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Project: Pine River Ranches #2 Subdivision

Date: May 9, 2018

To: The Pine River Ranches Homeowners Association Board Members

Cc:

From: Garth Glasco, P.E., S.E.

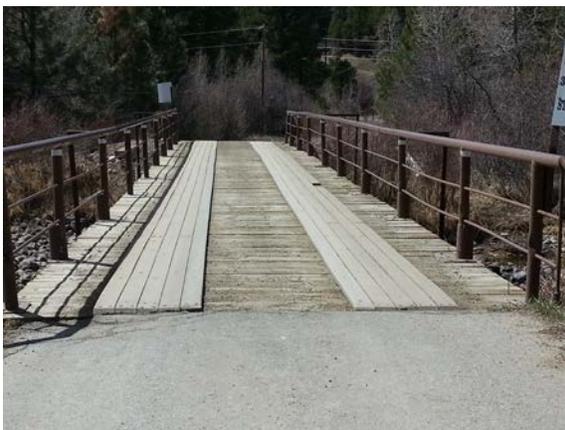
Re: Bridge Structure Assessment

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At your request, Goff Engineering & Surveying Inc. (Goff) provided a structural inspection for the Pine River Ranches #2 Subdivision bridge structure on Ludwig Drive, crossing the Pine River. The structural inspection request is to determine the general condition of the bridge at this time.

The Ludwig Drive bridge across the Pine River provides access to the Pine River Ranches #1 Subdivision, the Pine River Ranches #2 Subdivision, plus other parcels adjacent to the subdivisions. Approximately 100 lots are accessed by the bridge structure, many are year-around residences. The only access for these lots is the Ludwig Drive bridge.

The bridge was originally constructed in 1988, and is a single lane bridge approximately 12-feet wide. The bridge consists of an abutment on each bank, a central support located in the river, and two spans of 30 feet, and 44 feet. The primary structural bridge girders that carry the vehicle load are two steel "I" beams for each span. The deck of the bridge is constructed with 4x12 wood planks that cantilever over the "I" beams approximately 2'-8" each side. The cantilevered deck planks have additional support using steel angle brackets approximately 6-feet on center, supporting a 6-inch channel. Currently, the wheel planks are 1-inch trex decking.



Bridge Deck



Bridge Profile



Bridge Steel Bracket Support at Deck Cantilever

Goff provided a structural inspection of the bridge in 2006. In addition, we reviewed the inspection report provided by CH2M Hill, dated April 2, 2012. Both inspection reports concluded the bridge structure was adequate, as long as the bridge is specifically used in compliance with the rules defined on the road sign posted on the east side of the bridge: “Restricted bridge ahead G.V.W. 64,000 pounds max. Center of tire prints of any and all axles shall not exceed 72 inches. Tires must be centered on “T” beams of bridge super structure.”

Goff inspected the bridge structure again on Friday, March 23, 2018. At this time, the bridge inspection consisted of a visual observation of the overall condition of the bridge, and address any safety concerns. The load capacity of the bridge girders have been verified in previous reports.

As noted in previous reports, the existing bridge structure does not meet current bridge design codes, such as American Association of State Highway and Transportation Officials (AASHTO). When the bridge structure was originally constructed, the bridge structure did not meet any bridge design codes at that time. One of the primary intents of design codes is to ensure public safety.

If bridge users understand the bridge structure, and comply with the rules stated on the sign approaching the bridge, users can cross the bridge safely. Since our original inspection in 2006, and since the inspection by CH2M Hill in 2012, Ludwig Drive has become more used. During our recent field inspection, we observed at least (20) vehicles cross the bridge during a 1-hour period of time. At this time, one can easily surmise there are a number of users crossing the bridge who are unfamiliar with the bridge, and who miss the sign approaching the bridge.

If Ludwig Drive and the bridge were designed today for a 100 lot subdivision, in accordance with the La Plata County Code, the following will result:

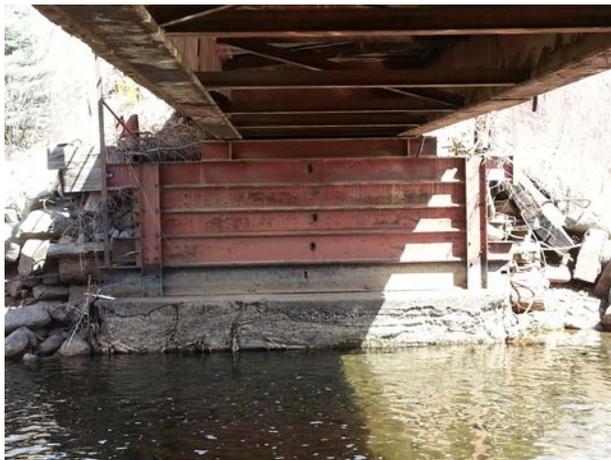
- Average Daily Trips (ADT) is approximately 800.
- Road width plus shoulders is 30 feet.
- Bridge to be designed in accordance with the AASHTO code and constructed in accordance with the Colorado Department of Highway Standard Specifications for Road and Bridge Construction.
- Clear bridge deck with is 30 feet.
- Pedestrian walkways and railings shall be as warranted.
- Since Ludwig Drive is a dead end road, a secondary access road, or emergency access road will be required.

The primary reason for the final item in the list above is to protect the health and safety of the subdivision residents. In this area, the primary emergency will be wildfires. It is foreseeable for a wildfire to close off access to the bridge, thus stranding subdivision residents and eliminating access for emergency vehicles.

During our recent site visit for the bridge inspection, we observed the following:

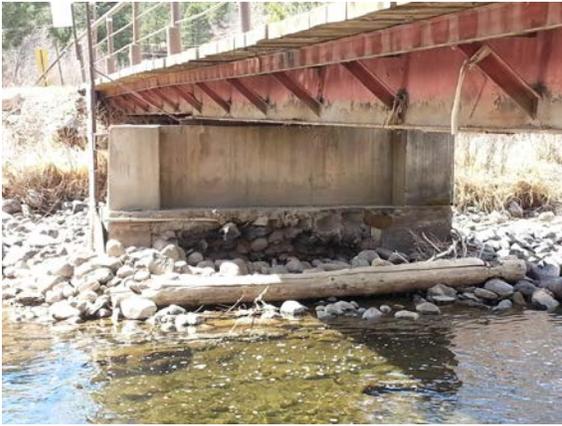
**Bridge Girders:** The bridge girders are structurally adequate for the posted load limit and speed. However the bridge girders are not structurally adequate in accordance with current AASHTO codes.

**East Bridge Abutment:** The east bridge abutment consists of horizontally stacked steel wide flange beams, with vertical steel channels embedded in a concrete foundation.



The east bridge abutment has experienced deterioration and settlements. Since the abutment is retaining soil, the lateral loads applied to the abutment has caused the top to deflect towards the river. Although the east abutment has been performing over the years, the abutment capacity is suspect and does not meet current AASHTO codes.

**Central Bridge Pier:** The central pier has experienced scour, undermining the central pier foundation.



**Bridge Decking:** Based on the many different vehicles using the bridge, many heavier construction vehicles, and the many different users, we consider the bridge decking to be not adequate, and poses a safety concern. The bridge decking is only adequate if the vehicles remain centered over the bridge girders below. If vehicles with heavier wheel loads veer to one side, loading the cantilevered portion of the decking, the decking will fail.



Underside of Bridge Decking



Cantilevered Bridge Deck Ends

**Bridge Guardrail:** The bridge guardrails are not in compliance with AASHTO code for strength or geometry. We consider the guardrails as very deficient and not safe. If a vehicle veers into the guardrail, and if the bridge decking does not fail first, the guardrail will certainly fail.



In summary, the subdivision bridge structure has performed and provided access for the past 30 years. However considering the population growth the subdivision has experienced, along the increased use of the bridge, we consider the overall bridge structure to be unsafe. We highly recommend the one-lane bridge be replaced with a new two-lane bridge, with a minimum 24-foot width, designed in accordance with current AASHTO code. If a second emergency access to the subdivision cannot be accomplished, we recommend the bridge width be 30-foot minimum.

Goff Engineering & Surveying, Inc. has been pleased to assist you in your project. If you require any additional information, or if you have any further questions, please do not hesitate to contact us. We are available to meet with you in any schedules meetings.