Memorandum

Subject:	Analysis of Sidewalk Removal from the Castle Creek Bridge
Project Name:	New Castle Creek Bridge Investigative Study with Revised Scope (the Project)
Attention:	City of Aspen (the City); Pete Rice and Carly McGowan
From:	Jacobs
Date:	July 26, 2024
Copies to:	Doug Stremel, Jim Clarke, and Beth Tosti

1. Introduction

A three-lane bridge replacement with a sidewalk was previously assessed in the final State Highway (SH) 82 Over Castle Creek Bridge Feasibility Study (Feasibility Study), with a total bridge width of 52 feet for a sidewalk, three lanes of traffic, and associated shoulders. Aspen City Council requested further investigation and comparison of two options:

- Three-lane Shifted: Provided two lanes of traffic during all construction phases
- Three-lane Faster: Eliminated 1 year of construction time

The current SH 82 bridge over Castle Creek has two sidewalks, one of which was widened in 2018. The north sidewalk is protected behind a barrier and is 8 feet wide. The south sidewalk on the bridge is unprotected and is 5 feet wide.

As part of the Project, the City currently is analyzing replacing the existing two-lane bridge with a three-lane bridge in the same approximate SH 82 alignment. This memorandum (memo) analyzes the potential removal of sidewalks from a new three-lane bridge[1] to reduce right-of-way (ROW) impacts and Project costs. Analysis of bridge phasing and associated impacts are based on available Geographic Information System (GIS) data, aerial photography, elevations, and roadway shape files.

The feasibility of sidewalk removal considered these aspects:

- Federal, state, and local policy, including Americans with Disabilities Act (ADA) requirements
- Volumes of pedestrian and bicycle users
- Potential alternative bicycle and pedestrian routes, considering increases in travel time and distance

[1] This memo does not address sidewalk removal from a rehabilitated bridge, a new two-lane bridge, or the Three-lane Centered options.

- Impacts to school campus usage or Safe Routes to Schools (SRTS)
- Construction impacts of sidewalk removal for a three-lane bridge replacement, including the following:
  - Construction phasing for a three-lane bridge (three 11-foot lanes and two 3-foot shoulders) with one lane in each direction during all phases of construction
  - Comparison to the previously assessed Three-lane Shifted and Three-lane Faster options, reviewing ROW impacts
  - Bridge construction schedule and cost
- Private property and utility impacts with and without a sidewalk

2. Federal, State, and Local Policy Implications

Federal, state, and local laws, regulations, and policies were considered when assessing sidewalk removal. Federal and state policies both state that existing pedestrian facilities cannot be severed or removed unless a reasonable alternative route is provided (reasonableness can consider cost, but this judgement is subjective and usually considered to be more than 20% of the overall Project cost). Further, City engineering standards require a sidewalk in this area. The ADA requires any new facility constructed by a government entity to meet ADA design criteria, regardless of the funding source. Based on these regulations, codes, and policies, it would be difficult to not include sidewalks on a future bridge, even if local funding were used for the Project. The following sections provide additional details about relevant federal, state, and local requirements.

2.1 Americans with Disabilities Act Requirements

Colorado Department of Transportation (CDOT) confirmed that any new construction in the public ROW would need to meet the ADA requirements and design criteria, specifically the Public Right-of-Way Accessibility Guidelines (PROWAG). These guidelines require a minimum 48-inch-wide sidewalk or path with a grade no greater than 5% and a cross slope no greater than 2.1%.

2.2 Other Federal Statutes

Federal requirements would apply to a future bridge replacement project if federal transportation funds are used. These requirements also would apply if the bridge is replaced as part of implementing a phase of the Preferred Alternative from the Entrance to Aspen Environmental Impact Statement (CDOT 1997) or if a new National Environmental Policy Act (NEPA) process were initiated.

The federal government can withhold approval of projects that would negatively impact pedestrians and bicycles. Relevant federal code and regulatory citations follow:

- 23 *Code of Federal Regulations* (CFR) 652 provides "procedures relating to the provision of pedestrian and bicycle accommodations on Federal-aid projects, and Federal participation in the cost of these accommodations and projects."
- 23 *United States Code* (USC) 109(m) relates to the severance of existing bike and pedestrian routes. No federal funding will be approved for a project that reduces pedestrian safety unless a reasonable alternative route can be provided. Specific language states that "[t]he Secretary shall not approve any project or take any regulatory action under this title that will result in the severance of an existing major route or have significant adverse impact on the safety for non-motorized transportation traffic and light motorcycles, unless such project or regulatory action provides for a reasonable alternate route, or such a route exists."
- 23 USC 217(e) specifically relates to federal funding for replaced or rehbilitated bridges, stating that safe accommodations must be provided as long as the cost is reasonable. Specific language states that "[i]n the case where a highway bridge deck being replaced or rehabilitated with Federal financial participation is located on a highway on which bicycles are permitted to operate at each end of such bridge, and the Secretary determines that the safe accommodation of bicycles can be provided at a reasonable cost as a part of such replacement or rehabilitation, then such bridge shall be so replaced or rehabilitated as to provide such safe accommodations." Although this statutory requirement only mentions bicycles, the U.S. Department of Transportation encourages states and local governments to apply this same policy to pedestrian facilities.

2.3 State Statute

State statute indicates that pedestrian and bicycle facilities must be constructed to provide safe access for all users. *Colorado Revised Statutes* 43-1-120 states the following:

- "It is in the best interest of all Coloradans to promote transportation mode choice by enhancing safety and mobility for bicyclists and pedestrians on or along the state highway system."
- "The department (of Transportation) has adopted a bike and pedestrian policy directive to further this goal."

- "It is necessary and appropriate to elevate the status of the bike and pedestrian policy of the department to that of law by codifying it in subsection (2) of this section…
  - The department and its subdivisions shall provide transportation infrastructure that accommodates bicycle and pedestrian use of public streets in a manner that is safe and reliable for all users of public streets.
  - The needs of bicyclists and pedestrians shall be included in the planning, design, and operation of transportation facilities as a matter of routine.
  - Any decision of the department to not accommodate the needs of bicyclists and pedestrians shall be documented based on exemption criteria that were established by the commission before the decision was made."

2.4 City of Aspen Policy

The City's *Engineering Standards* (City 2019) also require a sidewalk in any area that is not indicated in the adopted maps as a "Sidewalk Deferred Zone." The existing bridge is not in a Sidewalk Deferred Zone.

2.5 Colorado Department of Transportation and Federal Highway Administration Coordination

In a letter to CDOT dated May 7, 2024, regarding the Project, the City asked for clarification and confirmation on several aspects of the Project (City, pers. comm. 2024). In its response, CDOT (with Federal Highway Administration Coordination review and concurrence) confirmed the following (CDOT, pers. comm. 2024):

- The Castle Creek Bridge sidewalk must be replaced on a new or rehabilitated bridge if federal and/or state funding is used and a reasonable alternative route is not identified.
- If the City opts to self-fund, the sidewalk must be replaced on the new or rehabilitated Castle Creek Bridge if the route remains a state highway.
- Any new trail or path would need to meet the ADA design criteria.

CDOT bike and pedestrian coordinators for the state and for the region commented in an email that any alternative route would need to meet current ADA policy (PROWAG) and that it was unlikely that an alternative route would be determined to be reasonable unless it provided a comparable distance and grade (Ipsen and Van Vonno, pers. comm. 2024).

3. Existing Sidewalk History and Usage

The existing sidewalks' history and usage were reviewed to determine why they were constructed and to gauge if the sidewalks provide an important multimodal connection or if this facility is underused.

3.1 Sidewalk History

City staff provided a City Council memo from 2016 to inform the history of the sidewalk connection. The memo states that the Castle Creek Bridge and the Hallam corridor were identified as a deficient link in 2013 by the City's Open Space and Trails Board and other City departments. The City's Trail System Manager confirmed that the sidewalks at the time were narrow and unprotected from traffic. The trail was also recognized as a critical link for pedestrians and cyclists to access the north side of the city. In 2014, a conceptual plan was developed to address the deficiency.

In April 2016, a Living Lab experiment was conducted on the bridge to study its usage. A Living Lab is a temporary setup of a potential roadway, path, or signage change using cones or striping to model how traffic or pedestrians respond to a changed condition. Living Lab results indicated that cyclists split at Castle Creek Bridge between going toward the Marolt pedestrian bridge and continuing onto Hallam Street. The Living Lab also showed that the peak-hour usage on the bridge doubled for pedestrians and increased by 47% for bicycles. Overall, 28,337 pedestrians used the facility during the 3-month Living Lab trial.

Based on the community response to the Living Lab and community surveys about the need for this connection, the widened sidewalk and barrier were constructed in 2018.

The 2023 Aspen Trail Map (Figure 1) identifies the bridge sidewalks as a major east-west connection and part of the Hallam Bicycle and Pedestrian Route.

Figure 1: 2023 Aspen Trail Map

Source: City, 2023.

3.2 Aspen School Campus Usage and Safe Routes to Schools Designation

SRTS is a national program dedicated to improving the safety of students moving to and from school. The program provides strategies, resources, and funding to improve student safety. The Aspen School District Transportation Director confirmed that the Castle Creek Bridge is a designated SRTS route. The director also stated that approximately 230 students live within northwest Aspen and are likely to use the sidewalk on the bridge. Of those 230 students, 120 would be primarily using the bridge based on their age and ability to ride a bike, scooter, or skateboard instead of taking the bus or driving with their parents (Mahaffey, pers. comm. 2024).

Having a route that local parents consider safe for their kids can reduce vehicular traffic to and from school, as parents are more likely to allow their kids to ride their bikes, scooter, or walk. For example, in the City of Glenwood Springs, a small, separated section of sidewalk across a new pedestrian bridge at the corner of Midland and Mount Sopris Avenue, increased the safety and volume of children walking from the adjacent neighborhood to Sopris Elementary. Children no longer need to step onto the road shoulder on their route to school.

One could reasonably assume that the SH 82 congestion near the bridge adds incentive for parents to have their kids use other modes to travel to and from school. Removing the sidewalks on the bridge would likely lead to increasing vehicular traffic in the school peak drop-off and pickup hours.

3.3 Volume of Bicycle Usage

Different data sources were used to assess bike and pedestrian usage. City Engineering and Trails staff took bicycle counts using tube counters between 2015 and 2022 at two locations: (1) on the bridge and (2) at the North 6th and Hallam Street intersection, located approximately two blocks from the eastern bridge approach. The bicycle counts are summarized as follows:

- 6th and Hallam (June 2015):
  - Daily average: 233
  - Busiest day: 382
- 6th and Hallam (2017 through 2023 [except for 2018, when construction occurred]):
  - No average numbers available
  - Busiest days: Approximately 360 to 375
- Castle Creek Bridge (May 1 to August 31, 2016):
  - Daily average: 248
  - Busiest day: 740

Location-based service (LBS) cellular phone data also were used to assess bicycle usage on the Castle Creek Bridge. These data are summarized as follows:

- Daily average number of bikes in 2019: 700
- Daily average number of bikes in 2020: 740
- Daily average number of bikes in 2021: 560

The tube counts at 6th and Hallam varied significantly from the LBS cellular phone data averages on the bridge. This variability could indicate that many people cross the bridge and turn north or south on a different route before reaching 6th and Hallam.

The LBS data also show a significant drop in 2021, likely because of the COVID-19 pandemic. City staff believe that current volumes are more closely represented by the 2019 and 2020 numbers.

3.4 Comparison of Bicycle Usage on the Marolt Trail Bridge

City Engineering and Trails also took bicycle counts on the Marolt Trail Bridge during the same time frames. The counts, summarized as follows, appear to indicate that both facilities are well used by different groups of users:

- June 2015:
  - Daily average: 591
  - Busiest day: 1,027

- May through August 2016:
  - Daily average: 221 (including a counter malfunction)
  - Busiest day: 962.
- 2017 through 2023 (except for 2018, when construction occurred):
  - Daily average: 332
  - Busiest day: 1,782.

4. Alternative Routes

As noted in Section 2, the feasibility of not including sidewalks on a new Castle Creek Bridge depends on whether a reasonable alternative route exists or could be provided. No set standard exists for determining whether an alternative route is deemed reasonable. CDOT Bicycle and Pedestrian Coordinators have both said that distance, grade, and existence of another facility (a sidewalk for pedestrians, instead of a roadway shoulder) were important considerations. Also, both have confirmed that the ADA regulations (PROWAG) would apply to any newly constructed facility.

The extent to which a new route is considered out of direction compared to the existing bridge sidewalks depends on origins and destinations for bicycle and pedestrian trips, which can vary widely. Therefore, making comparisons required assuming common origins and destinations for these trips. These analyses assume a common western origin at the location of the existing bridge sidewalk and the Marolt Trail connection. To the east, two locations were used: (1) one based on access to the second most highly used bus stop in the system at 8th and Hallam and (2) one based on access to 7th and Main (downtown).

The comparison analyzed three alternative routes to each destination (Figures 2 and 3; Tables 1 and 2). The Power Plant Road route, marked by blue dashes on Figures 2 and 3, would require substantial construction to build an ADA accessible path, including path switchbacks, wheelchair rest areas, and retaining walls for support. The Marolt Trail route, shown in green, is a well-used pedestrian route crossing on a bridge over Castle Creek to the south.

Travel time on each route was based on a traffic engineering design criteria for pedestrian walking speed of 3 miles per hour, or 0.0501 mile per minute. Bicycle trip times were not included because of their variability.

Figure 2: Castle Creek Bridge West to 8th and Hallam Street Bus Stop

Table 1: Bike and Pedestrian Route Comparison from Castle Creek Bridge East to 8th and Hallam Street Bus Stop

Route	Distance	Pedestrian Walking Time
Castle Creek Bridge to 8th and Hallam (yellow line with "x" symbols)	0.19 mile	3.8 minutes
Castle Creek Bridge via Marolt to 8th and Hallam (green dots)	0.63 mile	12.6 minutes
Castle Creek Bridge via Power Plant Road to 8th and Hallam (blue dashes)	0.60 mile	12.0 minutes

Figure 3: Analysis of Routes into Downtown (7th and Main)

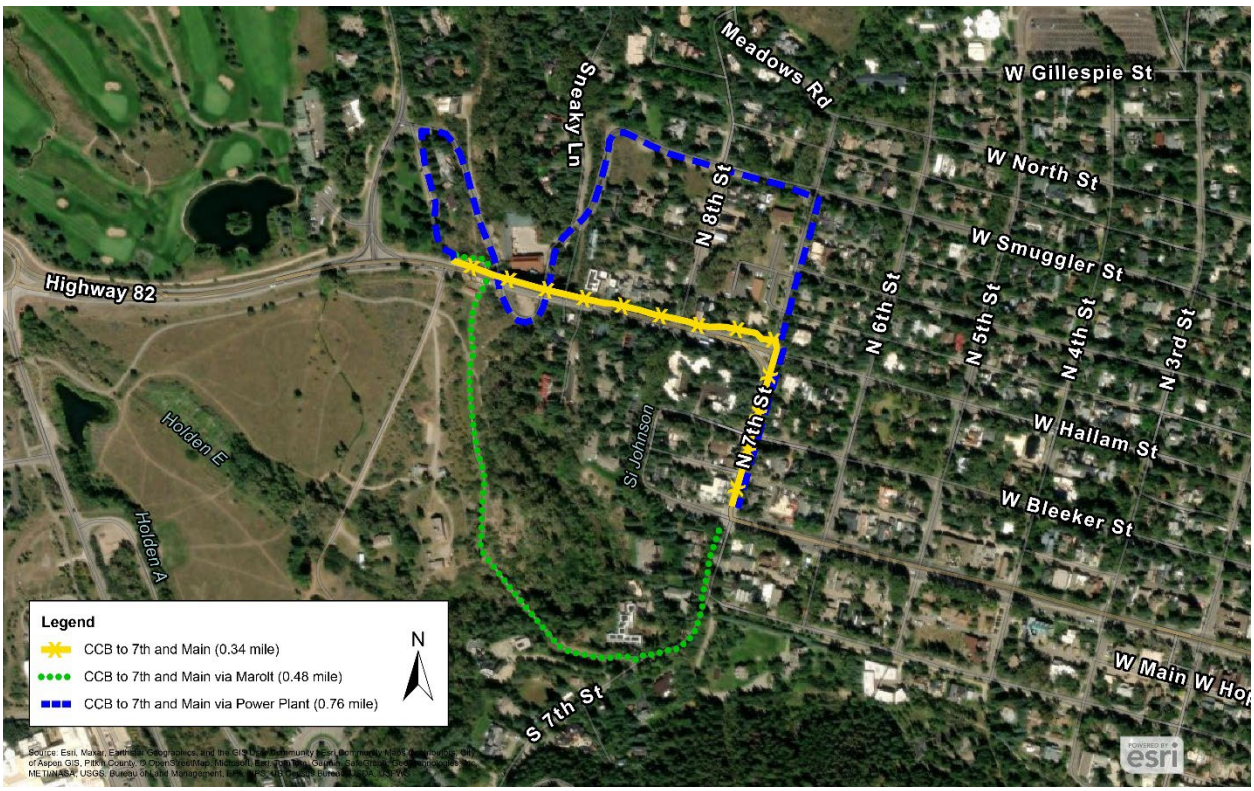


Table 2: Bike and Pedestrian Route Comparison from Castle Creek Bridge East to 7th and Main: Downtown Analysis

Route: Downtown Analysis	Distance	Pedestrian Walking Time
Castle Creek Bridge to 7th and Main (yellow line with "x" symbols)	0.34 mile	6.8 minutes
Castle Creek Bridge to 7th and Main via Marolt (green dots)	0.48 mile	9.6 minutes
Castle Creek Bridge to 7th and Main via Power Plant (blue dashes)	0.76 mile	15.2 minutes

Constructing a separate pedestrian bridge adjacent to the Three-lane Shifted bridge reconstruction is also feasible. The primary benefits of an adjacent separated structure are that the structure would allow pedestrians to remain on nearly the same alignment and grade as the existing sidewalks. The structure would better protect pedestrians from vehicular traffic and allow utilities to be relocated from the main bridge during construction, simplifying the construction. However, adding a pedestrian bridge would be unlikely to reduce overall costs.

5. Sidewalk Removal Impacts on the Bridge Options

When removing the sidewalk in the final configuration, the final bridge section would accommodate three 11-foot lanes and two 3-foot shoulders for a total out-to-out width of 42 feet, as compared to the 52-foot-wide options previously assessed in the Feasibility Study. Options that provide access for one lane in each direction (two-way traffic) during all construction phases were given priority. Pedestrian access during construction was eliminated if beneficial to the bridge construction. The benefits and challenges related to sidewalk removal on the ROW and bridge cost are summarized in the following sections for each option as compared to the same options with a sidewalk.

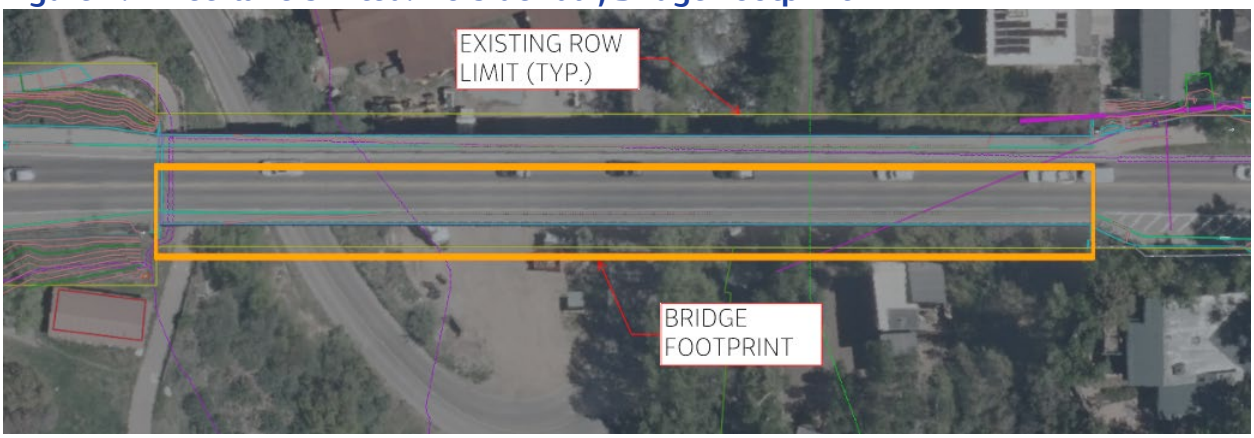
5.1.1 Three-lane Shifted: No Sidewalk

The Three-lane Shifted option was reassessed by removing the existing sidewalks in the final configuration; however, no significant benefits were observed. The existing sidewalk area cannot be used for vehicular traffic because the outside girder was designed for only pedestrian loading, which results in the same first phase of construction as previously presented for the Three-lane Shifted option. Refer to Figure 4 for the bridge footprint.

Benefits and challenges of this option are summarized as follows:

- **Benefits:**
  - Provides two temporary lanes during all construction phases
  - Results in narrower bridge width, which reduces overall bridge cost
- **Challenges:**
  - Maintains over 4 feet of ROW acquisition on the south side
  - Modifies the existing north sidewalk, removing the 3-foot sidewalk constructed in 2018
  - Retains a 4-year construction duration

Figure 4: Three-lane Shifted: No Sidewalk, Bridge Footprint



5.1.2 Three-lane Faster: No Sidewalk

Reassessment of the Three-lane Faster option with the sidewalks removed in the final configuration also provided no significant benefit. The main benefit of the original Three-lane Faster option was that it eliminated a construction phase by overbuilding the bridge width on both sides of the existing bridge, but it allowed only one lane of traffic on the existing bridge during the first phase of construction.

Without a sidewalk, the first phase of construction would still use a single lane of traffic as previously presented, which requires a companion detour for the opposing traffic direction. The total bridge width constructed would not change, as the required width is controlled by the second phase of construction, when two temporary lanes will be provided. Removing the sidewalk would only provide more room for vehicular access in the final configuration, further overbuilding the bridge beyond the width needed for only the traffic lanes and shoulders. The construction schedule would remain 3 years.

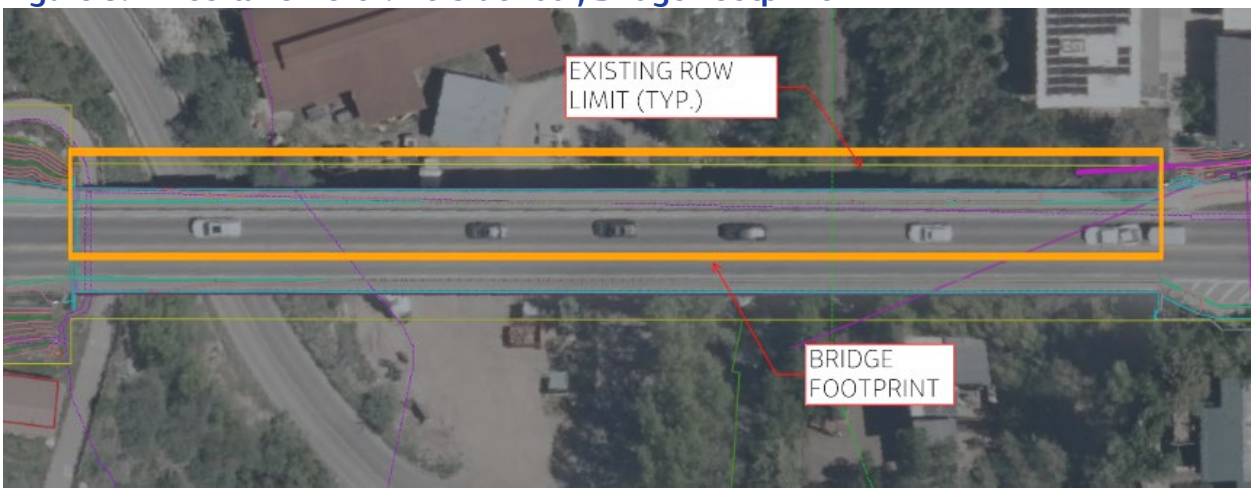
5.1.3 Other Option Considerations

Without the need for a sidewalk, other options that could accommodate two lanes during all phases of construction were briefly considered. Only one additional option, Three-lane North (Figure 5), could accommodate two lanes during construction. Shifting the bridge to the north was initially not considered feasible because of the ROW impacts.

The Three-lane North option was reassessed by removing the existing sidewalks in the final configuration; however, no significant benefits were observed. The new bridge location is still controlled by the first phase of construction to accommodate two lanes on the existing bridge. This option would require over 6 feet of ROW acquisition on the north side, resulting in a much larger acquisition area than the Three Lane Shifted (south) option. Beginning construction on the north side also requires all utilities to be relocated twice, increasing the cost and field time for utility work.

In summary, no traditional phased construction options accommodate two lanes of traffic on the existing alignment during all phases of construction without having ROW impacts. The Feasibility Study outlined one option that did not have ROW impacts, Three-lane Centered, which only accommodates one lane of traffic on the existing alignment in most construction phases.

Figure 5: Three-lane North: No Sidewalk, Bridge Footprint



5.2 Separate Pedestrian Bridge

Construction of an adjacent pedestrian bridge that supports utilities was considered. This concept is feasible and most advantageous combined with the Three-lane Shifted option, which does not extend beyond the north side of the existing bridge. This scenario allows the pedestrian bridge to be constructed first. The pedestrian bridge can also support the relocated utilities. Typically, a pedestrian bridge for this purpose is a prefabricated steel truss bridge.

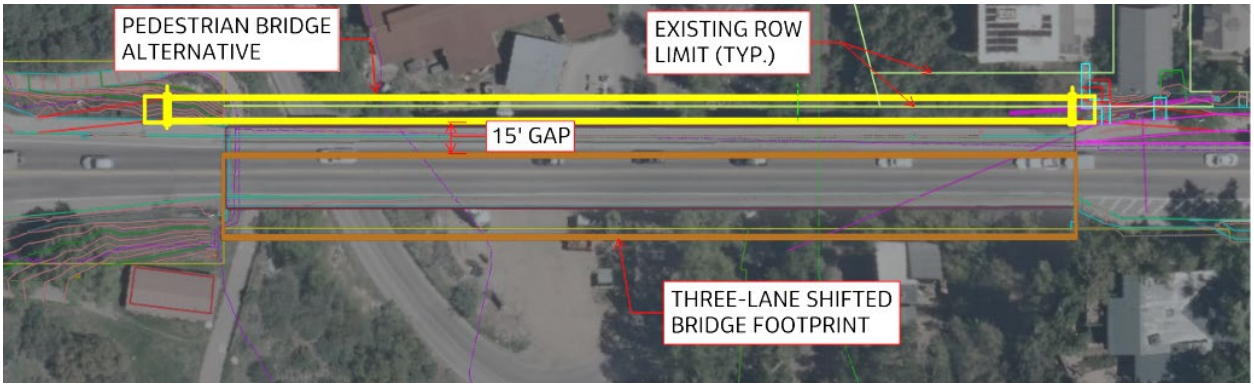
Benefits and challenges of constructing an adjacent pedestrian bridge are summarized as follows:

- **Benefits:**
  - Allows pedestrian access during all construction phases and permanently afterward. Section 4, Alternative Routes, provides additional information
  - Provides a support system for the relocated utilities, which can occur before the vehicular bridge construction starts
- **Challenges:**
  - Requires over 7 feet of ROW acquisition for a long stretch in the northeast corner
  - Requires reconstruction of each pedestrian access (sidewalk) for the residences at 926 to 930 West Hallam Street

- Introduces another bridge asset to maintain, with ownership to be determined between the City and CDOT
- Likely shuts down Power Plant Road for bridge erection if a prefabricated bridge type is used
- Requires retaining wall systems at both ends to adjust the grading for the new pedestrian bridge

The final configuration of a pedestrian bridge adjacent to the vehicular bridge would have a significant gap between the two bridges to accommodate construction phasing. The two bridges would be over 15 feet apart from one another. Figure 6 shows the approximate pedestrian bridge layout and inherent gap between bridges.

Figure 6: Pedestrian Bridge Footprint Adjacent to New Three-lane Bridge



The total site impacts to build a pedestrian bridge include the following:

- Almost 800 square feet (ft^2) of ROW acquisition, costing approximately $6,300,000[2]
- Additional 10-foot offset for a temporary construction easement (TCE), totaling $1,900,000[3]
- Approximately $2,500,000 in pedestrian bridge construction costs (does not include site construction cost)
- Closures on Power Plant Road for bridge erection

5.3 Comparison Summary Between Bridge Options

The three-lane bridge options with sidewalks previously analyzed in the Feasibility Study were compared to the similar alternatives without sidewalks. Table 3 summarizes the

[2] Assumes $8,000 per ft^2 of ROW acquisition, the same rate used in the Feasibility Study for accurate comparison.

[3] Assumes $1,500 per ft^2 of TCE, the same rate used in the Feasibility Study for accurate comparison.

comparison of the two sets of options, comparing ROW impacts, utility impacts, bridge cost, and construction duration.

Table 3: Comparison of Bridge Options With and Without a Sidewalk

Sidewalk Status	Bridge Options	ROW Impacts	Utility Impacts	Two Lanes Open During Construction	Bridge Cost Only[a]	Construction Duration[b]	Pedestrian Bridge Feasibility
Bridge with sidewalks	Three-lane Shifted	673 ft^2	1 relocation period required	On existing alignment	$10,000,000 (22,048 ft^2 of bridge area)	4 years	Not applicable
Bridge with sidewalks	Three-lane Faster	574 ft^2	1 relocation period required, or temporary support during construction	With temporary Marolt detour	$11,100,000 (24,557 ft^2 of bridge area)	3 years	Not applicable
Bridge without sidewalks	Three lane Shifted	673 ft^2	1 relocation required	On existing alignment	$8,100,000 (17,793 ft^2 of bridge area)	4 years	Feasible (requires separate pedestrian bridge)
Bridge without sidewalks	Three-lane Faster	574 ft^2	1 relocation period required, or temporary support during construction	With temporary Marolt detour	$11,100,000 (24,557 ft^2 of bridge area)	3 years	Not feasible
Sidewalk alternative	Pedestrian Bridge[c]	791 ft^2	1 relocation period	Not applicable	$2,500,000	< 1 year	Not applicable
Sidewalk alternative	Three lane Shifted with Pedestrian Bridge	1,464 ft^2	1 relocation period	On existing alignment	$10,600,000	4 years	Not applicable

[a] These costs do not represent complete Project costs, such as costs for ROW, TCE, mobilization, traffic control, site civil work, and other nonstructural items. Refer to Table 8 of the Feasibility Study for the cost estimates of the replacement alternatives with sidewalks.

[b] Refer to Table 7 of the Feasibility Study for the construction duration of the replacement alternatives with sidewalks.

[c] Excluding the utility impacts, the pedestrian bridge values are in addition to the vehicular bridge values.

6. Conclusions and Recommendations

Based on this analysis, conclusions and recommendations are as follows:

- The existing sidewalks provide an important and highly used bicycle and pedestrian connection.
- Federal and state policies dictate that removal of this connection would require providing a reasonable alternative route.
- Two of the alternative routes analyzed are substantially out of direction compared to the current route and are therefore deemed unreasonable. The third alternative route—a parallel and separated pedestrian bridge—could be constructed to serve pedestrians along the current alignment and grade. However, this pedestrian bridge would increase Project costs, increase ROW acquisition, and present other construction impacts.
- There is no significant benefit of sidewalk removal for ROW acquisition or utility construction.
- There are no traditional phased construction options that accommodate two lanes of traffic on the existing alignment during construction without having ROW impacts.

Based on this analysis, Jacobs recommends keeping sidewalks in the new three-lane bridge design.

7. References

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