The purpose of this memorandum is to summarize HDR’s feasibility study to reuse the existing west side steel staircase as part of MDT’s Higgins Ave Bridge rehabilitation project as requested by the City of Missoula.

Attached is an exhibit that shows the existing staircase relocated to the west to accommodate the bridge widening.

**Background**

HDR is under contract with MDT to provide engineering design services for the bridge rehabilitation project *(STPB 8113(8), UPN 8807000)*. The original scope of the project included relocating the existing stairs to accommodate widening of the bridge. However, it was later decided to replace the existing stairs primarily due to utility conflicts that would occur from the relocation. A new staircase design was developed to avoid the utility conflicts and provide some other upgrades for the stairway access to the bridge.

Based on subsequent coordination with MDT and the City, the utility conflicts are no longer a driving issue, and a renewed evaluation to reuse the existing staircase was deemed appropriate.

The goal of this feasibility study is to identify means of protecting utilities in place, determine what modifications to the staircase are needed, identify the possible impacts to Caras Park, evaluate ADA compliance, develop a cost estimate for re-using the staircase and determine other possible implications.
Summary of Recommendations for Reusing the Existing Staircase

Following a brief review of the existing staircase plans, site conditions, and proposed bridge rehabilitation project, HDR has the following recommendations if the existing staircase is reused:

- Relocate the force main sanitary sewer line in conflict with the new foundation. Alternatively, protect the sanitary sewer line in place with a concrete arch structure built around it to divert the pressure from the staircase foundation to either side the utility.
- Update the stairway handrail and tread risers to meet current ADA standards. This would require adding or replacing the current exterior hand rail and replacing/modifying the tread risers to eliminate the current gap.
- Modify staircase to fit within the reduced vertical space. Due to the bridge widening, some modifications are needed to accommodate the existing staircase height. Modifications would consist of cutting the columns to size, removing one or two bottom treads, and reworking the bottom stringers and handrail for the reduced height. Alternatively, the existing site at the base of the stairs could be re-graded to accommodate the existing stairs in-kind. However, significant grading may be required which would impact many of the existing features in Caras Park including drainage, landscaping, and access to the pavilion.
- The edge of the new bridge deck will be at a slightly different slope (north-south) than the existing staircase top landing. In order to account for this, the bridge deck concrete will have to be floated to match the stair landing or a custom cover plate will have to be fabricated to make up this difference.
- Updates to the current Higgins Avenue Bridge rehabilitation plans are necessary. The bridge plans will require updates to adjust the pedestrian rail layout, curb opening and reinforcement, and adjust the location of deck warping in the shared use path area.

Implications and Considerations

Based on HDR’s review, the following implications and considerations are noted if reuse of the staircase advances with the bridge rehabilitation project.

American Disability Act (ADA) Compliance

- Handrails: ADA standards (§ 505) as well as the 2018 IBC code (§ 1014.6) state that the handrails on staircases must be continuous around switchbacks or the handrails must continue 1-ft beyond the top stair at each landing. The current exterior handrail is discontinuous at each landing and does not extend past the top stair.
- Risers: Both ADA standards (§ 504.3) and the 2018 IBC code (§ 1011.5.5.3) state that the vertical riser between treads shall be solid over the full height of the riser. The current risers do not close the gap between the treads.
Utility Conflicts: The three lower landing foundations will need to be rebuilt within close proximity to four utility lines:

- A 12” diameter force main sanitary sewer line runs north-south under the proposed location of the 3 lower landing foundations. This line is located about 7-ft below ground. If the line remains in place it should be protected. For the purpose of this study it is assumed that this line would need a concrete arch built over top of it to redirect loading from the staircase.
- An 8” diameter gravity sanitary sewer lines also runs north-south under the proposed location of the 3 lower landing foundations. This line is about 15 ft below ground. It is assumed that there would be little pressure increase at this depth below ground and that this line would not need protection. However, excavation for any future repair/replacement of this line could potentially impact the staircase.
- Two 18” diameter gravity storm sewer lines converge on a manhole just to the west of the proposed staircase location. Both lines are between 7-ft and 10-ft underground and should not require relocation or protection from the staircase loading. However, they will need to be protected in place during the excavation and foundation work.

Impacts to Caras Park

- Reusing the existing stair foundations is not practical. New foundations that closely resemble the existing foundations are required to support the stairs in the new location. Decorative brick pavers to both the north and south of staircase will be disturbed by the open excavation required for new stair foundations required. The ground level landing on the north side will be directly on top of these brick pavers.
- The existing boulders and plaque currently located just west of the existing staircase will have to be removed and reset in a new location. Multiple Bike racks will need to be moved with the reset staircase. It is assumed that at least 2 trees will have to be removed by resetting the staircase in the proposed location.
- Overall, the existing use of the landscape near the pavilion may be impacted due to the shifted footprint of the relocated stairs.
- The relocated staircase will be significantly closer to the current construction permit boundary established for the bridge construction project. Additional negotiation of permit area may be needed for the contractor to excavate for the stair foundations. The use of temporary shoring is likely not practical since the shoring would be in conflict with the existing 18” storm sewer.

Modifications to the Existing Staircase: As described above, the existing staircase requires modification to fit vertically between the new bridge deck and existing ground in a new location. The following structural modifications would be necessary, and exclude any modifications that would upgrade the stairs to comply with ADA:

- Main Columns – Cut columns to proper length and weld on new base plates and cover plates to maintain the same member load capacity. Alternatively, structural analysis would be needed to confirm that the smaller column section (tapered columns) can support loads at the connection to foundation unit.
- Lower Landing Column – Cut columns to proper length and weld on new base plates.
- Lower Flight Stringers – Cut and revise the lower flight stringers in order to make up elevation difference.
- Handrail – Remove and rebuild lower portion of handrail in order to make up elevation difference.
- Grading – Localized grading work will be needed to make treads and stair landings function properly and meet ADA guidelines.

Alternatively, the existing ground in Caras Park could be re-graded to accommodate the existing staircase at its current height although this appears to be the most impactful and higher cost option. In general, this would create a depression in the landscape around the stairs of about one foot. There are many different variations on how the area could be re-graded to accommodate the stairs. Nonetheless, the cost to complete the re-grading is likely over $10,000 which is about the same cost estimated to revise the height of the stairs through structural modifications. Providing accessibility and drainage elements could significantly increase the cost associated with the re-grading option.

**Cost Summary**
The following represents the estimated construction costs associated with reusing the existing staircase.

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Foundations (incl. protection of sewer line)</td>
<td>$25,400</td>
</tr>
<tr>
<td>Staircase ADA Modifications</td>
<td>$8,300</td>
</tr>
<tr>
<td>Revise Height and Move Staircase</td>
<td>$43,000</td>
</tr>
<tr>
<td>Painting</td>
<td>$15,000</td>
</tr>
<tr>
<td>Miscellaneous Landscaping</td>
<td>$10,000</td>
</tr>
<tr>
<td>Total Cost</td>
<td>$101,700</td>
</tr>
</tbody>
</table>
EXISTING STAIRCASE RELOCATION

NOT TO SCALE

SECTION A-A

**Existing Right-of-Way**

- Existing edge of deck
- New edge of deck

**Existing Stairway Location**

- Relocate existing sewer
- Relocate existing sign
- Relocate existing boulders
- Relocate existing bike racks

**New Stairway Foundation (Typ.)**

- New footing (Wider than existing to help spread pressure around utility)
- Existing to help spread pressure around utility

**Groundline**

- Assumed excavation limits
- Structure
- Concrete arch structure
- Concrete arch

**Utility Protection**

- Underground power
- Storm sewer
- Force main

**Sanitary Sewer**

- Existing sanitary sewer
- 12" Ø Force main
- 6" Gravity sewer
- 8" Gravity sewer

**Existing Right-of-Way**

- Bike racks
- Existing Right-of-Way
- Existing stairway location

**Edge of existing brick pavers**

- New stairway foundation (Typ.)
- New stairway foundation
- Utility protection concrete arch structure

**NOT TO SCALE**

- Construction Permit
- Bike racks
- Storm sewer
- Force main
- Existing sewer
- 12" Ø Force main
- 6" Gravity sewer
- 8" Gravity sewer

**Sanitary Sewer**

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