Framing the City at the Point:  
The Development of Pittsburgh's Infrastructure in the 19th Century  
By Joel A. Tarr
Cities require infrastructure, but in few cities do the elements of the infrastructure impose so powerfully on our consciousness as in Pittsburgh. This city’s unusual topographical character — sharp contours, deep valleys, and river breaks — was a major factor in constraining and shaping development. As noted urban designer Frederick Law Olmstead, Jr., commented in 1910, “No city of equal size in America or perhaps the world, is compelled to adapt its growth to such difficult complications of high ridges, deep valleys and precipitous slopes as Pittsburgh.”

During the 19th and early 20th centuries, Pittsburgh evolved from a commercial/walking city to an industrial city with a modern networked infrastructure. Pittsburgh grew in area as well as population during these years, primarily through in-migration and annexation. These annexations created sharp tensions between the older and newer sections of the city, as developed and undeveloped areas competed over who would receive infrastructure and services and how it would be financed. In addition, class divisions throughout the city affected infrastructure provision, and over time, physical development was unevenly distributed throughout the city’s neighborhoods.

Urban infrastructure provides the technological framework of the modern city: its road, bridge, and transit networks; its water and sewer lines and waste disposal facilities; its power and communications systems. But while many aspects of the built environment can change rapidly, elements of the infrastructure, especially underground structures, are generally slow to alter. Infrastructure acts as both a force for development and a barrier to change, and nowhere is that better illustrated than in Pittsburgh.

The Walking City, 1816 – 1865

Pittsburgh’s prosperity in the 19th century was first as a mercantile center. Its location on the three rivers provided it with critical transportation and access to raw materials and to markets. The city soon developed as a transfer station for goods coming from the east over the Allegheny Mountains. State construction of the Pennsylvania Main Line Canal, completed in 1834, and the development of several railroad lines after 1852, reinforced its links to other cities and regions.

Pittsburgh, as well as surrounding towns, industrialized earlier than most other 19th-century cities. In addition to location, a key to industrialization was cheap energy, especially the rich Pittsburgh and Freeport coal seams that underlay the region. These provided fuel for numerous manufactories of iron, machinery, glass, and textiles as well as for copper and brass foundries. By 1850, ironmaking was the city’s chief industry; rolling mills, foundries, and boiler yards also employed a substantial part of the region’s work force.

For the first half or so of the 19th century, Pittsburgh was primarily a walking city. In 1850, for instance, the city’s 46,601 people lived in an area of 1,130 acres. Densities were high, and work and residence were usually closely linked. The city’s elite — bankers, merchants, industrialists, and professionals — lived primarily in the city center close to governmental, commercial, and mercantile activities. The working class resided on nearby streets and alleys or in the outlying wards. Many unskilled and semi-skilled workers lived in neighborhoods near the factories where they found employment.
A number of towns grew up around the city, the most important of which were Allegheny City on the north side of the Allegheny River; the industrial boroughs of Birmingham and East Birmingham on the south bank of the Monongahela River; and the Northern Liberties, Pitt Township, Oakland, and Lawrenceville boroughs, and Peebles Township toward the east. It was the annexation of some of these townships and boroughs between 1804 and 1846 that increased Pittsburgh's land area to 1,130 acres, though some localities opposed and even blocked the process. Access across the rivers was facilitated by private construction of toll bridges over the Monongahela and Allegheny rivers, built in 1818 and 1819 respectively; by the end of the 1850s, five bridges crossed the Allegheny and two the Monongahela.

Residents of both old and new areas demanded urban services, and the municipality gradually assumed this responsibility. Originally, city government focused on regulating local trade and checking market measurements, but revisions in the municipal charter added powers to provide services such as supervising streets and controlling the construction of vaults and privies. The City Councils (the City Council had two chambers until 1911) dealt with services through joint standing committees in areas such as streets and water, street lighting, fire engines, and markets. In fact, issues concerning streets, such as financing, openings, maintenance, lighting, and cleaning, consumed more of the Councils' time than any other question. State restrictions on municipal taxation and bonding powers, however, consistently limited service provision. Not until 1857 and 1858, for instance, did the legislature allow the city to levy special assessments on property owners for street and sewer improvements. By the end of the 1860s, streets in the city's commercial sections and in the wealthier residential areas were paved and lit, first with whale oil lamps and then with manufactured gas made from bituminous coal.

Water supply was another high priority. Pittsburghers initially drew their water from local rivers, ponds, and cisterns. The city provided some public wells, and private vendors peddled water in the streets. In 1822, citizens petitioned the councils to request that the municipality build a waterworks to supply water to the city from the Allegheny River, arguing that municipal ownership was required for improved fire protection, lower fire insurance rates, domestic and manufacturing needs, and to protect the public health. In 1826 the Councils approved the construction of a waterworks, its presidents boasting that the new waterworks would protect against fire and provide "beneficial effects to every manufactory and ... family in the City." The system, completed in 1828, utilized a steam pump to draw water from the Allegheny River and raise it to a million-gallon reservoir located on Grant Hill. By the end of 1850, the city had laid more than 21 miles of water pipe to serve 6,630 dwellings, stores, and shops. The waterworks represented the city's largest single expenditure during its first 50 years.

To protect the public health and avoid nuisances, used water, as well as storm water and garbage, had to be disposed of. City sanitary conditions were dismal; until the 1840s, sewers were made of wood or brick and stood above ground. They were meant primarily for storm water, but decaying wastes often filled them. Household wastes were disposed of in cesspools and privy vaults. Private scavengers under contract to the city were responsible for periodically emptying them but were notoriously inefficient, often creating serious nuisances. Cholera epidemics in the 1830s forced the city to organize its public health efforts but little was done to provide for better sewerage until
the 1840s. The city constructed its first underground sewers in 1848 and 1849 in the commercial district, but primarily to remove storm water from the streets, not to protect the public health.11

**The Rise of the Networked City, 1865 – 1910**

Transportation innovations led the way in creating the modern networked city. Pittsburgh, Allegheny City, and Allegheny County were all anxious to guarantee rail connections, and subscribed heavily to railroad bonds in the 1840s and 1850s. Some of these roads defaulted, leaving taxpayers with an added tax burden. Several railroads, however, reached Pittsburgh in the 1850s and accelerated the movement to the suburbs, as merchants and industrialists bought houses in outlying towns and commuted to work via train. By the 1860s, regular commuter trains connected the city with outlying areas, offering season tickets to commuters and excursion trains to nearby towns.12 Beginning in 1870, several inclined-plane passenger railways were put into operation and helped open the hilly areas of the city, especially on the South Side. New bridges over the Monongahela and Allegheny rivers facilitated trans-river traffic.13

Most significant for intra-city transport was the streetcar, first introduced in 1859. Initially powered by horses and mules, then cable, and ultimately by electricity, the streetcar dominated urban transport in Pittsburgh from the Civil War through the 1940s. Privately owned, the streetcar lines operated with city charters (usually of a 20-year duration) that required them to pay a percentage of their earnings to the city and to undertake some obligations in regard to street maintenance. By 1869, five horsecar lines operated 23 miles of track, and each Pittsburgh resident took approximately 50 rides per year. For the next two decades, entrepreneurs rapidly extended the streetcar network.

By 1888, the city had chartered 10 additional streetcar companies, and 172 horsecars ran over 56 miles of track in Pittsburgh and surrounding towns. They carried more than 23 million passengers for the year. Between 1888 and 1890, three horsecar lines operating to the east shifted from horse to

An early single truck electric car, built in the 1890s, photographed in Carrick.
by then, the city had 15.5 miles of cable line with cars that averaged twice the speed of horsecars. In the following decade, all the traction companies converted to electricity and invested in new routes. The region's total length of track increased from 113 miles in 1890 to 469 by 1902. In the same period, traffic rose from 46,299,227 passengers to 168,632,339 in 1902.

Many traction line entrepreneurs were politically connected; they were as interested in profits from land speculation and construction as they were in providing transport. The Magee-Flinn political machine, for instance, dominated the Councils in the 1880s and 1890s. Christopher L. Magee was president of two transit companies and director of five others. William Flinn was chairman of the city and county Republican organizations and a state senator, as well as a partner in the construction firm of Booth & Flinn, the company that handled most of the city's construction. Still, the transportation system was badly integrated, with many competing companies. No single streetcar line followed a route through the downtown area and across the bridges to another part of the region. By 1902, finally, the Pittsburgh Traction Company, controlled by George Westinghouse's holding company, the Philadelphia Company, had absorbed almost all of Pittsburgh streetcar lines and a more integrated system evolved.

The expansion and electrification of the Pittsburgh traction system caused major changes in the city's spatial order. Downtown became a center of commercial, office, financial, and shopping activity, losing much of its residential population. Among the most important structures in the new downtown were office buildings built by banks. From 1887 – 1907, banks constructed 16 new buildings, many of which were skyscrapers. The new downtown, however, could not have emerged without water, sewerage, and communications infrastructure, as well as transport.

While the downtown was losing residents, other sparsely populated areas gained. The East End, for instance, annexed in 1867, saw especially rapid settlement, with the number of dwellings in the area increasing from 5,350 in 1870 to 28,278 in 1900. An 1887 reorganization of the municipal government pushed through by the Flinn-Magee Machine facilitated this new development. State legislation permitted the formation of the Departments of Public Works, Public Safety, and Charity and gave the Councils the authority to form others.

For director of the important Department of Public Works, Magee and Flinn arranged the appointment of Edward M. Bigelow, city engineer and a cousin of Magee. Bigelow ran the department for more than 15 years, directing a vast program of activities. His most visible achievement was the creation of a park system, including Highland and Schenley parks. He was also responsible for equipping many neighborhoods with streets, water pipes, and sewers. Bigelow's programs were so expensive that he won the title of "the Extravagant." Not surprisingly, he channeled most municipal contracts to Flinn's construction company until he broke with the machine in the beginning of the 20th-century.

The city's rapid growth required increased supplies of water and the extension of water lines. In 1871, the city established a water commission and in 1879 it opened a new waterworks that drew water from the Allegheny River into reservoirs on Highland Avenue and in Herron Hill. From 1889 to 1900, the city built a yearly average of 15.4 miles of pipe; the water supply network increased in length from 268 miles in 1895 to 743 miles in 1915. The system, however, was plagued by extensive waste and
faulty pipes, resulting in frequent water shortages and campaigns by the Department of Public Works to induce citizens to cut water usage. In the 1890s, the Department began installing water meters. More serious than the waste was the increasing pollution of the water supply. The municipality drew its water from the Allegheny River, which became increasingly contaminated as the 350,000 inhabitants of 75 upriver communities used it to dispose of their untreated sewage. Pittsburgh itself contaminated its own supply, with sewer outlets located above its water intake pipes. The resulting pollution gave Pittsburgh the highest death rate from typhoid fever of the nation's large cities: over 100 deaths per 100,000 persons from 1883 to 1907. In contrast, the average for northern cities in 1905 was 35 per 100,000 persons.

In 1899, the Pittsburgh Filtration Commission, appointed by the mayor in 1896, confirmed the link between water quality and disease, and recommended construction of a slow-sand filtration plant as the most economical means of dealing with the public health problem. Voters also approved a bond issue in 1899 to build the plant, but factional political battles over control of construction contracts delayed final completion of the filtration plant until the end of 1907. Once in operation, the filtration system had dramatic effects; by 1912, Pittsburgh's death rate from typhoid fever equaled the average for the largest American cities.

Construction of a sewer system followed the expansion of the water supply network. In 1870, the city had only five miles of sewers, mostly downtown; five years later, mileage had increased to about 25 (13 miles of brick sewers and 11 miles of pipe sewers), mostly for storm water drainage. These sewers suffered from design faults and were often either undersized or oversized and subject to constant clogging. The city had no topographical maps until the 1870s, and sewers did not conform to topography; neither did they follow an overall engineering plan. Rather they were often built as a result of council members' attempts to meet the demands of their constituents. Without sewers, the great majority of households in the city depended on cesspools and privy vaults for disposal of domestic waste.

Debate raged between different professional groups and politicians about the design of the sewerage system. Should it be a separate, small pipe system that carried only domestic and industrial wastes, or a large combined system that could accommodate both wastewater and storm water? The engineering community convinced city officials of the superior virtues of the combined system in terms of both health and storm water removal; by the late 1880s, Pittsburgh had begun building a system of large combined sewers.
Between 1889 and 1912, civil engineers from the new Bureau of Engineering of the Public Works Department constructed more than 412 miles of sewers, almost all of the combined type. The construction of this planned sewerage system signified, as one recent writer said, a movement away from the “piecemeal, decentralized approach to city-building characteristic of the 19th century.”22 It was not until 1958, however, with the creation of ALCOSAN, that Pittsburgh sewage was finally treated. In addition, the combined system has left the city with a heritage of serious water pollution problems, especially under wet weather conditions.

Other modern infrastructures facilitated settlement of new areas of the city and neighboring towns. Telegraph and telephone service (provided by private utilities) became available in the late 19th century. By 1874, a business telegraphic network and a district messenger service facilitated communication within the city. When the telephone became available in the late 1870s, the business community quickly adopted it, followed by affluent residential neighborhoods.23

Electrical power became available during the same decades. The Allegheny County Light Company was founded in 1880, just six months after Thomas Edison had demonstrated the first practical electrical incandescent light bulb. Initially, numerous small companies provided direct current to users and many firms generated their own power. In 1887, however, George Westinghouse’s Allegheny County Electric Company began supplying alternating current to downtown users and then to residential neighborhoods. By 1900, his Philadelphia Company controlled most of the county’s electrical system.24

Natural gas was also an important energy source in Pittsburgh in the 1880s. The largest supply came from wells in Murrysville, but George Westinghouse had the good fortune to strike a major gas well on his North Point Breeze property in 1884. Iron, steel, and glass industries, as well as more affluent residential areas, used natural gas extensively. However, by the 1890s, local supplies were largely exhausted and much of the city returned to the consumption of coal and the consequent smoky conditions.25

**Conclusion**

By the end of the first decade of the 20th century, Pittsburgh had taken significant steps toward becoming a modern networked city. Most of its streets were paved and hundreds of miles of streetcar tracks covered the city and its suburbs. It had extensive water and sewer systems and a supply of filtered water. Many neighborhoods had electrical power and telephone services: police and fire departments responded to both telephone and telegraphic signals.

The quality of services supplied, however, varied greatly between neighborhoods. While the differences over infrastructure development prior to the Civil War often reflected a territorial split between old and new wards, the divisions in the late 19th-century tended to follow class lines. Working-class neighborhoods, especially those inhabited by recent immigrants and African Americans, often suffered poor services. Many streets in these neighborhoods remained unpaved well into the 20th century at a time when the growing middle-class districts were receiving new boulevards and smooth paving. Particularly costly from a health and nuisance perspective were inequities in water and sewerage services.
Thus, Pittsburgh’s major technological achievements were balanced by major deficiencies in health and quality of life for many of its citizens. The investigations of the Russell Sage Foundation’s Pittsburgh Survey, published in the years from 1909–1914, fully illustrated these discrepancies. It would not be until the second half of the 20th-century that many of these problems would finally be addressed.

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1 As quoted in City of Pittsburgh, Department of Public Works, The City of Pittsburgh and its Public Works (Pittsburgh, 1915): 35.
12 Tarr, Transportation Innovation and Spatial Change in Pittsburgh, 2-6. The city’s railroad debt reached $1.8 million and the county’s $3.3 million by 1855.
14 Craig Samuel, “The Mechanization of Pittsburgh Street Railways, 1886-1887,” Pittsburgh History 77 (Summer, 1994): 54-66. In addition, commuter rail service was extended and by 1890, 235 commuter trains a day entered the city; for the year, they carried 2,698,633 passengers.
15 Tarr, Transportation Innovation and Spatial Change in Pittsburgh, 7-14.
16 Ibid., 17-19.
19 A private company using Monongahela River as a source supplied the South Side.
25 Ibid., 258, n. 66.
26 For a recent review of the Pittsburgh Survey, see Maurine W. Greenwald and Margo Anderson (eds.), Pittsburgh Surveyed: Social Science and Social Reform in the Early Twentieth Century (Pittsburgh: Univ. of Pittsburgh Press, 1996).