Climbing the Mountain: The Allegheny Portage Railroad

When one considers the great engineering achievements of the United States, such enduring icons as the Golden Gate Bridge and Hoover Dam come to mind. But before the country could reach the technological level that made those feats possible, other projects of lesser stature had to precede them. Those all-but-forgotten projects, somewhat akin to the preposterous "flying" contraptions that came before the Wright brothers' memorable flight at Kitty Hawk, were essential precursors. A case in point is the design and construction of the Allegheny Portage Railroad, which carried passengers and canal boats over the Allegheny Mountains in Pennsylvania and featured the first railroad tunnel in the United States. Though beset by difficulties during its brief existence, the railroad is still considered a triumph of civil engineering and a significant achievement in the history of the nation's rail system.

The State Museum of Pennsylvania, PA Historical and Museum Commission

The Allegheny Portage Railroad was divided into segments referred to as levels and planes. The levels were relatively flat portions through which the rail cars were drawn initially by horses and later by locomotives. Stationary steam engines used ropes to haul railroad cars carrying boat sections and passengers up the planes or to let them down. A rail car at the top of one such plane can be seen entering the rear of the trainshed, circa 1900.

The construction of the Erie Canal—begun in 1817—marked a new era in transportation. But it also represented a threat to commerce in the commonwealth of Pennsylvania. As a result, Pennsylvania's government organized a board of commissioners to establish a canal system between Philadelphia and Pittsburgh. But in contrast to the relatively flat areas in New York through which the Erie Canal was being constructed, eastern and western Pennsylvania are divided by the Alleghenies. Nevertheless, two members of the three-member board failed to fully comprehend the effect that geography would have on their canal plans. The other board member, Charles Treziyulney, stated in an 1825 report that the Alleghenies were "thrown together as if to defy human ingenuity, and baffle the skill of the engineer."

During the next few years, the board commissioned several surveys to find the best route over the mountains. It determined that a canal would require too many locks and too much water to be practical. On the basis of reports about technological advances in Britain, the board envisioned a railway that would connect the east and west segments of the canal system. Together, those two segments formed what would be called the Main Line. The canals were to be 4 ft (1.2 m) deep and 40 ft (12 m) wide and were to include approximately 108 locks, spaced approximately every 1.5 mi (2.4 km).

By 1828 the excavation of the canals was well under way and the board turned its attention to the railroad portion of the system. It hired an engineer by the name of Nathan S. Roberts, who had been a principal engineer on the Erie Canal, to survey the area. But the board later reported that Roberts's results were insufficient to enable it to designate the exact location of the route. Soon thereafter it hired Moncure Robinson, a prominent engineer who would continue to play a significant role in the development of rail transportation in the United States. Robinson proposed a portage railroad that would use stationary steam-powered engines to pull individual cars up steep inclines and then would rely on horses to pull the cars across the level portions. The most controversial part of his proposal, however, was a railroad tunnel 1 mi (1.6 km) long near the summit of the railroad.

No railroad tunnel had ever been constructed in the United States, and the board questioned the possibility of constructing one of that length near the summit of a mountain. It appointed a three-person committee, namely, Robinson, Stephen H. Long, a lieutenant colonel in the U.S. Army Corps of Engineers, and John Wilson, a major in the Corps, to assess the feasibility of the entire proposal, including the tunnel. To Robinson's dismay, neither Long nor Wilson supported his proposal for the tunnel, and his idea was rejected. Nevertheless, the remainder of his proposal for the railroad was accepted and much of the Allegheny Portage Railroad was constructed according to Robinson's plans.

On March 21, 1831, after six years of surveys and debate, George Wolf, the governor of Pennsylvania, signed a bill passed by the general assembly authorizing the board to solicit contractors for a 36 mi (58 km) railway between the towns of Johnstown, to the west of the mountains, and Hollidaysburg, to the east. Sylvester Welch, who had been the principal engineer for the Main Line's western portion and had worked on the Erie Canal, was named chief engineer. (Welch's younger brother, Ashbel, also was a prominent civil engineer and became president of ASCE in 1882.)

In April 1831 Welch and his assistant, Solomon W. Roberts, explored the summit of the mountains to confirm the location of the railroad. Many years later, in a speech before the Historical Society of Pennsylvania, Roberts recounted the conditions of the mountains that early spring. "The weather was cold, stormy, and unfavorable; there was much snow on the mountain, and I remember particularly that on the evening of the first day, the wind was so high as to blow heavy pieces of bark from the bodies of dead hemlock trees." At that time, the engineers had no inkling of the extent to which weather would affect the railroad's construction and operation. Rattlesnakes and gnats also posed problems for the expedition.

The weather was not kind to the railroad's contractors during the winters of 1831–32 and 1832–33, and it took a severe toll on the workforce. Initially there were approximately 2,000 workers on the railroad project, but workers were in short supply once contractors started abandoning their work. Furthermore, the work—consisting mostly of clearing trees and vegetation for the roadbed—proved much more difficult than had been anticipated, leading to upward revisions of the cost estimates. Nevertheless, Welch remained optimistic and believed that a single-track system could be completed by October 1833.

The board approved the appointment of Edward Miller, an engineer who had spent the summer and fall of 1832 in Europe studying railway designs and machinery, as the engineer in charge of machinery. Miller provided Welch with valuable information and revised the designs of the rails and of the stationary steam engines at the inclines.

Despite the labor shortages and cold weather, construction of the culverts and drains progressed quickly. By December 1833 the board began to foresee that the railroad would be successful and well received by the public, and it stipulated that a second set of tracks be added. A single line of the railway was completed on March 18, 1834.

The railroad was divided into segments referred to as levels and planes. The levels were the relatively flat portions through which the rail cars would be drawn by horses and, within a few years, locomotives. Most of the canal boats plying the Main Line were built as modules that could be joined together when on the water but then separated for transport on railroad cars. The planes were the inclines, where stationary steam engines used ropes to haul cars carrying boat sections and passengers up or to let them down. (Hemp ropes were replaced with wire ropes designed and produced by the engineer John A. Roebling in 1844.) Once the top or bottom of a plane was reached, the car would be hitched to horses and towed across the level to the next plane. The switch to steam locomotives began in 1835 and made it possible to transport passengers and boat sections in multicar trains. The Allegheny Portage Railroad had 10 planes—5 on the west slope and 5 on the east—11 levels, 1 bridge, 73 culverts, 85 square drains, and 4 viaducts, all made of stone. Its track consisted of iron straps imported from Britain on top of wooden rails secured to stone slabs.

Despite the rejection of Robinson's idea, the railroad did include a tunnel, the nation's first. The Staple Bend Tunnel, constructed near Johnstown, was 901 ft (274 m) long, 19 ft (5.8 m) high, and 20 ft (6 m) wide, and it made it possible to exclude a tortuous path beside a long bend in the Little Conemaugh River.

The Allegheny Portage Railroad was indeed a novelty. Famous people, among them the British novelist Charles Dickens, made use of it. But the novelty quickly wore off, and as early as 1837 the state government was proposing to replace the railroad with one that did not have planes. Moreover, the severe mountain weather was wreaking havoc on nearly every part of the railroad, and constant maintenance was required.

This maintenance—together with the rapid advances in technology that were making portions of the railroad obsolete—convinced Pennsylvania in 1852 to opt for a new portage railroad that would not have planes and could be traversed in its entirety by locomotives. By 1855 a new portage railroad was completed and what was known as the Old Portage Railroad was abandoned and largely dismantled.

Even though the Allegheny Portage Railroad was little more than a brief note in transportation history, it was a significant cog in the wheel of engineering progress as well as in the nation's expansion westward. The route of the Allegheny Portage Railroad is included in the National Register of Historic Places, and the railroad has been formally recognized in ASCE's Historic Civil Engineering Landmark Program.

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