THE PENNSYLVANIA CANAL
Willard R. Rhoads

The construction of the Pennsylvania Canal at the present time by the Commonwealth of Pennsylvania with its population of 11,200,000 would be considered a great project. However, when it is realized that the canal was begun 134 years ago, when the population was only 1,200,000, it becomes evident that it was a tremendous undertaking, considering the men, money and material available at that time. The purpose of this paper is to tell the story of the canal from its inception to its sale or final abandonment without going into exhaustive details, for many books would be required to tell the complete history.

In 1826 the Legislature of Pennsylvania passed an Act, signed by Governor Andrew Shulze on February 25, that provided for "the commencement of a canal to be constructed at the expense of the state and to be styled 'The Pennsylvania Canal'." From earlier discussions in the Legislature this canal was to be "a navigable communication between the eastern and western waters of the state

Mr. Rhoads, a member of this Society, is an engineering graduate of The Pennsylvania State University. He has had published a History of St. Paul's Evangelical Lutheran Congregation of Numidia, Columbia County, Pennsylvania and a Genealogy of the Rarig Family also of Columbia County.—Ed.

This article is comprehensive in that it gives a picture of the main line of the Canal and its laterals. It is felt that it will be helpful to anyone seeking data on any part of the Canal as it contains names of the engineers and other facts, figures and drawings not easily found nor previously printed or assembled.—Ed.

and Lake Erie." In other words, from Philadelphia to Pittsburgh, and from Pittsburgh to Lake Erie.

The events that led to the passage of this Act, and the construction of almost 1000 miles of canals and railroads following the passage of this Act will be discussed in this paper. These events cover the period from 1826 to 1858, or roughly to the Civil War. It is well to remember that in 1826 Pennsylvania had only dirt roads with a few turnpikes, had had little experience in canal construction, and the steam locomotive and railroad had not yet been developed.

Before beginning the discussion of the canal it would be helpful to consider the topography and rivers of Pennsylvania to see what difficulties lay in the path of the canal. The outstanding physical feature of the state is the Appalachian Mountain range which extends across the state from northeast to southwest. This range begins in Maine and extends to Alabama. One low pass cuts the mountains in New York, and through it flows the Mohawk River. There is no low pass through these mountains in Pennsylvania, and that means that every road, turnpike, canal, or railroad that crosses the state must climb the mountains.

The region west of the mountains, an area of about 16,000 square miles, or more than a third of the total area of the state, was early known as the Ohio Country, and is served by the Allegheny, Monongahela and Ohio Rivers. Pittsburgh, located at the intersection of these three rivers, is blessed with natural water transportation, and for this reason was probably selected as the western end of the Pennsylvania Canal.

The region east of these mountains is served by the Susquehanna, Schuylkill and Delaware Rivers. The Susquehanna River serves the largest region, an area of about 21,000 square miles or almost half the total area of the state. However, the Susquehanna River flows right through the state and into Chesapeake Bay past Baltimore, Maryland, thus by-passing Philadelphia. This topography led to an 80-year struggle between Philadelphia and Baltimore for the traffic and commerce of the Susquehanna River valley.

Two great outstanding engineering problems in the construction of a canal from Philadelphia to Pittsburgh are herein revealed. The lack of a pass through the Appalachian Mountains and the lack of a river between Harrisburg and Philadelphia. If there had been a pass through the mountains, say beyond Altoona, and if the Susque-
hanna River had emptied into the Delaware River, say at Philadelphia, the history of our transportation problems, and I might add, the history of our state might have been entirely different.

Why was the canal built? Certain forces were at work in our nation that demanded transportation. The greatest of these forces was the fast growing population. The United States first consisted of the 13 original Colonies which successfully waged the Revolutionary War from 1775 to 1781. In the treaty with England in 1783 we received all the land east of the Mississippi River except Florida. In 1789 George Washington became the first president, and in 1790 the first census was taken. In the next few decades the population of the United States grew rapidly from 3,929,214 in 1790 to 12,866,020 in 1830.

In the early days the people settled along the Atlantic coast. In later years they climbed the mountains and settled in Western Pennsylvania and beyond. By 1820, 2,200,000 people lived in the states west of Pennsylvania. If we include Western Pennsylvania and Virginia the population was about 2,600,000.² The big problem was how to trade with these people living west of the mountains, how to buy their goods and how to sell goods to them. The dirt roads with the Conestoga wagons were not sufficient to meet their needs; some better form of transportation must be found. Some of our far-sighted leaders like George Washington felt that unless these people in the west were tied to the people in the east by transportation and communication they would not feel that they were a part of the national government so recently set up in the east.

Pennsylvania at this time was slow to realize the opportunity of serving these people with transportation, probably due to the Quaker conservatism and the general apathy of the citizens. However, DeWitt Clinton, Governor of New York, saw this demand and planned a canal from Buffalo to Albany. Ground was broken for the Erie Canal on July 4th, 1817, at Rome, New York, and was completed and opened on November 4, 1825. The canal was 364 miles long and required 83 locks. It followed the Mohawk River and was carried through the Appalachian Mountains in the pass mentioned earlier.

The Erie Canal was called "Clinton's Big Ditch" and "Clinton's Folly" by the skeptic, but the wiser men realized it was in fact a canal from the Atlantic Ocean to the Great Lakes which would provide transportation for the growing number of settlers in the west.

When DeWitt Clinton started work on the Erie Canal he had no engineers with experience in building canals. He therefore sent Canvas White, a promising young man, to England where White traveled 2000 miles along the canals, asking questions about locks, dams, boats, estimates of cost, and made many notes and sketches. James Geddes and Benjamin Wright were county judges and frontier surveyors, skilled in settling boundary disputes, and these men ran the first survey and line of levels across the state. Nathan S. Roberts had taught mathematics at an academy in New York state. All of these men developed into good engineers and helped Clinton design and build the Erie Canal.

When construction was nearly completed on the Erie Canal, the Legislature and the leading business men of Pennsylvania realized that the canal would attract trade of the growing west through the canal, down the Hudson River and into New York City, and that some plan or line of action was necessary to gain part of this trade. Philadelphia had been the leading city in the United States during colonial days. It was here that our national government was framed and set in motion. It was also the first city in the United States in commerce and industry. To lose this exalted position and fail to capture part of the western trade was a blow to the pride and dignity of Philadelphia and Pennsylvania.

An event of great importance had occurred south of Pennsylvania which threatened to divert more trade from Philadelphia. In 1805 a bill was introduced in Congress to build a substantial road from the east to the Ohio River. Work started at Baltimore and reached Cumberland, Maryland. Between 1811 and 1818 the road was extended to Wheeling, West Virginia, on the Ohio River. This was a hard surface road and was known as the National Road. It was later extended to San Francisco, and is today known as United States Route 40. Here was a road that reached the Ohio River and could serve the west, but the only means of transportation was the covered wagon and the stagecoach and this was not enough.

Another type of transportation originating in Baltimore threatened to capture part of the western trade. Here two bankers, Philip Thomas and George Brown, met at Brown's house on February 12,
1827 with 25 leading business men, and 16 days later, on February 28, 1827, organized the Baltimore and Ohio Railroad. The first stone was laid on July 4, 1828, and operation began on January 7, 1830. The line to Ellicott City, 13½ miles, was completed by May 24, 1830. This is the oldest railroad continuously operated by the same company, in the United States.

The three largest cities on the Atlantic seaboard in 1820 were New York City, Philadelphia and Baltimore. New York City grew rapidly following the opening of the Erie Canal. Baltimore grew rapidly from the trade of the National Road and the Baltimore and Ohio Railroad. It looked as if all trade with the expanding west would by-pass Pittsburgh and Philadelphia unless the state acted to gain a portion of this trade. With this background of history we will now see what Pennsylvania did to capture its share of this trade.

The Pennsylvania Legislature Passes the Three Canal Acts

The rivalry between New York City, Philadelphia and Baltimore for the trade from the west was reflected in the Pennsylvania Legislature when the Committee on Roads and Inland Navigation, on February 24, 1823 reported a bill entitled “An Act providing for the appointment of a board of commissioners for the purpose of promoting the internal improvements of the state.” After considerable discussion this Act was signed by Governor Shulze on March 27, 1824. This was the first Canal Act.3

The Governor appointed three commissioners, Jacob Holgate of Philadelphia, James Clark of Westmoreland and Charles Trezisyulney of Center County. They had no data to start with, and had to take to the field to collect information. They began a survey between Harrisburg and Pittsburgh on May 24 and by December 6, 1824 had surveyed and run levels over 480 miles. They surveyed three routes but expressed a preference for the middle route which followed the Juniata River.4

Philadelphia had much at stake and formed “The Pennsylvania Society for the Promotion of Internal Improvements in the Commonwealth.” Their plan of action was twofold. First, to prepare and distribute letters and pamphlets on the need for the canal, and


4 Wilson, History, 96.
TABLE No. 1
THE PENNSYLVANIA CANAL AND RAILROADS
SHOWING LENGTH, LOCKAGE AND LOCKS

<table>
<thead>
<tr>
<th>Number</th>
<th>See Name</th>
<th>Length (Miles)</th>
<th>Lockage (Feet)</th>
<th>Locks No.</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Columbia and Philadelphia Railroad</td>
<td>81.6</td>
<td>—</td>
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<td>2</td>
<td>Eastern Division</td>
<td>44.5</td>
<td>95.0</td>
<td>17</td>
</tr>
<tr>
<td>3</td>
<td>Juniata Division</td>
<td>127.5</td>
<td>576.0</td>
<td>91</td>
</tr>
<tr>
<td>4</td>
<td>Portage Railroad</td>
<td>36.69</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>5</td>
<td>Western Division</td>
<td>104.25</td>
<td>471.0</td>
<td>66</td>
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Total Main Line: 394.54 1142.0 174

Lateral Lines

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<tr>
<th>Number</th>
<th>Name</th>
<th>Length (Miles)</th>
<th>Lockage (Feet)</th>
<th>Locks No.</th>
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<tr>
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<td>59.75</td>
<td>164.0</td>
<td>23</td>
</tr>
<tr>
<td>7</td>
<td>Susquehanna Division</td>
<td>39.0</td>
<td>86.5</td>
<td>12</td>
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<td>8</td>
<td>North Branch Division</td>
<td>72.5</td>
<td>69.0</td>
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<td>73.0</td>
<td>138.5</td>
<td>19</td>
</tr>
<tr>
<td>10</td>
<td>Beaver Division</td>
<td>30.75</td>
<td>132.0</td>
<td>17</td>
</tr>
<tr>
<td>11</td>
<td>French Creek (Franklin) Division</td>
<td>22.25</td>
<td>128.5</td>
<td>18</td>
</tr>
<tr>
<td>12</td>
<td>French Creek Feeder</td>
<td>27.0</td>
<td>—</td>
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</tbody>
</table>

Total Lateral Lines: 324.25 718.5 96
Total Finished Lines: 718.79 1860.5 270

Unfinished Lines (by the State)

<table>
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<tr>
<th>Number</th>
<th>Name</th>
<th>Length (Miles)</th>
<th>Lockage (Feet)</th>
<th>Locks No.</th>
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<td>13</td>
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<td>90.0</td>
<td>189.5</td>
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<td>14</td>
<td>West Branch Extension</td>
<td>33.0</td>
<td>150.0</td>
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<tr>
<td></td>
<td>Shenango Canal</td>
<td>60.0</td>
<td>287.5</td>
<td>44</td>
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<td></td>
<td>Conneaut Canal</td>
<td>45.5</td>
<td>510.0</td>
<td>71</td>
</tr>
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<td>16</td>
<td>Wiconisco Canal</td>
<td>12.25</td>
<td>35.0</td>
<td>6</td>
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</table>

Total Unfinished Lines by the State: 240.75 1172.0 161
Total Lines begun by the State: 959.54 3032.5 431

Notes:—Above data from Tanner, Bishop and Reports of Canal Commissioners. (See Bibliography.) For length of finished lines in above table see Annual Report of Canal Commissioners, 1840, p 5. Feeder Canals, other than French Creek Feeder, are not included in the above table.
TYPE OF RAIL USED ON THE PORTAGE RAILROAD

SECTION OF RAIL
ELEVATION OF CHAIR

PLAN OF CHAIR

NOTE - DIMENSIONS TAKEN FROM ACTUAL RAILS IN THE HISTORICAL SOCIETY OF WESTERN PENNSYLVANIA PITTSBURGH, PENNA.

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thus mould public opinion and urge the Legislature to act. Second, to study the Erie Canal and the canals in Europe, to gain the necessary technical knowledge to build the canal. For this purpose they sent William Strickland, engineer and architect of Philadelphia, to Europe to study the canals. He returned with many ideas, sketches and drawings. His book of drawings covering the canal was highly respected and has been preserved to the present day.

The Pennsylvania Society then prepared a “Memorial” embodying the advantages of the canal which was sent to every newspaper and every county where it was widely discussed in school houses and public places. This led to a Bill in the Senate on February 28, 1825, entitled, “An Act to appoint a Board of Canal Commissioners,” which was signed by Governor Shulze on April 11, 1825. This was the second Canal Act.5

To bring pressure on the Governor and the Legislature to begin the construction of the canal, the Pennsylvania Society promoted the idea of a Convention at Harrisburg, attended by representatives of every county in the State. All counties but two responded. The Harrisburg Convention was held August 4 to 6, 1825, and was attended by 123 delegates of whom 94 voted for the canal and 29 voted against it.6 The Harrisburg Convention, after heated discussions for and against the canal, led to the introduction of a Bill on January 16, 1826, “An Act to provide for the commencement of a canal, to be constructed at the expense of the State, and to be styled ‘The Pennsylvania Canal’,” as outlined in the opening paragraphs of this paper. This was the third Canal Act, and was signed by Governor Shulze February 25, 1826. The Governor appointed a Canal Board of five men, and ordered work started at both the Harrisburg and Pittsburgh ends.7 Construction of the Pennsylvania Canal was officially begun on July 4, 1826, when Governor Shulze turned the first spadeful of earth just east of the Capitol Building.

General Location of the Canals

Before describing the construction of the canals it might be helpful to describe, briefly, the location and names of the various canals. In general there were two principal classifications, the Main Line Canal, and the Lateral Canals. The Main Line was the

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5 Bishop, State Works, 174-176, 179; Cummings, Pennsylvania Board, 2; Wilson, History, 98.
6 Bishop, State Works, 265.
7 Wilson, History, 99; Cummings, Pennsylvania Board, 2; Bishop, State Works, 185.
line from Philadelphia to Pittsburgh and was divided into five divisions. The Columbia and Philadelphia Railroad constituted the first division and extended from Philadelphia to the Susquehanna River at Columbia (81.6 miles). The Eastern Division extended from Columbia to Clarks Ferry along the Susquehanna River (44.5 miles). The Juniata Division extended from Clarks Ferry to Hollidaysburg along the Juniata River (127.5 miles). The Portage Railroad regarded as a division crossed the Allegheny Mountains from Hollidaysburg on the east slope, to Johnstown on the west slope (36.69 miles). The Western Division extended from Johnstown to Pittsburgh (104.25 miles). Total length of the Main Line from Philadelphia to Pittsburgh was 394.54 miles, which included 118.29 miles of railroad and 276.25 miles of canal.8

You may object and say this was supposed to be a canal from Philadelphia to Pittsburgh. True, but recall the two great obstacles pointed out at the beginning of this paper. There was no river to follow between Philadelphia and the Susquehanna River and there was no alternative but to build a railroad. In the western part of the state the Allegheny Mountains rose almost 1400 feet between Hollidaysburg and Johnstown and here again a railroad was necessary.

The Lateral Canals extended along the various rivers of the state and were divided into seven divisions. The Delaware Division extended from Bristol to Easton along the Delaware River (59.75 miles). The Susquehanna Division extended from Clarks Ferry to Northumberland along the Susquehanna River (39 miles). The North Branch Division extended from Northumberland to Lackawanna Creek along the Susquehanna River (72.5 miles). The West Branch Division extended from Northumberland to Farrandsville (10 miles west of Lock Haven) along the West Branch (73 miles). The Beaver Division extended from Beaver to five miles above New Castle along the Beaver River (30.75 miles). The Franklin Division extended from Meadville to Franklin along French Creek (22.25 miles). The French Creek Feeder extended from Lake Conneaut to Meadville (27 miles). The total length of the Lateral Canals was 324.25 miles. The total length of the Main Line and the Laterals was 718.79 miles. These lines were completed and placed in operation by the Canal Board.8

8 See Table No. 1, page 208.
In addition to the Main Line and the Lateral Canals other canals were started but not completed by the Canal Board. The North Branch Extension extended from Lackawanna Creek to the New York state line along the North Branch (90 miles). The West Branch Extension reached from Farrandsville to Sinnemahoning Creek along the West Branch (33 miles). The Erie Extension made up of two parts as follows: the Shenango Canal extended from New Castle to Lake Conneaut (60 miles) and the Conneaut Canal extended from Lake Conneaut to Lake Erie (45.5 miles). The Wiconisco Canal extended from Millersburg to Clarks Ferry along the Susquehanna River (12.25 miles). Total length of unfinished canals was 240.75 miles. As a rule these canals were sold to private canal companies who completed and operated them.

Construction of the Canal

The Act of February 25, 1826, gave the Governor authority to begin the construction of the Pennsylvania Canal. Governor Shulze therefore appointed a Canal Board of five men. He employed Nathan S. Roberts, who had worked on the Erie Canal, to locate the line between Pittsburgh and Freeport, at the mouth of the Kiskiminetas River, a length of 24 miles, and also appointed William Strickland to locate the line from Swatara Creek at Middle-town, to the mouth of the Juniata River, or Clarks Ferry, a length of 22.5 miles.

The Act of February 25, 1826, provided for less than 50 miles of canal construction, and it was most imperative that more work should be started. Accordingly, on April 9, 1827, "An Act to provide for the further extension of the Pennsylvania Canal" was approved by the Governor. It required the Canal Board to locate and contract for the following sections: the Juniata Division—Clarks Ferry to Lewiston; the Western Division—Freeport to Blairsville; the Susquehanna Division—Clarks Ferry to Northumberland; the Delaware Division—Bristol to Easton (to spend $100,000); and to commence work on the French Creek Feeders. The Act also authorized the Board to make surveys of various lines, including the North Branch from Northumberland to the New York state line; the Erie line from Pittsburgh to Lake Erie; and the Columbia and Philadelphia Railroad.  

The Act of April 9, 1827, showed a complete change of policy

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by the Canal Board. In all previous discussions of the proposed canal it was the general understanding that the canal (with the railroads) was to extend primarily from Philadelphia to Pittsburgh. Yet the Act included 39 miles of canal from Clarks Ferry to Northumberland along the Susquehanna River, and also included a canal along the Delaware River.\footnote{Ibid., 192.}

This was the beginning of a movement to build lateral canals along rivers that had not been included in earlier discussions. Lateral canals were originally planned to be built after the Main Line was in operation. The reason for including the lateral lines at this time was simple. In order to get approval for constructing the Main Line, the Canal Board had to agree to build lines in other parts of the state. It was logrolling in which certain members of the legislature refused to vote funds for the Main Line until a lateral canal was included within their own district. This did much to weaken the policy of the Canal Board during the following years. On the Erie Canal the main line was built first and they started to collect tolls, then added branches as needed. In Pennsylvania the Main Line and the branches were built at the same time and this method spread the work too thin. This was one of the basic weaknesses of the Pennsylvania Canal system, and was the cause of much of the financial difficulty encountered later.

The Annual Report of the Canal Board for December 1827 showed 162.5 miles of canal under contract, of which only 95.5 miles were for the Main Line. On March 24, 1828, another act was passed calling for further extension of improvements, namely—45 miles along each of the following rivers: Delaware, Conemaugh, Juniata and the North Branch of the Susquehanna; and ten miles from Middletown to Columbia. Construction of the Columbia and Philadelphia Railroad was also authorized.

The Annual Report of the Canal Board for 1828 notes that contracts had been let for 40.5 miles of roadbed for the Columbia and Philadelphia Railroad, and for 195.5 miles of canal. The canals included 23 miles along the west branch of the Susquehanna, 45 miles along the north branch of the Susquehanna, 35.5 miles along the Delaware, 10.5 miles of the French Creek feeder, 26.5 miles from Blairsville toward Johnstown along the Conemaugh, 45 miles along the Juniata and 10 miles between Middletown and Columbia.
This list included only 81.5 miles on the Main Line and 114 miles on the lateral lines.

On April 22, 1829, an act relative to the Pennsylvania Canal and the railroad was passed. It gave the Canal Board authority to enter into contracts for improvements along the Delaware and North Branch not yet started. It also directed that all work under progress should, if possible, be completed during the following year. The Canal Board Report of December 1830 noted that water had been admitted to 406 miles of canal and that 40.5 miles of the Columbia and Philadelphia Railroad were graded and ready for track laying. The Board also recommended that a railroad, in place of a macadam road, be used for the Allegheny Portage.

The Annual Report of the Canal Board for December 1831 shows that contracts were let for 155.75 miles of canals and feeders, of which only 50.25 miles were on the Main Line and 105.5 miles were for lateral canals. During the next two years 75 miles of new canal and railroad work were called for. In the December 1834 Report the canal commissioners stated that all lines of canal and railway authorized by law were completed. The length of the Main Line was 394.54 miles. When the canal was ready for use the state had undertaken and completed 637 miles of public improvements. Between 1836 and 1842, 135 additional miles of work were completed and 162 more were started, bringing the total public improvements to 934 miles. After 1842 the only work was on the North Branch Extension and the New Portage Railroad.

**Description of the Canal**

A canal is an artificial waterway, dug parallel to a river or creek, and built above the level of the river, so that the canal will not be flooded after every rain. The canals could not operate during the winter season, and the water was therefore drained out of the canal around Thanksgiving to prevent ice from destroying the canal banks and locks. In the spring when the canal was opened water was admitted directly from the river or by means of feeder canals, generally built up a creek valley. The dimensions of the canal, with few exceptions, were 40 feet wide at the top, 28 feet wide at

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the bottom with a depth of four feet of water. These are the dimensions used on the Erie Canal and the canals in Ohio, and may have been the dimensions brought back from Europe by Canvas White. Each foot of an average canal required about five cubic yards of excavation. However, there were many high and low locations which changed this yardage. The excavated material was used to build a ten foot towpath on one side, and a canal bank or berm on the other side of the canal.

The water in the canal was roughly level between locks, and the topography and drop of the ground determined the location of the locks. When the level of the ground dropped, say from six to ten feet, locks were built to lower the canal boats, after which the canal would continue with a level surface to the next lock. In general the locks were 90 feet long and from 15 to 17 feet wide. Where stone was readily available the side walls were built of large stone. In other places the locks were built of earth, lined with stone and covered with wooden sheathing.

Earth-moving machinery was unknown at this time, and the canal was dug by hand, using pick and shovel, wheelbarrows, black powder, horse-pulled drag lines and dump wagons. Many laborers could be employed working side by side along the line, as mile after mile of canal was dug. The building material at this time was lumber and stone, since iron, steel and concrete were not in use when canal construction started. Stonemasons were in great demand and the few masonry structures that remain today bespeak their careful work.

The lack of engineers to select the various routes and design the various bridges, aqueducts, locks and canals, was one of the most pressing problems when the work started in Pennsylvania. The only engineering college in America at that time was the Military Academy at West Point, established in 1802, and the army needed all the graduates. Apart from West Point the American engineers had to learn the hard way. Fortunately the Erie Canal was completed shortly before work started on the Pennsylvania Canal, and some of the engineers came to Pennsylvania to work on the canal and help train our engineers. These included Canvas White, James Geddes, Benjamin Wright, Nathan S. Roberts and DeWitt Clinton, Jr., son of the New York Governor.

Some men had natural ability as engineers, but most men served as apprentices under older and more experienced men. As
work on the canal proceeded many of these men developed into trained engineers. Among them were J. Edgar Thompson, William Milnor Roberts, Moncure Robinson, Sylvester Welch, Charles T. Whippo, Robert Faries, James D. Harris, Edward F. Gay, William B. Foster, Jr., Hother Hage, Charles S. Schlatter, Solomon W. Roberts, William Strickland and others.

Among the more difficult problems to be solved by the engineers was the construction of the dams, bridges and aqueducts. Three dams were required in the Susquehanna River between Clarks Ferry and Wilkes-Barre. They were located at Clarks Ferry, Sunbury and Nanticoke. The dam at Clarks Ferry was needed to carry the canal boats across the Susquehanna River. It was 1998 feet long and 8.5 feet high above the bottom of the river. It consisted of strong timbers cribbed together, and was filled with well packed stones, covering a base of 30 feet. To prevent damage from floods, the stone was covered with large timbers 35 feet long. Today heavy concrete walls would be necessary to build such a dam.13

The Shamokin Dam, just below Sunbury, was necessary to carry the canal boats from the canal on the west side of the river to Sunbury on the east side of the river to load coal brought down from Shamokin, Mt. Carmel, Centralia, Ashland and other places. The loaded boats would then return to the canal on the west side of the river and continue on to market. The dam was 2783 feet long, extended 9.5 feet above the bottom of the river, and was built on the same pattern as the Clarks Ferry Dam. It was named the Shamokin Dam in honor of the Indian village of Shamokin that was once located on the present downtown site of Sunbury. The dam at Nanticoke carried the canal from the west side of the Susquehanna River to the east side. It crossed at this particular point to reach a large station for loading coal in the vicinity of Nanticoke. The dam was 700 feet long and rose 12 feet above the bottom of the river.

Two types of bridges were used by the Canal Board to cross the larger rivers, towpath bridges and aqueducts. A towpath bridge was used at Clarks Ferry to cross the Susquehanna River and at Northumberland to cross the West Branch. The first bridge built at Clarks Ferry just below Amity Hall, was a lattice-type wooden bridge constructed on stone foundations, while the second bridge

13 Report of Canal Commissioners, 1830. 15.
was of the type built by Theodore Burr, famous bridge builder. These bridges carried two roadways, one in each direction for vehicular traffic. Boats were pulled across the river on the down stream side of the bridge, from two towpaths, located one above the other. Mules pulled the canal boats to the point where the canal joined the slackwater created by the Clarks Ferry Dam. The mules were then unhitched and taken up an inclined walk to the towpath from where they pulled the boat across the river. The boat was in the river while the mules were on the towpath.

Large aqueducts were used to cross the Allegheny River, both at Freeport and at Pittsburgh. Here the entire canal was carried across the river in a timber channel, supported on stone foundations, and the mules walked on the bridge adjacent to the channel. Both the boat and the mules were on the bridge above the river. In addition to the larger structures described above, many more smaller structures were needed to enable the canal to function. These included dams, aqueducts, bridges, culverts, waste weirs, roads, fences, shops, toll-houses, lock-houses, and weigh scales.

Description of the Main Line

As stated earlier the Main Line of the Pennsylvania Canal consisted of five divisions. From east to west they were the Columbia and Philadelphia Railroad, the Eastern Division, the Juniata Division, the Portage Railroad and the Western Division.\(^\text{14}\)

Since railroads were in their infancy at this time it is helpful to consider the work of John Stevens who lived in Hoboken, New Jersey. In 1811 he owned and operated a steam ferry between Hoboken and New York City. From his experience with his ferry he believed that steam could be applied to pull cars on a track, and if such an idea could be developed it would provide better transportation than canals. When DeWitt Clinton was working on the Erie Canal, Stevens wrote many letters to him claiming that railroads would serve New York state better than canals.

On February 6, 1815, Stevens obtained a charter from the state of New Jersey for a railroad from New Brunswick on the Raritan River to Trenton on the Delaware River. Later this became known as the Camden and Amboy Railroad. Camden was opposite Philadelphia and Amboy was opposite New York City, so this was in reality a railroad between Philadelphia and New York

\(^{14}\) See profile of Main Line and Portage Railroad, pages 210-211.
City. This was the first railroad chartered in the New World.\(^1\)

On March 13, 1823, the Pennsylvania Legislature granted a charter to John Stevens for a railroad from Columbia to Philadelphia, and this was the first charter for a railroad ever issued in Pennsylvania. Stevens formed a stock company, of which Stephen Girard was a director, selected the location for the railroad and asked the Legislature for $5,000 to build an experimental mile of track. However, the venture was so new that no one had any faith in railroads, and he failed to get the railroad started.

The plan for a railroad was revived by an Act of the Legislature on March 24, 1828, when the Canal Board ordered a survey of the route Stevens had earlier selected from Columbia to Philadelphia. Major John Wilson of the U.S. Topographical Engineers, was selected to relocate the line. He reported that the route was not favorable for a canal, but was suitable for a railroad. He therefore ran the surveys and prepared plans for a railroad between Columbia and Philadelphia, 81.6 miles long. Construction work started in 1829, a single track was completed by April 16, 1834, and the second track was completed by October 1, 1834.\(^1\)

Iron rails had not as yet been developed at this time, therefore the rails consisted of iron straps, three inches wide by one-half inch thick, fastened to wooden stringers, laid on crushed rock. The cars consisted of trucks drawn by horses, since the locomotive had not yet been perfected. Farmers along the route loaded their produce on a cart and hauled it on the track to Philadelphia with horses. They were merely following the custom used on the state-built turnpikes, where every shipper provided his own team and wagon. This practice led to a great deal of confusion and considerable profanity, and was finally corrected by the Canal Board.

The Eastern Division Canal extended along the east side of the Susquehanna River from Columbia to Clarks Ferry, and passed through Highspire, Steelton and Harrisburg. The route was selected and plans were prepared by William Strickland, assisted by Sylvester Welch, Edward F. Gay, F. W. Rawle and A. B. Warford.

Ground was broken for the entire Pennsylvania Canal at Harrisburg on July 4, 1826, and this also served as the ceremony for

\(^{15}\) John Stevens (1749-1838), inventor and engineer, became known as the “Father of American Railroads.” In 1870 his son Edwin founded the Stevens Institute of Technology at Hoboken, as a memorial to his famous father.

\(^{16}\) Wilson, History, 11-14.
beginning construction on the Eastern Division. However, on March 14, 1827, the "Penn Lock" cornerstone was laid on lock No. 6, at the foot of Walnut Street, with a colorful dedication. The ceremony was attended by the Governor, members of the Legislature, the burgess of Harrisburg with his town council, and a great concourse of people.

The Eastern Division was 44.5 miles long and contained 17 locks to overcome a difference in level or lockage of 95 feet. The outstanding structures on it were the dam and the towpath bridge across the Susquehanna River at Clarks Ferry as described earlier in this paper. All the work on this Division was completed by 1833.

The Juniata Division followed the Juniata River and the Frankstown Branch from Clarks Ferry to Hollidaysburg, a distance of 127.5 miles. It was the longest division on the Main Line. Many engineers worked on the plans and construction of this line. Canvas White made the preliminary survey in 1826. Other engineers included DeWitt Clinton, Jr., James Ferguson, Edward F. Gay, Robert Faries, and William E. Morris.

The canal passed through Mifflintown, Lewistown, Huntingdon, Water Street, Frankstown and on to a canal basin at Hollidaysburg. Most of these places were struggling villages when the canal passed through, but from the traffic of the canal they grew into thriving towns. In the Narrows, east of Lewistown, where the valley is narrow and the mountain side is covered with loose stones, the canal was built in the north edge of the Juniata River, with the river side of the canal protected by stone walls. The total drop in the line was 576 feet which required 91 locks. Work was begun in 1828 and was completed in 1833.

The Portage Railroad extended from Hollidaysburg to Johnstown, a distance of 36.69 miles, between which the Allegheny Mountains stood as a gigantic barrier. The rise from Hollidaysburg to the summit was 1398 feet in ten miles, and the drop from there to Johnstown was 1171 feet in 26 miles. Nowhere in the United States had canal engineers encountered such a difficult problem. Many surveys and studies were made by various engineers as to the best method of getting the canal boats over the mountain, before the Canal Board was finally satisfied with the plan and ordered construction to begin.17

17 Ibid., 100-105.

The Blair County Historical Society in the Baker Mansion in Altoona, Penn-
In 1824 the first three Canal Commissioners, Holgate, Clark and Treziyulney suggested extending the canal up each side of the mountain by a series of locks, and near the top connect the two ends by a tunnel four miles long. So little was known about tunnels at this time that the Canal Board defined a tunnel as "a hole like a well dug horizontally under a hill or a mountain." Later plans called for a macadam road over the mountain, in which the cargo would be hauled by wagons from the canal basin at Hollidaysburg to the canal basin at Johnstown.

By 1830 the route and the method of crossing over the mountain had not yet been settled by the Canal Board, and the Legislature and the public were becoming impatient with the delay. The reason for this feeling was simple, no goods could be carried over the Main Line from Philadelphia to Pittsburgh if this section of 36 miles was not completed. The Act of March 17, 1830, required three competent engineers to make a thorough study of the line over the mountain. The Canal Board appointed Moncure Robinson, S. H. Long, a Lieutenant Colonel of the U.S. Army, and Major John Wilson to make the study. After making the field surveys they presented their report favoring a railroad, rather than a turnpike or macadam road.

Following this report Governor Wolf, on March 21, 1831, approved "An Act to continue the improvements of the State by canals and railroads." Among the provisions was one authorizing the Canal Board to construct a railroad over the mountain from Hollidaysburg to Johnstown. The work was placed under Sylvester Welch as principal engineer and Moncure Robinson as consulting engineer.

The plan adopted was a series of ten inclines, five on each side of the mountain. These planes were powered by steam engines which pulled a truck, on which a canal boat was loaded, up a track by means of huge ropes, at the same time that another truck was let down. At Hollidaysburg and at Johnstown the track extended into the water of the canal basin. A truck was run down into the water, the canal boat was floated above the truck, lashed to it and the entire load was drawn to the top of the incline. Here, in the canal's early stages, the load was pulled along a fairly level track, by means of mules, to the foot of the next incline.

Pennsylvania, holds pictures, models, relics and a large assortment of books and papers relating to the Portage Railroad.
This procedure was repeated five times to reach the summit, and on going down the mountain it was reversed, the steam engine dropping the load down the incline. By this method canal boats were carried from the canal basin at Hollidaysburg to the canal basin at Johnstown, from which they would continue their trip in the regular canal. These canal basins served much the same purpose as parking spaces serve the automobile today. Here the canal boats could be parked or held until they could be moved up the inclined planes. These basins were large; the one at Johnstown covered 8.5 acres.¹⁸

The iron rails used on the track on the inclines were manufactured in Wales, shipped to Philadelphia, and carried by canal boats to the Portage. The rails, known as “edge rails,” had no base but were set in grooves in cast iron forms, with a base five inches by nine inches, called “chairs.” These chairs were fastened by two spikes driven into wooden pegs in stone ties about 24 inches square by 18 inches thick, spaced about three feet apart along the rail. Considerable difficulty was experienced in the spring of the year, by the heaving of the stones, when the frost came out of the ground.¹⁹

Hemp ropes were used to hoist the canal boats up and down the inclines. These ropes varied from 3600 feet to 6600 feet in length, were up to seven inches in circumference, cost around $3,000 and lasted only an average of 16 months. Considerable difficulty was encountered when any of these ropes broke, as such a misfortune put the incline out of service.²⁰

Work started on the Portage Railroad in May 1831 and the entire line was opened on March 18, 1834. Two improvements in operation were made later which were of great help. Wire ropes were substituted for hemp ropes on the inclines, and locomotives replaced mules in hauling the canal boats from plane to plane. Engineers who worked on the Portage Railroad included Sylvester Welch, Moncure Robinson, S. H. Long, Solomon W. Roberts, Edward Miller and W. Milnor Roberts.

In addition to the unique construction of the Portage Railroad itself, three additional rather unique structures were required:—the

¹⁸ The water for this canal basin and the canal was provided by a dam built about two miles above South Fork. During an eight inch rainfall the dam overflowed, washed out the bank and caused the Johnstown Flood of May 31, 1889.

¹⁹ See page 212 for sketch of rails.

²⁰ Wilson, History, 109, 131.
Skew Arch Bridge, the Conemaugh Viaduct and the Staple Bend Tunnel, two of which are still standing.

The Skew Arch Bridge, erected in 1832, is located on the east slope of the mountain, at the foot of old Incline No. 6, between Hollidaysburg and Cresson. It is a stone arch bridge, built on a skew or oblique angle to allow the Portage Railroad to pass under the bridge, and to allow the Huntingdon, Cambria and Indiana Turnpike, now U.S. Route 22, to pass over the bridge. The stones were laid without mortar and the bridge is in excellent condition today, a tribute to the wonderful skill of the stonemasons during that era.

Nearby is a monument, ten feet high, built of stones taken from the Portage Railroad track, that carries four bronze tablets on each of its four faces, briefly describing the Portage Railroad. This monument was erected by the State of Pennsylvania as a Memorial to the old Portage Railroad. It was dedicated on October 1, 1929, during the term of John S. Fisher, Governor. At the head of Incline No. 6, on top of the mountain stands the Summit Mansion House, formerly known as the Lemon House, built by Mr. Lemon about 1830. This was the hotel where travelers on the Portage Railroad stopped for meals and lodging. Should you drive over U.S. 22 west of Hollidaysburg today you can see the Skew Arch Bridge, the State Monument and the Lemon House.

The Conemaugh Viaduct, designed by Solomon W. Roberts, was located eight miles east of Johnstown. It was a high stone masonry structure, 28 feet wide at the top with one semicircular arch that had a span of 80 feet and a height above the water of 70 feet. The Viaduct carried the canal boats over the Little Conemaugh River, and was later used by the Pennsylvania Railroad for their main line tracks. It was destroyed by the Johnstown Flood of May 31, 1889. This was another example of the excellent work done by the stonemasons during the construction of the canal system.

The third important structure on the Portage Railroad was a tunnel cut through solid rock, located four miles east of Johnstown, at a place called Staple Bend. The tunnel was 901 feet long, 20 feet wide and 19 feet high. For 150 feet at each end its arches were made of cut stone. The tunnel, built in 1834 by J. and E. Appleton at a cost of $37,500, was the first railroad tunnel built in the United States. It is still in a good state of preservation and would attract
tourists except for the fact that it is inaccessible on a rugged mountain side. Both ends of the tunnel can be seen from the Pennsylvania Railroad trains, when leaves are not on the trees.

Many famous people travelled over the Portage Railroad. Charles Dickens of England, while touring the United States in 1842, described his trip over the mountain in an article that is still in existence. Well known Americans, such as Henry Clay, Jenny Lind the singer, and Presidents William Henry Harrison and Zachary Taylor made the trip over the Portage Railroad. Joseph Ritner in 1835 travelled over the road on his way to Harrisburg as Governor-elect.

The Pennsylvania Railroad stated in an official history in 1875, "The Portage Railroad over the Allegheny Mountains was, during all the time it remained in operation, one of the wonders of America." This was eminently true.

The Western Division of the Main Line extended from the canal basin at Johnstown to Pittsburgh, a distance of 104.25 miles. The canal followed the Conemaugh, Kiskiminetas and Allegheny Rivers, and passed through Blairsville, Saltsburg and Freeport to Pittsburgh. Nathan S. Roberts was location engineer on this line, assisted by other experienced engineers, including James D. Harris of Bellefonte, Edward Miller, Alonzo Livermore, Sylvester Welch and William Milnor Roberts. Work began in 1826 and was completed in 1833.

The outstanding structures on this Division included an aqueduct crossing the Allegheny River at Freeport and another at Pittsburgh, as described earlier in this paper. There was a short tunnel west of Blairsville at Tunnelsville and another tunnel under Grant's Hill in Pittsburgh. Sixty-six locks were required to overcome a drop of 471 feet.

Description of the Lateral Lines

In addition to the Main Line from Philadelphia to Pittsburgh the Canal Board built five lateral canals, totaling 256.5 miles along the Delaware and Susquehanna Rivers in the eastern part of the state.

The Delaware Division Canal, 59.75 miles long, extended from Bristol to Easton, along the western side of the Delaware River. The main purpose of this canal was to carry coal from the Lehigh Coal and Navigation Company at Easton to Philadelphia and Balti-
more. Engineers who worked on this canal included Henry G. Sargent, John Hopkins, James B. Sargent and others. Work was started in 1827 and was completed in 1830. The lockage between the two towns was 164 feet which was overcome by 23 locks.\textsuperscript{21}

The Susquehanna Division Canal extended 39 miles along the west bank of the Susquehanna River from Clarks Ferry to Northumberland, and passed through Liverpool, Port Treverton and Selinsgrove. Remains of the old canal can be seen at many points along the river, even to this day.

As early as 1826, John Bennett, surveyor from Luzerne County, ran a survey line from the New York State line to the Juniata River at Clarks Ferry, a distance of 161 miles with a drop of 343 feet. The engineers who designed and built the canal were Simeon Guilford, Hother Hage with a canal office at Liverpool, Francis W. Rawle and A. B. Warford. Work was begun in 1828 and was completed in 1831. The principal structures required on this division included the Shamokin Dam, as described earlier, and a towpath bridge across the North Branch at Northumberland. Twelve locks were required to overcome a drop of 86.5 feet.

The North Branch Division Canal extended along the Susquehanna River from Northumberland to the Lackawanna River above Pittston, a distance of 72.5 miles. The canal passed through Danville, opposite Catawissa, and through Rupert, Bloomsburg, Espy, Berwick, Nanticoke, Wilkes-Barre and Pittston. Charles T. Whippo located and designed the canal and was the first construction engineer. He was assisted by Matthew R. Stealey, William B. Foster, J. H. Petrie and John Bennett.

Ground was broken for the North Branch Canal at Berwick on July 4, 1828. People along the river from Northumberland to Wilkes-Barre gathered for the gala event. Water was admitted to the canal in November 1830, but it was not until September 27, 1831, that boats could pass over the entire length.

Seven locks were required to overcome a drop of 69 feet. In addition an outlet lock was required at Northumberland to lift the canal boats from the Shamokin Dam pool to the canal. The important structures needed in this division included a stone aqueduct at Rupert, a weigh scales at Beech Haven and a dam across the Susquehanna River at Nanticoke. Boat yards, where canal

\textsuperscript{21} In 1866 the Delaware Division was leased to the Lehigh Coal and Navigation Company.
boats were built or repaired, were located at Espy, Northumberland and Selinsgrove, while a few boats were built at Bloomsburg and Wilkes-Barre.\textsuperscript{22}

The West Branch Canal extended along the West Branch of the Susquehanna River from Northumberland to Farrandsville (about ten miles west of Lock Haven), a distance of 73 miles. The canal passed opposite Lewisburg, and through Milton, Williamsport, Jersey Shore and Lock Haven. Lumber and lumber products comprised the principal shipments on this division.

Engineers who designed and worked on this canal were James D. Harris, principal engineer, Francis W. Rawle, Robert Faries and William E. Morris. The work was begun in 1828 and was completed in 1834. There was considerable drop in this division, 138.5 feet, which required 19 locks.\textsuperscript{23}

The Wiconisco Canal extended from the mouth of the Wiconisco Creek in Millersburg, along the east side of the Susquehanna River, to the towpath bridge at Clarks Ferry, a distance of 12.25 miles. Evidence of the canal can still be seen along Route 14. The engineer in charge of this canal was Anthony B. Warford assisted by James Bradley. The canal required 6 locks to overcome a drop of 35 feet.

Work was placed under contract during August 1838, and was completed by a private company in 1845. By Act of the Legislature July 13, 1842, the Wiconisco Canal Company was incorporated to take over the entire works of the canal. The reason for building this canal was to carry coal from the terminal of the Lykens Valley Railroad in Millersburg, and deliver it to market. Here was a case where the Wiconisco Canal was taken from state ownership and placed under private control and operation.

\textit{Canals from Pittsburgh to Lake Erie} \textsuperscript{22,23}

The second of the Canal Acts, mentioned earlier, which was passed April 11, 1825, called for “the establishment of a navigable communication between the eastern and western waters of the State and Lake Erie.” In the preliminary discussion of the canal in

\textsuperscript{22} The North Branch Extension was begun in 1836 and was completed in 1856 when the first boat, \textit{Towanda}, passed Pittston for Elmira with a cargo of coal. The canal enjoyed considerable business for a number of years, but was partially destroyed by floods in 1865, and never recovered.

\textsuperscript{23} By an Act of the Legislature on April 14, 1838, the Canal Board was directed to locate and put under construction, a canal from Farrandsville to Sinnemahoning Creek, a distance of 33 miles. The canal was never completed.
1824, it was considered desirable to connect Pittsburgh with Lake Erie to capture part of the traffic that would normally pass over the Erie Canal on to New York City, and divert it to Philadelphia. However, when the engineers began surveying the line to Erie they found it was necessary to carry the canal over very high ground.

Lake Conneaut, in Crawford County, was near the high point in the route. It was 419 feet above Beaver and 510 feet above Lake Erie. In other words, here was another obstacle, more than a third as high as the Portage Railroad over which the canal boats had to be transported by inclined planes. However, on this line the ground sloped very gradually, thus it was possible to carry the canal over the high ground by means of ordinary canal locks.

Lake Conneaut, near the top of the divide, had to furnish feeder water for the canal north to Lake Erie and south to New Castle. However, the lake did not contain enough water for this purpose. To this end the Canal Board, as early as 1826, authorized the construction of a feeder canal to supply additional water to the lake. This was known as the French Creek Feeder because the water was obtained from French Creek.

The canal from Pittsburgh to Lake Erie was divided into several divisions, as follows:—Pittsburgh to Beaver, Beaver to New Castle, New Castle to Erie, French Creek Feeder and the French Creek Division.

The Western Division of the Main Line of the Pennsylvania Canal ended at the Monongahela River in Pittsburgh. From here the canal boats could reach Beaver by using the Ohio River, and no artificial canal was required between these two points.

The Beaver Division extended along the Beaver River from the town of Beaver to a point six miles above New Castle, a distance of 30.75 miles. In this distance the canal had a drop of 132 feet which was overcome by 17 locks. This left an additional drop (or rise) of 287 feet between the upper end of the Beaver Division and Lake Conneaut. Charles T. Whippo, who had located the North Branch Division, was the location and construction engineer for this division, assisted by Matthew R. Stealey. Construction work began in 1831 and was completed in 1834.

The French Creek Feeder was a project to add more water to Lake Conneaut, so that the lake would have sufficient water for lockage on the Erie Extension Canal. In 1826 the Canal Board hired Major David B. Douglass, a West Point Military Academy
expert and professor of mathematics, who had designed the Croton Aqueduct for the New York City Board of Water Supply, to make an investigation and report on a canal feeder to supply more water to Conneaut Lake. His report of January 1, 1827, indicated that by building a canal eastward from Conneaut Lake to French Creek above Meadville, a distance of 27 miles, he could utilize a head of 13.5 feet of water, sufficient to divert 212 cubic feet of water per second into the lake which would raise the level of the water in the lake about eight feet.

French Creek Feeder was a navigable canal but had no locks. It began at the mill dam of Daniel Bemus, three miles above Meadville on French Creek, and extended to Conneaut Lake, a distance of 27 miles. Work was started on the feeder canal during August 1827 and was completed in 1834. The engineers who worked on the design and construction of the canal, after Major Douglass had presented his report, were William Milnor Roberts, Charles T. Whippo, James Ferguson and Sylvester Welch.

Closely associated with the French Creek Feeder was the French Creek Division Canal that extended south along French Creek from Meadville to Franklin, a distance of 22.25 miles. Part of this length was by canal and part by slack water navigation, using French Creek. The canal had 18 locks, necessary to overcome a drop of 128.5 feet. The canal was built at about the same time that the French Creek Feeder was constructed. It did not prove to be a paying investment, although the canal did help to develop the community by providing cheap and easy transportation.  

The Erie Extension Canal began at a point six miles north of New Castle and continued past Sharon and Greenville to Conneaut Lake, and from there extended on to the city of Erie on Lake Erie, a distance of 105.5 miles. For convenience this length was divided into two parts, the Shenango Division and the Conneaut Division. The Shenango Division extended from New Castle to Conneaut Lake, a distance of 60 miles. The lockage of 287.5 feet was overcome by 44 locks. The Conneaut Division extended from Conneaut Lake to the city of Erie, a distance of 45.5 miles. The lockage of 510 feet was overcome by 71 locks.

The engineers who worked on the canal included William Milnor

Roberts and Charles T. Whippo. Major Douglass of West Point had made a study of the line from Conneaut Lake to Erie in connection with his study of the French Creek Feeder. Many difficulties were encountered on the Erie Extension. The cost greatly exceeded the estimate and progress was slow. Finally on March 7, 1843, the Legislature incorporated the Erie Canal Company, a stock company, to take over the Erie Extension.

At this time the canal from Conneaut Lake to Erie was not completed and Governor Porter asked the Erie Canal Company to complete the work, at which time the Beaver and French Creek Divisions would be turned over to them. This seemed reasonable, since part of a canal between Pittsburgh and Erie would be of little value to a private company; they would need the entire line.

The first boats to reach Erie through the canal were the Queen of the West, a packet boat loaded with passengers, and the R. S. Reed, loaded with coal from Mercer, on December 5, 1844. Considering this use of the canal as evidence of completion, Governor Porter turned over the Erie Extension, Beaver Division and the French Creek Division to the Erie Canal Company on January 10, 1845.

By this action the entire canal system from Pittsburgh to Erie was removed from state ownership and placed under private control and operation. In 1870 the Erie Canal Company was declared bankrupt and was sold to the Erie and Pittsburgh Railroad Company. The canal was abandoned in 1871, thus bringing to an end the dream of connecting Philadelphia with Erie by canals.

The New Portage Railroad

The inclined planes on the Portage Railroad were never satisfactory, either as to operation or safety. It required 33 changes of power to carry one canal boat over the mountain from Hollidaysburg to Johnstown, 12 stationary engines, 12 teams of horses or mules, 9 locomotives, and a minimum of 54 men.\textsuperscript{25} Shortly after the Portage Railroad was opened suggestions were made as to how the planes could be avoided. On September 28, 1836, the Canal Board directed Charles DeHaas, as principal engineer, to make a study and report on the feasibility of selecting a line that would replace the planes with a continuous railroad. DeHaas selected such a route but the idea was dropped.

\textsuperscript{25} Wilson, \textit{History}, 131.
On May 10, 1850, the Legislature passed an Act looking to the construction of a railroad to avoid the planes, and the Canal Board selected Robert Faries, as principal engineer, to make the survey. His report was adopted, work was started and by January 1, 1853, planes Nos. 1, 2 and 3 on the Johnstown side of the mountain were avoided.

Considerable opposition developed against the Robert Faries plan of removing the inclined planes, and the Legislature on May 4, 1852, provided for a Board of Engineers to check the Faries plan. William Milnor Roberts and Edward F. Gay were selected to work with Mr. Faries. The two engineers agreed with the Faries plan, which increased the length of the Portage Railroad from its original 36 to 45 miles—18 miles from Hollidaysburg to the summit, an increase of 8 miles, and 27 miles from the summit to Johnstown, an increase of one mile.

Work was begun on the avoidance of planes Nos. 4 to 10, and by July 1, 1855, the work was completed and the New Portage Railroad was opened, at which time travel over the old Portage Railroad ended. The New Portage Railroad included the Mule Shoe Curve, and part of this road can be seen from the Pennsylvania Railroad trains.26

The work of building the New Portage line was practically lost because the Main Line of the Pennsylvania Canal, including the New Portage Railroad, was sold to the Pennsylvania Railroad. The railroad took possession of the property on August 1, 1857, and operated the New Portage for three months at a loss, and then used the Horse Shoe Curve to reach the top of the mountain. During 1858 the Pennsylvania Railroad removed most of the rails from the New Portage Railroad and used them to extend the Pittsburgh, Fort Wayne and Chicago Railroad from Plymouth, Indiana, to Chicago.

Operation of the Pennsylvania Canal System

In 1834 the entire Pennsylvania Main Line Canal and the Lateral Branches were in operation and producing revenue. Three years later the entire country experienced the Panic of 1837. This panic was probably brought about by the over-expansion of public works, such as roads, turnpikes, canals and railroads, and by the unsound methods of financing some of them.

Business slowed down, canal tolls dropped, and the Canal Board

26 Ibid., 137.
had difficulty in meeting the interest on the loans borrowed to build the canal. This condition continued from 1839 to 1844. Various attempts were made to raise money by state taxation to meet the crisis, but such tax laws were seldom fully enforced. Finally on April 29, 1844, an act was passed by the Legislature for a real tax law. This law called for taxes on real estate, personal property, mortgages, bank stock, and all salaries from professions, trades and occupations except farming. The response was good and by 1845 business had returned to normal and interest payments on canal loans were resumed.

On the same date, April 29, 1844, an Act was passed to dispose of the Main Line Canal from Philadelphia to Pittsburgh for $20,000,000. No bids were received for this offer, probably because the price was too high. On October 8, 1844, a state-wide vote showed 149,748 in favor of selling and 124,598 opposed to selling the Main Line Canal. No further effort was made to sell the canal during the next ten years.

There were certain weaknesses inherent in the operation of the canal. The canal had to close down during the winter season, say from Thanksgiving to April first, spring freshets would sometimes wash out part of the canal banks, high floods might submerge the canal, and the Portage Railroad, with its ten inclines, was slow and expensive. A new movement grew out of this situation. The business interests of Philadelphia felt that an all-weather railroad across Pennsylvania was needed to capture the trade of the west. Accordingly on April 13, 1846, an act was passed by the Legislature to incorporate the Pennsylvania Railroad from Philadelphia to Pittsburgh.

A surprising situation developed at this time. The Baltimore and Ohio Railroad, which by this time had extended its railroad from Baltimore to Cumberland, Maryland, asked the Pennsylvania Legislature for a charter to extend their road through Pennsylvania to Pittsburgh. A temporary charter was granted to the Baltimore and Ohio Railroad on April 21, 1846, with the following conditions:—if the Pennsylvania Railroad had a bona fide stock issue of $3,000,000 of which ten per cent was actually paid in; and if the Pennsylv-
vania Railroad placed under contract 30 miles of track before July 30, 1847, they would get the charter, and the Act granting the Baltimore and Ohio Railroad a charter would be null and void.29

The Pennsylvania Railroad met these conditions and was granted a charter on February 25, 1847. Following the grant they pushed the construction of the new railroad with vigor and determination. Work started at both ends, and the first train from Philadelphia reached Pittsburgh on December 10, 1852, using the Columbia and Philadelphia Railroad and the Portage Railroad.

Sale of the Pennsylvania Canal

With the railroad now in competition with the canal, the Legislature again tried to sell the Main Line Canal. By an Act of April 27, 1854, they offered to sell the Main Line from Philadelphia to Pittsburgh reducing the price from $20,000,000 to $10,000,000. Again there were no buyers. A year later the Legislature passed the Act of May 8, 1855, offering to sell the Main Line for $7,500,000. On December 20, 1855, J. Edgar Thompson, President of the Pennsylvania Railroad, offered to pay $7,500,000 for the Main Line, and the line was officially purchased at a public auction held on June 25, 1857, at the Merchants Exchange in Philadelphia. The railroad took possession of the property on August 1, 1857.30

After the sale of the Main Line the state was anxious to dispose of the lateral lines. On February 25, 1858, a bill was prepared which provided for the sale of all transportation improvements still owned by the state, as well as for the completion of the Sunbury and Erie Railroad. This road had been chartered April 3, 1837, but little work had been done on it in the meantime. The Bill of 1858, therefore, called for the completion of the railroad as well as for the sale of the lateral lines. The purpose of the bill was this: If the trade from Lake Erie could not be captured by the Pennsylvania Canal the state would try to acquire some by a railroad built to Lake Erie.

The bill was signed by Governor Pollock on April 21, 1858, and authorized the Sunbury and Erie Railroad to purchase all the lateral works for $3,500,000, with the understanding that the railroad could sell all or part of the works. Within a short time the railroad sold the Upper and Lower North Branch Division to the

29 Ibid., 252.
30 Ibid., 254.
Model of Portage Railroad
Courtesy The Pennsylvania Historical and Museum Commission

Model of Canal Lock at New Hope — Delaware Division
Courtesy The Pennsylvania Historical and Museum Commission
Canal Boat Is Raised on Inclined Plane, Powerhouse Shown in Background
Courtesy The Pennsylvania Railroad Company

Top of Inclined Plane No. 6 Looking East, Lemon House Shown on Right
Courtesy The Pennsylvania Railroad Company
North Branch Canal Company for $1,600,000; the West Branch and Susquehanna Divisions to the West Branch and Susquehanna Canal Company for $500,000; and the Delaware Division to the Delaware Canal Company for $1,775,000.\footnote{31}{Ibid., 258-259.}

Pennsylvania had now disposed of all canals and lateral canals, and since there was no longer any need for the Canal Board, it was formally abolished by Act of January 25, 1859. In accordance with the Act all books, papers, maps, records and all other property belonging to the Board, were handed to the Auditor General of the State. In February 26, 1885, they were transferred to the Department of Internal Affairs where they still remain. In 1959 Hubertis M. Cummings, Research Associate, Bureau of Land Records, prepared an outline of the above canal records. Canal historians are deeply indebted to Dr. Cummings for this comprehensive outline. The Canal Board had been organized March 27, 1824, and had served the state for a period of 34 years.

*Operation of Lateral Canals After Sale by the State*

On May 1, 1866, the Legislature incorporated the Pennsylvania Canal Company, which assumed control of the waterway division of the Main Line, the North Branch Canal and the West Branch and Susquehanna Canals. The canal boats passed to Columbia, where they crossed the Susquehanna River by tugs to Wrightsville, and continued on their way on the Susquehanna and Tidewater Canal, delivering their cargoes to Baltimore, Philadelphia and New York City.

After 1865 no use was made of the Western Division, and after 1889 little use could be made of the Juniata Canal above Newport, as it had been destroyed by the storm that caused the Johnstown Flood. After 1894 use of the Susquehanna and Tidewater Canal ended, and the North and West Branch Canals could accept cargoes for canal ports only as far as Columbia, and finally in 1901 the Pennsylvania Canal discontinued all its waterway activities.\footnote{32}{Cummings, Pennsylvania Board, 222-223.}

On April 11, 1901, President I. J. Wistar issued a printed notice stating that the Pennsylvania Canal Company lines along the North Branch, the West Branch and the Susquehanna Branch have been abandoned from and after this date. The last boat left Nanticoke on December 9, 1900, bound for Bloomsburg with a shipment of
coal. In February 1901 the Philadelphia Press noted, "The Canals of Pennsylvania have outlived their usefulness, and it is only a question of time when they will be abandoned." 33

Conclusion

As we review the history of the Pennsylvania Canal system 100 years after the sale of the Main Line and 60 years after the abandonment of the remaining Lateral Canals, how are we to judge the value of the Canal to the State? We find both assets and liabilities.

Liabilities. The State never made any money on the canal system. The cost of building and operating the canals was greater than the total income. The Canal Board built too many branch canals, due to the logrolling of the Legislature, which never paid for themselves. The canal never captured much of the great trade from the western states.

Assets. Many values accrued to the State and its citizens from the canal. The canal brought in many settlers who cleared the land and established homesteads. It provided cheap transportation to many sections of the State, and thus furnished outlets for new industries. It stimulated the growth of villages and towns. It provided work for thousands of laborers and skilled workers, such as carpenters and stonemasons.

Building the Pennsylvania Canal was a gigantic undertaking that attracted many capable men and developed and trained many leaders. Three Governors of Pennsylvania received their early training on the canal: Francis R. Shunk served as Governor from 1845 to 1848, William Packer served from 1858 to 1861, and John W. Geary served from 1867 to 1873. Matthias Baldwin furnished an early locomotive for the Columbia and Philadelphia Railroad and went on to found the great Baldwin Locomotive Works in Philadelphia. John Roebling worked on the canal and later designed and built the wire rope that replaced the hemp rope on the Portage inclines. He built bridges at Pittsburgh, Wheeling and Cincinnati before he became famous as the builder of the Brooklyn Bridge.

The design and construction of the Pennsylvania Canal system proved to be a great training ground for engineers. John Edgar Thompson worked on the canal and later became Chief Engineer

33 Ibid., 229.
and President of the newly created Pennsylvania Railroad. William Milnor Roberts after working on the canal became the builder of the transcontinental Northern Pacific Railway. Robert Faries became chief engineer of the Sunbury and Erie Railroad. Many other engineers who served with the Canal Board left to take responsible positions and build railroads which at this period were expanding very rapidly.

Probably the greatest value of the canal was that it carried the commerce and transportation of Pennsylvania from the era of the covered wagon to the era when the locomotive and railroad were fully developed and rendered the canal unnecessary.

So fades, so perishes, grows dim and dies,
All that the world was proud of.

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