



January 18, 2019

Ed Rodgers  
Delaware Riverkeeper Network  
925 Canal Street, Suite 3701, Bristol, PA 19007  
215 369 1188 ext 102

RE: Golden Pheasant Bridge  
**M&A #3575-1**

Dear Ed:

At your request, I met you at the Golden Pheasant Bridge on January 12, 2019 to review the recently completed interim repair project. I also reviewed the corresponding documentation for the project that you provided. This letter report summarizes my observations.

The bridge crosses the Delaware Canal and is located adjacent to the Golden Pheasant Inn. The canal towpath extends below the bridge on the east side. The superstructure consists of concrete cast on steel deck that is supported by four 30-inch deep structural steel beams made of weathering steel. The steel beams are supported on concrete caps that measured 3 feet wide and varied in thickness from 18 to 21 inches on the east abutment. The concrete caps are supported by the original stone masonry abutments.

The construction plans indicate that the average daily traffic count is 2147 vehicles and that the bridge is rated for Pennsylvania maximum legal loads.

According to the documentation provided, the bridge was constructed in 1932, but since the adjacent Golden Pheasant Inn was constructed in 1857, it is likely that the stone masonry abutments were constructed earlier during the canal era to support a bridge access the canal and allow access to the inn. The bridge is listed as a contributing element to the Erwinna Historic District.

The bridge width was measured to be about 16'-8" between concrete curbs with a clear width between steel guardrails of about 16'-0". There is a stop sign at each end of the bridge as well as one-lane bridge signs. We witnessed considerable traffic during our time at the bridge. Each vehicle stopped before proceeding across the bridge using the full width as a single lane. When vehicles arrived at both ends of the bridge at the same time, one vehicle would cross while the vehicle in the other travel direction waited at the stop sign.

The stones at the base of the abutments are typically larger than at the top. Stone sizes were measured from 2 inches to 10 inches in height and varied up to 54 inches in length. There is a concrete apron or skirt at the base of the west abutment that predates the repair project. The coursing of stones at the west abutment above the concrete skirt slopes toward the middle, and may indicate past settlement of the masonry.

In photos of the masonry abutments taken after installation of the concrete caps, there are numerous cracked stones, deteriorated stones, and mortar joints with missing mortar. This stone masonry was later repaired by

filling the joints between stones with mortar. There are still cracked and deteriorated stones, but the abutment is providing adequate support to the superstructure.

Construction plans and specifications for the masonry repairs were not provided with the other project documents. This documentation did include an email request from the Friends of the Delaware Canal dated July 24, 2018 requesting information about proposed masonry repairs: *"In order to better understand the effects on the existing abutments that bookend the Delaware Canal as well as the wingwall, would the consultant or engineer please provide additional details about the extent of work and procedures involved in "Repoint and repair stone masonry abutments and reconstruct partially collapsed wingwall at southwest corner of the structure".* The response email dated July 30, 2018 states: *"Thank you for your email. I shared your email with the PennDOT project manager and the design consultant. The only work proposed for the abutments is resetting loose and missing stones and repointing, as necessary. The partially collapsed wingwall at the southwest corner of the bridge will be reconstructed in-kind."*

There are a number of common elements shared between the Golden Pheasant Bridge and the Headquarters Bridge:

1. Spans – Both bridges support simple span superstructures supported on historic stone masonry substructures. The Golden Pheasant bridge span is 45 feet and the Headquarters has three spans of about 25 feet each. The Golden Pheasant's longer span produces heavier loads on the masonry abutments than Headquarters shorter spans.
2. Stone masonry coursing - both bridges have similar sized larger stones near the base of the abutment and similar sized smaller stones near the top.
3. Stone damage – the stone masonry for both bridges contains cracked and deteriorated stones. Both bridges supported traffic loads on these masonry abutments prior to repairs, and the Golden Pheasant now supports full PennDOT legal truck loading on stone masonry that was repaired.
4. ADT – the average daily traffic on the Golden Pheasant is 2174 vehicles and Headquarters is 643 vehicles according to the PennDOT 2012 Biennial report.
5. Lane width – There is a 16-foot lane with on the repaired Golden Pheasant bridge and a similar to the original 16-foot lane width used at Headquarters bridge and was proposed for that bridge in our preliminary design plans that we provided you.
6. Concrete cap – A concrete cap was placed on Golden Pheasant and a similar cap was proposed for Headquarters. These elements distribute the loads from the superstructure into the abutments.
7. Contributing elements to Historic District – The Golden Pheasant Bridge was identified as a contributing element to the Erwana Historic District and the Headquarters Bridge was identified as a contributing element to the Ridge Valley Rural Historic District.

Although the Golden Pheasant Bridge project plans were labelled "Interim Emergency Repair", the bridge superstructure repair was constructed using standard PennDOT details and materials. If maintained, this bridge will provide adequate service for a long period of time. A similar approach could be employed at the Headquarters bridge, where the stone masonry piers and abutments can be also repaired to support a new superstructure that uses standard PennDOT details and materials. According to the project email documentation provided, the design and construction of the Golden Pheasant Bridge repair was completed in less than 6 months.

The recent repair project at the Golden Pheasant bridge demonstrates a successful combination of a modern 16-foot wide superstructure supported on a repaired stone masonry substructure that allows the preservation of historic materials. If a similar repair project was implemented at the Headquarters Bridge, it could be further improved by the following:

1. Using painted or galvanized steel stringers, or precast concrete stringers to avoid rust stains from weathering steel
2. Basing mortar repair materials on a cementitious material which allows for better vapor transmission than Portland cement, such as natural cement
3. Installing grouting repairs to the stone masonry prior to placing the concrete caps for better load distribution of superstructure self-weight
4. Using a more attractive bridge barrier such as PennDOT standard PA Type 10M rather than W-beam.

Based on my site visit and review of project documents, it is my opinion that the repair project recently and successfully installed at the Golden Pheasant bridge could be implemented in a similar manner at the Headquarters bridge and provide as good or better results.

Sincerely,

**McMULLAN & ASSOCIATES, INC.**

A handwritten signature in blue ink that reads "Douglas E. Bond".

Douglas E. Bond, PE  
Vice President