Preliminary Traffic Report (MDT Activity 112)

Exposition Dr & 1st Ave N

Billings, Montana

NH-16-1(53)0

UPN-7908000

March 2021

EXPO&1ST

MONTANA MDT DEPARTMENT OF TRANSPORTATION

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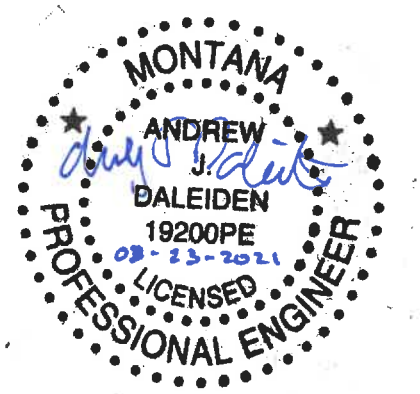

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Project No. 20783

March 2021

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REFERENCES

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2. Montana Department of Transportation. Functional Classification Map. 2018.
3. Montana Department of Transportation. *Right of Way and Utilities Operations Manual*. 2016.
4. Transportation Research Board. *Access Management Manual*. 2017.
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6. Transportation Research Board. *Highway Capacity Manual 6th Edition*. 2016.
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INTRODUCTION

This report addresses Activity 112 (Preliminary Traffic Report) for the Exposition Dr and 1st Avenue N – Billings final design project. The project includes lane modifications, traffic signal modifications. median work, and minor realignment of approaches to the Exposition Drive/1st Avenue N intersection in Billings, MT. This report discusses the following:

- data collection and analysis of existing and future no-build transportation conditions,
- development of concept alternatives,
- selection of the preferred alternative, and
- identification of other traffic related issues consistent with MDT's guidelines for a Preliminary Traffic Report (Reference 1).

Project Area

Located in Yellowstone County, within the Billings city limits, the Exposition Drive/1st Avenue N intersection is located 1.3 miles northeast of downtown Billings and just southwest of MetraPark. This intersection resides on the Camino Real International Trade Corridor that connects Canada, United States, and Mexico, and is a critical junction that provides local and regional connectivity to downtown Billings, US 87, Highway 3, and Interstate 90. Figure 1 illustrates the project location within Billings and Yellowstone County. Figure 2 (on the next page) illustrates the project study area, including study intersections. The eastern project limits end at the Dick Johnston Bridge which crosses the Yellowstone River and provides access to Interstate 90. A Montana Rail Link (MRL) railroad facility is located to the south of the study area and runs parallel to 1st Avenue N and US 87 over the Yellowstone River.

Figure 1 Project Vicinity Map

Figure 2 Project Study Area

EXISTING AND FUTURE NO-BUILD TRANSPORTATION CONDITIONS

This section addresses existing and future conditions at the Exposition Drive/1st Avenue N intersection. The traffic related issues presented in this section were used to develop and evaluate concept alternatives and select the preferred alternative. *The Existing and Future Year 2040 Transportation Conditions and Analysis Memorandum is shown in Appendix A.*

Roadway Characteristics

There are three major roadways within the study area – Exposition Drive, 1st Ave N, and 4th Avenue N. All three major roadways are owned by MDT. 4th Avenue N is a one-way road in the eastbound direction. There are two traffic signals in the study area at the Exposition Drive/ 1st Ave N and Exposition Drive/4th Ave N intersections, and the other study intersections and driveways are unsignalized, stop-controlled intersections. Additional characteristics about the roadways are shown in Table 1.

Table 1 Study Roadway Characteristics

Roadway	Functional Classification[1]	Number of Lanes	Posted Speed (mph)	Sidewalks	Bike Lanes	Median	Daily Traffic Volume	
							Year 2019	Year 2040
Exposition Drive (S of 4th Avenue N)	Principal Arterial	6	35	Yes	No	Yes	36,745	35,675[2]
1st Avenue N (W of Exposition Drive)	Principal Arterial	4	35	Partial	No	No	28,088	31,145
1st Avenue N (E of Exposition Drive)	Principal Arterial	4	45	Partial	No	No	29,562	30,132
4th Avenue N	Principal Arterial	3	35	Yes	No	No	11,858	13,357

[1]From MDT's Montana Functional Classification Map (Reference 2)

[2]Traffic volume is not anticipated to grow by year 2040 due to the addition of new regional roadway connections (Inner Belt Loop and Billings Bypass) and because Exposition Drive / 1st Avenue N intersection is south of the 4th Avenue N / 6th Avenue N couplet and will not be affected by growth on the couplet

Access Locations and Spacing

MDT standards for access management are in the Right of Way and Utilities Operations Manual (Reference 3). The manual gives access density and spacing recommendations based on the highway classifications. Exposition Drive, 4th Avenue N, and 1st Avenue N (west of Exposition Drive), fall within the "Developed" classification, where access densities may be greater than 25 access points per mile and there is little vacant land left for development. 1st Avenue N (east of Exposition Drive) falls under the "Intermediate" classification, where access densities should fall between 5 to 25 access points per mile and where these is still opportunity for development. The access points should have minimum spacing distances of 300 and 250 feet on undivided and divided roadways, respectively. It is also recommended that a minimum spacing of one-quarter mile exist between traffic signals.

The existing access point and signalized intersection spacing on 1st Avenue N and Exposition Drive do not meet MDT standards. Further guidance from the Transportation Research Board's (TRB) Access Management Manual states that lowering the spacing between access points and traffic signals can increase the number of crashes on the roadway (Reference 4).

Bicycle, Pedestrian, and Transit Considerations

The existing level of activity for bicyclists and pedestrians is low but increases during events at the MetraPark. Deficiencies in bicycle and pedestrian infrastructure are as follows:

- No marked pedestrian crossings between 4th Avenue N and N 13th Street on Exposition Drive/1st Avenue N (approximately 3,100 feet), including no crosswalks at the signalized intersection at Exposition Drive/1st Avenue N
- Gaps in the sidewalks on the south side of 1st Avenue N between N 13th Street and Exposition Drive
- Limited connectivity for bicyclists or pedestrians to the Jim Dutcher shared-use path along the Yellowstone River

There are five transit routes that go through the Exposition Drive/Exposition Drive/1st Avenue N intersection and four transit routes that go through the 4th Avenue N/Exposition Drive intersection. The transit routes have no permanent stops within the study area and utilize a flag down system. The transit routes are operated by MET Transit (Reference 5).

Safety Analysis

Kittelson obtained and evaluated crash data from a four-year period (January 1, 2015 and December 31st, 2018) from MDT for the Exposition Drive/1st Avenue N intersection. A summary of the crash data and analysis is as follows:

- There were 87 total crashes (approximately 22 per year).
- Rear-end and side-swipe related crashes were the most common crash types and comprised approximately 47 percent and 28 percent of the total crashes, respectively.
- There were no reported bicycle or pedestrian-related crashes (no bicycle facilities or pedestrian crossings are present at the intersection).
- Approximately 70 percent of the crashes were Property Damage Only (PDO) and approximately 29 percent of the crashes involved personal injury. There was one reported fatality.
- Many crashes (approximately 53 percent) occurred between 12:00 PM and 6:00 PM.

Operational Analysis

Kittelson performed an operational analysis on the roadway system under existing (year 2019) and future (year 2040) conditions during the weekday AM and PM peak hours. The purpose of the operational analysis was to identify existing and projected operational deficiencies in the roadway system. Level of service (LOS), 95th percentile queue lengths, and volume-to-capacity (v/c) ratios for individual movements were calculated in Synchro using the Highway Capacity Manual (HCM) 6th Edition methodology (Reference 6). The v/c ratios for overall intersection operations were calculated using the HCM 2000 methodology (Reference 7).

Existing Conditions (Year 2019)

Traffic Volumes

Traffic volumes for all scenarios were collected on weekdays in June 2018 for the signalized intersections and in February 2019 for the unsignalized intersections for the AM (7:00 to 9:00 a.m.) and PM (4:00 to 6:00 p.m.). Traffic volumes for the signalized intersections were also collected during the weekday and Saturday midday periods (11:00 a.m. to 1:00 p.m.). The turning movements were balanced between intersections to account for inconsistencies between data collected on different dates. Daily traffic volumes were also summarized for study roadways based on information from a year 2016, 24-hour traffic count and from the Regional Travel Demand Model. *Raw count data for the study intersections and driveways can be found in the Existing and Future Year 2040 Transportation Conditions and Analysis Memorandum. Existing and future volumes on the study roadways, including heavy vehicle percentages, are shown in the Preferred Alternative section of the report.*

Freight Considerations

Heavy vehicles comprised approximately 6.5 percent, 8.0 percent, and 3.2 percent of total entering traffic volumes at the Exposition Drive/1st Avenue N intersection during the AM, midday, and PM peak hours, respectively. The north and east legs of this intersection reside on the Camino Real International Trade Corridor that connects Canada, United States, and Mexico.

Traffic Operations

The Exposition Drive/1st Avenue N intersection is at capacity with a v/c ratio of 1.03 during the PM peak hour. The Exposition Drive/1st Avenue N westbound right-turn movement is the only movement to operate above capacity, with a v/c ratio of 1.42 and a 95th percentile queue length of 2,100 feet during the PM peak hour. The 6th Avenue N/Exposition Drive northbound movement has a calculated 95th percentile queue length of 378 feet during the PM peak hour, but field observations show that it often extends to the 4th Avenue N/Exposition Drive intersection (approximately 450 feet) due to the near-constant flow of northbound traffic from the eastbound-left turn and northbound-through movements at the 4th Avenue N/Exposition Drive intersection. Figure 3 displays drone footage of the study area during a weekday, PM peak hour with typical queue lengths.

Figure 3 Queue Lengths During Weekday PM Peak Hour

Traffic patterns can change significantly as people enter or exit events at MetraPark. At the beginning of events, volumes increase at the 4th Avenue N/Exposition Drive intersection's northbound-right, southbound-left, and the eastbound-through movements, and at the Exposition Drive/1st Avenue N intersection's westbound-right turn movement. At the end of events, volumes increase at the 4th Avenue N/Exposition Drive intersection's southbound-through movement and the Exposition Drive/1st Avenue N intersection's southbound-left turn movement. Many trips travel from Interstate 90 to MetraPark to attend the events, which results in an increase in demand at the Exposition Drive/1st Avenue N and 4th Avenue N/Exposition Drive intersections.

Future No-Build Conditions (Year 2040)

Growth Assumptions

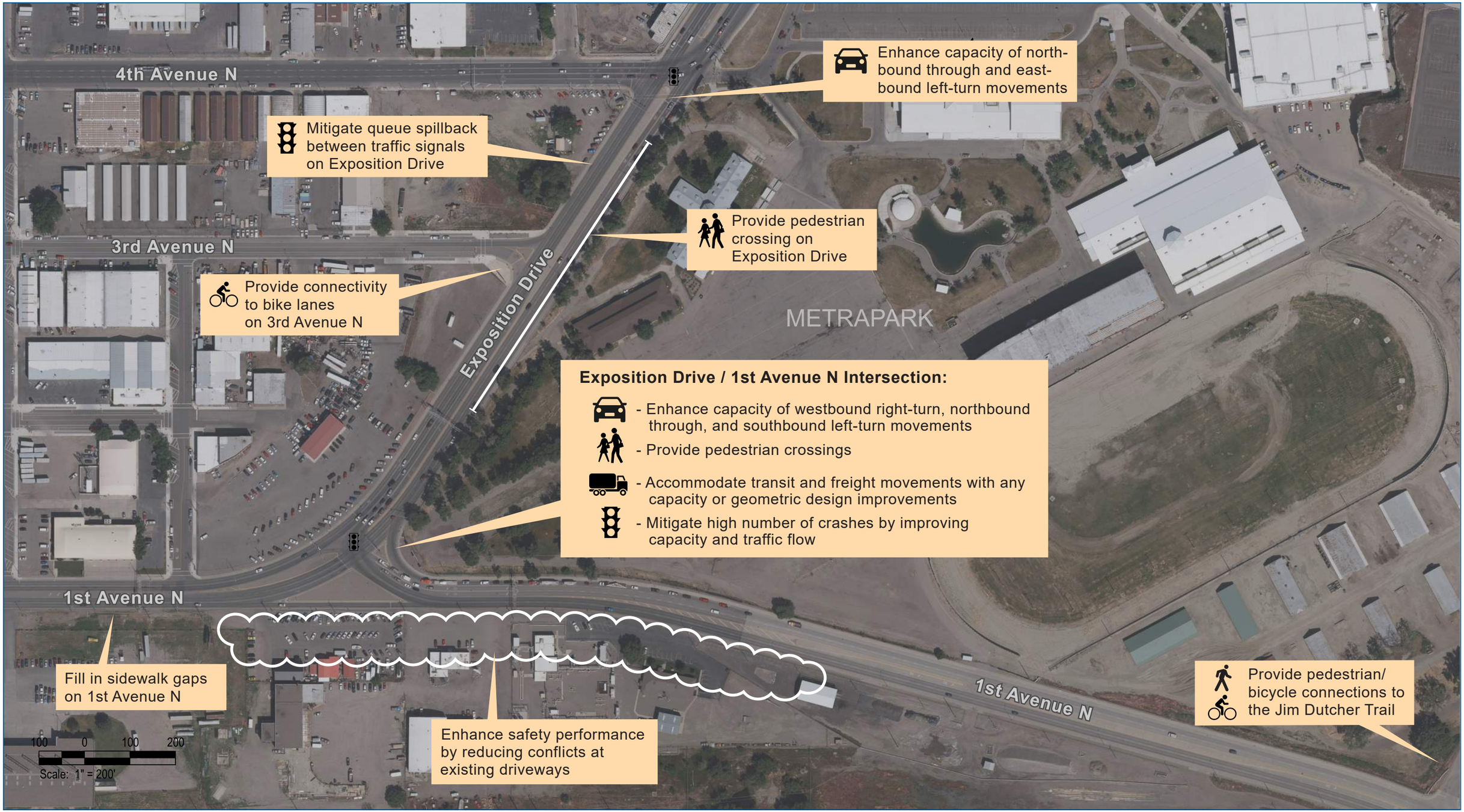
Based on data from the Regional Travel Demand Model, other recent studies, and historical growth rates in the region, Kittelson applied an average annual, compounded growth rate of 1.0% to all existing traffic volumes to develop the projected future year 2040 traffic volumes.

Traffic Operations

The 4th Avenue N/Exposition Drive and Exposition Drive/1st Avenue N intersections are expected to operate over-capacity in year 2040, with v/c ratios of 1.07 and 1.20 during the AM and PM peak hours, respectively. It is worth noting that, although the v/c ratio calculated using HCM 2000 methodology of the 4thAvenue N/Exposition Drive intersection is greater than 1.0 during the PM peak hour, the calculated LOS ("D"), average intersection delay (35.6 seconds), and v/c movements for individual movements calculated using HCM 6th Edition methodology indicate that the intersection will operate below capacity. There are limited opportunities to improve capacity on the 4th Avenue N/Exposition Drive intersection as part of this project, but improvements should be considered as the intersection will be close to capacity in the year 2040.

Opportunities for Improvement

Based on the deficiencies identified in the existing and future conditions analysis, the project team identified opportunities for mitigation to consider when developing the alternatives. These opportunities for improvement are summarized on Figure 4.



Existing Traffic Signal

Opportunities for Improvement
Billings, Montana

Figure
4

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CONCEPT ALTERNATIVES

This section describes the tiered process that was used to develop and screen the intersection concept alternatives, and what ultimately led to the selection of the preferred alternative for the Exposition Drive/1st Avenue N intersection.

Alternatives Development and Screening Process

The project team applied a tiered process to develop and screen the intersection alternatives. The project team identified 16 initial options ranging from conventional intersection form to alternative intersections to grade-separated to system changes through new connections. Seven of the initial alternatives were advanced to a Tier 1 analysis. Three of those alternatives were advanced to a Tier 2 analysis which was used to select a preferred alternative. Figure 5 illustrates the overall alternatives development and screening process for the project.

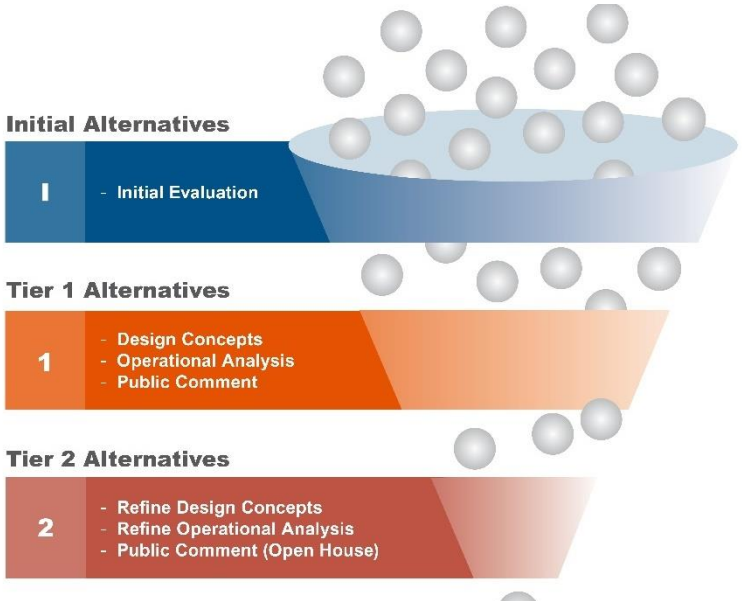


Figure 5 Alternatives Development and Screening Process

Evaluation Criteria

The following describes the evaluation methodology implemented in the tiered approach. Each of the alternatives was evaluated based on the following criteria:

- **Safety Performance** – Is the alternative improving congested conditions? Are queues being reduced to reduce the potential for rear-end crashes?
- **Number of Free Right-Turns** – Are pedestrians required to cross a free right-turn lane? What is the potential for speed differentials or merging operations downstream?
- **Pedestrian Facility Quality** – What type of pedestrian facilities are provided? What is the quality of the pedestrian crossings at study area intersections?
- **Bicycle Facility Quality** – What type of bicycle facilities are provided? What is the quality of the bicycle crossings at study area intersections?
- **Traffic Operations (2040 AM/PM Peak Hour Level of Service)** – What level of service (LOS) will the intersection experience under 2040 conditions? Are queues reduced for the critical movements (e.g. westbound right-turn lane)?
- **Traffic Operations Lifespan (After 2040)** – How long after year 2040 will the intersection remain under capacity (intersection volume-to-capacity ratio of less than 1.0)?
- **Right-Of-Way Impact** – Relatively how much property is impacted?
- **Number of Properties Impacted** – How many properties are impacted?
- **Design and Construction Cost Estimates** – What is the relative cost between alternatives?

Stakeholder and Public Outreach

Development of the preferred intersection alternative included a public outreach effort to engage project stakeholders. This public outreach effort included regular engagement with a Project Advisory Committee (PAC), members of the public and other regional stakeholders. The PAC served as local experts and helped the project team identify area needs, opportunities for improvement, and provided feedback on the intersection alternative development. The PAC included local business owners and representatives from local government organizations (i.e., City of Billings, Yellowstone County Commission, MetraPark, etc.).

Kittelson presented the initial alternatives to the PAC, MDT and Yellowstone County Commission in June, July and August 2019. Through this discussion, the project team selected six alternatives to advance to Tier 1. Kittelson presented the Tier 1 concepts to the PAC, MDT, and local property and business owners in September 2019. Through the discussion, three alternatives were chosen to advance to Tier 2. Kittelson presented the Tier 2 alternatives to the PAC, MDT and to the public during an Open House in December 2019. The project team held 1-on-1 meetings with business and property owners in February 2020, as well as status update with MDT. The project team performed some additional site investigations between February 2020 and October 2020, which led to selecting Alternative 4 as the preferred alternative in November 2020.

Materials related to stakeholder and public outreach efforts are shown in Appendix B. Included in Appendix B is the Public Involvement Plan, PAC meeting notes, the Open House summary, and information about property owners engaged during the project. Appendix B is a working document that will be updated based on future engagement with stakeholders.

Project Schedule

An overview of the project schedule, including PAC meeting and open house dates, is shown in Figure 6.

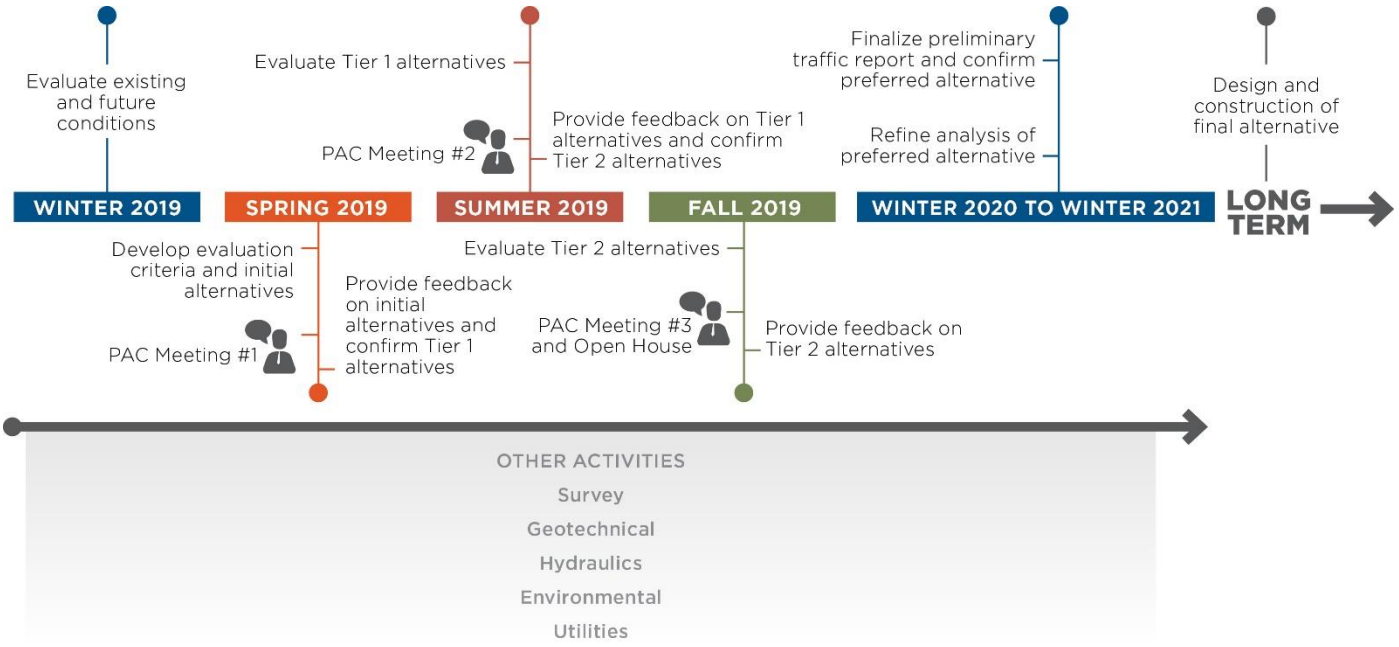


Figure 6 Project Schedule

Initial Alternatives

The project team identified 16 initial options for the Exposition Drive/1st Avenue N intersection ranging from conventional intersection form to alternative intersections to grade-separated to system changes through new connections. The initial alternatives went through a high-level screening against the evaluation criteria and were presented to the PAC, MDT, and Yellowstone County Commission in June, July, and August 2019. *Appendix C includes graphics, descriptions, and evaluation results for the initial alternatives.*

Evaluation Results

The initial alternatives are listed below. The ***bolded and italicized*** alternatives were moved forward into Tier 1 based on the evaluation results and feedback from project stakeholders.

- Conventional Signal
  - ***No-Build***
  - ***Westbound Shared Left/Right-Turn Lane OR Single Westbound Left-Turn Lane and Dual Westbound Right-Turn Lanes***
  - ***Free Westbound Right-Turn Lane Plus 4th Northbound Through Lane***
  - ***Dual Westbound Right-Turn Lanes***
  - Triple Southbound Left-Turn Lanes
  - Triple Southbound Left-Turn Lanes and Dual Westbound Right-Turn Lanes
- Multilane Roundabout
  - Three Circulatory Lanes
  - Three Circulatory Lanes with Westbound Right-Turn Bypass
- System & Alternative Routes
  - Extend Montana Avenue/1st Avenue North One-Way Couplet
  - Extend Exposition Drive to I-90 with New Interchange
  - New Connection Through MetraPark
- Alternative Intersections and Grade Separation
  - ***Displaced Left-Turn Intersection (Southbound Left-Turn Lane)***
  - Southbound Left-Turn Lane Flyover
  - Restricted Crossing U-Turn Intersection (Westbound Left-Turn Lane)
  - Grade Separated Overpass for Northbound-Through Lanes
  - Grade Separated Trumpet Interchange

Tier 1 Alternatives

Kittelson evaluated the six, Tier 1 alternatives based on concept designs of the alternatives, a detailed traffic analysis and meetings with the PAC and local property and business owners. *The Tier 1 Evaluation and Screening memorandum is shown in Appendix D, and includes the concept designs for each Tier 1 alternative.*

Descriptions of Tier 1 Alternative

Descriptions of the primary lane configuration modifications for each Tier 1 alternative are listed below. The Tier 1 alternatives also included minor modifications to the Exposition Drive/4th Avenue N intersection, and bicycle and pedestrian improvements, including additional pedestrian crossings at the Exposition Drive/1st Avenue N intersection and new pathways.

- Alternative 1 - No-Build
  - Existing infrastructure remains in-place. Potential signal timing adjustments, but no equipment changes.
- Alternative 2 - Westbound Shared Left/Right-Turn Lane
  - Converts one of the existing westbound left-turn lanes into a shared left/right-turn lane and brings northbound right-turn lane through traffic signal at the Exposition Drive/1st Avenue N intersection
- Alternative 3 - Single Westbound Left-Turn Lane and Dual Westbound Right-Turn Lanes
  - Converts one of the existing westbound left-turn lanes into a right-turn lane and brings northbound right-turn lane through traffic signal at the Exposition Drive/1st Avenue N intersection
- Alternative 4 - Free Westbound Right-Turn Lane
  - Converts existing westbound right-turn lane into a free right-turn lane and brings northbound right-turn lane through traffic signal at the Exposition Drive/1st Avenue N intersection
- Alternative 5 - Dual Westbound Right-Turn Lanes
  - Provides second westbound right-turn lane and brings northbound right-turn lane through traffic signal at the Exposition Drive/1st Avenue N intersection
- Alternative 6 - Partial Displaced Left-Turn
  - Provides partial displaced left-turn intersection, including a free westbound right-turn lane. Adds new signal at Exposition Drive/3rd Avenue N for cross-over and brings Exposition Drive/1st Avenue N northbound right-turn lane through traffic signal.

Tier 1 Evaluation Results and Feedback from Stakeholders

The evaluation results for the Tier 1 alternatives are shown in Table 2 (on the next page). Alternatives 2 and 3 had low, estimated costs and property impacts. However, these two alternatives provided limited traffic operations lifespans and provided minimal benefits to people walking and biking. Alternative 6 provided the highest benefits to traffic operations, but also had the highest estimated costs and impacts on adjacent properties. Alternatives 4 and 5 provided traffic operations lifespans of 8-12 years (after year 2040), improved bicycle and pedestrian connections, and had medium estimated costs and impacts to adjacent properties.

The Tier 1 alternatives were presented to MDT and at PAC Meeting #2 on September 19th, 2019. Attendees were provided comment forms to give their feedback and recommendations for alternatives to advance to Tier 2. Based on the feedback from stakeholders and screening against evaluation criteria, the following alternatives were brought forward into the Tier 2 analysis:

- Alternative 1 - No-Build (carried into Tier 2 evaluation to provide baseline comparison to other alternatives)
- Alternative 4 - Free Westbound Right-Turn Lane
- Alternative 5 - Dual Westbound Right-Turn Lanes

Table 2. Tier 1 Alternatives Evaluation

Criteria		Safety Performance	Number of Free Right-Turns	Pedestrian Facility Quality	Bicycle Facility Quality	Traffic Operations (2040 AM/PM Peak Hour LOS[1])	Traffic Operations Lifespan (After 2040)	Right-Of-Way Impact	Number of Properties Impacted	Design and Construction Cost Estimates
Alternative	1	Lower	1	Lower	Lower	C/High delay E	0 years	None	0	None
		No pedestrian or bicycle crossings provided at intersection. Volume-to-capacity ratio is 1.20 with high delay (PM). Queues are long for the westbound approach.								
	2	Medium	0	Medium	Medium	C/Low delay E	0 years	Lower	7	Lower
		South leg crossing requires two phases. Limited sidewalk/pathway improvements. Volume-to-capacity ratio is 1.06 with medium delay (PM). Queues are less for the westbound approach.								
	3	Medium	0	Medium	Medium	C/Low delay E	0 years	Lower-to-Medium	8	Lower
		Limited sidewalk/ pathway improvements. Volume-to-capacity ratio is 1.07 with medium delay (PM). Queues are longer for the westbound left-turn lane.								
	4	Medium	1	Higher	Higher	C/D	8-12 years	Medium-to-Higher	13	Medium
		Requires crossing at free right-turn. Provides pathway connection to Jim Dutcher Trail. Volume-to-capacity ratio is 0.90 (PM). Queues are less for the westbound approach.								
	5	Medium	0	Higher	Higher	C/D	8-12 years	Medium	13	Medium
		Provides crossings and several multi-use path options. Provides pathway connection to Jim Dutcher Trail. Volume-to-capacity ratio is 0.90 (PM). Queues are significantly less for the westbound approach.								
	6	Medium	1	Medium-to-Higher	Medium-to-Higher	B/B	16-20 years	Higher	13	Higher
		No crossing provided on east leg of intersection. Pedestrian and bicycle crossing on south leg potentially requires two phases. Provides pathway connection to Jim Dutcher Trail. Volume-to-capacity ratio is 0.82 (PM). Queues are significantly less for the westbound approach.								

[1]Level of Service – Indicates the average level of vehicle delay at an intersection. Calculated with HCM 6th Edition Methodology.
Orange shading represents the Tier 1 Alternatives selected for further analysis in Tier 2.

Tier 2 Alternatives

Kittelson evaluated the three, Tier 2 alternatives based on concept designs of the alternatives, a detailed traffic analysis and meetings with the PAC and local property and business owners. *The Tier 2 Evaluation and Screening memorandum is shown in Appendix E, and includes the detailed concept designs for each Tier 2 alternative.*

Tier 2 Concept Designs

The Tier 2 concept designs are shown in Figures 7 and 8 for Alternatives 4 and 5, respectively. The Tier 2 concept designs incorporated existing cadastral survey data to identify impacts to the adjacent right-of-way and potential utility conflicts.

Tier 2 Evaluation Results and Preferred Alternative Selection

The evaluation results for the Tier 2 alternatives are shown in Table 3. The Tier 2 alternatives had similar traffic operations, traffic operations lifespans, right-of-way impact, costs, and safety performance. They also provided similar pedestrian and bicycle facility quality, although Alternative 4 required bicyclists and pedestrians to cross a free westbound right-turn (signalized movement). Alternative 4 provides additional northbound capacity at the Exposition Drive/4th Avenue N intersection.

The Tier 2 alternatives were presented at the Public Open House #1 on December 11, 2019 at the Billings Public Library. The open house included information about the Exposition Drive and 1st Avenue N project, including information about the project schedule, project process, reasons for the project, and information about the Tier 2 alternatives. In addition to the open house held at the Billings Public Library, the information provided at the open house and an online survey was emailed to the open house attendees and other project stakeholders for additional opportunities to provide feedback. A summary of the comments received from the Public Open House, PAC Meeting #3, and other Tier 2 public outreach efforts are as follows:

- Comment forms from Public Open House and PAC Meeting #3:
    - When given the prompt “things to accomplish in this project”, the most common responses were related to bicycle/pedestrian improvements, reduced congestion, safety improvements, beautification of the area, and improved access to properties south of the intersection.
    - There were few responses that preferred Alternative 4 to Alternative 5, or vice versa.
        - MetraPark indicated their preference for Alternative 4
- Email comments sent to MDT and project team:
    - Property and business owners south of the intersection have concerns about the potential removal of “left turn in” and “left turn out” movements from 1st Avenue N to the driveways south of the intersection.

Based on the results of the Tier 2 evaluation, feedback received from PAC Meeting #3 and Public Open House #1, and further coordination with MDT, Alternative 4 was selected as the preferred alternative for further refinement and evaluation.

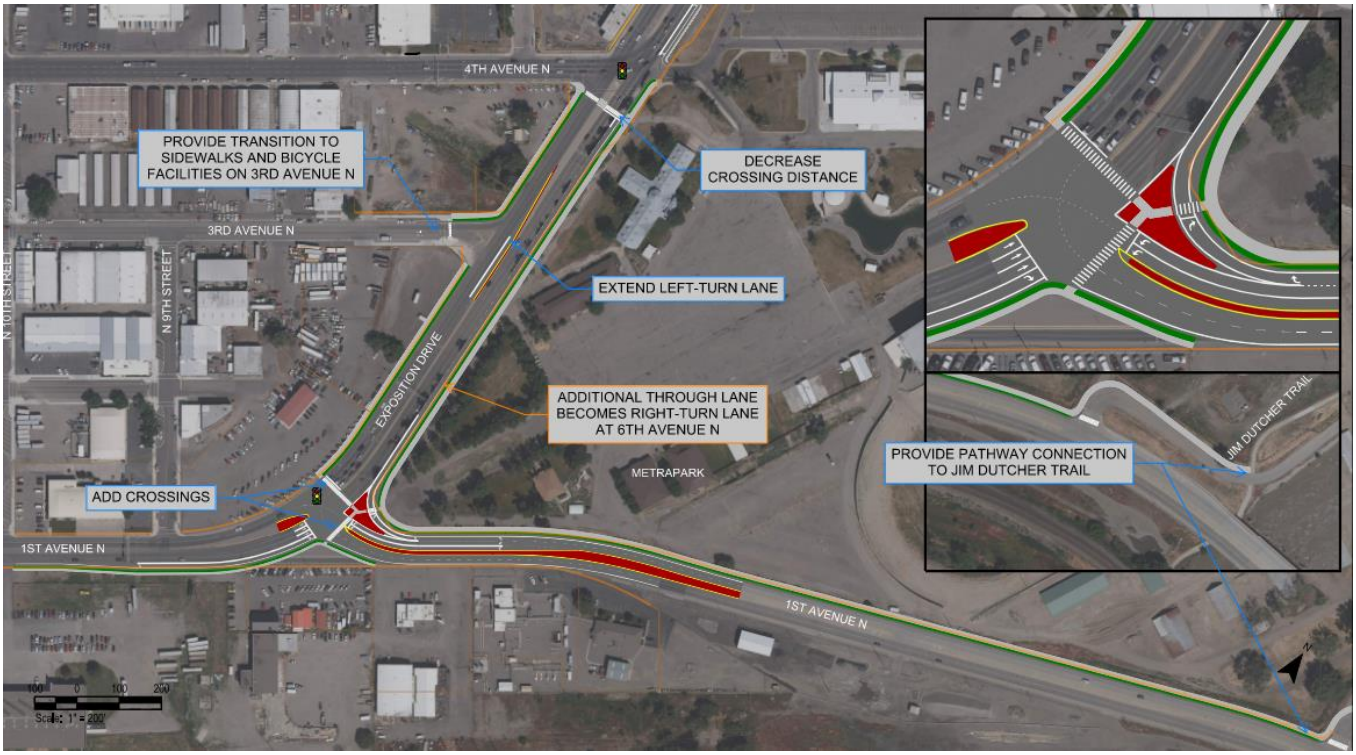


Figure 7 Alternative 4 - Free Westbound Right-Turn Lane (Tier 2 Concept Design)

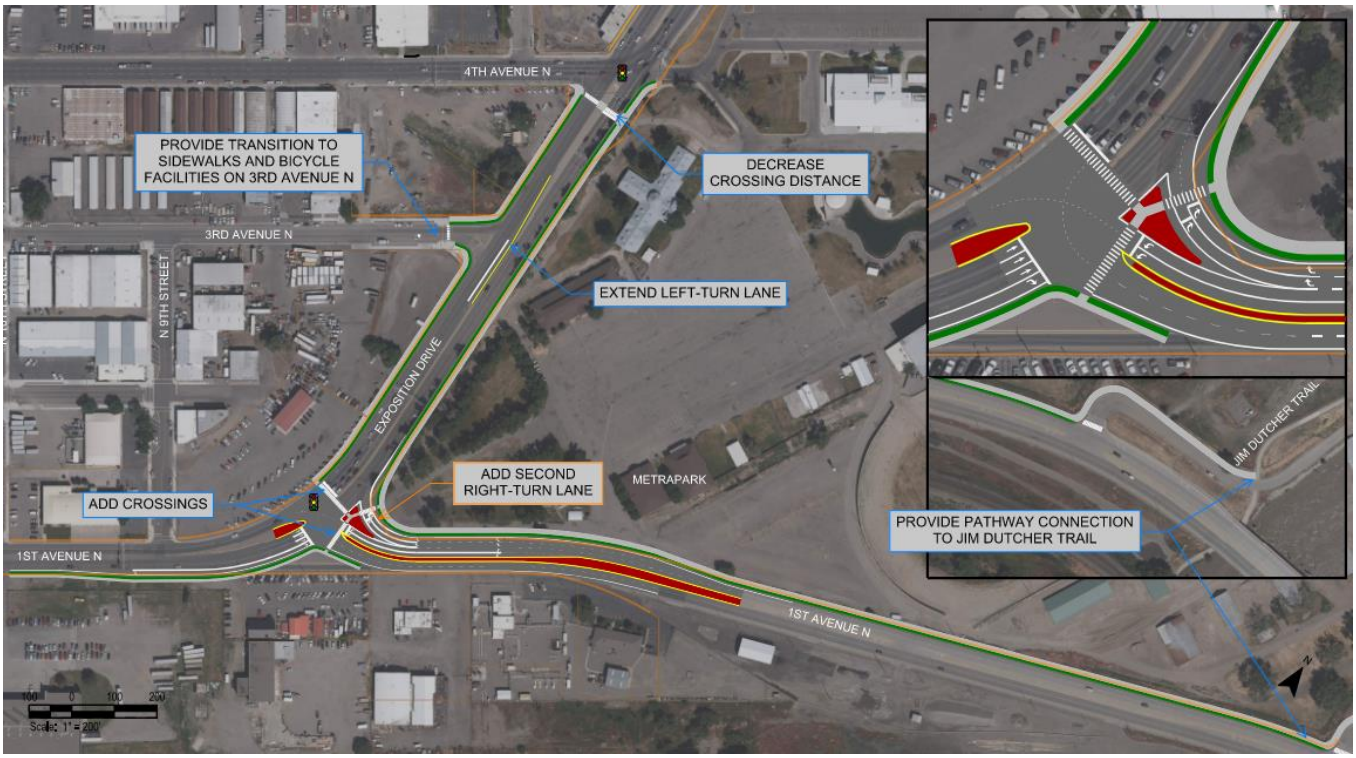


Figure 8 Alternative 5 - Dual Westbound Right-Turn Lanes (Tier 2 Concept Design)

Table 3. Tier 2 Alternatives Evaluation

Criteria		Safety Performance	Number of Free Right-Turns	Pedestrian Facility Quality	Bicycle Facility Quality	Traffic Operations (2040 AM/PM Peak Hour LOS[1])	Traffic Operations Lifespan (After 2040)	Right-Of-Way Impact (ft^2)	Number of Properties Impacted	Design and Construction Cost Estimates
Alternative	1	Lower	1	Lower	Lower	C/F	0 years	0	0	None
		No pedestrian or bicycle crossings provided at intersection. Volume-to-capacity ratio is 1.20 with high delay (PM). Queues are long for the westbound approach.								
	4	Medium	1	Higher	Higher	C/D	8-12 years	59,500	7	$7,500,000
		Requires crossing at free right-turn. Provides pathway connection to Jim Dutcher Trail. Volume-to-capacity ratio is 0.90 (PM). Queues are less for the westbound approach. Provides additional northbound capacity at Exposition Drive / 4th Avenue North intersection								
	5	Medium	0	Higher	Higher	C/D	8-12 years	55,000	7	$7,400,000
		Provides crossings and several multi-use path options. Provides pathway connection to Jim Dutcher Trail. Volume-to-capacity ratio is 0.90 (PM). Queues are significantly less for the westbound approach.								

[1]Level of Service – Indicates the average level of vehicle delay at an intersection. Calculated with HCM 6th Edition Methodology

PREFERRED ALTERNATIVE

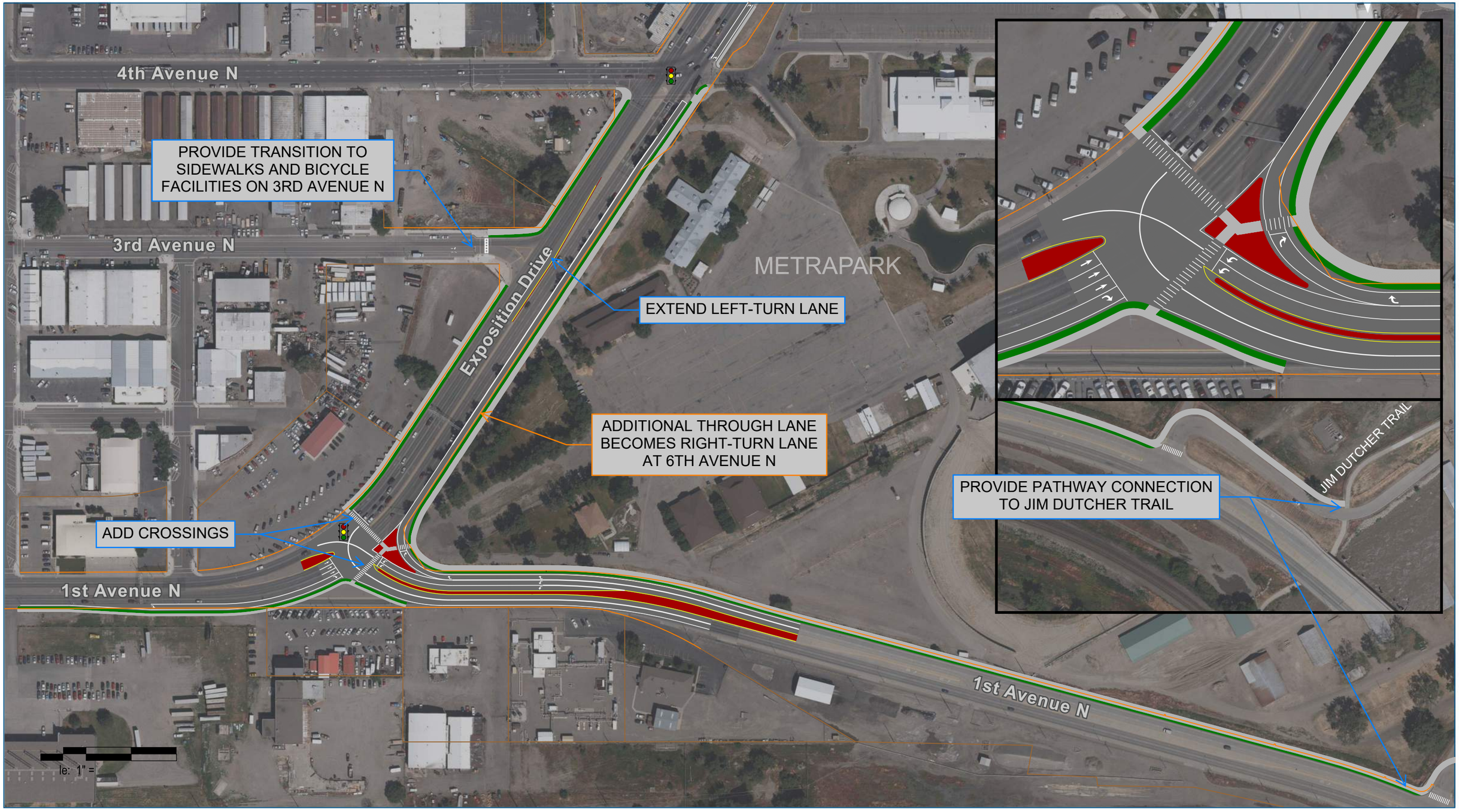
This section describes the preferred alternative (previously referred to as Alternative 4 – Free Westbound Right-Turn), including the preferred alternative design graphic, traffic related issues that affect operational characteristics of the design, and ongoing investigations.

Preferred Alternative Concept

The preferred alternative is shown in Figure 9. The preferred alternative provides the following components:

- Converts existing westbound right-turn lane into a free right-turn lane to improve capacity and lower vehicle queues for the westbound right-turn movement
- Removes northbound right-turn slip-lane and brings northbound right-turn lane through the traffic signal at the Exposition Drive/1st Avenue N intersection to improve vehicle safety
- Provides fourth northbound travel lane on Exposition Drive between 1st Avenue N and 4th Avenue N to allow for free westbound right-turn movement, the 4th northbound travel lane becomes the right-turn lane at 6th Avenue N
- Extends southbound left-turn lane at the Exposition Drive/1st Avenue N intersection to accommodate vehicle queues
- Refines intersection alignment to improve turning radii for trucks
- Adds pedestrian crossings to east and north legs of Exposition Drive/1st Avenue N
- Provides an opportunity for a pathway on both sides of Exposition Drive between 1st Avenue N and 4th Avenue N, provides sidewalks elsewhere
- Provides an opportunity for a pathway connection on north side of 1st Avenue N from Exposition Drive to Jim Dutcher Trail

The Preferred Alternative memorandum contains additional information about the preferred alternative design, development, and selection and is shown in Appendix F.



Sidewalk or Pathway
Roadway
Landscaping
Median
Right-Of-Way
New or Modified Traffic Signal

Preferred Alternative
Lane Configurations
Billings, Montana

Figure
9

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Traffic Volumes and Operations

This section describes the year 2020 and year 2040 traffic volumes and operations at the Exposition Drive/1st Avenue N and Exposition Drive/4th Avenue N intersections with the preferred alternative.

Year 2020

Year 2020 traffic volumes and operations at the Exposition Drive/1st Avenue N and Exposition Drive/4th Avenue N intersections with the preferred alternative are shown in Figure 10. Also shown on Figure 10 are daily traffic volumes on Exposition Drive and 1st Avenue N. The Exposition Drive/1st Avenue N intersection with the preferred alternative is expected to operate under-capacity and at LOS A and LOS D in the weekday AM and PM peak hours, respectively.

A sensitivity analysis was conducted with the preferred alternative under year 2020 PM peak hour traffic conditions during the beginning of a MetraPark event. At the beginning of events, traffic increases at the Exposition Drive/4th Avenue N intersection's northbound-right turn, southbound-left turn, and eastbound-through movements and the Exposition Drive/1st Avenue N intersection's westbound-right turn movement. A sensitivity analysis was not conducted for traffic conditions at the end of events, since the end of events typically do not fall during the AM or PM peak hours.

Table 4 shows the adjusted traffic volumes used in the MetraPark sensitivity analysis. The adjusted traffic volumes were determined from traffic volumes collected during a MetraPark event in 2019. The sensitivity analysis showed that traffic volumes generated by MetraPark events can be accommodated by the preferred alternative at the Exposition Drive/1st Avenue N and Exposition Drive/4th Avenue N intersections. The only potential operations issue is at the Exposition Drive/4th Avenue N intersection southbound-left turn movement. The southbound-left turn is a permissive movement with low traffic volumes. Based on experience watching event traffic in the field, southbound-left turn movement was able to find gaps in the northbound traffic stream. With the preferred alternative, Exposition Drive will have four through lanes opposing the southbound left-turn lane. MDT may want to consider changing the southbound left-turn to protected-permissive phasing due to the change in number of opposing through lanes.

Table 4 Year 2020 MetraPark Sensitivity Analysis - Traffic Volumes

Scenario	PM Peak Hour Traffic Volumes			
	Exposition Drive and 1st Avenue N	Exposition Drive and 4th Avenue N		
	WBR	NBR	EBT	SBL
Base Condition (Year 2020 PM Peak Hour)	**871**	**6**	**8**	**8**
Metra Park Sensitivity Analysis	**971** *(+100)*	**256** *(+250)*	**208** *(+200)*	**88** *(+80)*

Traffic operations worksheets for the preferred alternative in year 2020 conditions and for the MetraPark sensitivity analysis are shown in Appendix G.

4th Avenue N

11,858 (13,357) AADT

3rd Avenue N

502 (3,138) AADT

Exposition Drive

36,745 (35,675) AADT

Existing Future

Existing Future

1st Avenue N

28,088 (31,145) AADT

29,562 (30,132) AADT

1st Avenue N

METRAPARK

AM PERIOD: 1,632 / 7; 269 / 8 / 91; 4.9%; 808 / 26

PM PERIOD: 1,132 / 8; 1,454 / 8 / 173; 2.1%; 2,152 / 6

Year 2020

AM PERIOD: 2,011 / 9; 365 / 10 / 112; 996 / 32

PM PERIOD: 1,395 / 10; 1,792 / 10 / 213; 2,652 / 7

Year 2040

AM PERIOD: 942 / 741; 6.5%; 531 / 413; 289 / 220

PM PERIOD: 565 / 751; 3.2%; 871 / 419; 1,276 / 424

Year 2020

AM PERIOD: 1,161 / 913; 654 / 509; 356 / 271

PM PERIOD: 696 / 926; 1,073 / 516; 1,573 / 523

Year 2040

Weekday

9

3

Weekday

Weekday

10

12

14

>1300

MontanaFair Saturday

1

172

Typical Metrapark Event Day

100 0 100 200

Scale: 1" = 200'

Level of Service

- A - C
- D
- E
- F

Vehicle to Capacity

- <0.70
- 0.70 - 0.89
- 0.90 - 0.99
- >1.00

AM | PM

LOS / V/C

Percent Heavy Vehicle

Existing (Future) AADT

Preferred Alternative Year 2020 and Year 2040 Conditions
Billings, Montana

Figure 10

EXPO&1ST

Year 2040

Year 2040 traffic volumes and operations at the intersection with the preferred alternative are shown in Figure 10. The Exposition Drive/1st Avenue N intersection is projected to operate at LOS C and LOS D in the weekday AM and PM peak hours, respectively. In the PM peak hour, the Exposition Drive/1st Avenue N intersection is projected to have an overall v/c ratio of 0.90. The expected traffic operation lifespan of the Exposition Drive/1st Avenue N intersection preferred alternative is 8-12 years beyond year 2040. The Exposition Drive/4th Avenue N intersection is expected to be near capacity in year 2040 conditions with the preferred alternative, with an overall v/c ratio of 0.94. The eastbound left-turn movement at the Exposition Drive/4th Avenue N intersection is a long-term deficiency and is projected to have a 95th percentile vehicle queue length of 950 feet in the weekday PM peak hour. *Traffic operations worksheets for the preferred alternative in year 2040 conditions are shown in Appendix H.*

Queue Findings

95th percentile vehicle queues at the Exposition Drive/1st Avenue N intersection with the preferred alternative are shown in Table 5 for the AM and PM peak hours in year 2020 and year 2040 traffic conditions. Also shown in Table 5 are the 95th percentile queues for the northbound and eastbound movements of the Exposition Drive/4th Avenue N intersection. The turn-lane storage lengths shown on the preferred alternative in Figure 9 were designed to accommodate the queue lengths shown in Table 5.

Table 5 Preferred Alternative - 95th Percentile Vehicle Queues

Scenario		95th Percentile Vehicle Queue Lengths (feet)							
		Exposition Drive and 1st Avenue N						Exposition Drive and 4th Avenue N	
		WBL	WBR	NBT	NBR	SBL	SBT	NBT	EBL
Year 2020	AM Peak Hour	235	0	113	140	411	180	72	131
	PM Peak Hour	275	0	500	317	485	297	675	765
Year 2040	AM Peak Hour	300	0	142	186	555	382	73	170
	PM Peak Hour	320	0	652	411	615	346	790	947
Preferred Alternative Design Vehicle Storage Lengths (ft)									
Preferred Alternative		375	N.A.	750[2]	430	720	1100[1]	1100[1]	1400[2]

[1]Distance to adjacent signalized intersection
[2]Distance to next major cross-street (N 10th Street)

Design Considerations

This project is currently in the survey phase of MDT's design process, which includes survey, design and right of way phases. The survey phase includes the process for identifying a preferred alternative, as well as field investigations for survey, right of way, geotechnical, drainage, and environmental conditions. The project team identified the preferred alternative, but still has several investigations and refinements to complete before moving from survey phase to the design phase. This section discusses some of the design consideration of the preferred alternative and key ongoing investigations for the project.

Signal Phasing

Figure 11 shows the recommended signal phasing and potential AM and PM peak hour splits at the Exposition Drive/1st Avenue N intersection. The splits are based on year 2040 conditions and accommodate the anticipated walk and flash don't walk times for pedestrian crossings.

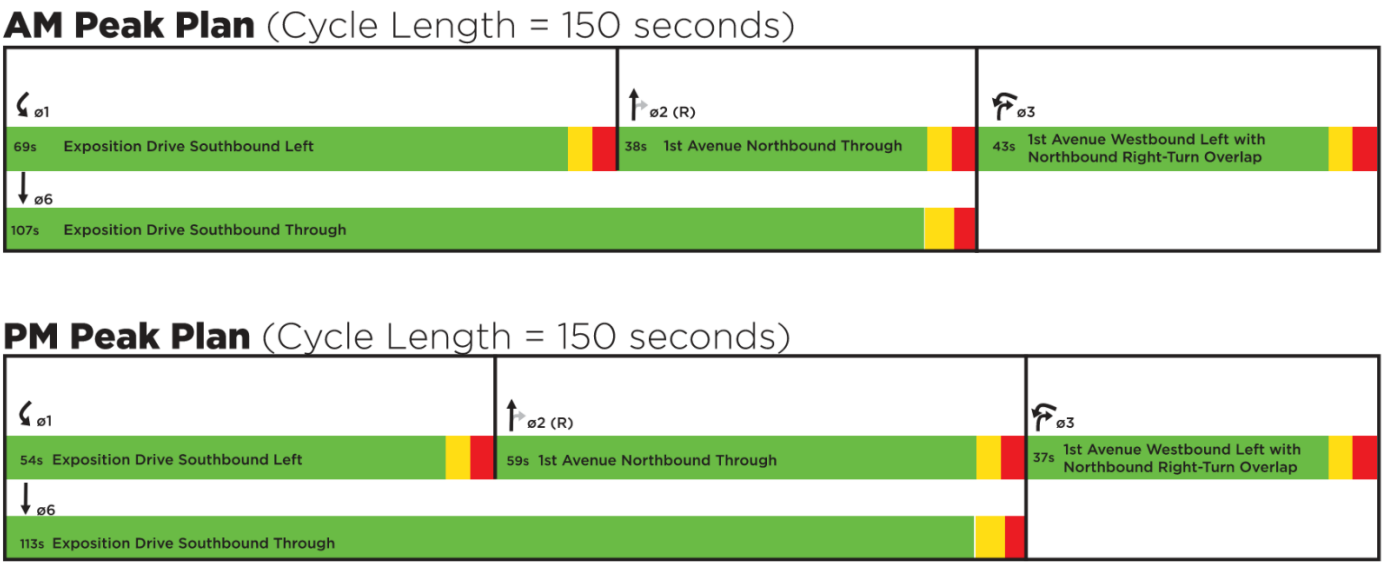

Figure 11 Exposition Drive and 1st Avenue N Preferred Alternative Signal Phasing and Splits

As shown in Figure 11, the southbound left-turn movement (phase 1) and westbound left-turn movement (phase 3) have protected phasing. The northbound right-turn movement incudes an overlap phase (phase 3) to improve operations for this movement.

Bicycle and Pedestrian Considerations

The preferred alternative aims to improve connectivity for bicyclists and pedestrians through the following improvements:

- Adds pedestrian crossings to east and north legs of the Exposition Drive/1st Avenue N intersection
- Provides sidewalks on the south side of 1st Avenue N from N 10th Street to Exposition Drive
- Provides an opportunity for a pathway on both sides of Exposition Drive between 1st Avenue N and 4th Avenue N
    - Includes transition to existing bicycle and pedestrian facilities on 3rd Avenue N
- Provides an opportunity for a pathway connection on north side of 1st Avenue N from Exposition Drive to the Jim Dutcher Trail, located adjacent to the Yellowstone River
- Adds signal control for pedestrians and bicyclists crossing at the free westbound right-turn of the Exposition Drive/1st Avenue N intersection

SUP Funding and Maintenance

MDT's Highway State Special Revenue Account (HSSRA) and Shared Use Paths in MDT Right-of-Way policies (Reference 2) dictate funding and maintenance responsibilities for inclusion of a shared-use path (SUP) on a project. As the project moves forward, MDT will need to explore a funding and maintenance agreement for the proposed SUP, in particular the segments adjacent to MetraPark located on the east side of Exposition Drive and north side of 1st Avenue N. In most cases, MDT requires that the local government or private entities fund the future maintenance of the SUP through

the execution of a standard construction and maintenance (C&M) agreement. *More details about the justification for a SUP are provided in Appendix E.*

Access Management

This section describes access management considerations for the preferred alternative. The project team is continuing to evaluate access options and will be conducting conversations with MDT, property owners, and business owners. Figure 12 through 15 show several access options being considered. Previous options included development of a backage road or frontage road for the properties to the south of the intersection, which were found to be infeasible due to space constraints and railroad proximity.

Figure 12 reflects conditions similar to existing conditions, where most driveways are legally restricted to right-in, right-out. Figure 13 allows u-turns at the intersection of Exposition Drive/1st Avenue N and is otherwise similar to existing conditions. Figure 14 develops left-in access at N 9th Street with a new access road for western properties. Figure 15 develops left-in access for all properties. *Detailed plots of the access management options are shown in Appendix I.*

A final recommendation is pending follow-up conversations.

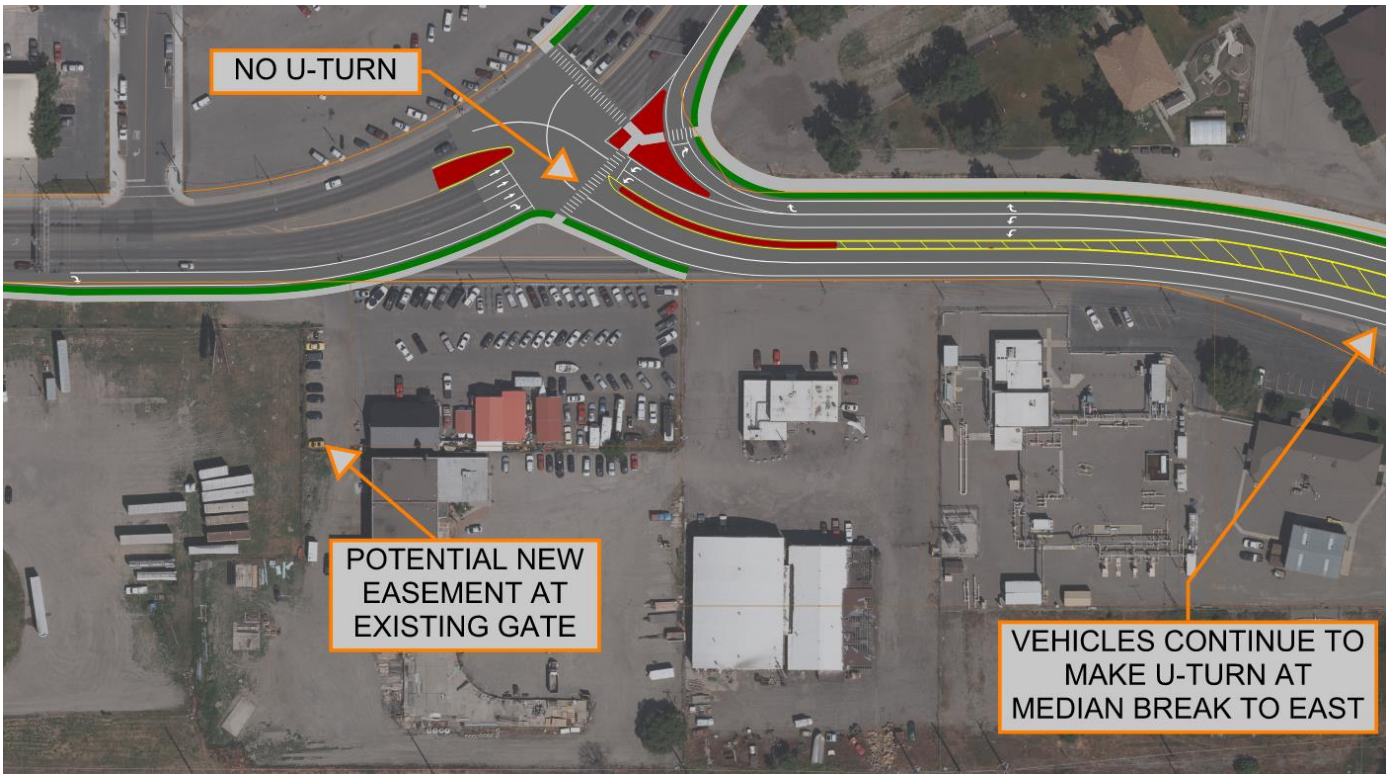

Figure 12 Access Management Option 1

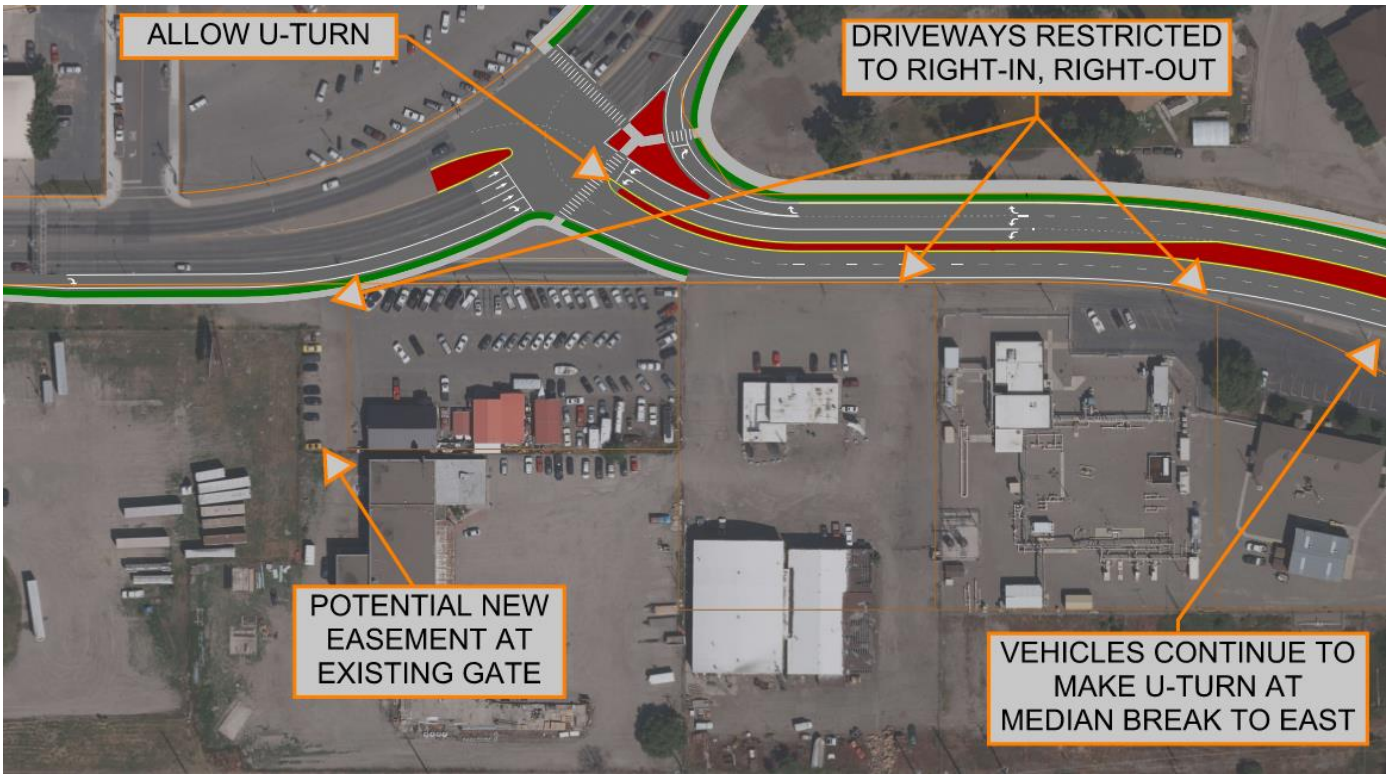

Figure 13 Access Management Option 2

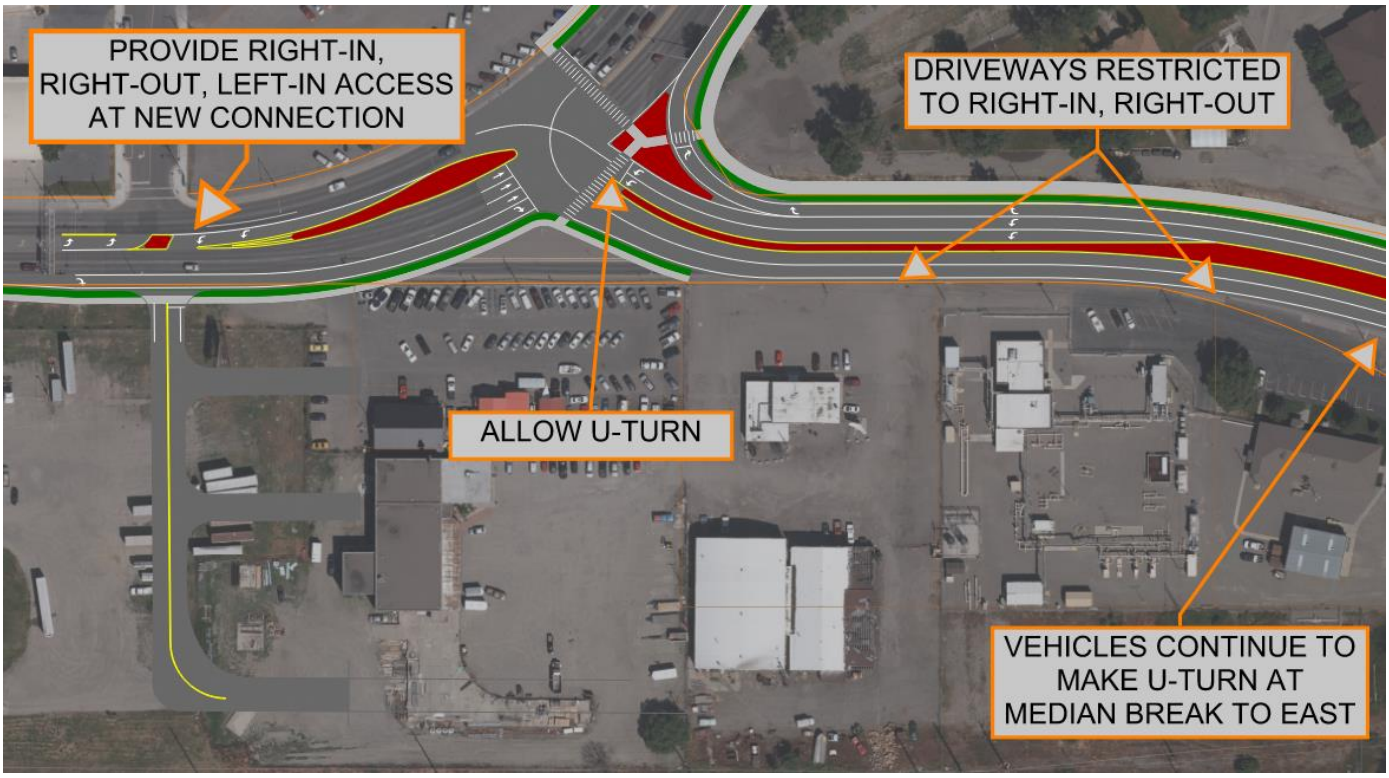

Figure 14 Access Management Option 3

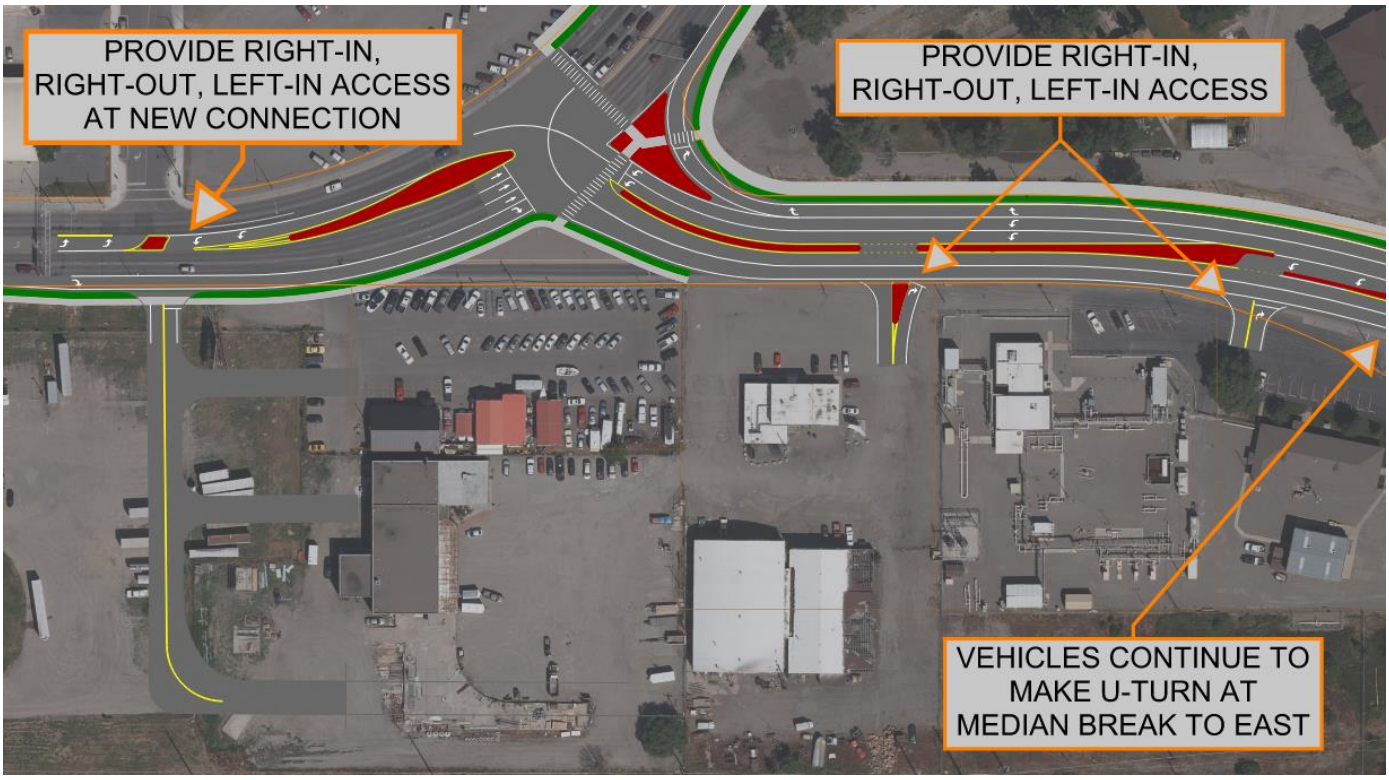

Figure 15 Access Management Option 4