

TRANSPORTATION DEVELOPMENT AND INSTITUTIONAL CHANGE

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Summary

This chapter traces the development of transportation institutions, organizations, and systems in the United States, where since about 1800, consumer sovereignty has been the institutional foundation. Intercity and urban transportation evolution is examined during three periods from 1790 to 2000. During each of these periods there was acceptance or consensus on rules for the organization of transportation providers, particularly regarding the relative participation of state and private organizations. The chapter also compares US transportation development with that in France and the United Kingdom at several points since the late nineteenth century and concludes by reflecting on whether different institutional traditions result in different outcomes.

During the first period, 1790–1840, mercantile interests and states built transportation infrastructure in the form of roads and canals that were open for a toll to all users. In the following period, roughly 1840–1910, the idea prevailed that private corporations should plan, build, and operate transportation infrastructure with little state oversight. The Progressive movement in the U.S. reformed and strengthened the administrative capacities of all levels of government at the beginning of the twentieth century and heralded the third era of transportation consensus, which was that government would build transportation infrastructure and private interests would provide and operate vehicles to use it.

Snapshots of French and English transportation institutions show major differences. Governments were stronger and more centralized than in the U.S., and their employees were trained in technical institutions. The ethos of land development was not a central force in the evolution of French and English society and certainly was not an activity for the common folk. These conditions led to projective government leadership in the development of railroad and streetcar systems, even though private capital actually built and operated most of them well into the twentieth century.

1. Introduction

Transportation systems include not only infrastructure and vehicles but also institutions and organizations. Institutions are the rules and laws by which transportation infrastructure is built and operated. Organizations are the human agencies that operate within the rules to make decisions affecting the transportation infrastructure and vehicles.

According to D.C. North, over the course of history institutions, organizations, infrastructure, and vehicles incrementally and interactively evolve along paths that differ greatly among the world's countries. The paths are dependent upon the nature of the institutions and organizations that existed at the beginning of any historical period, and the paths of different societies do not necessarily converge over time. To understand the nature of institutions and organizations of a given country at any one period of time

requires knowledge of the historical evolution of the transportation system in that country.

This chapter focuses on the evolution of transportation systems in the United States, with some comparisons to the evolution of systems in England and France and occasionally other Western European nations. The purpose is to illustrate the process of transportation system change to better understand the scope for human agencies making radical changes to the system in the near future. The occasional comparisons to England and France are intended to offer perspectives from countries with somewhat different institutional heritages.

Since the 1790s, the United States experienced three lengthy periods of acceptance or even consensus about the relative roles of government and the private sector in the development of the nation's transportation system, punctuated by periods of relatively rapid change. This chapter examines the events that led to each period of consensus and the institutions and organizations, both intercity and urban, associated with each period. Discussions about similarities and differences between the US and the English and French experiences occur in each section.

2. US Transportation System Evolution before the Railroad

The major US institutions informing the development of transportation during the early nineteenth century were that country's Northwest Ordinance, adopted in 1787, and the Constitution, ratified shortly thereafter. By establishing rules pertaining to private land development and the creation of new states, the Northwest Ordinance provided the framework for expansion of the country over the ensuing century. The act was based on the evolution of custom both in England and the colonies over the preceding 150 years, and its framework nurtured the ethos that land speculation and development were natural paths to wealth for ordinary citizens. It also designated the Mississippi and Ohio Rivers as free avenues of transportation.

The Constitution established two structures. One was a federal governmental system in which state governments were the major players except for matters of national interest. The other was a separation of powers in the national government between legislative, executive, and judicial branches of government. State governments also emulated the separation of power structure and created democratically controlled local governments, whose powers and geographical territories the states set. Generally, states viewed governmental land development responsibilities as residing at the level of local governments.

2.1. Transportation Organizations in 1800

At the beginning of the nineteenth century, transportation organizations in the United States differed little from those in colonial times. The larger cities on the eastern seaboard, Philadelphia, New York, Baltimore, and Boston, in common with the smaller tidewater towns, communicated and traded as much with England as they did with each other. Small sailing ships, differing little from those two hundred years earlier,

connected the two continents. Such ships, as well as smaller craft, also plied the eastern seaboard.

In 1800 trans-Atlantic shipping was irregular and indirect. The most common shipping organization was the transient or tramp trader, a ship individually owned by a merchant in any of the major cities along the eastern seaboard. Seeking inexpensive cargoes that would command high prices somewhere else, tramp captains took their ships from port to port for as many as two years before returning home. More reliable and increasingly important after the turn of the century, however, were regular traders, somewhat larger ships owned by the larger merchants in the major cities. Originally carrying only merchandise of the owners' firms, regular traders typically confined their routes to a small number of larger ports. After 1800, regular traders increasingly offered themselves as common carriers for general freight and passenger traffic and added to the traffic of the owning merchants. Because they regularly operated between a handful of cities, regular traders offered passengers more reliable service than tramps, but prospective passengers still could not plan on when ships would leave or arrive. Regular traders did not sail by schedules but only when their holds were full.

In 1800, little freight or passenger transportation occurred over land, on the rivers, or along the coast because of the time required for movement. In 1790, for example, it took 31 days for news of events happening in Philadelphia to reach Pittsburgh, roughly 500 km to the west, and 10 days to reach Boston, roughly the same distance by water to the northeast. While roads crisscrossed the settled parts of the eastern seaboard, most were tracks carved out of woods, many impassible to wagons. Where wagons could operate, ruts, mud, and stumps hindered movement. Road maintenance, which in most cases was deplorable, was the responsibility of adjacent landowners, who typically had more pressing concerns for their time and labor. Stagecoaches used the roads that linked the larger cities in the Northeast, but the stages themselves were not well used. Wagon freight transportation was too expensive for commercial agriculture to occur more than a few kilometers from bays and estuaries. Navigable rivers became the principal means of exporting crops from the interior, particularly in the Ohio and Mississippi River valleys as those regions became settled. Commodities were floated down rivers over distances reaching up to 3200 km, but upstream travel was so costly that it was feasible for only light, high-value objects. Sea travel along the coast also was slow and unreliable.

2.2. The Blossoming of Transportation Organizations 1790–1840

By 1841, the year that the Morse telegraph was invented, overland, river, canal, and coastal water transportation in the US was much faster and cheaper than in 1790. News of events in Philadelphia now required less than 5 days to reach Pittsburgh and less than 4 days to reach Boston. Far away St. Louis (1600 kilometers) was receiving news of Philadelphia events only 11 days after they occurred. Cities in the US grew rapidly as the percentage of the total population living in the cities grew. Also, trade among cities was heavy and growing rapidly.

The change in the nation's transportation system and the associated rise of internal trade began about 1790 with the gradual concentration of trans-Atlantic regular traders in

New York, whose command of the Hudson River gave that city a larger hinterland market than other cities. The introduction of steamboat service in 1807 intensified the importance of trade along the Hudson River. European goods destined for other eastern seaboard cities increasingly reached New York first and then were trans-shipped to coastal traders, thereby improving the frequency and reliability of coastal shipping.

The 1790s also witnessed the beginning of significant road improvements financed by private companies chartered by states, by the states themselves, and by the national government. A private company chartered by the state of Pennsylvania opened a stone and gravel toll road, or turnpike, between Philadelphia and Lancaster in 1794 and removed 20 days from the time that it took for news to reach Pittsburgh from Philadelphia. Financed mostly with private money in the more densely populated states and a combination of private and state funds elsewhere, turnpike construction quickly spread throughout the Northeast. Common carrier stagecoach services expanded from the few which remained from the colonial period. By the 1820s, some turnpike construction, mostly state-financed, took place in Indiana and South Carolina.

The national government also became involved in internal transportation improvements. Congress authorized internal transportation improvements where there was demand for projects involving more than one state or where states were not yet organized. Navigation improvements to the Mississippi and Ohio Rivers fell into the former category, as did a road linking the rivers to the eastern seaboard. The task for carrying out such projects fell to the Army Corps of Engineers, whose officers studied French textbooks on road construction and navigation improvement practices. Built to French engineering standards and financed by tolls, the National Road was built by the national government westward from Cumberland, Maryland, reaching the Ohio River in 1818 and Columbus, Ohio, in 1833. At the same time, the national government built thousands of kilometers of primitive post roads for the carriage of mail in regions of the South and West as they were opened to settlement.

The War of 1812 was partly responsible for arousing popular enthusiasm for internal transportation improvements. By blockading US ports, the British deprived the United States of European manufactured goods, leading to an expansion of domestic production. The blockade also severed the coastal lines of internal communication. During the blockade, some long-distance wagon shipments negotiated the local road system along the eastern seaboard successfully but with great difficulty, highlighting both the feasibility and the terrible condition of overland transportation. This awareness, as well as rapidly growing internal trade after the war, led groups of merchants in various regions to seek internal transportation improvements. Their efforts included enlisting the support of legislators in state capitals for chartering and financing internal transportation improvements.

2.2.1. Packet Lines and Common Carrier Service

Numerous transportation improvements ensued under the increasing domination of New York as the nation's entry port. In 1818, five New York merchants organized the Black Ball Line, a partnership that bought four regular traders and sailed them as common carriers between New York and Liverpool. The term "common carrier" meant that the

ships operated according to published timetables and accepted all freight and passengers willing to pay published rates. This institution became known as a packet line. The first competitor did not appear until 1822, but after that date packet line competition intensified between New York and major European ports. Ships grew rapidly in numbers, and also size and speed. Steamships displaced sailing packets in the 1840s.

River, lake, and coastal water steamboats also grew in numbers and size. In the East, most were organized as packet lines, owned by major merchants in the principal cities served. In the Ohio, Mississippi, and Missouri River Valleys, most steamboats were owned by single investors and were operated in tramp service. There were also important packet lines on the western rivers, however.

2.2.2. Canals

Merchant interest also turned to the construction of canals. New York merchants persuaded the New York State legislature to build and operate a 500 kilometer canal connecting the Hudson River with the Great Lakes. Construction began in 1815, and what became known as the Erie Canal opened for through business in 1825, funneling even more of the western trade through New York's harbor. The canal was open to any individual or company that wished to operate boats on it in exchange for the payment of tolls. The heavily used canal was a financial success, setting off a canal construction boom in the Northeast and in the Ohio-Great Lakes region. By 1840, about 5400 kilometers of canals were operating in the United States. Because of their heavy capital requirements, most of the canals were built and operated by state governments, although the national government also subscribed \$3 000 000 in capital and 4 000 000 acres of public lands to canal projects.

Subscription of public land to companies building transportation infrastructure became a popular form of government subsidy. State agencies or private companies receiving such land could sell land-backed bonds to investors. Investors anticipated that future sale of the land would bring profits regardless of the profitability of the transportation enterprise.

2.2.3. The Concept of Public Highways Open to Private Competitors

Robert Fulton and Robert Livingston, who in 1807 successfully applied steam power to a riverboat, obtained monopoly rights from the New York State legislature for operating steamboats on the Hudson River and Long Island Sound. The Hudson River monopoly ran counter to the ethos of open river navigation espoused for western rivers in the Northwest Ordinance and aroused resentment. In 1824, the US Supreme Court found that river and bay monopolies that hindered interstate trade were in violation of the United States Constitution. In the following year, the New York state legislature revoked Livingston's and Fulton's monopoly. Henceforth, rivers and bays were considered public highways open to the use of all comers.

Other forms of transportation infrastructure were viewed similarly. Improved roads, canals, and ports were considered open to all potential users, whether individuals or partnerships. That users should pay fees to traverse the facilities was at best grudgingly

accepted. Most toll-financed roads lost money, in part because of users that circumvented tollgates

3. A New Consensus: The Railroad Era in the US

The organizations that provided transportation in the United States took a major turn in the 1840s, largely because state governments overextended themselves on earlier transportation projects and because the new technology of railroads demanded huge infusions of new capital. Most of the canals and toll roads lost money, despite their importance to the development of communication and commerce. Easy money from state banks also encouraged rampant business speculation. The resultant financial panic of 1837 diminished the financial credit of the states, which then were displaced by the limited liability corporation as the proactive agent of transportation development. After recovering from their financial setbacks, states and the national government continued to provide charters, cash, and land grants to corporations to entice railroad construction into particular areas, but the proactive capacity for government institutions to plan, construct, or operate transportation enterprises withered. A new consensus emerged. Private corporations should plan and build transportation infrastructure and vehicles and also operate common carrier service over this infrastructure.

3.1. The Rise of the Multidivision Corporation

Although no interregional railroads existed in the United States in 1837, railroad potential for stimulating economic development was widely anticipated. Railroads were not a new technology—primitive versions of track systems that supported and guided wagons existed as early as the sixteenth century in German coalmines, and by the end of the eighteenth century, several thousand kilometers of gravity and horse-powered colliery railroads existed in England. The large scale of English colliery railroads was testimony to the dramatic increase in demand for coal in England in the eighteenth century during the industrial revolution.

The use of railroads as a common carrier form of transportation was new, however. Colliery railways were constructed and operated as adjuncts to coal production by companies mining coal, but in 1821 a private company, the Stockton and Darlington Railway was organized in the Newcastle coal district with the sole purpose of building a 56-kilometer line that could be used by several colliery companies and anybody else who might want to use it for a fee. The Stockton and Darlington opened in 1825. Several years later, other entrepreneurs adapted the Stockton and Darlington model to serve dense freight and passenger demand between the two large industrial cities of Liverpool and Manchester. The Liverpool and Manchester opened in 1830 as a common carrier railroad for both freight and passengers, using company-provided steam-powered trains operating with published schedules and tariffs. It was highly profitable from the outset, and thereafter privately financed railroad construction rapidly expanded throughout England.

At the end of the 1820s, English railroad development caught the interest of mercantile interests in several US eastern seaboard cities, who sought transportation investments that would counter New York's Erie Canal initiative in tapping western trade. All were

faced with higher mountain crossings compared to New York, making canal construction more costly and less effective, and although several states did initiate canal projects to connect seaboard cities with western rivers, railroads increasingly were seen as the means to out-flank the Erie Canal. Pennsylvania started construction of a combination of canals, inclined planes, and short railroads to link Philadelphia with Pittsburgh and the Ohio River during this period, and both Boston and Baltimore promoted railroads connecting with western water-trade routes. The first common carrier railroad to open in the United States was the Baltimore and Ohio, which began operating horse cars over a 21-kilometer line running west from Baltimore in 1830, the first link in what its promoters envisioned as a transregional trunk route to the West. By the panic of 1837, numerous common carrier rail lines had opened and were being extended in the United States, but as of yet none had achieved the status of interregional carrier. The first interregional rail trunk opened in 1840 between Boston and Albany, but it was not for another decade until other trunk routes opened between the eastern seaboard and the West.

During the 1840s, US railroad promoters looked for financial support, increasingly in Boston and New York where merchants and shippers had amassed large pools of capital, and not long after in London and other European capitals. Promoters discovered that the corporation, which separated ownership from management, was an ideal organizational structure for raising capital in places far removed from where it was needed. Unlike the production process of contemporary large-scale industries such as cotton mills, which took place in one location where owners typically managed, the railroad production process was spread over distances of hundreds and ultimately thousands of kilometers. The challenge of operating and coordinating a technology of unprecedented complexity that spanned such distances, with hundreds of different points where expenses were incurred and revenues were taken in, was met by adaptations of the corporation structure. Because management was separated from ownership, it was possible to expand its complexity and geographic scope.

New forms of management departmentalized by both function and geographic scope developed through trial and error from roughly 1845 to about 1890, according to Cochran's analysis of managerial correspondence during that period. Functional line departments included operations and maintenance, accounting, and traffic solicitation. Geographical divisions included suborganizations with their own line departments that managed sections of the railroad as large or larger than crew districts, which ran for about 160 km along main rail routes. The routing of authority through both the line functions and geographical divisions involved conflicts, and different railroads took different approaches to resolve the conflicts. The Pennsylvania Railroad, for example, decentralized managerial authority to its division organizations to a greater extent than most railroads, while its rival, the New York Central, centralized authority in its headquarters to a greater extent than most. In either case, however, there emerged a new cadre of managers, white-collar bureaucrats, who managed by interpreting statistics flowing through the system. The process of creating what ultimately became the model of the modern multidivisional corporation, with its irresolvable conflict between functional and divisional authority, was one of trial and error spanning roughly the period from 1845 to 1890.

Railroad lines interlaced most of the eastern half of the United States by 1860, but they did not yet constitute a national system. Different corporations built their lines with different gauges, and lines of different companies often did not connect with each other in major cities. Some large rivers remained unbridged. The exigencies of prosecuting the US Civil War effort (1861–1865), particularly in the North, eliminated these impediments and also helped create new institutions whereby owners of railroad cars could send their cars over the tracks of other railroad corporations and be reimbursed for doing so. Such measures led to a unified national railroad network serving the United States at the end of the 1860s, even though it was composed of hundreds of corporations. The network opened huge markets for entrepreneurs and ushered in the era of large-scale business enterprise, whose management structure was based on the model of the railroad multidivisional corporation. Other forms of transportation, such as canals, coastal and lake steamers, riverboats, and roads fell into decline.

3.2. Urban Transportation Developments, Institutions, and Organizations

From 1870 to 1910, roughly the period of railroad dominance in the United States, the nation's population increased from 39 million to 92 million people. Of this 53 million-person increase, 32 million occurred in urban areas. Before the late 1880s, however, there was no corresponding form of urban transportation that had the impact on urban form that railroads had on the development of the country. Walking remained the primary form of local transportation, and as cities mushroomed in population, the need to locate activities within walking distance of each other led to huge increases in density.

Beginning in the 1830s, attempts were made to mechanize urban transportation in the United States, but before the invention of the electric streetcar in 1888 none were cheap or fast or extensive enough to displace walking as the dominant mode. The electric streetcar, on the other hand, had a major impact on urban transportation and the institutions providing it. The entrepreneur and inventor Frank Sprague installed a streetcar system in Richmond, Virginia in 1888 that was widely copied. By 1891, Sprague and other capitalists had installed over 200 streetcar systems in US cities.

With average operating speeds of sixteen to twenty-five kph including stops, streetcars extended the range in which people could travel within a given amount of time. Despite heavy capital requirements in the form of power plants, electric distribution systems, heavier track structures, and electric rail cars, streetcars had much lower operating costs per car mile than horse cars or cable cars. By setting fares low enough to attract masses of middle class passengers, managers still achieved adequate profit margins and volumes to more than cover the charges on heavy capital investments and also make substantial profits.

Recognized as natural monopolies, streetcar companies were allowed to consolidate by local governments into citywide streetcar monopolies, popularly known in the press as “traction trusts.” By 1900, large traction trusts controlled most if not all streetcar service in most US urban areas. To increase demand for the electric power that they generated, many of these traction trusts also provided electric distribution systems for commercial and residential users in their urban areas. In Boston, New York, Philadelphia, and

Chicago, traction trusts also built specialized local passenger railroads called rapid transit on elevated structures above city streets or in subways below street grade, sometimes in city-owned tunnels outfitted by private companies with track, electrification, and signals, and privately operated.

Entrepreneurs also organized companies to adapt streetcar technology to meet rural travel demands. What became known as interurban electric railways extended from the centers of cities in rich farming districts to rural towns and other cities. Lines typically ran 20–100 kilometers, but some were considerably longer. The first interurban opened in 1892 between Portland, Oregon and Oregon City; by 1914 approximately 24 000 kilometers of interurban routes were operating in the United States, with the densest concentration in the densely populated and rich farming regions of Ohio, Indiana, and Michigan.

By the first decade of the twentieth century, private corporations revolutionized urban passenger transportation in US cities and in rural hinterlands beyond. Local traction trusts provided intra-urban and suburban passenger transportation, and with interurban electric railways other local corporations challenged national railroad corporations in rural areas. In addition, intercity railroad corporations provided suburban service to several of the larger cities. The urban transportation revolution did not substantially change the wagon movement of freight within cities, however. Because of the high cost of wagon haulage, commerce generally remained centralized near large rail yards and warehouses.

4. A Change in Consensus Again

One of the major differences between the evolution of private western European and US transportation institutions was how their respective publics received them. Before the 1900s, most government organizations in the US lacked technical expertise and exerted weak control over the development and operation of private streetcar monopolies and railroad corporations. Such weakness deprived passengers and shippers from influence on transportation policy except in the market place, which was distorted. User frustration led to public hostility toward private corporations, which led to reactive and adversarial government responses focused on regulation.

Ineffective regulation of both railroads and streetcar companies in the United States from the 1870s through about 1910 led to the abandonment of the consensus of private corporate provision of transportation infrastructure during the first two decades of the twentieth century. This did not mean that streetcar companies and railroads were brought under government ownership. As Altshuler points out, the US political system embraces radical change not by sweeping out the old order but rather by superimposing a new order over the old. The new order in this case was the government provision of nonrail transportation infrastructure: first water, then roads, and eventually air.

Water transportation improvements were carried out by the Army Corps of Engineers, but road improvements did not begin until the wave of governmental reforms that swept through the United States between 1900 and 1920: the Progressive Era of US politics. The reforms strengthened and professionalized administrative capacities at all levels of

government. New highway departments were viewed as one component of the Progressive Era reforms to liberate the country from the grip of both local and intercity private transport.

The strong antipathies that existed circa 1900 between US transportation enterprises and major business groups were unknown in France and Germany. In those countries strong, projective government involvement with railroads and streetcar companies led to cooperative relationship between private transportation institutions and governments. Such cooperation fostered the evolution of technical expertise in government agencies that dealt with the private intercity and local rail corporations and eventually to smooth government takeover of intercity and urban rail infrastructure.

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Biographical Sketch

Gregory L. Thompson is a Professor in Urban and Regional Planning at Florida State University, where he has taught courses in planning and transportation planning for 14 years. He has written a book and articles on planning, costing, and decision-making in the US railroad industry and more recently has conducted research and written on the topic of transit performance and policy in decentralizing regions. He background includes a Masters of City Planning Degree from the University of California at Berkeley followed by ten years in transit planning in Edmonton, Ottawa, Berkeley, and San Diego, before obtaining his PhD in Social Science from the University of California at Irvine in 1987.