# FEASIBILITY STUDY FOR THE EAST BRADY TUNNEL AND PORTALS

## EAST BRADY TUNNEL
## UNDER S.R. 0068 AND S.R. 2023
## BRADY TOWNSHIP
## CLARION COUNTY, PENNSYLVANIA

***Prepared for***

**Allegheny Valley Land Trust**

***Prepared by***

**American Geotechnical & Environmental Services, Inc.**
**Canonsburg, Pennsylvania**

***and***

**Senate Engineering Company**
**Pittsburgh, Pennsylvania**


**JANUARY 2014**

**Revised APRIL 2015**
**A.G.E.S., INC. PROJECT NO. 13060L**

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April 10, 2015

Mr. William F. Braun, P.E.
Senate Engineering Company
U-PARC
420 William Pitt Way
Pittsburgh, PA 15238

Re: Feasibility Study for the East Brady Tunnel and Portals - **Revised**
Feasibility Study Report
A.G.E.S., Inc. Reference No. 13060L

Dear Mr. Braun:

American Geotechnical & Environmental Services (A.G.E.S.), Inc. is pleased to submit the Feasibility Study Report for the above referenced project. Included in this report is the preliminary evaluation of the existing conditions at the project location, repair options, and recommendations.

We wish to extend our appreciation to be of service to you. Should you have any questions or require additional information, please contact us.

Very truly yours,

**American Geotechnical & Environmental Services, Inc.**

Vishal Patel, E.I.T.
Geotechnical Specialist

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Project Geotechnical Manager

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# 1.0 INTRODUCTION

## 1.1 Location and Description

The East Brady Tunnel is located approximately 1.7 miles east of the town of East Brady in Brady Township, Clarion County, Pennsylvania. The tunnel passes below S.R. 0068 and S.R. 2023 at approximately 503 feet and 363 feet, respectively, above the invert[1]. It was completed in 1915 and last operated by Consolidated Rail Corporation circa in 1984. Since then the rail tracks have been removed and the right-of-way deeded over to Allegheny Valley Land Trust (AVLT). Rock cuts approximately 70 and 80 feet high are present on north and south portals and extend 200 feet and 350 feet from the face of the portals, respectively. The tunnel is approximately 2,468 feet long from portal to portal[2]. The floor elevation at north and south portal is 855 feet and 847 feet, respectively. It has an inverted U shape because the arch is cylindrical, the walls are vertical, and the invert is approximately flat. It is approximately 30 feet wide and 25 feet high at the crown. The site location is presented on the General Location Map and Project Location Map on Figure 1 and Figure 2, while the tunnel layout is presented in Appendix A.

## 1.2 Tunnel Background Information

Literature review and keystones at tunnel crown indicate that the tunnel was completed in 1915. Tunnel construction was handled by Pennsylvania Railroad and constructed by the Allegheny Construction Company. The tunnel crown and spring-line consists of poured concrete of approximately 3 feet in thickness with one layer of brick for surficial protection from locomotive gases. Drainage relief weep holes were installed during original construction on an as-needed basis along the length of the tunnel.

Based on a visual walk through of the tunnel on March 30, 2011 and field inspection on August 12, 2013, only minor repairs have been performed throughout the life of the tunnel. Generally, the tunnel is in good condition except for a washout of a portion of the tunnel crown at the north portal of the tunnel. Other visually observable conditions include some surface spalling and

scaling of the concrete/brick lining and uncontrolled water seepage into the tunnel. The invert area has been leveled on the left side (south to north) and the right side deepened to create a drainage channel.

The March, 2001 report on the *Stability of the East Brady Tunnel* by the Wexford Consulting Group included studies and analysis for the sections of tunnel immediately beneath S.R. 0068 and S.R. 2023. The conclusion of this report was that the tunnel was stable at those locations primarily because of the good condition of the concrete lining. This was accepted by the Public Utility Commission (P.U.C.). The PUC abolished the crossing. The PUC Order is contained in Appendix I. By extrapolation, the rest of the tunnel showed no signs of complete collapse except for the washout area near the north portal. However, certain aspects of the tunnel were further investigated for this report. Mainly the loose, spalling bricks and concrete along with potential for seasonal development of icicles due to uncontrolled groundwater seepage were investigated. An Icicle Survey is contained in Appendix J.

### 1.3 Purpose and Scope

The purpose of this report is to investigate the condition of the tunnel including the rock cuts at the portals in order to determine the tunnel's feasibility to be used as a bike trail. Tunnel repair options and recommendations are also presented in the report.

The following tasks were performed for the preparation of the report:

- Literature search and review of available information for the structure location.
- Detailed inspection of tunnel and record baseline conditions.
- Geologic field reconnaissance to visually identify any surface features that may impact the feasibility of the proposed construction.

- Geologic mapping of the portal rock cuts and observable strike/dip measurement of joints.

- Tunnel baseline condition drawings and rock slope photo mosaics.

- Options for stabilizing/rehabilitating the existing portal rock cuts.

- Options for the repair/rehabilitation of the tunnel, including repair of the tunnel at the north portal, surface scaling and deterioration of the brick/concrete, and control (outletting) of the groundwater.

- Preliminary quantities and cost estimates for selected options.

- Preparation of this report which documents the data that has been collected.

## 2.0 GEOLOGIC SETTING

### 2.1 Topography

The site is located in the Pittsburgh Low Plateau of the Appalachian Plateaus Province of Pennsylvania (Figure 3). The Pittsburgh Low Plateau section is characterized by smooth to irregular surfaces, with relatively narrow valleys, strip mines, and reclaimed lands. Local relief is low to moderate (1,200 feet to 1,700 feet above sea level). The geologic structure consists of moderate to low amplitude open folds decreasing in occurrence northwestward. The origin of the topography is fluvial erosion, periglacial mass wasting, and strip mines.

### 2.2 Soils

According to the National Resource and Conservative Service and Penn State College of Agricultural Sciences, the soils present in the vicinity of the site are the Dekalb channery loam (Df), Dekalb stony loam (Dv), Gilpin channery loam (Gc), Gilpin silt loam (Gs), and Gilpin soils (Gv). Refer to Figure 4 and Appendix F for further information on indicated soils.

### 2.3 Site Geology

According to the published literature, the bedrock at the site belongs to the Pennsylvanian aged Pottsville Formation and the Mississippian aged Mauch Chunk Formation. The geology above the site consists of Mauch Chunk Formation of Mississippian age and Pottsville, Allegheny, and Glenshaw formation of Pennsylvanian age in ascending order (Figure 5).

The Upper Freeport coal marks the transition between the Conemaugh Group and the Allegheny Formation at approximate elevation of 1,340 feet to 1,360 feet above mean sea level (MSL). The Upper Freeport coal has been extensively strip-mined in the area[1]. The Allegheny Formation is approximately 270 feet to 300 feet thick. The Allegheny Formation has varying and repeating layers of coal, limestone, and clastics, ranging from claystone or underclay to coarse sandstone. There are multiple coal units in the Allegheny Formation below the Upper Freeport coal and they

are as follows in descending order: Lower Freeport, Upper Kittanning, Middle Kittanning, Lower Kittanning, Scrubgrass, Clarion, and Brookville coal. Brookville coal marks the transition between the Allegheny and Pottsville Formations at approximately 1,000 feet MSL.

No strip mining or deep mining has taken place over the East Brady tunnel due to the thickness of coal seam which is deemed too thin to be of commercial value to mining companies[1].

The Pottsville Formation is subdivided into (in descending order) the Curwensville Member and the Elliott Park Member. The Curwensville Member extends from the base of the Brookville coal to the base of the Lower Mercer clay. The Homewood Sandstone is present below the Brookville coal and is well developed, ranging up to 25 feet in thickness. It consists of a medium to coarse-grained quartzose sandstone. The Elliott Park Member extends from the base of the Lower Mercer coal to Mississippian-Pennsylvanian unconformity. (An unconformity is a buried eroded surface separating two rock strata of different ages.) The unconformity is approximately at elevation of 880 feet to 900 feet MSL at north portal and 820 feet to 840 feet MSL at south portal[1]. It is predominantly sandstone which correlates with the Upper Connoquenessing sandstone and ranges up to 65 feet thick. The sandstone is fine to medium grained, very light to light-gray or light-brownish-gray, quartzose sandstone. Below the sandstone, the Quakertown coal may be sporadically developed and it ranges from 0.0 to 0.5 foot thick.

Below the Connoquenessing sandstone lies the Mauch Chunk Formation (Mississippian). It consists of red to reddish-brown mudstone and siltstone, and brown, reddish-brown, and greenish-gray sandstone and conglomerate. It is estimated to be 3,000 to 4,000 feet thick. The lower member displays an interbedding of red siltstone and sandstone, and tan to brown sandstone and conglomerate. Reddish-brown to olive-gray lenticular sandstone and reddish-brown siltstone and mudstone characterize the middle. The upper member consists of interbedded red sandstone and mudstone, and gray conglomerate more characteristic of the overlying Pennsylvanian Pottsville Formation[4].

## 2.4 Bedrock along Tunnel

From literature review and field observation of the rock outcrop near the tunnel openings, it appears that the openings are stratigraphically located near the transition between Mississippian and Pennsylvanian systems. Field observation at the south portal shows that Lower Connoquenessing is the sandstone adjacent to the portal and the overhang above the Upper Connoquenessing (Figure 6). Observed directly below the Upper Connoquenessing and above the Lower Connoquenessing is the weathered shale and claystone that could be associated with Quakertown coal. Observations at the north portal show that rocks near the portal were mostly claystone and shale that could be associated with the Mauch Chunk Formation (Figure 6). The overhang of sandstone above the claystone at approximately 915 to 920 feet MSL is considered to be the base of Lower Connoquenessing. Please refer to Appendix C for picture of rock cuts near each portal.

Structurally the project area is located within the Brady's Bend syncline. The axis of the syncline is aligned approximately N64E and crosses the tunnel in its central region at approximately right angles to its axis, so that the bedding dips into the hillside at both portals[(1)]. The bedrock in the area is dipping toward the axis of the syncline that travels through the middle of the tunnel.

Based on field observations and literature review, it appears that the tunnel itself is largely in the Upper and Lower Connoquenessing blocky sandstone with approximately a third of the tunnel section into the shale and claystone on the north side. Bedding is observed to be largely horizontal across the tunnel with vertical joints.

## 2.5 Oil and Gas Wells

According to the Pennsylvania State University's "Pennsylvania Spatial Data Access" (PASDA) database, there are four (4) wells reported within 2,500 feet of the tunnel. The nearest well is within 200 feet of the tunnel. All the wells are located west of the tunnel inside Brady's Bend. Refer to Figure 7 for PASDA oil and gas well location map.

## 2.6 Water Wells

A search of a one (1) mile radius from water well records from the Pennsylvania Department of Natural Resources, Bureau of Topographic and Geologic Survey records show two (2) wells within approximately 1,500 feet of the East Brady Tunnel (Figure 8). Well number 12966 is located at approximate elevation 1,340 feet and the record shows the depth at 213 feet (approximate elevation 1,137 feet). The well was drilled in 1928. The record shows an 8-inch casing, but does not indicate the depth of the casing. No static water level elevation is indicated. Well number 90813 was drilled in 1978 and the location indicates an elevation of 1,140 feet. The depth of the well is 104 feet, and the well record shows the bottom of the casing at 68 feet. The well record indicates a static water level of 88 feet.

With the floor of the tunnel between elevations 855 and 847 feet, the difference between the bottom of these wells and the roof of the tunnel is 150 to 250 feet.