18th century Canal Project Delivery:
Schuylkill & Susquehanna Navigation Co. and Philadelphia's dismal failure

Michael O'Connor, PE,
Chief Engineer, Frederick and Pennsylvania Line Railroad museum

In the 21st century, ASCE's Grand Challenge to civil engineers is to significantly enhance the performance and value of infrastructure project over their lifecycles. ASCE wants to drive transformational change into twenty-first-century infrastructure projects from planning to design to project delivery. What lessons from the past can offer insights into accomplishing this goal? In particular, what insights can a late 18th century engineering project offer the 21st century civil engineer? How does the engineering challenges of that internal improvement project tell us about how infrastructure is delivered in the 21st century? This paper looks to address some of those questions. [1]

The first part of answering this question is to look at how our concept of infrastructure and its function has evolved over the profession's history. In the 21st century, infrastructure has been characterized as the mechanism that delivers the "fundamental needs of society: food, water, energy, shelter, governance" and "without infrastructure, societies disintegrate, and people die." [2] In the late 18th and 19th centuries, these same efforts were first known as communications and then internal improvements. The latter term was used historically in the early United States for "…the creation of a transportation infrastructure: roads, turnpikes, canals, harbors and navigation improvements."[i] The 18th century was focused on trade and arose out of rivalries between the large cities of the early republic, namely Philadelphia, Baltimore and New York.

As a society, Americans enjoy the use of "highway, waterway, air, and rail systems that have allowed the unparalleled mobility of people and goods. Water-borne diseases are virtually nonexistent because of water and wastewater treatment, distribution, and collection systems. Also, telecommunications and power systems have enabled our economic growth." [3] Therefore, for any society, its economy is "inextricably linked with the infrastructure that supports it (and) the social, political, and economic structure of a society can magnify or mitigate the effects of a failure in infrastructure and vice versa." [2]

During the period of 1789-1820, the focus of Philadelphia mercantile interests was central Pennsylvania and its vast Susquehanna watershed draining two-thirds of Pennsylvania. Pennsylvania however, was so situated physiographically that most of its trade was carried out of the State away from its chief city and the Federal capital, Philadelphia by its two rivals; Baltimore at the base of the Susquehanna system and Albany on the north. It was estimated that half of the produce shipped down the Susquehanna river ultimately went to Baltimore, not Philadelphia. Philadelphia wanted not only control of the vast interior of Pennsylvania but also that of the rapidly developing northwest territories as well. In that timeframe, it meant river navigation and the use of two great rivers, the Susquehanna and the Allegheny/Ohio. Separating Philadelphia from use of the first was a smaller watershed, the Schuylkill river.

The only way Philadelphia could hold onto its trade advantage was to overcome the two physical barriers, first the low ridge crossing between the Susquehanna and the Schuylkill at Lebanon, Pennsylvania (500 feet above tidewater) and the front range portage at the Allegheny mountains (2,322 feet above tidewater), east of Pittsburgh. The critical link in that plan hinged on building the first link between the Schuylkill and Susquehanna rivers or what was promoted as the "golden link". Much like Wood creek was to become the

[1] This paper borrows heavily on a paper the author co-wrote with Decker Hains entitled "The Civil Engineering Body of Knowledge: Supporting ASCE's Grand Challenge" (Paper ID 22178) presented at the 2018 ASEE annual conference with Hains as the lead author. It also borrows heavily from the Wikipedia article on the Schuylkill and Susquehanna Navigation company. This was also primarily written by the author.

"lynchpin" for the Western Inland Lock Navigation company waterway to the Great Lakes.[2] Except New York built that link in 1803 whereas Philadelphia only completed that link in 1828 with the Union canal.
Although Philadelphia started its river surveys in the 1770s some twenty years ahead of New York with its plan for the Western and Northern Inland Lock Navigation companies in 1792, most of the canal schemes in that period such as the Schuylkill and Susquehanna and Potomac company were not successful and successor companies had to step in to finish the work. Despite Philadelphia and Pennsylvania's "heroic efforts" to hold their share of the internal trade which in 1796 was forty percent more than New York; by 1825 with the opening of the Erie canal, Philadelphia's trade was forty-five percent less than New York. [3]
A second theme in this paper is the current attention within ASCE on project lifecycles. Traditionally though of solely in terms of cost, lifecycles have many other important meanings. The early canals were constructed were constructed facilities using some materials such as masonry that still sand today and others such as wooden lock gates that had a useful life of twenty years. While the canals had service lives going into the 100 years plus range with masonry works, their economic usefulness was cut short by the advent of steam and railroad technologies. Even the Erie canal had its peak traffic coincide in 1855 with the completion of the Pennsylvania railroad (then called the Central Pennsylvania) and Baltimore and Ohio railroad crossing the Alleghenies in 1854.
A parallel to this is the railroad industry building the last transcontinental roads such as the Milwaukee road extension to Seattle (1910) and Western pacific (1909) right before the opening of the Panama Canal which severely impacted the industry. The railroad industry itself was eclipsed by the automobile and trucking industries and had its peak year in 1916. What type of technology lifecycles will we see in civil engineering over the next fifty years that will change civil engineering? How do we incorporate that experience into our project planning today? Think of this in terms of the autonomous vehicles being developed in our time period.
A third theme is the role social media and content management play in promoting civil engineering today. Some of the ASCE materials that were used in developing the Schuylkill and Susquehanna Navigation company article on Wikipedia have been downloaded 20-30 times since they were published. Conversely, since the article was first drafted in 2016 to this writing in later 2018, a total of 1,800 people have read the article and currently five people a day read it. All told about 50 people a day read civil engineering content that the author has written on Wikipedia. The author has separately estimated that there are over 80,000 articles on civil engineering on the site and an average of 1.25 million people per day read this material.
The questions for all professional engineers is what does this material say about our profession? Is it high quality content, relevant and interesting? Will it create a favorable impression on the young people reading it looking for information on the history and heritage of our great profession? I hope that you will be part of an effort to achieve that goal.

References

[1] ASCE's Grand Challenge,

[2] Lord, Jr., Philip L. (1993). The Neck on Mohawk River - New York's First Canal. The Canal Society of New York State.
[3] History of the canal system of the State of New York together with brief histories of the canals of the United States and Canada, Noble E. Whitford. 1905

[2] Hart, Steven D., et al. "Infrastructure and the Operational Art: A Handbook for Understanding, Visualizing, and Describing Infrastructure Systems" US Army Engineer Research and Development Center, (2014)

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[i] Review by Tom Review of John Lauritz Larson's http://www.h-net.org/reviews/showrev.php?id=6907 Internal Improvement: National Public Works and the Promise of Popular Government in the Early United States, University of North Carolina Press, 2001. ISBN|978-0-8078-4911-8.