W.O. 16-21
Exposition Drive
Pedestrian Crossing Feasibility Study

Billings, MT
April 2017
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1 Introduction

A grade-separated pedestrian crossing of Exposition Drive is a key element in the revitalization of the East Billings Urban Renewal District (EBURD). As identified in the 2013 Exposition Gateway Concept Plan and the 2013 City of Billings Hospitality Corridor Planning Study, a pedestrian crossing at Exposition Gateway would provide a vital connection between the east end of the EBURD and MetraPark, making this area of Billings a unique destination for the community and region.

The Exposition Drive Pedestrian Feasibility study will identify and evaluate practical options for a pedestrian grade separated crossing across Exposition Drive between 1st Ave N and 6th Ave N in Billings, MT. Exposition Drive is a principal arterial on a north-south alignment in Billings that currently provides three lanes in each direction with a center turn lane at intersections in the project location.

A grade separated pedestrian crossing will significantly enhance a connection over the busiest thoroughfare in Montana to the busiest entertainment venue in the region. Other benefits include enhancing future development by encouraging investment in adjacent idle property, improving connectivity and safety, providing opportunities for event organizers, and allow users to enjoy amenities within walking distance in the Exposition Gateway Area.

Pedestrian grade separated options reviewed as part of this report include an underpass structure (or tunnel) and an overpass structure.

2 Site Locations

Option 1 – South of 4th Ave N.

One potential crossing location for the pedestrian grade separated crossing is the south side of the intersection of Exposition Drive and 4th Avenue N.

4th Avenue N is currently classified, and planned to remain a principle arterial and serves as a primary access route to the MetraPark and Billings Heights. Being a major arterial, 4th Ave N has a high traffic volume demand, which can reduce the comfort for non-motorized users. In addition, based on the MDT 6th Ave N/Bench-Blg, Phase 2 Traffic Report, a flyover of 4th Ave N over Exposition Drive is identified as a long-term recommendation to improve traffic performance at the 6th Ave N/Bench Boulevard and Exposition Drive intersection.

The north side of the intersection of Exposition Drive and 4th Ave N is currently being redeveloped, and limits the possibilities of a
pedestrian grade separated crossing due to the proximity of N 7th St on the west side and the MetraPark parking lots on the east side.

The signalized intersection at Exposition Drive and 4th Ave N includes an existing at-grade pedestrian crossing on the south side of the intersection, providing pedestrian access across Exposition Drive to the main entrance of the MetraPark complex.

**Option 2 – Intersection of 3rd Ave N.**
A second potential crossing location for the pedestrian grade separated crossing is near the intersection of Exposition Drive and 3rd Avenue N.

3rd Ave N is identified in the Exposition Gateway Concept Plan and EBURD Master Plan as a future signature street. This would serve as the center hub for the Exposition Gateway Area, with improved landscaping, enhanced pedestrian amenities, plazas and gardens. 3rd Ave N was reconstructed in 2015 from North 10th Street to Exposition Drive and included curb extensions (bulb-out) at pedestrian crossings, new curb gutter and sidewalk, bike lanes, street lights and new asphalt pavement.

The roadway is classified as a local street and provides direct access to adjacent land use and businesses within the Exposition Gateway Area. The vehicular speed along the roadway is 25 mph, a lower speed as compared to 4th Ave N.

This option would allow a grade separated crossing on either the north or south side of the 3rd Ave N intersection and the ramp of a crossing to run parallel to Exposition Drive connect future commercial and retail space and allow pedestrians to exit the ramp at the middle entrance of the MetraPark complex, potentially with a new pedestrian only entrance to MetraPark.

**Option 3 – North of 1st Ave N.**
Another potential crossing location for the pedestrian grade separated crossing is north of the 1st Ave N intersection.

1st Ave N is classified as a principle arterial, which has a high traffic volume demand, and can reduce the comfort for non-motorized users.

The Montana Department of Transportation (MDT) is planning to improve the intersection at Exposition Drive and 1st Ave N. At the time of
this study, the intersection improvement project is in the early stages of preliminary engineering and improvements are unknown. Improvements discussed with MDT could include an additional northbound lane along Exposition Drive or a change in geometric at the intersection, possibly making the pedestrian crossing longer in this location compared to other locations.

Existing pedestrian features are limited along 1st Ave N to the west and HWY 87 to the east of Exposition Drive, reducing the demand of pedestrians to and from this location. Access to MetraPark from this location of the project area is farther away from the primary event locations on the MetraPark property as well as farther away from the future primary development opportunities within the Exposition Gateway and EBURD.

Midblock Crossings.
Other locations for the pedestrian grade separated crossing would include a midblock crossing between 3rd Ave N and 4th Ave N. Based on the potential for pedestrian generation along the signature street of 3rd Ave N, and unknown future development opportunities at this time, a midblock crossing is not being considered as a practical location option for the crossing.

2.1 Preferred Crossing Location.
Based on the existing roadway classifications, future planning efforts in the Exposition Gateway Area, and long-term intersection improvements by MDT within the corridor, the preferred crossing location is identified as the intersection of 3rd Ave N and Exposition Drive.

Figure 2-1. Exposition Drive Site Map
3 Existing Utilities

This assessment identified several potential utility conflicts in the project area using according to as-built plans, City of Billings records and publically available GIS data sources. The potential conflicts are outlined below.

Two main storm drain trunkline pipes are buried below Exposition Drive and follow a parallel alignment to Exposition Drive. One of the storm drain trunklines is on the east side of Exposition Drive. This storm drain is an eight-inch pipe that runs north from 1st Ave N to approximately 2nd Ave N, then turns into a 12-inch storm drain pipe from 2nd Ave N to 3rd Ave N. A 24-inch storm drain trunkline flows east along 3rd Ave N and joins the 12-inch pipe at a manhole junction and a 30-inch storm drain trunkline continues north to the main entrance of MetraPark and then flow east to an outfall at the Yellowstone River. The other storm drain trunkline is on the west side of Exposition Drive. This storm drain is a 24-inch trunkline that flows north from 1st Ave N to 4th Ave N, then east along the main entrance of MetraPark. According to previous studies, by others, the existing storm drain system in the area was installed decades ago and no longer meets the overall capacity needs of the area.

A 6-inch water main exists along Exposition Drive, and a 12-inch water main exists along 3rd Ave N within the study area.

According to the National Pipeline Mapping System (NPMS) an oil pipeline exists along the east right-of-way of Exposition Drive from 6th Ave N down to 1st Ave N, and then heads east towards I-90.

Figure 3-1. Utility Conflicts with Underpass Alternative
Underground utilities will be significantly impacted by the underpass crossing option. The underpass will either have to be constructed below the existing utilities, or a sizable portion of the utilities will need to be relocated around or below the crossing. Gravity flow storm drain pipes could require a pump system to maintain the existing gravity flow below or around a new underpass structure. An evaluation of costs associated with utility relocation is not included within the scope of this study. However, these impacts and costs will need to be considered prior to final of the preferred alternative.

Figure 3-2. Existing Utilities
4 Design Criteria

The grade-separated pedestrian crossing of Exposition Drive will be designed in accordance with the following documents where applicable:

- AASHTO LRFD Bridge Design Specifications, Seventh Edition
- MDT Structures Manual
- ADA/PROWAG grade requirements
- The geometric requirements are as follows:
  - Minimum vertical clearance over Exposition Drive = 18'-0"
  - Minimum horizontal pedestrian clear path width = 10'-0"
  - Minimum vertical pedestrian clear path (underpass) = 10'-0"

5 Grade Separated Alternatives

5.1 Overpass Alternative

An overpass alternative would provide a crossing alternative where pedestrians cross over Exposition Drive. An overpass would cross Exposition Drive with a single main span bridge structure. The length of the main span would vary depending upon the final crossing alignment. However, the main span would be in the range of 175-200 feet long which would accommodate a future additional northbound lane along Exposition Drive. An overpass would require a series of ramps to gradually raise the pathway up to the appropriate elevation of the main span crossing above Exposition Drive. Some general characteristics, advantages, and disadvantages of an overpass are listed below:

- Less Traffic Disruption. An overpass would have less disruption to traffic on Exposition Drive during construction compared to an underpass. The large truss span can be assembled on-site and lifted into place during a single road closure at night. This requires significantly less disruption to traffic compared to an underpass which would require phased construction and reconstruction of Exposition Drive.

- Better Pedestrian Security and Safety. An overpass is more visible, and generally has a reduced risk for vandalism and crime compared to an underpass. Users of the overpass may have a heightened sense of security compared to traversing an underpass of approximately 180-feet in length.

- More Complex Approach Structures. The largest disadvantage of an overpass option is that it will require more extensive approach/access ramps than an underpass. This is due to the larger difference in grade between the walkway and the roadway that is needed for the overpass option. There are multiple options for the ramps leading up to the main span including earth filled retaining wall structures or 50’ to 100’ open spans. Regardless, the total required length is approximately 350-feet at each end of the
overpass, in order to meet ADA requirements. Other access options include stairs or direct connection to future buildings, such as hotels, providing access from within the building.

The overpass and ramps would have pedestrian fences that meet AASHTO guidelines to improve safety of the users and motorists passing below the underpass. The fence on the overpass could also include aesthetically designed panels to depict a mural, shapes or break up the typical chain-link fence aesthetics.

Practical options for a pedestrian overpass superstructure include using steel or concrete girders with a concrete deck, a prefabricated steel truss or a tied arch superstructure.

**Girder-Type Superstructure.**
A girder superstructure would support the walkway on a concrete deck above concrete or steel girders. This option would increase the required elevation of the path above the roadway due to the significant increase in superstructure depth compared to the truss option described below. The result would be an increase in ramp length for a girder supported main span alternative. Given the site constraints, extended ramp lengths are not desirable and the girder supported superstructure option was not considered in detail.

**Truss-Type Superstructure.**
A prefabricated supplier-designed truss can provide a single span of 150’-200’ at an economical price while reducing the ramp length needed compared to a girder superstructure. The reduced ramp length is due to the shallower distance between the low chord and the walkway on a truss compared to a girder superstructure bridge. Two common types of trusses include a parallel chord style truss which has the top and bottom chord parallel, and an arch style truss which has an arching top chord. For the span length anticipated with this crossing (~175-200 ft.), the parallel chord design truss is generally more economical whereas the arched truss could be used for aesthetic reasons.

Figure 5-1. Truss-Type Superstructure Example
For this type of crossing, a single, prefabricated truss main span is typically the most cost effective overpass alternative. Although a two-span arrangement could work, it would require intermediate supports within Exposition Drive, which is not desirable, and would provide with no apparent advantage compared to a single span. Therefore, for the purpose of this study, a supplier-designed, single span, prefabricated steel truss superstructure is assumed for the overpass option.

The overpass alternative would be designed with a minimum vertical clearance of 18' which would accommodate all legal traffic, including non-permit loads for trucks. To meet the needs of oversized loads, mega loads or other special commercial motor carrier accommodations, the overpass alternative could be designed to have a removable main span.

5.2 Underpass Alternative
An underpass would provide a crossing alternative where pedestrians cross under Exposition Drive. Some general characteristics, advantages, and disadvantages of an underpass are listed below:

- **Reduced Ramp Length.** To maintain the existing grade of Exposition Drive, the depth of the structure combined with the minimum clearance height of the opening will drive the length of the ramps leading down to the underpass. Assuming a 10-foot high opening, the bottom of the underpass would be approximately 14-feet below existing grade. Compared to a 17' minimum clearance requirement for the overpass option, this results in reduced ramp length for the underpass option.
- **Vertical Design Limitations.** It is desirable to maintain the existing roadway grade of Exposition Avenue to avoid impacts to right-of-way or current property owners in the vicinity of the project. As a result, changes to the roadway grade to accommodate the underpass crossing such that buried utilities can be avoided were not considered to be a practical option.
- **Complex Drainage Design.** The topography of the area is generally flat and an underpass could require a complex drainage system for storm water. Pumps may be required to accommodate storm drainage within the underpass and flooding could occur during large storm events.
- **Walls or Slopes Required at Approaches.** The ramps leading down to the underpass require either slopes or retaining walls along the sides of the pathway. Using slopes for stability between the pathway and the existing ground opens the area, provides landscaping opportunity and increases visibility. The drawback of sloping the sides is the right-of-way area increases significantly. Retaining walls reduce the required right-of-way area, but require additional cost for the structural wall and reduce visibility compared to a sloped cut.

Underpass alternatives could include a precast concrete 3-sided box, precast concrete arch or a steel plate arch. A general description of each is summarized below.
Precast Concrete 3-Sided Box.
A 3-sided box is a common option for an underpass either on precast or cast-in-place foundations. Utilizing slopes on the approach ramps or tiered walls, the underpass can have an open approach compared to using vertical walls.

Precast Concrete Arch.
An open bottom precast concrete arch is another option similar to the precast 3-sided box, but with longer span capabilities and possibly a more aesthetically pleasing appeal.

Figure 5-2. Precast Arch Example

Steel Plate Arch.
An open bottom steel plate arch or culvert is another alternate to be used for an underpass. A steel arch would require more cover which leads to a deeper pathway and longer approach ramps compared to a concrete alternative.

Although the costs for each specific underpass option will vary, the overall cost for an underpass project including ramps and other incidentals would be similar. Therefore, a detailed evaluation of underpass structure types was not performed as part of this study.
5.3 Preferred Alternative

The overpass alternative is preferred based upon the following:

- Impacts to existing utilities would be extensive, possibly infeasible, or cost prohibitive to mitigate for an underpass option.
- An overpass creates a more visible crossing for users, and generally has a reduced risk for vandalism and crime compared to an underpass.
- Aesthetic opportunities can be applied to the overpass to enhance the crossing as a gateway into the City of Billings.
- The topography of the area is generally flat and an underpass could require a complex drainage system for storm water. Pumps may be required to accommodate storm drainage within the underpass and flooding of the underpass could occur during large storm events.
- An overpass would have less disruption to traffic on Exposition Drive during construction compared to an underpass. The large single span structure can be assembled on-site and lifted into place during a single road closure at night. An underpass would require phased construction and reconstruction of Exposition Drive.

6 Connection/Access Options

Future development in the Exposition Gateway could include hotels, commercial businesses or a conference center allowing for access to the pedestrian crossing to be provided by various options. Access options include ramps meeting current Americans with Disabilities Act (ADA) guidelines, stairs, or even a connection to future buildings with access provided within the interior of those buildings.

Ramps.
Ramp lengths and layouts would be designed based on a 5% maximum grade per current ADA and Public Rights-of-Way Access Guidelines (PROWAG).

SWITCHBACK STYLE.
Ramps alternating direction every 50-ft to 100-ft would allow the ramp structure to be localized in one area compared to an approximately 350-ft by 10-ft long linear ramp structure. The alternating ramp option would require approximately 10,000 to 12,000 SF of future right-of-way to be required.

OPEN SPAN OPTION – OVERPASS ALTERNATIVE.
The ramps rising up to the main crossing could be constructed from a similar truss type span to aesthetically match the main span over Exposition Drive. Alternatively, beam spans could also be used as ramps. The open spans can be preferable when it is important to perpetuate sightlines along the roadway being crossed.

RETAINING WALLS WITH FILL OPTION – OVERPASS ALTERNATIVE.
Vertical retaining walls with earthen fill are another ramp option. Precast concrete panels with an MSE fill or cast-in-place concrete retaining walls with structural fill are viable alternatives for
this option. By using vertical walls, the footprint of the ramps will be minimized compared to using landscaped fill slopes.

Stairways.
The ramps would provide ADA access to the crossing. However, stairways can be added to the ends of the ramps and connect to the sidewalks along Exposition Drive to provide direct access to the crossing. This option helps to prevent jaywalking across the street by providing an efficient, direct access to the overpass (or underpass).

Future Building Connection.
Connections within future development can provide access to the pedestrian crossing for the public, while enhancing the security to close access to or from the crossing after business hours for the future buildings as well as MetraPark. Options for future building connections could include removing the pedestrian ramp structures, and installing a short bridge span between the building and the structure, or providing a secondary access from the pedestrian ramps to future buildings, while maintaining full public access to the overpass from the pedestrian ramps.

7 Aesthetic & Additional Options
Some additional options to consider are summarized below:

Lighting.
The use of LED lighting is an efficient means of increasing the visual appeal of the structure while increasing safety at night by enhancing visibility. The shared use path approaches can also be enhanced by utilizing street-type lighting to increase usage and safety.

Formliners.
Formliners are generally cost effective methods to add aesthetic detail and texture to precast and cast-in-place concrete. Custom formliners can also be designed to depict a custom scene or specific design to fit the desired appearance.

Landscaping.
Through the use of landscaping, the site around the crossing can give a park-like atmosphere and blend into the recreation areas around the MetraPark complex or future adjacent green-space.

Custom Designed Span.
For the Exposition Drive Crossing, a custom designed span can also be designed to meet any future corridor aesthetic requirements or site developer’s guidelines.

Roof or Covering.
A roof or covering added to the overpass truss and ramps will protect users from inclement weather. This benefit also helps reduce snow accumulation on the structure, reducing winter maintenance costs and effort.
Heated Structural FRP Deck Panels.
Heated deck panels are a relatively new technology that could be used instead of a traditional concrete deck to prevent the build-up of snow and ice on the overpass structure during the winter months. Heated deck panels add a considerable cost to the structure compared to traditional deck materials.

Security Gates.
If desired from a security perspective, lockable gates could be installed at either end of the pedestrian ramps, or crossing structure, to prevent public access to MetraPark or other private buildings if connections are made to those properties from the pedestrian crossing. Security cameras could also be installed to help deter vandalism.

Advanced Aesthetics.
Depending on funding availability, advanced aesthetics could be included with the pedestrian crossing to create a signature element in the community. Advanced aesthetics, shown in the rendering below, can draw inspiration from its surrounding architectural heritage, and the natural environment. The details of advanced aesthetics details can come together to make a bridge that is unique to Billings and could stand as a landmark entrance.

Figure 7-1. Rendering of Exposition Drive Pedestrian Overpass with Advanced Aesthetics

The proposed costs of the pedestrian crossing are greatly affected by various aesthetic treatments and additional options, which could add $500k to $1M or more to the overall project costs.
8 Summary

The following table summarizes the possible advantages and disadvantages of the overpass and underpass crossing alternatives.

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<th>Alternative</th>
<th>Construction Cost Range</th>
<th>Advantages</th>
<th>Disadvantages</th>
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| Overpass    | $3 million to $5+ million* | • Less construction impact to traffic during construction  
• Potential to connect to future buildings  
• Roadway reconstruction not required  
• Reduced underground utility impacts  
• Generally considered safer from a user perspective  
• Opportunities for a custom designed gateway structure | • Longer and more technical ramp structure required  
• Higher structure cost. |
| Underpass   | $3 million to $5+ million* | • Lower structure cost.  
• Reduced ramp length. | • Substantial impact to existing utilities - deemed infeasible  
• Potential for flooding during large storm events  
• More susceptible to vandalism than an overpass  
• Generally considered less safe from a user perspective |

* Upper cost limit dependent on ramp and access features, aesthetic treatments, utility relocations, and other enhancement features.

Preferred Alternative

The overpass alternative is preferred based upon the following:

- Reduced impacts to existing utilities
- More visible crossing for users, and better safety
- Aesthetic opportunities for a gateway into the City of Billings
- Less disruption to traffic during construction

Many architectural features and aesthetic options are available for an overpass, depending on final design and funding for the project.
Appendix A – Preliminary Cost Estimates
# Overpass Alternative Preliminary Cost Estimate

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**Base Overpass Construction Estimate**: $2,035,000.00  
**Contingency (25%)**: $508,800.00  
**Construction Subtotal**: $2,543,800.00  
**Engineering - Design & Construction (20%)**: $508,800.00  
**Total**: $3,052,600.00

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# Underpass Alternative Preliminary Cost Estimate

## Underpass Alternative

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**Base Underpass Construction Estimate**: $2,050,000.00  
**Contingency (25%)**: $512,500.00  
**Construction Subtotal**: $2,562,500.00  
**Engineering - Design & Construction (20%)**: $512,500.00  
**Total**: $3,075,000.00

## Additional Underpass Options

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<td>LS</td>
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