35	0.35	0.25	0.25	0.25	0.42	1.00	1.00
Sat Flow, veh/h	934	1480	171	1181	1709	1448	725	2628	665	1628	2524	685
Grp Volume(v), veh/h	245	0	193	118	143	288	29	287	284	312	378	370
Grp Sat Flow(s),veh/h/ln	934	0	1651	1181	1709	1448	725	1663	1630	1628	1624	1586
Q Serve(g_s), s	20.1	0.0	6.9	6.5	4.7	12.8	2.5	12.5	12.7	2.9	0.0	0.0
Cycle Q Clear(g_c), s	24.8	0.0	6.9	13.4	4.7	12.8	2.5	12.5	12.7	2.9	0.0	0.0
Prop In Lane	1.00		0.10	1.00		1.00	1.00		0.41	1.00		0.43
Lane Grp Cap(c), veh/h	365	0	583	406	604	511	271	416	408	484	845	826
V/C Ratio(X)	0.67	0.00	0.33	0.29	0.24	0.56	0.11	0.69	0.70	0.64	0.45	0.45
Avail Cap(c_a), veh/h	442	0	720	504	746	632	271	416	408	484	845	826
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(l)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	0.91
Uniform Delay (d), s/veh	27.0	0.0	19.0	23.8	18.3	20.9	23.4	27.2	27.3	18.2	0.0	0.0
Incr Delay (d2), s/veh	3.0	0.0	0.3	0.4	0.2	1.0	0.8	9.0	9.5	2.7	1.6	1.6
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.3	0.0	2.4	1.8	1.8	4.2	0.5	5.7	5.7	3.7	0.4	0.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	30.0	0.0	19.3	24.2	18.5	21.9	24.2	36.2	36.8	20.9	1.6	1.6
LnGrp LOS	C		B	C	B	C	C	D	D	C	A	A
Approach Vol, veh/h		438			549			600			1060	
Approach Delay, s/veh		25.3			21.5			35.9			7.3	
Approach LOS		C			C			D			A	
Timer - Assigned Phs	1	2		4		6		8				
Phs Duration (G+Y+Rc), s	12.6	25.0		33.4		46.6		33.4				
Change Period (Y+Rc), s	5.0	* 5		5.1		5.0		5.1				
Max Green Setting (Gmax), s	12.6	* 20		34.9		35.0		34.9				
Max Q Clear Time (g_c+14), s	14.9	14.7		26.8		2.0		15.4				
Green Ext Time (p_c), s	0.6	1.7		1.5		5.2		2.1				

Intersection Summary

HCM 7th Control Delay, s/veh	19.7
HCM 7th LOS	B

Notes

* HCM 7th computational engine requires equal clearance times for the phases crossing the barrier.

HCM 7th Signalized Intersection Summary
 4: S. Billings Blvd. & Midland

Trailhead Commercial
 12/28/2025



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	250	51	143	26	71	97	70	320	9	46	401	188
Future Volume (veh/h)	250	51	143	26	71	97	70	320	9	46	401	188
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No		No		No		No		No		No
Adj Sat Flow, veh/h/ln	1723	1723	1723	1709	1709	1709	1709	1709	1709	1723	1723	1723
Adj Flow Rate, veh/h	278	57	159	29	79	108	78	356	10	51	446	209
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	3	3	3	3	3	3	2	2	2
Cap, veh/h	406	142	395	374	231	315	328	632	18	376	839	711
Arrive On Green	0.35	0.35	0.35	0.35	0.35	0.35	0.38	0.38	0.38	0.04	0.49	0.49
Sat Flow, veh/h	1196	401	1120	1156	654	894	772	1654	46	1641	1723	1460
Grp Volume(v), veh/h	278	0	216	29	0	187	78	0	366	51	446	209
Grp Sat Flow(s),veh/h/ln	1196	0	1521	1156	0	1548	772	0	1701	1641	1723	1460
Q Serve(g_s), s	17.8	0.0	8.6	1.6	0.0	7.1	6.2	0.0	13.6	1.4	14.3	6.9
Cycle Q Clear(g_c), s	24.9	0.0	8.6	10.1	0.0	7.1	12.2	0.0	13.6	1.4	14.3	6.9
Prop In Lane	1.00		0.74	1.00		0.58	1.00		0.03	1.00		1.00
Lane Grp Cap(c), veh/h	406	0	537	374	0	546	328	0	650	376	839	711
V/C Ratio(X)	0.69	0.00	0.40	0.08	0.00	0.34	0.24	0.00	0.56	0.14	0.53	0.29
Avail Cap(c_a), veh/h	486	0	639	452	0	650	328	0	650	511	839	711
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(l)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	28.2	0.0	19.5	23.3	0.0	19.1	21.3	0.0	19.4	14.1	14.2	12.3
Incr Delay (d2), s/veh	3.1	0.0	0.5	0.1	0.0	0.4	1.7	0.0	3.5	0.2	2.4	1.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.0	0.0	2.8	0.4	0.0	2.4	1.2	0.0	5.4	0.5	5.3	2.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	31.3	0.0	20.0	23.4	0.0	19.4	23.0	0.0	22.9	14.3	16.6	13.3
LnGrp LOS	C		C	C		B	C		C	B	B	B
Approach Vol, veh/h		494			216			444			706	
Approach Delay, s/veh		26.4			20.0			23.0			15.5	
Approach LOS		C			B			C			B	
Timer - Assigned Phs		2		4	5	6		8				
Phs Duration (G+Y+Rc), s		45.4		34.6	8.4	37.0		34.6				
Change Period (Y+Rc), s		6.4		6.4	5.0	6.4		6.4				
Max Green Setting (Gmax), s		33.6		33.6	10.0	18.6		33.6				
Max Q Clear Time (g_c+I1), s		16.3		26.9	3.4	15.6		12.1				
Green Ext Time (p_c), s		3.0		1.3	0.0	0.7		1.0				
Intersection Summary												
HCM 7th Control Delay, s/veh			20.7									
HCM 7th LOS			C									

Intersection						
Int Delay, s/veh	9.2					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↔		↔	↑	↔	↔
Traffic Vol, veh/h	443	244	14	166	234	9
Future Vol, veh/h	443	244	14	166	234	9
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	300	-	0	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	482	265	15	180	254	10

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	0	747	0	825 614
Stage 1	-	-	-	-	614 -
Stage 2	-	-	-	-	211 -
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	-	-	862	-	342 492
Stage 1	-	-	-	-	540 -
Stage 2	-	-	-	-	824 -
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	862	-	336 492
Mov Cap-2 Maneuver	-	-	-	-	336 -
Stage 1	-	-	-	-	540 -
Stage 2	-	-	-	-	810 -

Approach	EB	WB	NB
HCM Ctrl Dly, s/v	0	0.72	41.32
HCM LOS			E

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	336	492	-	-	862	-
HCM Lane V/C Ratio	0.756	0.02	-	-	0.018	-
HCM Ctrl Dly (s/v)	42.4	12.5	-	-	9.3	-
HCM Lane LOS	E	B	-	-	A	-
HCM 95th %tile Q(veh)	5.9	0.1	-	-	0.1	-

Intersection						
Int Delay, s/veh	3.4					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↔		↔	↑	↔	↔
Traffic Vol, veh/h	408	119	36	127	112	37
Future Vol, veh/h	408	119	36	127	112	37
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	300	-	0	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	443	129	39	138	122	40

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	0	573	0	724 508
Stage 1	-	-	-	-	508 -
Stage 2	-	-	-	-	216 -
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	-	-	1000	-	392 565
Stage 1	-	-	-	-	604 -
Stage 2	-	-	-	-	820 -
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1000	-	377 565
Mov Cap-2 Maneuver	-	-	-	-	377 -
Stage 1	-	-	-	-	604 -
Stage 2	-	-	-	-	788 -

Approach	EB	WB	NB
HCM Ctrl Dly, s/v	0	1.93	17.26
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	377	565	-	-	1000	-
HCM Lane V/C Ratio	0.323	0.071	-	-	0.039	-
HCM Ctrl Dly (s/v)	19	11.9	-	-	8.7	-
HCM Lane LOS	C	B	-	-	A	-
HCM 95th %tile Q(veh)	1.4	0.2	-	-	0.1	-

Appendix C: Intersection Cost Participation Calculations

City of Billings Intersection Cost Participation Worksheet: Trailhead Commercial

Shading Key: **No such movement** Movement has no project traffic in either peak

3: Mallowney at Midland

Lane Group (critical)	Lanes	AM Peak Hour		PM Peak Hour	
		Vproject	Per Lane	Vproject	Per Lane
EB T	1	14	14	26	26
WB L	1	29	29	60	60
WB T	1	12	12	24	24
EB L					
NB T					
SB L	1	75	75	144	144
SB T					
NB L					
Project Critical Lane Volume		118		230	
Critical Lane Capacity		1200		1200	
% Increase		9.8%		19.2%	
Max % Increase		19.2%			

4: S. Billings Blvd at Midland

Lane Group (critical)	Lanes	AM Peak Hour		PM Peak Hour	
		Vproject	Per Lane	Vproject	Per Lane
EB T					
WB L					
WB T					
EB L	1	25	25	37	37
NB T					
SB L					
SB T					
NB L					
Project Critical Lane Volume		25		37	
Critical Lane Capacity		1200		1200	
% Increase		2.1%		3.1%	
Max % Increase		3.1%			