

Champions of the Public Interest

An Excerpt from Chapter 1 -The American Civil Engineer
William H. Wisely

William Wisely was Executive Director of the American Society of Civil Engineers from 1955 to 1972. His book, The American Civil Engineer, published in 1974, documents the origins of the profession in America, the establishment of the American Society of Civil Engineers (in 1852) and the role of the Society in the affairs of the profession from its beginning until the time of the book's completion.

In this selection Wisely briefly describes the important role engineers played in the early development of the nation.

The first half of the 19th century was a crucial period in the youth of America. Migration to the west from the eastern seaboard extended to the Mississippi by 1820. This development was largely rural in character, with 90 percent of the national population of 10 million living in settlements of less than 2,500. The fertile western farms were devoted to food crops, while agriculture in the South was dedicated to the production of cotton. Manufacturing was making a modest beginning in New England and some larger western cities.

Facilities for communication and transport were sorely needed to integrate these regional elements into a national structure for trade and commerce. Fortunately, these services were to be forthcoming through many bold and imaginative enterprises in which engineers played important roles.

The earliest non-military engineering art was applied mainly in the domain of transportation. The 1787 laws establishing the Northwest Territory decreed that 2 percent of revenues from land sales would be allocated to construction of the National Road or "Cumberland Pike" from Washington to the Ohio



The National Road

River. Begun in 1806, the first 130 miles to Wheeling, Virginia (now West Virginia), were opened in 1820, and the road was eventually extended to Columbus and St. Louis. The project was significant in that it represented the first use of federal funds for major civil works construction. The 9,000 miles of rock-and-gravel-surfaced roads in 1820 grew to 88,000 miles in the next four decades.

Equally significant was the Canal Era, even though it was to be shortlived. Beginning with the South Hadley and Middlesex Canals in Massachusetts (1793 and 1804), the period was highlighted by the greatly successful Erie Canal in New York (1825) and followed by the Union Canal in Pennsylvania (1829), the Morris Canal in New Jersey (1831), and the Chesapeake and Ohio Canal (1851). By mid-century the steam engine was in general use for water and land transportation. About 3,000 miles of canals were in operation in 1840, by which time the waterway was rapidly yielding its leading role in transportation to the railroad.

The South Carolina Railroad was the first in the United States. It was soon followed by the Baltimore and Ohio; the Pennsylvania; the Pittsburgh, Fort Wayne and Chicago; the Rock Island; and the Erie railroads. It is noteworthy that the Erie was to be a training ground for seven engineers who were later to become presidents of the American Society of Civil Engineers.

By 1852, the experimental and early development phase of the American railroad industry was accomplished, with about 9,000 miles of operating trackage. This increased ten-fold in the next thirty years.

The railroad brought new emphasis to the art of bridge building, which until the early 19th century was largely confined to timber and stone masonry. The middle years of the century, however, brought a renaissance in bridge building, both in the transition from wood to cast and wrought iron as well as in the advancement from the early empirical trussed arches to the proprietary trusses of Howe, Pratt, Warren, Whipple, Bollman, Fink and others. The systematic analysis of stress in the truss members and early efforts toward rational design soon followed. The first metal truss bridge (cast and wrought iron) was designed and built on the Reading Railroad in 1845. By mid-century wrought iron was in general use as a structural material, and the arrival of the Bessemer converter in 1856 introduced the Steel Age.

In 1850, there were 83 municipal water supplies in the United States, thanks largely to pioneering efforts in Boston, New York City and Bethlehem, Pennsylvania. The supplies provided untreated water from wells, springs and surface sources. The earliest American work on water treatment was initiated at St. Louis in 1866, when slow sand filters were utilized.

Although some sewer lines in Boston were in operation by 1800, the earliest public system of sewers was built in Chicago in 1855 under the direction of City Engineer E. S. Chesborough. By 1860, public sewer systems were serving about a million people in ten of the largest cities. Sewage was discharged without treatment to the nearest watercourse.

What manner of men were these "civil engineers" who were assuming such a significant leadership role in planning, building and managing the bold public works projects that were shaping America in the mid-19th century? The term

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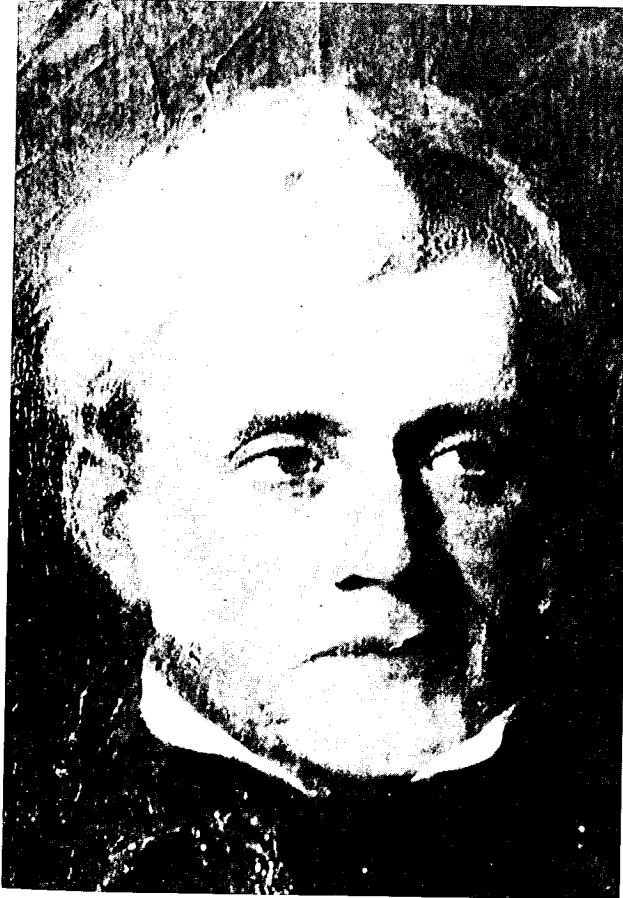
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"Civil Engineer" was first adopted by John Smeaton, builder of early roads, structures and canals in England, who about 1782 signed himself under that title in presenting expert testimony in the courts.

In America the Continental Congress legislated the appointment of engineer officers in the army, most of these positions being filled by Europeans. Although this "Corps of Engineers" was disbanded at the end of the Revolutionary War, it was reconstituted in 1794 and has prevailed ever since. The United States Military Academy was created by act of Congress in 1802, with the intent that it would function as an arm of the Corps of Engineers. This administration prevailed for more than 60 years. In 1821 the Congress enacted legislation directing the Corps of Engineers to make surveys of major roads and canals, and prescribed that this work be performed by office and field parties under the direction of a supervisory board, all to be jointly constituted of "engineer officers" and "civil engineers." This is certainly one of the earlier distinctions in America between the military engineer and the civilian or "civil" engineer.



Sylvanus Thayer

The importance of the United States Military Academy as a source of trained engineers is attested by the fact that of 572 graduates in the period 1802-1829, 49 had been appointed chief or resident engineers on railroad or canal projects by 1840.

Thus, most of the formally educated engineers of this period were graduates of West Point, the remainder having supplemented their general academic training by scientific study and field experience. A large segment of engineers in the mid-1800's, however, had little or no formal education, acquiring their technical knowledge through self-study and apprenticeship, often as axmen or rodmen in surveying parties. The roads, canals and railroads on which they worked served as their "universities."

Engineering education in America began in the United States Military Academy, which produced its first graduate in 1802. The curriculum was greatly strengthened during the tenure of Sylvanus Thayer as Superintendent from 1817-1833. The first civil engineering course outside of West Point was offered in 1821 by the American Literary, Scientific and Military Academy, later to be known as Lewis College and then, in 1834, renamed Norwich University. The first civil engineering degree was conferred by Rensselaer Polytechnic Institute in 1835. By mid-century engineering courses were being offered by Union College (1845), Harvard College (1846), and Yale College (1846). In the next twenty years about seventy institutions of higher learning initiated engineering programs.

The national census of 1850 counted only 512 civil engineers, of whom two-thirds were resident in the states of Massachusetts (68), New York (62), Ohio (59), Pennsylvania (55), Connecticut (46) and Wisconsin (44). Although few in numbers, they were an elite group in stature. Regardless of the pathway of their careers, the civil engineers of this era were supremely confident of their capabilities, and they jealously guarded their independence of professional decision and action. As champions of the public interest, they were outspoken in their criticism of questionable political and industrial management. Their performance earned them prestige, public respect and financial remuneration to a degree unexcelled by any other profession at the time.

* This institution had been founded in 1818 by Alden Partridge, himself a graduate of West Point {1806} and the first professor of engineering in the United States {at West Point from 1813 to 1817}.

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