

10/27/23

Subject: Existing Structure Assessment Results – Main St. Bridge, Central City**Project No.: 22039****Prepared by: Courtney Wand**

Summary of Previous Steps

In late 2022, Origin Design assisted Central City by presenting several alternatives for the repair or replacement of the existing Main St. bridge over the Wapsipinicon River. The existing bridge has two 4 ft. wide sidewalks and a 24' wide roadway. The north sidewalk is currently closed to pedestrians due to advanced concrete deterioration. The south sidewalk has also experienced deterioration though it is currently open to pedestrians.

After presenting 3 alternatives to the City, it was decided to proceed with Alternative 1 which consists of replacing the existing sidewalk concrete slabs and re-using the existing steel brackets and steel railings. Origin Design also prepared preliminary structural calculations at that time which determined that the exterior steel beams would generally be strong enough to support replacing the existing 5" thick sidewalk slabs with new 6" thick slabs.

Existing Structure Assessment Results

As part of the current phase, Origin Design performed additional structural calculations to determine if the existing sidewalk brackets or connections would require any strengthening to support a new sidewalk slab. The existing brackets, connections, railings, and exterior beam were also inspected using a snooper truck on October 11, 2023. The results of those efforts are summarized below.

Structural Calculation Evaluation

An in-office evaluation of the structural components supporting the sidewalk slabs was completed. It was determined that the existing steel brackets, bolted connections, and edge channels generally have adequate capacity to support a new sidewalk slab. Summary Table 1 of each component's load to capacity ratio is included below. A ratio of 1.0 indicates that the member is exactly as strong as required to support the anticipated loading. Ratios less than 1.0 indicate that the component has reserve strength. Figure 1 depicting each analyzed location is also below.

As noted in the table, the exterior beam does not have appreciable reserve capacity (ratio=0.995). As a result, it is not recommended that the sidewalk be widened to create a 5'x5' ADA turning space because adding additional load to the exterior beams would result in the bridge having less than the full legal load capacity for all of the Iowa DOT's required vehicles. Therefore, it is not possible to create the 5'x5' turning space on the bridge without needing to restrict legal traffic on the roadway portion which would be detrimental to the bridge's use, or without modifying the exterior beams, which is not included in the current project scope. Please retain this summary document in the project's file.

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Table 1 - Structural Analysis Results

Component	Ratio of Load/Capacity	Notes
Exterior channel	0.58	15% general reduction in capacity due to observed condition
Short (without Light Pole) Bracket Member	0.24	5% general reduction in capacity due to observed condition
Short Bracket Bolted Connections	0.89	Based on member strength versus actual loads. Does not include reductions for missing hardware, corrosion.
Long (with Light Pole) Bracket	0.18	5% general reduction in capacity due to observed condition
Long Bracket Bolted Connections	0.58	Based on member strength versus actual loads. Does not include reductions for missing hardware, corrosion.
Exterior Beam	0.995*	No reductions taken due to beam condition. *Additional analysis of splice plate required.

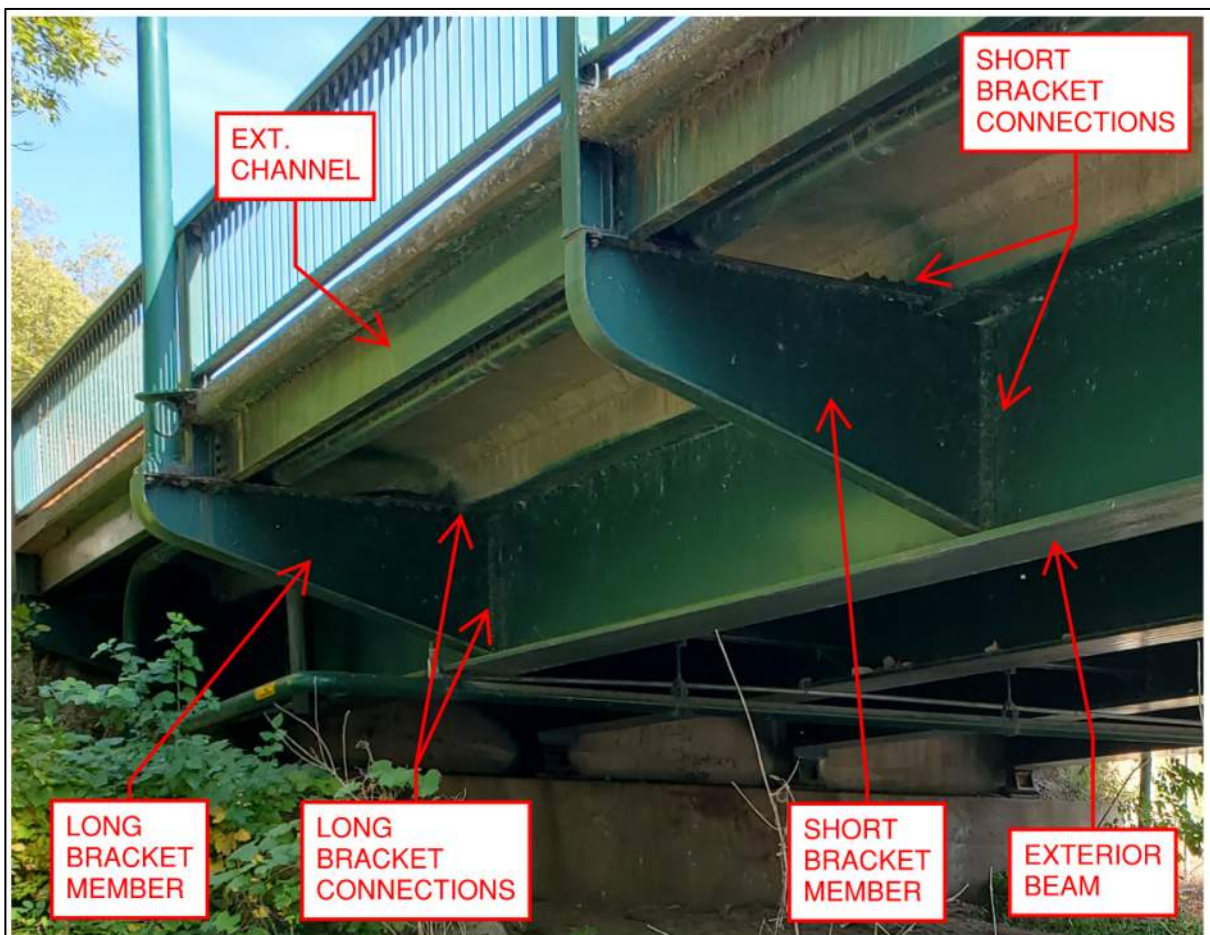


Figure 1 - Analysis Locations

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Field Assessment Evaluation

A snooper inspection was completed on October 11, 2023 by Nathan Miller of Origin Design. Trevyn Cunningham from Central City Public Works was also present to coordinate traffic control. The investigation covered the underside of both the north and south sidewalks. The general condition of the sidewalk supporting members such as the brackets, exterior channels, railing and bracket connections, and exterior beams were observed. Photos of the key findings are included in Table 2 below.

Table 2 - Key Photos

Photo	Description
	Underside view

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Underside
of sidewalk
slab



Long
bracket,
corrosion
of rail post
connection
and top
plate of
bracket.
Blistering of
bracket
web.


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	<p>Closeup of bracket top plate and railing post connection</p>
	<p>Exterior channel section loss at railing connection</p>

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	<p>Exterior channel general corrosion and pack rust along length</p>
	<p>Failed drain</p>

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	<p>Split light pole plate, exterior channel corrosion, bracket top plate corrosion</p>
	<p>End of short bracket plate</p>

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	<p>Isolated corrosion of exterior beam top flange near drain</p>
	<p>Missing nut and corroded bolt at railing connection on bracket, corrosion and section loss of bracket top plate and web</p>

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	<p>Bracket top plate severe section loss at railing connection</p>
	<p>Exterior beam, corrosion of splice plates near drain</p>

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Closeup of exterior beam splice plate corrosion and section loss



Light pole strapped to railing. Split connection plates.

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	Bracket top plate connection to exterior channel
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Recommendations

Based upon the results of the structural calculations and field assessment, the following are our recommendations to add to Alternative 1 in addition to replacing the sidewalk slabs, deck drains, and concrete curbs as initially proposed.

- > **Replace the exterior channels.**
 - A WF "I-beam" section of similar height could be used to replace the existing channels.
 - Include new bolted connections for reconnecting to the existing railing and light poles.
- > **Remove and reinstall the existing steel railing. Replace light poles.**
 - Once removed from bridge, repair or replace damaged or corroded bases and connections from existing railings.
 - Failure of multiple light poles necessitates replacement.
- > **Repair or replace select locations of the sidewalk brackets.**
 - Primarily the top plate of the brackets was noted to have the most corrosion and section loss near railing connections. Repair or replace the most severe sections.
 - Other areas include select locations where the bracket connects to the exterior beam.
 - It may be more economical to replace entire brackets in some locations.
- > **Calculate impact to bridge capacity of the corroded splice plates on the exterior beam.**
 - Recommendation will depend on the required strength versus actual strength remaining.
 - Repair or replacement in this location is not economically feasible.
- > **Painting**
 - Spot repainting of exterior beam.
 - Blasting and repainting in-place cantilever brackets.
 - Blasting and repainting of existing railings once removed from bridge.
 - Painting new light poles and new exterior channels to match existing paint.



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Next Steps

The following are the recommended next steps for the project.

- > **Evaluate the corroded exterior beam splice plates.**
- > **Prepare estimate of probable construction costs for the additional work in the Recommendations.**
- > **Compare the estimates of probable construction costs for the 3 original alternatives with the updated Alternate 1 costs.**
- > **Meeting to review Alternative costs and confirm scope.**
- > **Field topographic survey to establish sidewalk tie-in points.**
- > **Final Design Development**

- > **The schedule summary is as follows:**

Milestone	Original Schedule	Actual or Anticipated Completion Dates
Authorization to Proceed	September 1 st , 2023	September 6 th , 2023
Snooper Inspection	Late September 2023	October 11 th , 2023
Existing Structure Assessment	October 6 th , 2023	Mid-October* *Except topo survey still to be completed
Assessment Results Virtual Meeting	Early October 2023	Late October 2023
Final Design Development plan delivery	December 8 th , 2023 for review at December 13 th , 2023 Council Meeting	May shift due to potential increases to Final Design scope.
Bidding	January 2024	Would shift if Final Design is shifted.
Construction	Completed by September 30, 2024	May or may not need to shift depending on final scope of project if Contractors are still anticipated to be able to complete the work over spring/summer.

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> The design fee effort summary is as follows:

- Snooper inspection took only 1 day to complete instead of 2 days.
- Existing structure in-office calculations took the anticipated amount of time.
- Additional efforts will be required to analyze the exterior beam splice plates as a result of the snooper inspection.
- Additional efforts will be required to develop estimates of probable construction costs for new scope items identified in the Recommendations section as a result of the inspection.
- Overall, the Existing Structure Assessment fee is anticipated to increase by \$4,500 considering both the reduction in snooper efforts and the addition of more analysis.
- The Final Design Development would need additional fee if additional details and repair items are to be included in the plans.