
GANNETT FLEMING MEMORANDUM

Date: January 27, 2016

To: Radnor Township

From: Gannett Fleming

Re: Eagle Road Culvert Field View

A field view was performed on November 4, 2015 of the above-referenced culvert located just west of its intersection with North Wayne Avenue which carries Eagle Road over Gulph Creek in Radnor Township, Delaware County. The field view was performed to determine the need for the structure's repair, rehabilitation, or replacement. The field view was limited to observation of the above ground, visible and accessible elements. Elements below water line or ground line were not assessed. Load ratings and structural plans of the existing bridge were not available at the time of field viewing.

Structure Description

The at-grade dual corrugated metal pipe culvert is approximately 25' long and carries two (2) 10'-0" lanes of vehicular traffic. The dual corrugated metal pipe structure has a skew of approximately 70 degrees, an approximate rise of 40", and a span of 6'-3". The headwall is comprised of grouted stone masonry.

Gulph Creek flows from northwest to southeast. The waterway alignment entering the culvert is generally straight with a gradual transition from the streambed into the pipes.

There is a 4' wide (out-to-out) pedestrian concrete slab bridge located approximately 13' downstream from the edge of roadway, the pedestrian bridge features 48" high steel railing on both sides.



General View of Culvert and Pedestrian Bridge



Underdeck View of Pedestrian Bridge

Structure Findings

The condition of the culvert, grouted stone masonry headwalls, as well as structure-mounted guiderail were viewed to determine if any deficiencies could compromise the structure's functionality. Findings on the culvert are summarized as follows:

Culvert

Both steel pipes are heavily corroded with rust laminations throughout. Water flow is diverted to the east pipe only. There is significant silt deposits throughout the west pipe and at the inlet. Water depth in the east pipe at the time of field investigation was approximately 6 inches.



West Pipe with Heavy Silt Built-up



East Pipe with Apparent Heavy Rust

The dual corrugated metal pipes appear to be misaligned at the un-spliced abutting joints and have areas of distortion due to differential movement. The misalignment of the joint in the west pipe has resulted in the loss of fill behind the pipe wall. The crown of the east pipe for a distance of approximately 12 feet from the inlet appears to have excessive deformation. The location of the misalignment and deformation falls within the roadway travel lane.



Misaligned/Distorted West Pipe Shows Loss of Fill Material



Upstream portion of East Pipe shows Excessive Deformation & Separation from Abutting Section

Grouted Masonry Headwalls

The south headwall is comprised of piled and grouted stones and has a few locations of missing grout joints and is in overall fair condition. The north headwall has areas of voids and loose stones above and between the corrugated pipes.



South Grouted Masonry Headwall



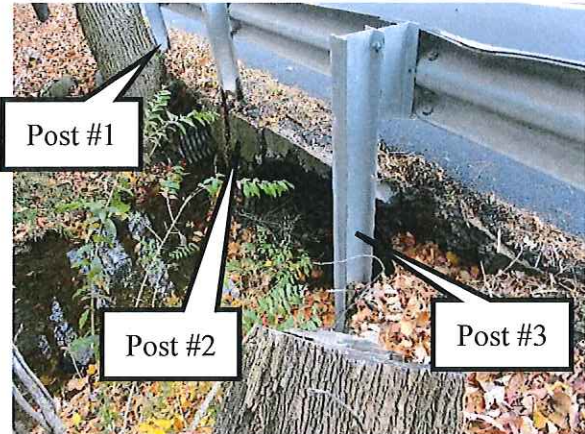
North Grouted Masonry Headwall

Structure Mounted Guiderail

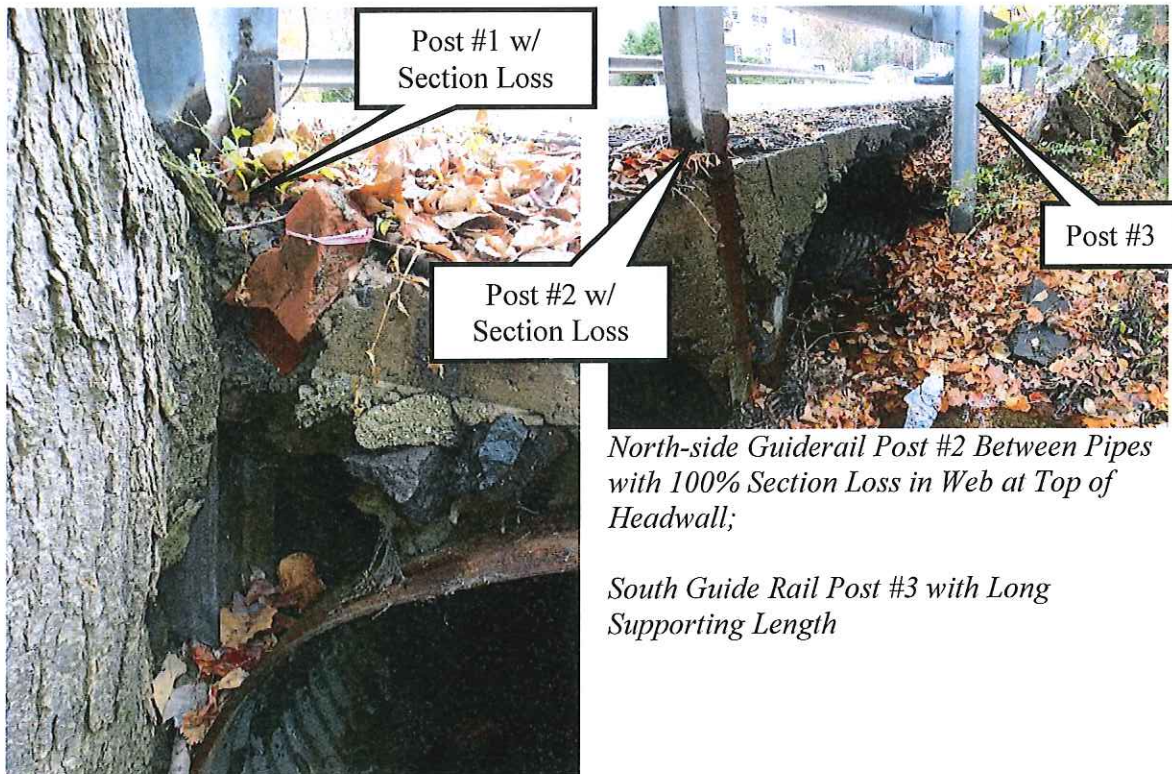
Guiderail extends across the culvert on both sides with railing posts engage each structure headwall. For the south headwall, the three posts are mounted to the headwall with baseplates and anchor bolts, these post and anchor bolt connections are in good condition, however the load carrying capacity of the headwall is questionable. For the north headwall, only the middle post (post #2) engages the headwall. There is severe section loss in posts #1 & #2. Post #1 is supported by a tree, post #2 is cast in the headwall and post #3 is supported from streambed, posts and guiderail are displaced.



Guiderail Posts at South Fascia



Guiderail Posts at North Fascia



North-side Guiderail Post #1 Behind Tree

North-side Guiderail Post #2 Between Pipes with 100% Section Loss in Web at Top of Headwall;

South Guide Rail Post #3 with Long Supporting Length

Conclusions

The corrugated metal pipes have extensive surface rust throughout. The pipes are misaligned at the un-spliced abutting joints with the east pipe showing signs of distortion. There is extensive silt build up in the west pipe and inlet with stream flow diverted primarily to the east pipe. The north grouted masonry headwall has areas of voids and loose stone, the headwall does not have capacity to provide anchorage for guiderail posts.

Safety Features

The north edge of the roadway is deteriorating and subsiding. Posts of guiderail system along north side are deteriorated and substandard. A large tree adjacent to north end of culvert does not allow for adequate guiderail deflection. Guiderail along south side of the roadway is in better condition and does contain end treatments, but is substandard.

Environmental

Eagle Road crosses Gulph Creek which supports protected water uses for Warm Water and Migratory Fishes (WWF/MF) according Title 25, Chapter 93 of Pennsylvania State Code. The stream is not trout-stocked nor does it support a naturally reproducing trout population. A PNDI database search was conducted and no state or federal endangered species were identified as a result of the search.

According to the Pennsylvania State Historic Preservation Office's Cultural Resources GIS website, the North Wayne Historic District is located southeast of the bridge. We assume that the proposed work will not impact this Historic District.

It appears that replacement of the bridge would require a PADEP General Permit #11 for Maintenance, Testing, Repair, Rehabilitation or Replacement of Water Obstructions and Encroachments. It is assumed that federal authorization for this activity can be authorized by PASPGP-4 that will be issued by PADEP.

If wetlands are present, and greater than 0.05 acres of impacts are expected, GP-11 does not apply and A Joint Chapter 105/Section 404 Permit may be required.

Geotechnical

A Site Geology Map, extracted from the Geologic Quadrangle Maps of Pennsylvania, indicates that the Eagle Road structure is underlain by mica schist of the Glenarm Wissahickon Formation (Xgw). According to *Engineering Characteristics of the Rocks of Pennsylvania*, the Glenarm Wissahickon Formation (Xgw) is described as an oligoclase-mica schist that is coarsely crystalline.

For a replacement structure, the geotechnical investigation will consist of drilling four borings to a maximum depth of 30 ft below the ground surface. Rock will be cored for 5 ft if encountered. Laboratory testing will be conducted on the recovered samples as necessary. Following the subsurface investigation and the laboratory testing GF will prepare a brief memo with recommendations.

Recommendations

Based on the field assessment and finding, it is recommended to replace the deteriorated corrugated pipes.

The following short-term recommendations are made in order to extend the serviceability of this structure:

- Repack grouted north head wall to avoid continue undermining of pavement material.
- Replace guide rail and posts along north fascia per RC-52M.

A conceptual construction cost estimate and estimate of engineering cost is provided for the recommended work.

Eagle Road over Gulph Creek Culvert Replacement

Construction Item Estimate:

	Structure:	Unit	Qty	Unit \$	Item Cost
1	Bypass Pumping	LS	1	\$7,000	\$7,000
2	Removal of Existing Structures	LS	1	\$10,000	\$10,000
3	Class 3 Excavation	CY	170	\$60	\$10,200
4	Structure Backfill	CY	89	\$50	\$4,450
5	#2A or AASHTO #8 Aggregate under Culvert	CY	45	\$100	\$4,500
6	#57 Aggregate	CY	2	\$100	\$200
7	Class AA Concrete for Headers	CY	2	\$2,000	\$4,000
8	Reinforcement Bars, Epoxy Coated	LB	200	\$3	\$600
9	Riprap	CY	50	\$80	\$4,000
10	Precast Box Culvert	LS	1	\$45,000	\$45,000
11	Precast Box Culvert Outlet Section	LS	1	\$6,000	\$6,000
12	Alternate Grouted Cutoff Wall	CY	12	\$100	\$1,200
13	Bridge Railing	LF	36	\$200	\$7,200
				Total Str. Cost:	\$104,350

Roadway

1	Clearing and Grubbing (incl removal of large tree)	LS	1	\$5,000	\$5,000
2	Class 1 Excavation	CY	75	\$25	\$1,875
3	Approach Pavement	SY	160	\$55	\$8,800
4	Precast Concrete Curb	LS	1	\$2,000	\$2,000
5	Traffic Control	LS	1	\$2,400	\$2,400
6	Guide Rail (incl 4 turn downs)	LS	1	\$9,250	\$9,250
				Total Roadway Cost:	\$29,325

Total Construction Cost: \$133,675

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+ 5% Mobilization

+ 20% Contingency

Construction Total: \$168,000

Engineering Fee: \$98,300

Total Project Cost: \$266,300