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The Development of Transportation, With Special Emphasis Upon the Changing Importance of the Railroad in the United States

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The Development of Transportation,
With Special Emphasis Upon the
Changing Importance of the
Railroad in the United States

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Nancy E. Coleman
May 1, 1968
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The Development of Transportation, With Special Emphasis Upon The Changing Importance of the Railroad in the United States

The comprehensive study of transportation dates from 1850, the year Dionysius Lardner published his *Railway Economy: A Treatise on the New Art of Transport.* That publication viewed transportation from the economic aspect and set the stage for seventy-five years of intensive investigation of transportation by some of the world’s leading economists, including Fetter, Hadley and Taussig.

From 1925 to the late 1950's interest in transportation declined as other, more pressing, economic problems presented themselves. The "boom and bust" financial conditions of the Twenties and Thirties demanded immediate attention. War required rapid adjustment in production, consumption and attitude. Postwar conditions of creeping inflation on the homefront, with ever increasing economic and military commitments abroad, commended the attention of all Americans.

Recently, however, a combination of circumstances has once again shifted the attention of economists to the field of transportation. These circumstances include urban congestion, the increased use of computers in route, rate and service calculations, the enormous scale of capital investment in air facilities and highways, and the financial difficulties and adjustment problems of America's vast rail network. Transportation is finally reclaiming its rightful place as a field of considerable economic import.
Section One

Transportation as the Foundation of Economic Development

The most vital and most often overlooked function of transportation is to provide a foundation for the economic growth of the nation. Regional specialization, large-scale production and mass distribution, all elements vitally essential to economic growth and development, require a highly efficient, cheap system of transportation.

The immediate function of transportation is to create place and time utility through the physical transfer of goods and persons from one place to another at the required time. "Utility" may be defined as the ability to satisfy a human want.

Transportation creates place utility by changing the location of objects and people from places where usefulness is low to those where it is high. Goods move so that production and distribution may occur. A person travels because he can add more satisfaction by doing so.

The effect of transportation on time utility is not simple. Sometimes, when the scarcity of a commodity is great, speed looms as the most important factor: the sooner the good reaches its destination, the greater its utility. Progress in transportation may then be measured by the reduction of the adverse effects of elapsed time. At other times, goods are not immediately needed at destination, and a slower mode of transport becomes desirable as a means of providing mobile storage.

Transportation, through its effect on utility, determines what goods will be produced and where they will be marketed. The total utility of a commodity or service depends largely upon the combination of its time and place utilities, which, in turn, depend upon transportation and, more specifically, the cost of transportation. A good will be produced and sold only if its total utility
exceeds the cost of creating utility. A free market economy, such as that in America, will eventually eliminate the production of all commodities not meeting this criterion.

By utilizing the economies of scale to fullest advantage, American industry has achieved large-scale production. Such production allows goods to be made more cheaply than would be otherwise possible and depends heavily upon efficient and relatively cheap transportation. Large quantities of raw materials must be brought into the central plant, often from great distances. Large-scale production cannot operate in a vacuum; mass distribution is necessary to move the goods out once they have been manufactured. Transportation permits and encourages this mass distribution.

Transportation leads to the economies of regional specialization. When a geographical area specializes in the production of only one or a few items, its other needs must be met from outside sources. The given area must also have access to a large market for its limited variety of produce. Transportation is essential to this exchange.

Finally, transportation cost determines the size and location of supply and market areas. If transportation is relatively cheap, supplies may be economically drawn from distant sources, and wider markets will be possible. The locality can then prosper without producing most or all of the goods it needs.

Besides creating utility and providing a basis for large-scale production, transportation also helps to determine price. It effects the ultimate charge to the consumer first as a cost of production; the expenditure on transportation must be added to the price of the raw materials and supplies in determining the cost of production inputs. Transportation then becomes a cost of distribution. The increased speed of modern transportation has tended to reduce
the costs of distribution, other than the actual cost of transportation itself, because a smaller investment in finished goods in transit is required than in the past. **Storage**, another facet of transportation, allows goods to be distributed some time after manufacture and may thereby increase their worth.

Transportation also induces lower prices, price equalization and price stability. As has been mentioned, transportation costs make up a large share of the final price of any item. At present, about twenty cents out of every dollar the consumer spends goes to transportation. Any reduction in transportation cost will, therefore, reduce the total cost at destination. Lower transportation costs also effect price indirectly, since lower costs induce more producers to compete in a given market, and increased competition works toward price reduction.

Price equalization is a consequence of the exchange of goods between various localities. The spread between prices in different places becomes lesser as a more efficient transportation network develops. Goods move from areas of low price (reducing supply and increasing price) to areas of high price (increasing supply and reducing price). Theoretically this process will continue until the difference in price for a given commodity between any two markets is just equal to the cost of transporting the good from one area to the other.

If transportation did not exist, each area would be entirely dependent upon local production for all its needs. Under such circumstances, the price of a commodity would be low when the good was readily available and high when it was scarce. Great variation in price would result over time. Transportation helps to reduce this variability and to stabilize price by making commodities from distant markets available when the given area's production is low and by
distributing local produce to other areas when production is high. Thus, the supply in a given area remains relatively even year round, and prices differ over time only by the cost of transportation.

Since accessibility is measured in terms of cost and time, transportation plays a large role in determining the location of economic activity. Positional factors, including the accessibility of an area to raw materials, to market, to fuel and power and to labor with the requisite skill, generally dominate and determine the general area of location. The optimum position becomes one where transportation charges per unit are at a minimum. Within this general area, the exact location depends upon certain site factors, such as zoning and building ordinances, tax rates, labor legislation, unionization, topography, climate, culture and community attitude. Thus, before production even begins, economic activity depends upon transportation.

In order to take full advantage of certain transportation economies, a plant will usually locate either at the source of the raw material or at the market. By locating at one of these two places, a manufacturer avoids duplication of terminal and other fixed charges associated with loading and unloading. He also gains the advantages of the tapered rate structure common to nearly all modes of transport; rates increase at a decreasing rate, so the producer pays a lower total bill than he would if he located at some intermediate point instead.

Under certain special circumstances, however, a producer may elect to locate at a point between raw material and market. But even here transportation considerations are paramount. Two of the three possible reasons for choosing an intermediate position depend upon transportation factors. First, the place may be a break-bulk point where a change in the mode or vehicle of transport is required. Since loading and unloading operations occur anyway, why not locate the plant here? Second, transit privileges, such as storage-in-transit,
fabricating-in-transit and creosoting-in-transit, may apply at that point. Such privileges tend to nearly equalize the transportation charges at the intermediate point with those at either the raw material source or the market. The last reason for locating at an intermediate point, the only one not directly involving transportation considerations, is the industry's being classified as a "foot-loose" industry, meaning that transport charges do not constitute a large portion of its cost and its labor needs may be met anywhere.

Without an adequate transportation system an economy may survive, but its standard of living will be low, and many of its people will live in poverty, deprived of many of the necessities and most of the comforts of life. National defense will be weak and national unity nonexistent. Yes, transportation is truly necessary for economic growth and development.
Section Two

Transportation and the United States Economy

With an efficient, balanced transportation network all about us, we, as Americans, tend to take transportation for granted. Transportation is, however, part of our culture and heritage. It played a central role in the discovery, settlement and growth of America. The westward movement, by covered-wagon, steamboat and train, was made possible by transportation developments. Transportation has also helped to maintain national political unity and national defense by bringing together persons of many diverse backgrounds and interest, facilitating the rapid dissemination of ideas and knowledge and fostering a breakdown of provincialism.

To gain some understanding of the importance of transportation in modern American life, let us examine several points. First, America's annual transportation bill amounts to approximately one fifth of the Gross National Product (GNP). In 1966 Americans spent seventy and one-half billion dollars on freight transport and eighty-one billion dollars on passenger movement. These figures do not include the nearly two billion dollars spent by various governmental units (1963) for their own transportation facilities.

The transportation industry is one of the nation's largest employers. In 1965, the more than nine million persons employed as carrier personnel, transportation equipment manufacturing personnel, related industry personnel and state and federal government transportation employees made up approximately thirteen percent of the total American labor force. This percentage has remained relatively constant since 1940. These workers are well paid. The average annual earnings of transportation workers in 1965 was $7,473, a figure far superior to the averages of many other industries. (See Appendix, Figure 1)

Since most modes require great amounts of capital, the annual investment figure for transportation is quite large. Private investors poured more than
one hundred thirty-nine billion dollars into the network by 1963. Various governmental units also make large annual capital expenditures on transport facilities, especially highways, and in fiscal 1965 the federal government budgeted over eleven billion dollars for transportation.

While the government spends a good deal on transportation, it does not do so without receiving much in return. In 1965 taxes levied on transportation accounted for nineteen percent of all federal revenues and thirty-four percent of all state revenues. Nearly all highways are built and maintained by funds collected in the form of highway user taxes, notably the gasoline tax.

Finally, the transportation industry is a major consumer of the nation's industrial output. Its shopping list includes over one hundred thousand distinct items ranging from soap to steel, toothpicks to telephone poles, paper to parachutes. (See Appendix, Figure 2.)

How does the rail industry fit into this glowing picture of transportation's contribution to modern American life? National and regional rail coverage is excellent. Railroads serve some three thousand counties in the United States, containing more than ninety-nine percent of the nation's population. Highly developed cooperation among the various railroads permits rail cars to move with almost perfect freedom from one line to another. The details of interline exchange and revenue division are handled completely by the railroads involved, so from the shipper's viewpoint it is as though the vast rail network were a single nationwide railroad.

The total rail system consists of two hundred eleven thousand route miles and around three hundred forty-four thousand track miles. The rolling stock used on these tracks includes approximately twenty-eight thousand locomotives, twenty thousand passenger cars and one million five hundred thousand freight cars (1966). The book value of total railroad investment
lies around thirty-six and one-half billion dollars. Annual operating revenues for the rail lines average ten and one-half billion dollars, with net profits after taxes coming to five hundred million dollars.\(^{15}\)

The firms comprising the railroad industry vary considerably in size. While there are over four hundred line-haul railroad companies, ninety-nine percent of the traffic is handled by the less than one hundred companies classified as Class I railroads by the Interstate Commerce Commission. (They are so classed on the basis of having gross annual operating revenues of five million dollars or more.) These same companies account for ninety-six percent of total mileage and ninety-three percent of railroad employment. Even within this group, however, size and importance vary greatly. For example, the ten leading companies account for one half of all railroad employment and operate forty-four percent of the total mileage, fifty-two percent of the locomotives, fifty-seven percent of the passenger cars and fifty percent of the freight cars.\(^{16}\)

The rail network employed a labor force of seven hundred and thirty-five thousand in 1965 and paid out five billion dollars in wages.\(^{17}\) This situation shows a marked change from the labor picture in 1946 when, with approximately the same route mileage, the railroads employed one million four hundred thirty-nine thousand workers for 3.9 billion dollars.\(^{18}\)

Railroads form the backbone of America’s intercity freight movement, accounting for forty-three percent of all ton-mileage.\(^{19}\) The rails look to their freight business for over four-fifths of their revenues. These receipts average out to about one and three-tenths cents per ton-mile. The average load weighs thirty-eight tons, while the length of haul averages two hundred fifty miles for the individual carrier and four hundred seventy miles for the rail network.\(^{20}\) Passenger traffic plays a much lesser role.
A Brief General History of Transportation

Transportation has a long and varied history dating back to prehistoric times. Before the invention of the wheel, early man transported his goods across land by means of four conveyances still in use in some areas of the world today. The earliest of these was man himself, carrying objects on his head or shoulders. But man had a rather limited carrying capacity, even with the yokes and shoulder poles he developed to make the job easier, and, therefore, he soon turned to pack animals to carry his goods.

While the use of pack animals introduced no great speed advantage (a fully loaded horse or camel moves at about two and one half miles per hour), any pack animal, except the dog, could carry more than a man. Pack animals continued to be important down through history wherever the need for land transportation was great and good roads and wheeled vehicles lacking. In the eighteenth and early nineteenth centuries, pack horses played an indispensable transportation role in both Great Britain and America, serving as the chief means of land freight transport.

To accommodate passenger transportation, man designed portable chairs. The Assyrians, Babylonians, Greeks and Romans used these in ancient times. Introduced into Europe as a result of Asiatic influence, portable chairs took the modern form of sedan chairs, with side windows and a glazed door at the front. As late as the eighteenth century sedan chairs remained popular in England, where most of them were for public hire.

But both man and beast are better suited to pulling than to carrying, so several dragging conveyances developed early. An animal pulling a sledge or travois could drag a load more than twice as heavy as it could carry. These
devices found special favor where the terrain was snowy or icy or the load too heavy or too bulky to be carried by a single pack animal.

The ancient Egyptians used a very different type of dragging device to haul huge rocks long distances. The load, placed on a platform, was pulled by slaves or animals over a series of rounded beams placed at right angles to the direction of movement. As the load moved forward, the rear beams became free and were then placed under the front of the loaded platform. Beams used this way served as rollers and probably inspired the invention of the wheel.

The invention of the wheel, perhaps the most important transportation innovation of all time, marked the start of the next period of transportation history. Sometime between 8000 B.C. and 4000 B.C. man invented the wheel for use on vehicles. Between 3500 B.C. and 2600 B.C. the use of the wheel spread through Asia and northern Africa and reached Europe around 1500 B.C. But the Western Hemisphere knew nothing of it until European settlers arrived in the sixteenth century.

The first wheels were flat circular pieces of wood chopped from a tree trunk. Next, man attached several flat pieces of wood to make wheels of great diameters; these wheels produced little friction and could surmount large obstacles. Efforts to make stronger, lighter wheels led to thin wooden wheels reinforced by metal crossbraces. Eventually wheelmakers eliminated the wood in the center, thus introducing the spoked wheel.

The wheel has contributed greatly to land transportation. It reduced friction and increased the weight that could be moved at a given speed with a given amount of power.

With or without wheeled vehicles, however, land transportation remained costly compared to water transportation which did not require great amounts
of animal or slave labor and for which the way was already available. It was only natural, therefore, that most primitive people learned some sort of navigation.

Early water conveyances varied greatly in structure. The simple hollowed-out log probably came first, followed by a wide assortment of bark canoes, water-proof baskets, skin-covered frameworks and inflated hides. The means of propulsion differed also, including paddling with hands, feet or wooden paddles, poling, rowing, towing from shore and using sails. Additions to and modifications of these early forms eventually led to large ocean vessels used for trade.27

Man first used the sea for trade about 2800 B.C. when Egyptian ships began sailing the Mediterranean Sea, carrying papyrus and grain to Phoenicia to be bartered for wood. But it remained for the Phoenicians to extend maritime trade to the entire Mediterranean and beyond. Later the Greeks assumed leadership of the seas.

Oarsmen and sails propelled these ancient Mediterranean vessels. Lacking compasses, ancient mariners stayed within sight of land whenever possible. Often white marble monuments were erected along the shore to serve as guidance markers for ships. The first lighthouse appeared near the end of the Greek period.28

It remained for the Romans, however, to develop the most advanced system of sea and land transportation that the ancient world had ever seen. The system permitted trade, encouraged regional specialization and enabled Rome to administer and defend a vast empire stretching from Great Britain to the Persian Gulf.

Most interregional trade was done by sea. The Romans facilitated such trade by driving the pirates from the seas and establishing the political unity and peace necessary for the wide-scale development of trade. Roman ships
sailed the Mediterranean and the Atlantic, venturing as far as India and the east coast of Africa in search of exotic merchandise and wealth.

The Romans were antiquity's greatest road builders. The road system, built for military and political purposes, encompassed fifty thousand miles of main roads extending from Rome to Britain, Gaul, Germany, Spain, Greece and some parts of Africa and Asia. The most famous of these roads, the thirty-five foot wide Appian Way, connected Rome and the lower Italian provinces.  

In some respects Roman roads were notably modern in construction. Sharp curves were avoided whenever possible, and provision was made for drainage by building the roads higher than the surrounding land, with the road's middle higher than its sides. The one serious defect in some of these roads was the existence of steep grades which greatly reduced the capacity of the roads. The government had to limit the load allowed on the roads and often set a very low figure.

But just as transportation contributed to the growth and maintenance of the mighty Roman Empire, so also did it contribute to the Empire's decline. Technologically, transportation was not yet capable of supporting so huge an entity. Part of the blame for the dissolution of the Roman Empire lies in the inadequacy of the transportation system.

Following the breaking of the Empire, the civilized world entered the Middle Ages. During this time the feudal system flourished and transportation languished. Large, frequent tolls levied by feudal lords, favored individuals and the Church greatly handicapped transportation on roads and rivers and through ports. Piracy and highway robbery further disrupted travel.

The feudal system, based as it was on small, self-sufficient units, had little need for long distance transportation. Roman roads fell into disrepair,
and after two to four centuries, though the routes were still used, road surfaces were no longer stone but dirt. The dirt became dusty in dry weather and muddy in wet; when the mud dried, deep ruts remained.

Individuals travelled mainly by horseback, though women, children and men too sick or too old to ride occasionally used litters. Goods moved by pack animal or in small, two-wheeled carts drawn by horses or donkeys.

Some important advances in horse breeding, horse shoeing and harnessing techniques developed during this period, making more economical transportation of goods possible and sparking a demand for road improvement. Some upgrading of roads did begin in the twelfth century, but most roads remained in poor condition, and the volume of land traffic stayed small.

Whenever possible, goods moved by water rather than land. The building of dikes and quays facilitated travel on inland waterways. In the twelfth century canals built in the lowlands to connect the rivers made water travel easier. Merchants or towns built the canals, then charged ship owners tolls or taxes to use the routes. Since locks had not yet been invented, boats in the canals were floated onto inclined planes and raised or lowered by ropes.

In the waters of the North Sea area, small, rather unsafe vessels predominated. Lacking compasses, they sailed near the coast and, so, often wrecked on the shore. Under feudal law the goods of a wrecked ship became the property of the lord who owned the land. Some, seeing in this an opportunity to augment their incomes, installed misleading lights to cause shipwrecks.

On the Mediterranean Sea large vessels capable of carrying a thousand passengers developed. The Crusades stimulated Mediterranean Sea trade under the Italian City States.

Although 1453, the year the Turks captured Constantinople, is generally taken to mark the end of the Middle Ages and the beginning of the Renaissance,
no sudden break was evident. The change from one era to the next came as a long, gradual process. Increased demand for improved transportation resulted from the development of strong, unified nations, the growth of European trade and the expansion of European interests to other parts of the world.

Several advances in the art of navigation aided transportation by sea at this time. The compass, first used by the Chinese, then the Moslems, came into use in the Mediterranean Sea area in the fourteenth century and in the North Sea the following century. Starting around 1485 European sailors determined the altitude of heavenly bodies with the astrolabe; that instrument was succeeded by the quadrant in the sixteenth century and the sextant in the eighteenth century. The use of the jib sail made possible great advances in close-hauled sailing (sailing as nearly against the wind as performable). By developing this skill, navigators freed their vessels from dependence upon wind direction and reduced the need for oarsmen.

The introduction of the cannon on ships also lessened the demand for oarsmen. Fighting could now take place at long range, so the need for speed and close maneuvering declined.

In the field of road development, France made the greatest gains. During the seventeenth century the French government adopted regulations to eliminate the excessive tolls which existed under the feudal system. The government spent great sums of money on road improvement, and, while the highways were still far from satisfactory, the French enjoyed the best roads in all Europe.

English roads of this period fell into two classes: free parish roads maintained by taxes on local inhabitants and main turnpikes supported by tolls on the users. Between 1760 and 1774 the British government actively established
turnpike companies by chartering turnpike associations. These groups were empowered to borrow money in order to improve certain roads. The association then charged tolls to pay off the debt and to keep the highways in good repair.

Several new types of vehicles developed for use on these improved roads. During the sixteenth century long wagons (covered wagons), carrying goods and about twenty passengers, and coaches (closed, four-wheeled carriages) appeared in England. In the mid-seventeenth century Parisians saw the rise of the cabriolet or "cab," a light, two-wheeled vehicle used to transport merchandise and people.

The first urban bus service started in Paris in 1662. Bus coaches holding eight passengers ran on fixed schedules over regular routes and charged uniform rates. The number of passengers was, however, disappointing, and the enterprise was discontinued.

British intercity stage coach service began in the 1600's and reached its peak of excellence between 1820 and 1840. These coaches traveled at ten or eleven miles per hour.\textsuperscript{35} They later fell victim to the railroad, for they could not match the economy and speed of the steam engine.

The high cost of overland transportation and the invention of locks led to the active development of inland water transportation. Locks were invented at the close of the Middle Ages and the start of the Renaissance. Located where the water level changed, these devices permitted vessels to remain afloat while being raised or lowered, eliminating the necessity of removing a ship from the water in order to change its level.

Inclined planes still remained in some areas to rival locks in canal construction. They were cheaper to construct and more practical where the level difference was great. They did, however, impose a strict limit on boat size.
As in road building, France led in the improvement of inland water transportation. The government granted individuals the right to collect toll for a certain number of years in a given area after they had improved navigation in some way. Private groups built and operated several canals under this plan. The Lanquedoc Canal (the Canal of the Two Seas) was the most amazing of these in that it provided an all-French water route from the Mediterranean to the Atlantic. Completed in 1681, this canal covered one hundred seventy-five miles and contained sixty-five locks.

For most of this time England did little to develop its inland water system. But when it finally got started, during the period from 1760 to 1830, Britain built so many canals that this period is called the Canal Era of British history.

The late 1700's saw the invention of the steam engine which quickly proceeded to revolutionize the transportation industry. Steam power replaced animal and wind power in propulsion and led to the development of several new modes of transportation, notably the steamboat and the railroad locomotive.

In more modern times, the internal combustion engine of the World War I era and the nuclear power of the Sixties have once again changed the face of the transportation industry. Yet even today older modes are still in use in large areas of the world, including America.
Section Four

A Brief History of Transportation in the United States

(Excluding the History of the American Railroad)

The history of American transportation is the history of the nation itself. In the early years Americans were restricted to the Atlantic seaboard by a lack of adequate transportation facilities. Later, as man finally conquered the mountains, many new modes of transportation developed to carry American settlers across the continent. The United States could never have grown into the world giant it is today had it not had the backing of a superior transportation network. Let us follow the development of this network from its earliest beginnings down to the present time.

Since land travel proved slow and tedious over roads which were merely widened Indian trails, water transportation played an important role in the lives of early colonists. With numerous rivers along the east coast, the way was readily available. The first settlement typically proceeded inland along these water routes. As late as 1818, two-thirds of the market crops of the Piedmont Plateau region were still raised within five miles of some river, the remainder not more than ten miles from one.

Shipbuilding became the first manufacturing industry in America. But the ships built in New England during the 1600's were designed for ocean voyages and could not be used in inland water travel. Instead, barges, mackinaw boats and keel boats sailed the nation's rivers. All these vessels were long and flat-bottomed, capable of navigating in very shallow water. Normally they sailed only one way, being broken up for lumber at destination. Later, river steamers appeared, making upstream transportation possible. These ships did not, however, reach their fullest development until after the Civil
As has been mentioned, many early roads, called traces, were merely extensions of primitive Indian trails. For the construction and maintenance of public roads, towns and counties depended upon taxes levied on local inhabitants, who were permitted to provide labor in lieu of cash. This system resulted in roads of poor quality which often became impassable in wet weather. The lack of adequate roads greatly limited the maneuverability of troops during the Revolutionary War.

Passengers travelled these roads either by stagecoach or horseback, and various commodities moved by mule train, horseback or Conestoga Wagon. This latter conveyance originated among the Pennsylvania Dutch near Conestoga Creek, Lancaster County, Pennsylvania, around 1700. The wagon was patterned after English wagons but modified by being longer and deeper. It sagged in the middle to prevent freight from bouncing out enroute. About 1800 the Conestogas became public carriers. Wagoning with these vehicles reached its peak in 1830 when three thousand travelled daily from Philadelphia to Pittsburgh. Soon after that their importance declined as railroads came into their own.

Because of the inadequacy of local roads, turnpike construction began shortly after 1790. These surfaced roads were built and maintained on main routes by turnpike companies chartered by state governments. The companies charged tolls averaging ten to thirteen cents per ton-mile.

The first and most famous of these toll roads was Lancaster Pike. The Philadelphia and Lancaster Company obtained a charter for the road in 1790 and began construction in 1792. The sixty-two mile long route, completed two years later at a cost of nearly a half million dollars, proved to be a financial success. Many of these roads were not, however, as productive as had been hoped and were either turned over to the state or allowed to revert to wilderness.
Since a good East-West road was a matter of national interest, the federal government undertook the construction of the Cumberland Road or National Turnpike in the early nineteenth century. (This stretch is now U.S. Route 40.) Congress made the first federal appropriation in 1806, but the road did not actually start westward from Cumberland, Maryland, until 1811. By 1818 the Road extended to the Ohio River at Wheeling, West Virginia, and by 1838 it had reached Vandalia, Illinois. The Cumberland Road never reached St. Louis and Jefferson, Missouri, as had been intended, however, because Andrew Jackson, a strong states'-righter, persuaded Congress to abandon the project during his administration. The Road was then turned over to the states through which it ran.

While the major thrust in canal building came during the 1820's and 1830's, interest in canals existed even during the eighteenth century. The first American canal was the Middletown and Reading Canal, in operation in 1762. During the late 1700's, several short canals were built around rapids and falls to improve inland water transportation. For instance, the Dismal Swamp Canal in North Carolina reached completion in 1794. A canal around the falls of the Connecticut River was finished the same year.

The construction of the Erie Canal sparked the American Canal Era, which ran from 1825 to 1837. The Erie Canal, lying wholly within New York State, connected the Hudson River at Albany with Lake Erie at Buffalo. On the initiative of DeWitt Clinton, New York began the three hundred sixty-four mile project in 1817 and built it in nineteen sections which were finally pieced together in 1825. The overall cost totalled seven million dollars. For fifty years the Canal remained the most important single trade route between the seaboard and the Midwest. It was such a financial success that its revenues for the first ten years of operation completely covered the construction costs. During
the fifty-seven years tolls were collected, revenues exceeded the original cost and subsequent maintenance by more than forty-two and one half million dollars.

In an attempt to offset the effects of the Erie Canal, Pennsylvania inaugurated a public works project designed to combine the best aspects of rail and canal transportation. The combination consisted of the Philadelphia and Columbia Railroad, a canal from Columbia to Hollidaysburg, the Portage Railroad to Johnstown and, finally, another canal from Johnstown to Pittsburgh and the Ohio River. In this system canals totaling two hundred seventy-eight miles ran through the relatively flat areas while one hundred seventeen miles of rail sections extended over the hilly and mountainous terrain. When a boat reached a rail junction it was placed on wheels and drawn up and over the mountains by means of cables and a stationary steam engine. The system was completed in 1834, but travel by it proved slow and costly, and the project could not compete successfully with the Erie Canal.

Several other states attempted canals along the eastern seaboard. The Chesapeake and Ohio Canal, the James River Canal, and the Miami and Erie Canal were all begun during this era. Between 1820 and 1840 various eastern states incurred more than two hundred million dollars in debt for canals.

These canals were shallow, designed to serve flat-bottomed vessels propelled by mule power. The greatest difficulties encountered consisted of obtaining an adequate water supply and constructing locks to overcome differences in land elevation. Despite their great popularity, canals had two inherent limitations which eventually led to their decline: first, they could operate only during certain months of the year because the water froze in the winter; second, they lacked flexibility because they had to run parallel to rivers in order to obtain a water supply.

Canals were not the only outgrowth of America's desire for better water
transportation at this time. After Newcomen discovered the principle of the steam engine in 1703, many men attempted to build a workable steamboat. Henry developed one at Conestoga Creek, Pennsylvania, about 1765. Later, in 1786, John Fitch successfully operated a steamboat on the Delaware River; by 1790 he had a line operating regularly between Philadelphia and Trenton. When Congress denied him backing for his venture, Fitch journeyed to France seeking funds. While he was there his papers fell into the hands of Robert Fulton, who may have used the ideas in perfecting his own famous craft which eventually set sail on the Seine in 1803. 

Out of these rather disorganized beginnings developed the American steamboat which, with its Mississippi runs, became an American institution. By 1820 more than fifty steamers were making regular trips between Louisville and New Orleans. The steamboat gave great impetus to American settlement and trade.

The Great Lakes and their connecting transport arteries also played an important part in the settlement and development of America at this time. Several improvements were necessary to adapt the Great Lakes to the new commercial vehicles, however. The Welland Canal around the Niagara Falls opened in 1829 to connect Lakes Ontario and Erie and, consequently, to connect the Great Lakes to New York harbor. The Soo Canal, joining Lake Superior and Lake Huron around St. Mary's Falls opened in 1855. Further improvements included several other canal, harbor and channel development projects; the improvement of the Detroit River Channel between Lake Erie and Lake Huron stands out as the most notable of these.

From the Civil War to World War I, inland waterways could not, in most cases, compete favorably with the railroads. The effect of the rails on the Erie Canal was so great that New York State had to discontinue tolls in 1882. In fact, the Great Lakes, with their low cost of transport and special position in
connection with steel production were the only water routes not seriously
effected by the rise of the railroad.

In overland transportation the rails came close to complete domination
for a time. But in the 1890's a concerted effort by three groups (the rail-
roads, the farmers and the bicyclists) led to a renewal of interest in
improved roads. Later, following the application of the internal combustion
gasoline engine to automobiles, a fourth group was added to the supporters of
highway betterment.

The states first took up the task of road improvement in the late
1890's. New Jersey became the first state to establish a state highway depart-
ment and to set up a building program. The other states quickly followed
suit, and, by 1915, forty-five states had state aid laws, forty had state
highway departments, and twenty-four had state highway systems.

But local ownership, maintenance and construction could not lead to
the development of a truly integrated, modern highway system. This development
waited Federal direction and funding.

The federal aid system originated in 1916 with a seventy-five million
dollar Congressional appropriation to be spent on highway improvement over a
period of five years. The 1916 act set the basic pattern for domestic highway
development: 1. the states would own, construct and maintain the roads; 2. the
federal government would allocate funds among the states on the basis of mileage,
area and population; and 3. state highway departments would be established to
designate, coordinate, engineer and implement highway construction.

In America the "pipeline industry" refers only to pipelines which carry
crude oil and products. The first such line was laid in western Pennsylvania in
1865. The industry experienced no great expansion until 1930. One reason for
this very slow development was the strong vested interests of the railroads
and teamsters. Railroads in many areas refused to allow pipelines to run under their tracks. In view of the vastness of the rail network in the late nineteenth century, this restriction greatly limited the growth of pipelines.

Maritime travel at this time operated under American policies established in the eighteenth and early nineteenth centuries. (In fact, maritime transportation is still governed by these rules.) First, in 1789 Congress declared that only vessels built in the United States could be registered as American vessels. This ruling was designed to protect American shipbuilders whose costs were higher than those of foreign builders. Then in 1817 Congress passed a statute forbidding vessels with foreign registry to operate in American coastal trade.

A number of innovations in maritime transportation combined to reduce the cost and time of ocean transportation service. Iron ships, propelled by steam, gradually replaced wooden ships. The older clipper ships, which reached their peak from 1843 to 1860, were too dependent upon the wind and gained speed only by sacrificing cargo space. The construction of the Suez Canal (completed in 1869) encouraged trade between Europe and the Orient by reducing the total distance of the trips and, thereby, reducing their time and cost. Finally, the opening of the Panama Canal in 1914 shortened the distance from the Atlantic to the Pacific by some eight thousand miles and enabled water transportation to compete with the rails for transcontinental traffic.

Air transportation, the only truly twentieth century mode of domestic travel, began December 17, 1903, when the Wright Brothers made the first heavier than air flight at Kitty Hawk, North Carolina. Since then, air transportation has undergone astounding technological growth, most of it since World War I.

Before World War I the railroads accounted for nearly all the intercity transport of goods and passengers. Since the War, however, the increasing economic and service advantages of other modes have led to their now carrying most
of the passengers and over one half of all intercity freight as measured in ton-miles. This latter traffic is almost evenly divided among motor, water and pipeline carriers, with the airlines coming in a poor fourth, hauling only one-tenth of one percent of the total. See Appendix, Figures 3 and 4.) This rapid growth in all modes except the rails may be attributed to great advances in technological innovation, especially the development of the internal combustion engine, and to public support of transportation in the form of government aid.

While some highway improvement had occurred before the First World War, real progress awaited governmental involvement. Such direction and aid as was necessary to build a really coordinated highway network came only after the broad adoption of the state gasoline tax. In 1919, Oregon became the first state to adopt this user's tax; other states quickly followed suit.

Yet even this aid was not enough. Each state built roads on an internal advantage basis only, and interstate travel remained difficult. A truly integrated American highway system required federal government intervention.

Federal action came when Congress passed the Highway Act of 1921, often referred to as the "Seven Percent Act." This bill granted funds to the states for highway construction, but, in order to get an integrated national system, it also set forth two limitations on the use of the funds. First, the money could be used only on roads designated as primary highways. And second, these highways could not exceed seven percent of the total state mileage.

Highway improvement accelerated during the Great Depression. Legislators favored road construction and repair projects as methods of promoting employment and generating income. Some expansion of the system took place, but the major emphasis was upon merely bettering the existing roads.

The second American turnpike era began in 1939 with the opening of the
Pennsylvania Turnpike and continues today. Then, as now, the need for limited access, high-speed highways was recognized.

During the Second World War, little or no highway work took place. Vehicles for private and commercial use went out of production. Gasoline was strictly rationed and travel sometimes restricted. Motor transportation equipment and the highway system itself both deteriorated greatly during this time, leading to a tremendous need for post-war repair and expansion.

In the twenty years from 1944 to 1964 federal, state, and local governments spent more than one hundred forty-five billion dollars improving and maintaining the American highway system. The largest single chunk of this amount went to the construction and maintenance of the National System of Interstate Highways. This network, which today links most major United States cities with forty-one thousand miles of the most densely travelled highways in the nation, was originally authorized by Congress in 1944. The legislature appropriated $46.2 billion to be used over a period of thirteen years. The 90:10 matching ratio fund was to receive its revenues from motor vehicle registration fees, excise taxes and gasoline taxes. Actual implementation of the plan did not come, however, until 1956 when the federal financing portion was put on a trust fund basis and federal gasoline and excise taxes were directly linked to the construction of the Interstate System.

Nearly three and one-half million miles of roadways and streets crisscross the face of America today. More than two and one-third million miles of these are surfaced, 1.1 million with high-or intermediate-type surfacing.

This constantly improving network of highways has greatly influenced American motor transportation. From an infant industry at the time of the First World War, it has grown to be a modern giant. There are over sixty-five million
automobiles, three hundred thousand busses and thirteen million trucks on the nation's roads today. Approximately thirty-three percent of all freight (in ton-miles) and ninety-two percent of all passengers (in passenger-miles) move by motor carrier. Private automobile transportation dominates in this latter field, carrying nine-tenths of all passengers.

After World War I, the great improvement of the highway system, the wide acceptance of the automobile and the ease of entry into the motor carrier industry led many people to provide truck and bus transportation on a common carrier basis. Following the Second World War the expansion was even more rapid, and today motor carriers are second only to the rails in provision of freight service. Along with this rapid rise, the individualistic, competitive aspect of motor transportation intensified, requiring governmental regulation of the mode.

The first regulatory act came during the Depression. The Motor Carrier Act of 1935 brought interstate motor carriers under the Interstate Commerce Commission as Part II of the Interstate Commerce Act. The Interstate Commerce Commission today classifies all interstate carriers as Class I (annual gross operating revenues of more than one million dollars per year), Class II (annual gross operating revenues of between two hundred thousand and one million dollars per year) or Class III (annual gross operating revenues of less than two hundred thousand dollars per year) carriers. Of the sixteen thousand interstate carriers on today's roads, nearly twelve hundred fall in Class I and slightly over twenty-five hundred in Class II.

Actually, however, not more than one-third of all trucking firms are subject to economic regulation by the Interstate Commerce Commission, since most firms either engage exclusively in intrastate or exempt carriage or are registered in the private category. The states may regulate some of these, but usually only
in such non-economic aspects as speed, safety and weight and size limitation.

The modern trucking industry is essentially characterized by short hauls. Over one-half of all trips are less than five miles one way, and the average trip is only eleven miles. Trucks afford excellent local coverage, and, since trucks operate on very flexible schedules, they can leave and arrive according to the customer's wishes.

National or regional coverage is less complete. Restricted territories are common, and few interchange agreements (through or joint routes and rates) exist. Only one percent of all truck trips extend over one hundred miles one way. Much still remains to be done in the area of long hauling in the trucking industry.

The bus industry has come much farther in providing through service and interchange privileges than the truckers. Part of this greater progress is no doubt due to the smaller number of companies and the domination of the industry by a few large nationwide or regionwide organizations. Passenger carriage remains the chief business of the bus lines, and the thirteen hundred intercity bus companies use approximately thirty thousand busses to provide half a billion passengers with twenty-three billion passenger-miles of service annually.

The nearly twelve hundred intercity bus companies which engage in interstate transportation come under Interstate Commerce Commission regulation. That body classifies busses as Class I (annual gross revenues of two hundred thousand dollars or more), Class II (between fifty thousand and two hundred thousand dollars annually) and Class III (less than fifty thousand dollars annually). As these classifications seem to indicate, the scale of operations in busing is much lesser than in trucking.

The development of American air transportation has been greatly influenced
by two major forces: war and government. Up until World War I, flying was considered merely an oddity. The War led both to the acceptance of air travel and to the training of a large number of pilots. When the fighting ceased, the federal government provided numerous surplus "Jenny's" at low prices for those wishing to enter the air transport field.

Government played an even more important role in actually promoting air transportation, both through subsidies for airmail service and through provision of airports and airways. The federal government conducted the early pioneering efforts in airmail service. Experimentation began in 1918, with the first transcontinental service coming the following year. By 1924 continuous day and night transcontinental service was possible. Privately owned air companies finally began carrying the mails in 1925 under the provisions of the Kelly Act, and by 1927 the government had retired from this field.

Early air transport companies depended not only upon indirect subsidy through mail contracts but also upon government-provided airports. At first the federal government built and maintained airports, but later the Air Commerce Act of 1926 prohibited this practice. Since that time the federal government has provided aid and construction funds to locally owned and operated airports.

During the 1930's air remained a little used means of transport. Aircraft developed slowly, and air travel was uncomfortable and expensive. Most airlines depended upon mail business to keep them alive. Another war was needed to push air transport forward.

As a result of its speed and flexibility, the airplane was widely used during World War II. Aircraft design accelerated, and many construction principles were perfected. Thousands of persons learned to fly, and many principles of air freight handling developed. But perhaps the most important thing the War did for air travel was to cause great numbers of military and civilian personnel
to travel by air. The popularity of air transport quickly spread.

After the War, air companies, using many of the war-developed principles and techniques, offered reliable service at reduced rates and on frequent schedules. By the late 1950's more passengers moved by air transportation than by any other domestic mode except the automobile. Today air travel is the leading type of commercial passenger transportation.

Air freight has also grown, but still remains a very small part of the total freight carriage picture. Three types of air freight carriage are available today: air freight, air express and air parcel post. Air freight, the first and most important of these in terms of volume, offers relatively rapid service at a good rate. Next, airlines offer air express in cooperation with the Railway Express Agency (REA Express); while this is the fastest, most reliable type of service, it also proves the most expensive, normally restricted to very small shipments. The United States Postal Department offers the third service, air parcel post, at low rates for small shipments; however, speed is lost by slow pickup and delivery service.

The primary advantage of air freight is speed. Distributors may be able to reduce their overall costs by carrying smaller inventories. The principle disadvantages are the high rate structure and limited service coverage. On a ton-mileage basis, air freight rates still average ten to twelve times as high as those for rail and three to four times as high as those for trucks. Also, coverage is generally limited to movements between major points.

With American commercial airlines operating eighteen hundred aircraft, employing one hundred seventy-five thousand people and controlling some three billion dollars in annual operating revenues, some sort of regulation is obviously necessary. The Civil Aeronautics Board (CAB), a federal agency created by the 1938 Civil Aeronautics Act, provides economic supervision, while
the Federal Aviation Agency (FAA) regulates airlines in the area of safety and engages in the development of airports and navigational facilities. Historically, the FAA has had a greater impact upon commercial airlines than the CAB because the government has not wished to stifle the rapid development of the airlines by imposing rigid economic regulations.

Recent developments in domestic water transportation have led to increased interest in and emphasis upon this mode. While water provides little passenger service, it accounts for nearly one-third of the freight ton-miles moved domestically. It may be split into three divisions for easier consideration: 1. the Great Lakes, 2. inland rivers and canals, and 3. coastwise and inter-coastal waters.

The Great Lakes, covering ninety-five thousand square miles and having a coastline eighty-three hundred miles long, form America's fourth seacoast. To take advantage of the cheap water transportation, products move in to the seventy commercial harbors from considerable distances. During the eight-month ice-free navigation period, lake steamers carry iron ore, grain, pulpwood products and other semi-processed or raw materials eastbound and coal, petroleum products, limestone and manufactured goods westbound.

In 1959 the completion of the long-discussed St. Lawrence Seaway Project made the Great Lakes accessible to large ocean-going vessels via the St. Lawrence River. Now at least three-fourths of the world's merchant marine vessels can maneuver through the locks and channels of the Project and get into the Great Lakes. This is the deepest penetration of ocean transport in the world.

Excluding the Great Lakes and the seacoasts, the United States contains some twenty-nine thousand miles of navigable waterways. The vast majority of these lie in the Mississippi River Basin and the eastern section of the nation. Protected passage from the Middle Atlantic States to the Mexican border
is possible through a series of canals, rivers, bays and inlets. This passageway was of vital importance during World War II when the submarine menace off our shores prevented much intercoastal navigation.

In the Far West, sailing is not as smooth. Inland transportation operates mainly on the large waterways, such as the Columbia-Snake River System, San Francisco Bay and Puget Sound. Most other rivers west of the Mississippi River Basin are presently unsuitable for commercial navigation.

Inter-city water transportation accounts for approximately nine percent of the nation's total intercity freight. The industry is characterized by numerous small businesses. Around seventeen hundred barge and towboat companies, with an investment of about eight hundred fifty million dollars, operate on inland waterways. Most of these do not come under Interstate Commerce Commission regulation; four hundred are private carriers, and more than eleven hundred others fall into exempt categories.

The weakest member of the water transport family is coastwise and intercoastal transportation. From America's beginning as a separate nation such shipping has been restricted to vessels built, owned and operated by American citizens. (The Merchant Marine Act of 1920, often referred to as the Jones Act, contained the most recent expression of this "cabotage" principle.)

Threat of submarine attack and government requisition and regulation of ocean-going vessels drastically restricted coastwise and intercoastal water traffic during the Second World War. The industry has never fully recovered. Rate and service competition from the rails, trucks and pipelines has prevented recovery, and there is little chance that ocean-borne domestic tonnage will regain its importance in the foreseeable future.

The Wheeler-Lea Transportation Act of 1940 brought domestic water carriers operating in river, canal, Great Lakes, coastwise and intercoastal
traffic under Interstate Commerce Commission regulation as Part III of the Interstate Commerce Act. For purposes of regulation, the I.C.C. has classified these carriers as Class A (annual gross operating revenues of over five hundred thousand dollars), Class B (annual gross operating revenues between one hundred thousand and five hundred thousand dollars) and Class C (annual gross operating revenues of under one hundred thousand dollars). Numerous exemptions and exceptions exist, however, so not more than twelve percent of domestic water transport actually comes under I.C.C. control.

From the shipper's point of view, the main advantages of inland water transportation appear to be the low freight rates and the water facilities' ability to more easily handle certain bulk commodities. The chief disadvantages are the slow, infrequent service, the lack of good areal coverage and the frequent delays due to adverse weather conditions.

One final type of water transport remains to be considered — maritime transportation. Most American international trade moves on foreign-flag vessels because foreign rates are lower. American shipping companies pay much higher wages and construction costs and, so, are subject to very high operating costs. To meet these costs the companies must charge higher rates than foreign shippers.

The United States has long attempted to overcome this handicap through the provision of subsidies. Mail subventions (overpayments for the carriage of mail) were used up until 1936 when the Merchant Marine Act discontinued them and substituted construction and operation differential subsidies instead. Under this new system the federal government pays part or all of the cost difference between construction in the United States and construction abroad and all of the operation cost difference. The government has also made low
interest loans available to American companies and sold many excess naval vessels to the merchant marine at a low price. Still, Americans spend much more to buy space on foreign ships than foreigners do to purchase space on our vessels.

The last important transportation mode in America today is the pipeline. At the present time, pipelines rank as the third largest freight carriers, moving eighteen percent of the total domestic ton-miles. More than one hundred organizations, with a total investment of more than four billion dollars, own and operate two hundred thousand miles of pipeline. These operations range in size from under ten miles to over ten thousand miles.

Of the two major types of pipelines, oil and natural gas, the oil pipelines are by far the more important. This network consists of gathering, crude and product lines. The gathering lines receive oil in the field and transport it to a central distribution center. From here the crude lines carry unrefined oil to refineries. Finally, the product lines distribute the refined products to other refineries or to distribution points in the consumption areas.

Pipeline oil movements have recently been running at about a quarter of a trillion ton-miles a year. Nearly half of all oil traffic moves this way. And due to the extreme mechanization of the industry, this enormous movement is accomplished by fewer than twenty-five thousand employees.

Natural gas did not begin moving by pipeline until after World War II. The Big Inch Pipeline, which played such an important role in oil movement during the War, has been used successfully to carry natural gas since the War. The Federal Power Commission (under the Natural Gas Act of 1938), rather than the Interstate Commerce Commission, regulates the movement and sale of natural gas.
Today, the efficiency of pipeline operations, coupled with the rising costs of other modes, has stimulated interest in transporting other commodities by pipeline. Successful tests have been run moving fluids, wheat and other small grains and semi-liquid forms of coal, ore and wood. Mass movements of these commodities have not yet proven practical, but, in light of constantly improving pipeline techniques, may show themselves to be so in the future.

Yes, the story of transportation is the story of the nation itself. As America grew and developed from a rural farming country to an industrial giant, transportation changed and grew also, always attempting to more fully meet the needs of the American people. While today we have an integrated, well-balanced system, with no single supreme mode, this has not always been the case. At various times in the past one mode or another gained dominance and seemed to be the ultimate in transportation, until another mode improved and toppled it. Let us now turn to a study of the railroad, the dominant mode during much of the nineteenth century.
Railroads in the United States

The railroad industry was born in England about the middle of the seventeenth century. The rail structure to support and guide vehicles developed first. The earliest rails were of wood and rested directly on the ground. Iron rails appeared one hundred years later. For the first one hundred and fifty years these roads worked by gravity or horse and mule power. A single coal wagon with a capacity under two tons served as the vehicle of transport.

As early as 1795 similar systems appeared near Boston to haul bricks. Baron Leipar operated such a road at his kilns near Leiperville, Pennsylvania, in 1809.\(^7\)

Attempts to adapt the steam engine to the propulsion of land vehicles began at the turn of the nineteenth century. Oliver Evans achieved some measure of success in 1804 when he developed an amphibious vehicle. This paddle-wheeled flatboat on wheels was propelled by a steam engine both on land and in the water.\(^7\)

Experimentation continued throughout the early nineteenth century, but little further success resulted until Peter Cooper of New York constructed the "Tom Thumb" in the late 1820's. Attaining a speed of eleven miles per hour on its initial run,\(^7\) this experimental engine demonstrated the practicality of the steam locomotive and heralded the coming of the railroad as a new mode of land transportation.

The Granite Railway Company built the first American rail line, the Quincy Tramway, in 1826 to haul granite from the quarry in Quincy, Massachusetts, to the Bunker Hill Monument in Boston. This early line used wooden beams with iron strips as rails. Stationery engines and horses provided the power;\(^7\) no
locomotives were yet used.

The Baltimore and Ohio Railroad is generally credited with being the first commercial railroad in the United States. It was chartered by the State of Maryland in 1827, and on July 4th of the following year Charles Carroll, the sole surviving signer of the Declaration of Independence, laid the cornerstone. 76 Passenger carriage began in January 1830 and freight transportation the following May.

Horses and sails powered the first trains to travel on this new road. 77 But later in 1830 Peter Cooper successfully operated the "Tom Thumb" on the line. This engine, rated at about one horsepower, pulled a carriage with thirty-six passengers a distance of thirteen miles in less than one hour, attaining speeds of eighteen miles per hour at some points. 78

In 1827 the citizens of Charleston, South Carolina, chartered America's second railroad, the Charleston and Hamburg, in order to secure the trade of the central Georgia cotton belt to the city. Operations began in December 1830 under the management of the South Carolina Canal and Railroad Company, now part of the Southern Railroad. The line was the first road in the United States specifically designed for steam locomotion. Running from Charleston to Hamburg, a distance of one hundred thirty-six miles, it was the longest line under single management in the world. 79

Observing the success of these two roads, other groups soon began building railroads. The Commonwealth of Pennsylvania became the first state to enter the field when, in 1834, it built the Philadelphia and Columbia Railroad, an eighty-one mile line connecting Philadelphia and Columbia (on the Susquehanna River).

The primitive character of these early railway projects would be readily apparent to today's rail traveler. When steam engines first appeared, officials
often sent a horse car along with the train — in case of a breakdown. Passengers occasionally had to get out and push. But perhaps the most unusual feature was that these early roads were considered public highways; anyone who supplied his own car and power and who conformed to a few rules of operation could use them. Later railroads supplied cars and power, but the cars ordinarily did not go beyond the owning carrier's lines.

In view of this experimental character and the people's great desire for improved transportation, it seemed only natural for the states to aid railroad construction, especially after the federal government distributed its surplus revenues to the states in 1837 in an attempt to strengthen state treasuries. Since turnpike, stagecoach and canal companies opposed actual state construction and operation of railroads, state aid usually took less direct forms. These methods included purchase of stocks and bonds, donations of cash or state securities, low interest loans, tax exemptions and exclusive privileges.

During the railroads' early experimental years (1830 to 1848), growth was hampered by three factors: technological problems, the opposition of vested interests and difficulties in raising capital. First, in the technical area, early locomotives developed such a small amount of horsepower that they could pull only limited loads. A lack of adequate bridges greatly confined the scope of rail construction and service; this shortage resulted from both a deficit of funds and a lack of know-how in bridge building. But the principle obstacle of the era proved to be the great diversity of gauges in use. This variation required a transfer of shipment or travel every few miles.

The vested interests of canal and stagecoach companies caused numerous stumbling blocks to be erected before early railroad development. They sometimes
persuaded state legislatures to refuse railroads corporate charters or to place burdensome conditions on the charters. For example, one railroad was prevented from hauling freight. Others had to invest part of their capital in canals, construct wooden fences where the line ran near canals so the tow animals would not be frightened and pay tolls for hauling freight which would otherwise move on state-owned canals. But the railroad was so superior to the older modes of transport that its opponents could only delay its progress, not prevent it.

The last major problem of the railroads was the raising of sufficient capital. The capital-intensive nature of the rail industry required much investment. But little cash was available in those times, and investment in an untried industry could prove extremely hazardous. The states provided some funds in the form of loans, stock subscriptions and gifts. The federal government aided the rails indirectly by surveying prospective routes and not requiring duty (1832–43) on iron imported by rail companies for use as rails. Also, European investors loaned considerable sums to rail operations and to the states and eventually came to own the majority of stock in some enterprises, such as the Illinois Central.

This period also saw many developments and innovations which later contributed to the railroad's rise to power. Weak, undependable engines, iron covered rails and inflexible granite foundations all soon gave way to better equipment. Eight-wheeled locomotives appeared and gradually took on characteristics to distinguish them from their British cousins. These innovations included a pilot or cowcatcher to remove obstacles from the track, a cab to protect the engineer from the elements and a sandbox to hold sand to provide better traction on steep grades.
Iron covered rails proved to be a safety hazard since the straps came loose under heavy loads even at low speeds. Robert Stevens designed a cast-iron "T" rail which was stronger and more efficient. He also pioneered the use of wooden ties to replace the inflexible granite blocks previously used under rails. The rails could now bear heavier loads, making economical operation of the roads possible.

Some attempts at cooperation between the railroads and the much older modes appeared. For instance, the schedule of the Mohawk and Hudson Railroad was set up to coordinate with the packet boat schedules out of Schenectady for Buffalo, Utica and Rochester. A little later the Finch stage line adjusted its schedule to connect with trains of the New York and Harlem Railroad; reduced rates for through trips were available.

With most of the initial difficulties out of the way, the railroad industry entered a period of rapid expansion which lasted from 1849 to 1870. (See Appendix, Figure 5, for an idea of the extent of this later growth.) During this time the nation's rail network was increased by forty-four thousand miles and many small roads united by means of end-to-end combinations to form large systems. Unlike some later mergers, these combinations were definitely in the public interest, since they led to increased traffic, reduced expenses and lower rates. This lengthening of lines also led to increased competition and improved service.

Four major reasons for this rapid expansion may be cited. First, and most often recognized, this was a period of westward movement. The discovery of gold in California in 1848 brought about boom transportation conditions as Americans flocked westward to get rich quick. Amid this optimistic atmosphere, with money readily available, many people were willing to invest in the railroad business.
Immigration from Western Europe (especially Ireland and Germany) reached all time highs, and many immigrants moved directly west, with the aid of the Railroads. Native Americans also felt the restless, pioneering spirit and moved westward in search of cheap, fertile land. The Homestead Act of 1862 aided in this quest by granting one hundred sixty acres of unappropriated public land to any citizen or applicant for citizenship who resided on and cultivated the land for five years.

Secondly, this was a period of increasing production in both the agricultural and manufacturing areas. Adequate transportation was needed to facilitate the exchange of goods between various areas of the nation.

Next, several technical improvements made the rails more efficient and reliable. The adoption of the uniform gauge, the use of steel rails and equipment and the introduction of the air brake all contributed to the railroad's rise.

Finally, the government made grants of land to the railroads. The federal government owned vast areas of open land in the West and South. For many years this land was offered to settlers at $1.25 an acre, but, since the land was far from transportation and markets, few buyers could be found. Stephen Douglas of Illinois, an ardent advocate of the railroad, felt that land grants might tempt private capital into railroad construction in the West and aid the government at the same time by increasing the value of the land retained by the government. Douglas, Henry Clay and several other statesmen persuaded Congress to go along with this plan, and, on September 20, 1850, President Millard Fillmore signed the Land-Grant Act into law.

The first grant was made to the State of Illinois, which immediately turned the 2,595,133 acres over to the Illinois Central Railroad to aid in
construction. Under the terms of the Act, the Illinois Central received a two hundred-foot wide right of way plus alternate, even-numbered sections for a distance of six miles on either side of the track. If any of this land had already been given to others, an amount equivalent to that pre-empted was selected by the railroad from land fifteen to twenty miles from the lines. Land in excess of that needed for the actual construction was to be sold to raise funds. Some western railroads and southern railroads in Mississippi, Alabama and Florida received other federal land grants.

Altogether, the railroads received title to 131,350,534 acres (over two hundred thousand square miles) of land to aid in the construction of a total of eighteen hundred miles of line, less than eight percent of the total mileage built in the United States. The land amounted to less than one-tenth of the public domain and, at the government's price of $1.25 per acre, would have brought something under thirty-one million dollars into the United States Treasury.

Contrary to popular opinion, these land grants were not gifts to the railroads. The terms of the Act provided that the lines would pay for the grants through rate reductions on government traffic. At first government freight and personnel moved free, but the Supreme Court later ruled (in the case of the Lake Superior and Mississippi Railroad Company vs U.S.) that the government was entitled only to free use of the right of way and should pay for the use of railroad facilities and labor. Government deductions then became standardized at fifty percent on passenger and freight transportation and eighty percent on mail carriage.

Land grants ended in 1871, but rate reductions continued into the 1940's. The Transportation Act of 1940 finally eliminated deductions on mail, freight
and personnel, other than military personnel and materials, effective 1942. Then under the Boren Act, 1946, all land yet undeveloped was returned to the government, and all land grant reductions ceased altogether. By that time the railroads had already contributed one and one-quarter billion dollars to the federal government in payment for the lands transferred to them under the Land-Grant Act. This figure amounts to more than ten times the value of the lands at the time they were granted.

The government also benefited from the land grants in another way. As soon as Congress passed the Act, the government doubled its selling price for land. With rail transportation assured, settlers eagerly snapped up the lands of the odd numbered sections at $2.50 per acre. Thus, the government received the same total amount of money it had wanted, but not obtained, from the lands before the grants.

In addition to the land grants, several other forms of governmental aid helped finance rail construction. At the state and local level, governments subscribed to stock, provided loans, guaranteed bonds, made outright gifts and granted tax exemptions, eminent domain rights and monopoly and banking privileges. The federal government surveyed, excused import duties on railroad iron and granted loans.

Although all this government aid was important, the real reason for the railroads' rise to dominance lay in their physical or technological advantage. While rail charges were slightly higher than water transport rates, rail transportation generally provided faster service, and trains could go where there were no navigable water routes. Few roads could carry much traffic, and even the best roads led to only a limited number of destinations.

Another major benefit resulting from this period of expansion was the acceptance and development of the modern corporate form of business. The corporation proved to be the only business form capable of raising the huge sums of
money necessary to finance a railroad. Today nearly all large businesses, and
many small ones, are incorporated in order to raise funds and to protect the
owners from financial disaster in case of business failure.

During the Civil War, as men on both sides of the Mason-Dixon Line
marched off to battle, leaving home and occupation behind, most rail construction
slowed down. The War did prove the economic and military advantages of rail
transportation, however, and the North's superior rail network played an important
role in Union victory.

The North regarded a rail connection with the Pacific Coast (to secure
California and the West to the Union) a military and political necessity.
Accordingly, in 1863, President Lincoln signed into law an Act of Congress
fixing Omaha, Nebraska Territory, as the eastern terminus of a proposed trans­
continental railroad. The Union Pacific Railroad was to build westward from
this point. The newly formed state of California chartered the Central Pacific
Railroad to build eastward from Sacramento to meet the Union Pacific. Ground
was broken at both Omaha and Sacramento in 1863.96

The builders faced numerous problems. Rails had to be sent by railroad
and water from eastern mills. Ties had to be brought in from forests hundreds
of miles away. Building equipment and locomotives for the Central Pacific had
to travel to California by ship around Cape Horn.97

Despite all these problems, construction pushed forward, and tracklaying
proceeded with remarkable speed. Hordes of land-hungry settlers followed the
rails, and boom towns sprang up all along the right of way.

Finally, on May 10, 1869, the two lines met, and the rails were joined at
a point called Promontory, in the Promontory Mountains north of the Great Salt
Lake, Utah. To mark this historic event, the completion of the nation's first
transcontinental rail line, a spike of California gold and a spike of Nevada silver were driven by distinguished officials.

The railroad thus brought the Atlantic and Pacific coasts within a few days journey of each other and ended the necessity of long voyages around the Cape Horn, perilous journeys through the Isthmus of Panama and long, dangerous overland trips by covered wagon or stagecoach.

Following the Civil War railroad construction moved ahead faster than ever before. The nation was growing, and the railroad was keeping pace. In some ways the railroads caused part of the nation's growth, for the availability of the rails to transport agricultural and manufactured products and, thus, to increase the degree of specialization, made possible the realization of America's increased production potential.

Continued combination and coordination at this time led to overexpansion of the rail system and to intolerable competitive situations. To reduce competition and to solidify their financial positions, many railroad promoters engaged in some rather questionable financial practices. With business ethics at a low level, some promoters forced rail lines into over-liberal contracts with construction companies the promoters themselves owned; they thus got rich quick at the expense of corporate stockholders. Excesses in construction and promotion were common and overcapitalization prevalent. The overcapitalized corporate structure then faced the nearly impossible task of paying bond interest and showing a profit on securities which frequently did not represent real assets.

In an attempt to accomplish this task, railroads engaged in several discriminatory pricing practices. A railroad would charge lower rates on long, competitive hauls than on shorter hauls where it had a monopoly, even though the shorter trip was often part of the longer route (long-short haul...
discrimination). Large, steady shippers paid lower rates than smaller, infrequent shippers. Rates were often changed suddenly after advance notice had been given to only a few favored shippers.

Previously the atmosphere had been one of strong support tempered by occasional criticism. But now the public attitude changed to one of fear, resentment and retaliation. Many farmers and small businessmen who had invested in rail stock felt they were being shortchanged in the corporate manipulation and excess stock promotion. This feeling was particularly strong in the Midwest where many agrarians had invested heavily in rail promotions, only to find that once operation began rates were high, service poor, discrimination rampant and investment returns nil. Falling farm prices, due to an increase in supply as railroads brought in products from the West, further added to the rural discontent.

Farmers of the midwestern states (particularly Illinois, Iowa, Wisconsin and Minnesota) banded together in a secret, semi-fraternal society called the Patrons of Husbandry or, more popularly, the Grange. This organization, founded in Washington, D.C., in 1867 by Oliver H. Kelley, had as its primary objective the promotion of the social and intellectual life of the farmers. Its program quickly broadened to encompass economic and political objectives as its members sought to lash out against their apparent enemies, the railroads and grain elevators.

The tool of this agrarian revolt was the ballot box. In the late 1860's and early 1870's, agriculturalist representatives were repeatedly elected to the state legislatures. There they worked through democratic channels for the regulation of monopolistic rail practices and helped to write the first American measures for comprehensive regulation of a whole industry.

From 1869 to 1874 the legislatures of the four Granger States enacted
stringent acts, known as the Granger Laws. The Illinois legislature passed the first such law in 1869. That bill gave the legislature power to set minimum rates, but was not very effective. A second act two years later strengthened this initial legislation by establishing a board of warehouse and railroad commissioners and forbidding long-short haul discrimination where the same kind of traffic was involved. Then in 1873 an even more comprehensive act was passed, transferring the power to set minimum rates from the legislature to the Board of Commissioners, prohibiting discrimination and ending the railroad practice of supplying public officials with free passes.

The Granger Laws enacted by all four states (Illinois, Minnesota, Wisconsin and Iowa) typically had four parts. First, the legislature or some other designated body would establish maximum rates. Where the rates were set by the legislature, the system failed. Extremely complicated rate structures required the formulators to have much information about costs and movements; legislators lacked this knowledge. Railroad commissions worked out better. The persons appointed to these boards either already had a knowledge of the task or stayed in office long enough to learn the intricacies of the system.

Second, pro-rate clauses stringently regulated local discrimination. A rail line could not charge the same or higher amount for similar commodity movement over a short distance as over a longer stretch anywhere on its line.

Next, the acts reflected the popular view that competition was the most effective regulator by prohibiting mergers and closely regulating any coordination.

Finally, free passes to officials were labeled bribery and prohibited altogether.

Needless to say, the railroads were not too happy about these new measures. They reacted with six major court cases and a widespread educational campaign (similar to today's public relations programs) designed...
to point up the injustices of the acts as well as their impracticability and hasty passage. The rail lines insisted that they could not operate under such restriction, and their claim seemed to be backed by the problems arising out of the Panic of 1873.\textsuperscript{104}

In the face of this "proof" and the unsound and inoperable nature of much of the regulation, Minnesota, Wisconsin and Iowa repealed their Granger Laws in the middle and late 1870's. Illinois, with its railroad commission, was the lone holdout.

But during their brief existence the Granger Laws made several lasting contributions to America. They represented the first attempts in the nation to regulate an entire industry, served as a basis for later transportation regulation (especially the Act to Regulate Commerce in 1887), and set a legal precedent for subsequent regulation of other industries.

Before continuing with the regulation aspect of the railroads' past, however, let us first consider the developments of the 1880's, often cited as the most important decade in railroading history. Approximately seventy-five thousand miles of track were added to the American rail system, much in the western part of the nation as several additional routes to the Pacific were completed. With the linking of the Santa Fe and Southern Pacific at Denning, New Mexico, the nation saw the completion of the second transcontinental rail route in 1881. Several others followed, and today there are seven transcontinental lines.

By 1900, the basic rail network had been laid. The little expansion which continued into the twentieth century consisted merely of filling in the rail system with branch lines.

Standardization of track gauge stood out as another major accomplishment. In 1871 twenty-three different gauges, ranging from three to six feet, were in
use in various sections of the nation. Standardization was no easy task, since locomotives and equipment, as well as track, had to be converted. But in 1886, through teamwork and joint effort, the standardization of gauge at four feet, eight and one-half inches became an accomplished fact. Such uniformity permitted interchange of cars among railroads throughout the nation and eliminated the necessity of frequent unloading and loading of freight as goods moved from one line to another.

Joint effort and study also resulted in two major technical improvements. Air brakes, first patented in 1869 by George Westinghouse, underwent exhaustive tests near Burlington, Iowa, in 1886 and 1887. The successful operation of these brakes on a fifty-car test freight train under all sorts of operating conditions led to the brakes' introduction on lines across the nation. Long trains and heavy loads could finally be moved safely over the rail network. Air brakes became required by law in 1893 but were not actually universally adopted until some twenty years later.

Steel rails replaced iron rails on most of the nation's track. Steel rails permitted greater speeds and heavier loads and, at the same time, reduced costs. These rails were first introduced in the 1860's, but by 1880 less than one-third of the rail system had them. One decade later, however, they were in use on four-fifths of the network.

One final accomplishment of this decade effected not only the rail lines but the entire nation as well. Prior to 1883, each railroad ran its trains by the local time of the city in which it had its headquarters. But on November 18th of that year, railroads abolished the sixty-eight local times and adopted Standard Time. This system divided the nation into four zones based on sun time at the 75th, 90th, 105th and 120th meridians west of Greenwich,
England. Four standards of time (Eastern, Central, Mountain and Pacific), each one hour apart, were thus set up. Acceptance of this time schedule rapidly spread from coast to coast and moved throughout the world. It is interesting to note that this orderly method of reckoning time instituted by the railroads and used by the entire nation was put into effect without federal legislation of any sort. Not until thirty-five years later (March 19, 1918) did Congress pass the Standard Time Act, officially recognizing the system.¹⁰⁹

Let us now return to the economic regulation of the railroads and follow the events leading up to the major piece of regulation effecting the railroads, The Act to Regulate Commerce.

In 1872, at President Grant's suggestion that an investigation of transportation be undertaken, a special Congressional committee was set up. The Windom Committee investigated the possibility of cheaper transportation and reported its findings to Congress in 1874. This report concluded that the defects and abuses of the railroads were insufficient facilities, discrimination and unduly high charges. Recognizing competition as the best regulation, the Windom Report noted, however, that private competition often ends in combination. The Committee, therefore, recommended public ownership and operation of at least one railroad which, unable to combine, would act as a regulator.¹¹⁰ As a result of this Report, several attempts were made to pass bills to regulate the rail system. None, however, passed.

Next came a series of Supreme Court rulings dealing with the regulation of transportation. In 1877, in the case of *Munn v. Illinois* (94 U.S. 113), the State of Illinois was charged with violating the due process clause of the United States' Constitution by requiring a grain elevator company to lower its rates.¹¹¹ The Court drew upon the seventeenth century opinion of Lord Chief Justice Hall that common carriers have always been regulated in society. It further declared
that some businesses become "affected with the public interest" and are no longer private; these businesses may then be regulated in the public interest without violating the Constitution of the United States. 112

In 1886, in the case of Wabash, St. Louis and Pacific Railway Company v. Illinois (118 U.S. 557), the Supreme Court reversed one of its previous rulings (in the Peik v. Chicago and Western case) and said that where a long-short haul situation involved interstate traffic the state could not regulate it. The federal government alone had the power to regulate interstate commerce, and "unless and until the federal government acted to regulate commerce, interstate movements could not be regulated." 113

In that same year Senator Cullom headed a committee investigating transportation. The Cullom Committee Report emphasized the abuse of monopoly power by the railroads, highlighting such discriminatory practices as personal discrimination (including rebates and lower rates for larger shippers) and place discrimination. This Report, coupled with the Wabash case ruling, forced a legislative decision. A compromise bill was worked out between the House and Senate, and the Act to Regulate Commerce of 1887 resulted. It was passed on February 4, 1887, and became effective April 5, 1887.

This Act, more popularly known as the Interstate Commerce Act, was designed to facilitate and promote commerce, eliminate discrimination and place all shippers on an equal basis. Originally the Act applied only to railroads, but it has been amended many times until it now contains separate parts covering all types of public transportation except air, maritime shipping, and natural gas movement.

The original piece of legislation contained six sections, all of which stressed the control of discrimination. The first section required that all
rates, both freight and passenger, be "just and reasonable." The second and third parts prohibited personal and general discrimination and required that under similar circumstances all shippers and areas be treated equally. Part four outlawed long-short haul discrimination under "substantially similar circumstances and conditions" which the Act defined as meaning "...over the same line, in the same direction, the shorter being included in the longer..." This inclusion provision made the section notably less stringent than the pro-rate clauses of the Granger Acts. In an attempt to foster competition, section five prohibited pooling agreements. Finally, part six provided that all rates and fares should be published and strictly observed and that advance public notice be given of any rate change.

The provisions of the Act were to be administered by the Interstate Commerce Commission (ICC), an independent executive agency set up by the Act itself. That body originally consisted of five members appointed by the President with the consent of the Senate. Congress empowered the Commission to inquire into the business of common carriers by hearing complaints, taking testimony and subpoenaing documents. It could, upon adequate findings, issue cease and desist orders and determine awards of damages. The actual penalties, however, were imposed by a court of law in cases initiated by the Commission. Finally, the ICC was to make an annual report to Congress and to recommend legislation it considered necessary.

The Interstate Commerce Commission appeared to be a powerful body, but two Supreme Court decisions quickly sapped that strength. In the Maximum Rate Case of 1897 the Court ruled that the setting of rates was not a given or implied power of the Commission. The ICC could only rule on the reasonableness of a particular rate, not state what that rate should be. Thus, the Interstate Commerce Commission lost its effective control over rail rates.
In the Long-and-Short Haul or Alabama Midland Case, the Supreme Court ruled that section four of the Act (the long-short haul clause) applied only when "substantially similar circumstances and conditions" existed and interpreted "substantially similar" to mean practically identical in all respects.

Since such conditions seldom prevailed, the ICC was left with little control over this type of discrimination.

Congress first acted to correct the deficiencies of the Interstate Commerce Act and to bring about the more effective functioning of the ICC in 1906, with the Hepburn Act. This law granted the ICC power to specify maximum rates after existing rates had been found unlawful in a suit initiated by some third party. The Commission was given the right to require through and joint rates and thirty days' notice before a rate change. Finally, under the Commodity Clause of this Act, railroads engaged in interstate commerce were prohibited from hauling in such commerce any commodity which they either produced or owned; this clause practically put the railroads out of the mining business.

The Mann-Elkin Act of 1910 further increased the power of the ICC by permitting it to set maximum rates on its own motion. The measure also amended the long-short haul clause, eliminating the words "substantially similar;" the burden of proof now rested with the railroads.

Of the several other regulatory acts passed between 1910 and the First World War, the most important was the Panama Canal Act of 1912. Effective July 1, 1914, the Act made it unlawful for any rail line to have interest in a water carrier which might compete with the railroad, except with ICC approval. This law broke the railroads' control of the Great Lakes carriers and gave the public the advantage of competition between the rail and water carriers.

The peak of railway mileage came in 1916 with 253,152 miles of line and
over 400,000 miles of track. Since then, many miles of line have been abandoned as railroads attempted to cut back expenses and become more efficient operators.

Private ownership and operation of the railroads has always been, with a few exceptions, the policy of the United States. One such exception came in the early days of railroading when a few states built and operated lines for several years. A second exception occurred during World War I. Under the Act of December 28, 1917, the federal government took over the operation of the railroads because congestion on the lines supposedly threatened the war effort. Directed by the Railroad Administration, the rails operated at a loss to taxpayers of approximately two million dollars a day. Finally, on March 1, 1920, after twenty-six months of congestion and delays, the federal government turned the rail lines back to their owners.

As a result of the bungled operation of the railroads during the War, America came to recognize the great importance of having a strong railway system. Accordingly, Congress enacted The Transportation Act of 1920, which contained several far-reaching amendments to the Interstate Commerce Act. Many of these changes reflected a partial shift in the public attitude toward the rail industry in that they placed more emphasis upon strengthening the rails and protecting carrier revenues and less upon preventing discrimination and high charges. Recognizing the causes of financial weakness in the railroads as excessive debt, overexpansion and excessive competition, the framers of The Transportation Act sought to lessen these conditions. The first provision of the Act empowered the ICC to control minimum and actual rates as well as maximum charges. Other sections of the bill encouraged consolidations and mergers by permitting pooling, with ICC permission; prevented continued
overexpansion by forbidding extension of lines without ICC approval; and
restricted increased indebtedness by requiring ICC approval of all security
issues.

In 1933, under the pressure of a deepening depression, Congress amended
The Transportation Act of 1920 by adopting The Emergency Transportation Act of
1933. There were simply too many railroads in America; therefore, the new
Act weakened consolidation requirements in an attempt to encourage mergers.
Despite this favorable climate, however, little consolidation occurred. This
failure may be traced to another clause of the same act which said the position
of labor could not be worsened by consolidation, that is, the number of workers
could not be reduced. This clause was intended to preserve as many jobs as
possible for American workers, but it removed nearly all hope of consolidation,
for mergers designed to increase efficiency could not absorb the duplicate
work forces which resulted. The Act was considered a failure.

Since then several other attempts at strengthening the rails have been
made. In 1948 the Reed-Bulwinkle Act exempted the railroads from prosecution
under the anti-trust laws, thus sanctioning the practice of the lines getting
together to decide fares and to offer joint and through rates. Ten years
later, in the Transportation Act of 1958, a new rule of rate making was spelled
out based upon the public's need for adequate service and the carrier's need
for revenues. This Act also prohibited the ICC from considering the effects on
other modes when deliberating rail rate changes.

Despite all these measures, however, the rails have remained in trouble
for many years and have declined from overwhelming dominance as a carrier mode.
Although the actual ton-miles of freight carried by the rails has increased,
keen competition from trucks, pipelines, and water carriers has whittled away
at the railroads' proportion of the total traffic, until today only forty-three
percent moves by rail. (See Appendix, Figure 3.) Contrast this figure with
the better than ninety percent share of the market the rails enjoyed in the late 1800's.

Rail passenger transportation declined even more sharply than freight transport, and now the railroads account for only two percent of the total movement and twenty-six percent of common carrier travel. (Nearly ninety percent of total passenger travel in the United States moves by private automobile.) But the continuation of this downward trend is not considered to be highly adverse to the railroads, in light of the unprofitability of most of their passenger operations and the small contribution (four percent) of passenger movement to the total revenues of the rail lines.

The uneconomical expansion of the late nineteenth century could not sustain itself in the new, more highly competitive twentieth century. The rails had to readjust, and since 1916 they have abandoned more mileage than they have constructed. From the all-time high of 253,152 miles of line and over 400,000 miles of track, the system has gradually declined, until in 1966 American railroads embraced two hundred eleven thousand miles of line and three hundred forty-four thousand miles of track.

But due to improvements in equipment, road and methods, the total carrying capacity of the nation's railways has increased. It is significant that during the Second World War, despite the vast extension of federal government regulation in the economic realm, the railroads continued to be privately owned and operated. Of course, the government did exercise some control over the railways through the Office of Defense Transportation, but the wartime railroad was so efficient that few people agitated for any change in the method of operation. In contrast to the great losses under government operation during World War I, the privately operated rails contributed three million one hundred seventy-two thousand dollars.
a day in taxes to support the government and the war effort. More than ninety-seven percent of all troops and ninety percent of all Army and Navy supplies and equipment were transported by rail. With one-third fewer locomotives, one-fourth fewer freight cars and one-fourth fewer employees, the rail lines of the Second World War period handled twice the traffic moved during the First World War. And at the close of the War, despite rises in prices, wages and taxes, freight rates were at or below the pre-war levels and passenger charges had increased only slightly.

Since the end of World War II, America's railroads have invested over seventeen billion dollars in additions and improvements to the system, and the rate of technological advance has been rapid. Because the future of the rail network obviously lies in freight, the most revolutionary changes have taken place in that field.

The rails have recently been more progressive in the acquisition of modern and diversified rolling stock. For example, new dunnage free (DF) cars contain sliding partitions to form compartments and to hold back and protect freight shipments in transit. These cars eliminate the need for shelving, blocking, bracing, padding, sawdust, straw and other portable or loose materials previously used as dunnage and save time in loading and unloading.

New automobiles move from factories to dealer distributing points throughout the nation in new, specially designed, multi-level rack cars. In 1964, three million motor vehicles moved by this rapid, low-cost method; that number represented a six-fold increase from the 1959 volume. During the same period (1959-64), the rail's share of new auto shipments jumped from eight to thirty-five percent.

Many new techniques and services have also been developed to increase the flexibility and completeness of railroad areal coverage. One such development is
"piggyback" or "trailer-on-flatcar" (TOFC) service. A fully loaded truck trailer is carried on a rail flatcar for the line-haul portion of the journey, with pick-up and delivery service made by attaching a truck tractor. This service combines the long-haul and national coverage advantages of the railroads with the local flexibility advantages of motor carriage. Piggyback operations have grown rapidly since the early 1950's, and in 1964 nearly one million such cars were moved.138

Two newer variations of this same service are "fishyback" (rail cars are carried on "roll-on, roll-off" water carriers) and "birdyback" (truck trailers move by air transport).

Associated with the piggyback, fishyback and birdyback services is containerization, a service whereby durable, interchangeable containers of various standard sizes move, fully loaded, from vehicle to vehicle. This service reduces handling and, thus, increases speed and lowers cost.

The unit train, one of the newest developments in railroading, demonstrates how the volume-carrying economies of the railroads are being put to work. Continuously linked cars carrying bulk cargoes, such as coal, shuttle between origin and destination with little or no switching, uncoupling and handling operations and the costs they entail. Today roughly one-fifth of all coal carried by train moves on unit trains.141

The Illinois Central Railroad has come up with yet another new idea in the service line. Under the Illinois Central's "rent-a-train" plan, a company can rent an eighty-six car train for one million dollars per year, then run the train as frequently as desired. So far, five such trains have been rented to midwestern grain companies.142

And, as in nearly every phase of contemporary business, computers play
an important role in modern railroading. Today some of these electronic wizards control the enormous task of putting freight trains together, taking them apart and keeping track of the cars. Tomorrow railroad operation by computer is a definite possibility. A computer could be programmed with each day's traffic and be asked to develop mathematical models for the particular operations needed. This would include the number of trains, crews and maintenance personnel necessary. In this way, a computer could plan an entire railroad operation.

Yet, despite all these fantastic improvements and the generally prosperous economic conditions in America, the modern railroad has faced enormous financial problems. The percentage rate of return on investment has reached as high as four percent during only five years since World War II. This rate declined constantly during the mid-fifties, reaching a low of less than two percent in 1961. At that time over one-fifth of the principal rail lines were operating at a loss. Through 1964 things improved slightly, and the return rate rose to just over three percent. But this figure compares very unfavorably with even mediocre performances in other industries. If these conditions do not soon improve, it is uncertain how long the railroad industry will be able to continue operation in its present form.

What has caused these financial problems? First, much business has been lost to competing modes which offer more convenient service. Then, too, the rails still have much excess capacity due to the long-lived nature of most plant investments. The railroads have simply been unable to adjust their capacity to the reduced demand and, so, have suffered extremely high fixed costs.

Government regulation of rates hampers price flexibility and makes it difficult for rail managers to adjust prices to meet rapidly changing traffic conditions. The government taxes railroad property heavily; for every dollar
paid to investors in dividends, two dollars are paid in local, state and federal taxes.\textsuperscript{145}

Finally, obsolete labor union rules have resulted in gross overstaffing of the lines. Featherbedding reflects the requirement imposed by unions that excess personnel be employed.

These financial problems of the railroads concern everyone. Businessmen are interested in service and rate levels. The consumers, who ultimately bear the burden of any rate increase, worry about higher commodity prices. Taxpayers wonder if possibly government aid or ownership may become necessary. And all Americans rely upon the rails to help maintain national security.

Under present conditions and within the foreseeable future, the railroad will remain the backbone of America's long distance bulk commodity trade. Our economy, as we know it, could not possibly operate without the rails. The question, then, is not whether to have rail service, but rather what shall the nature of that service be? Shall it continue under private ownership or be taken over by the government? Few favor a government takeover, but many feel it to be inevitable unless the present financial situation can be improved.

Perhaps the only realistic hope for improvement lies in mergers. Railroads must unite, increase in size and decrease in number if they are to survive. In many cases, the combination of two, three or more small lines into one relatively large company could create substantial economies, faster service improvements and enable rails to once more compete favorably with the other modes of transport.

One such merger took place recently and may have opened the way for numerous such combinations in the future.\textsuperscript{146} After ten years of frustrating negotiation, deliberation and delay, the Pennsylvania Railroad and the New York Central Railroad finally received permission to begin merging into a single
railroad giant, the Penn Central. Completion of the merger process will require at least eight years. The new line will operate on forty thousand miles of track in fourteen states and two Canadian provinces and will be the nation's largest private landholder, with real estate holdings all over America. Its total assets are set at about 6.3 billion dollars, and the company plans on annual revenues of almost two billion dollars. In plan and performance the Penn Central will serve as a model for the American railroad of the future.

Yes, the railroad has had a long and interesting history, a history of vital economic importance to the nation and to the world. Throughout the nineteenth century, from its early halting beginnings through its rapid rise to enormous power and dominance, the rail industry paralleled the growth of America itself. On into the twentieth century the rail system remained important, especially in the movement of bulk freight, but, because of numerous financial problems and inherent limitations, the rails could only watch as more and more of their traffic was lost to new, better service modes. Recent attempts at modernization for the purpose of re-attracting traffic have succeeded to a limited degree, but the real future of the railroad lies in its ability and willingness to cut back excess capacity and to readjust to decreased demand through mergers aimed at financial stability. No one knows what lies in store for the rails during the remainder of the twentieth century. Will they once more regain a dominant position in transportation or fall hopelessly by the wayside, yet another victim of Almighty Progress? We can only wait and see.
Figure 1. Average Railroad Wages in the United States: 1926 - 1966

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<th>Year(s)</th>
<th>Hourly Wage</th>
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<tr>
<td>1931 - 35</td>
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<tr>
<td>1966</td>
<td>3.17</td>
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</table>

a — Adjusted to include retroactive wage increases.

Figure 2. Transportation is a Heavy User of Other Industries' Products, Consuming:

- 71% of Rubber
- 53% of Lead
- 52% of Petroleum
- 35% of Zinc
- 29% of Steel
- 28% of Cement
- 22% of Aluminum
- 19% of Copper

<table>
<thead>
<tr>
<th>Year</th>
<th>Rail Amount</th>
<th>%</th>
<th>Truck Amount</th>
<th>%</th>
<th>Oil Pipeline Amount</th>
<th>%</th>
<th>Great Lakes Amount</th>
<th>%</th>
<th>Rivers &amp; Canals Amount</th>
<th>%</th>
<th>Air Amount</th>
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Figure 5. Railway Development in America

1830
(23 miles)

1840
(2,808 miles)

1850
(9,021 miles)
1962

(187,000 miles of road
and
300,000 miles of track)

FOOTNOTES


2 Ibid., p.5.


4 Internal economies refer to savings or gains accruing to a firm as a result of expanded production within the individual firm. External economies are the gains on the part of an individual firm resulting from an expansion of the industry as a whole.

5 Sampson, p.7.

6 Ibid., p.8.


9 Ibid., p.17.

10 Ibid., p.19.

11 Ibid., p.25.

12 Sampson, p.12.

13 Transportation Association of America, p.20.

14 Sampson, p.48.


16 Sampson, p.44.

17 Transportation Association of America, p.17.


19 Transportation Association of America, p.7.

20 Sampson, p.45.

23 Ibid., p.17.
24 Ibid., p.15.
25 Ibid., p.16.
26 Ibid., p.17.
27 Ibid., p.19.
28 Ibid., p.21.
29 Ibid., p.22.
30 Ibid., p.25.
31 Ibid.
33 Ibid., p.27.
34 Ibid., p.28.
36 Ibid., p.32.
37 Sampson, p.17.
40 Sampson, p.19.
41 Mossman, p.37.
43 Mossman, p.37.
44 Sampson, p.22.
45 Ibid.
46 Mossman, p.38.
The railroads wanted improved roads to provide local transportation from the point of production to the rail connections. Farmers needed better roads to cart their produce to market more easily. And the cyclists desired smoother riding conditions for the pursuit of their sport.

The first motor vehicle in America appeared in 1895. By 1909 motor transport had become very important in the United States.

The United States Army took over mail service for a short time during 1934. A large loss of planes during bad weather caused a public outcry, however, and mail carriage reverted back to private carriers under the Air Mail Act of 1934.

Exemptions applicable to water carriers fall into four categories: 1. the carriage of liquid cargo in bulk, 2. the carriage of three or fewer commodities, 3. exempt private carriage, and 4. other.
The railroads in New England and New York used a standard gauge of four feet, eight and one-half inches, but the roads in Pennsylvania, Ohio, and the South used a variety of gauges.


99 Mossman, p.49.

100 Grain elevator companies also exploited their monopoly position by charging farmers extremely high rates. Without the services of the elevators, grain crops would rot, so growers had little choice but to pay the high prices.

101 Mossman, p.49.

102 Sampson, p.244.


104 The Panic of 1873 was a brief, sudden and severe depression of the type characteristic of the nineteenth century. Some railroads went bankrupt; rail construction decreased; and several lines suspended interest and dividend payments. The railroads claimed their problems resulted from the Granger regulation, but it seems more reasonable to blame the general business depression, excessive capitalization and overexpansion for the rail's woes.


107 Grossman, p.146.


111 Since storage is one phase of the transportation function, storage companies are considered to be transportation companies.

112 Sampson, p.244.


See Amette S. Redford, David B. Truman, Andrew Hacker, Alan F. Westin
and Robert C. Wood, Politics and Government in the United States (New York, 1965),
p.339 for a description of the function and structure of independent regulatory
agencies, such as the I.C.C. The Commission has grown over the years, until it
now has eleven members appointed by the President with the consent of the Senate.
One of these members serves as chairman of the body.

The federal government still operates the Panama Railroad and the Alaska
Railroad for much the same reason that states ran the early roads—a great need
for transportation exists, but private individuals are unwilling to undertake
the construction and operation of such carrier facilities.

Association of American Railroads, Railroads in America, pp. 24-25.


Ibid., p.49.

Sampson, p.264.

Ibid., p.167.

Transportation Association of America, p.7.

Ibid.; pp.11-12.

Ibid., p.11.


Ibid., p.56.

Association of American Railroads, Quiz on Railroads and Railroading

Association of American Railroads, Railroads in America, p.25.

Ibid., p.27.

Association of American Railroads, Miracle, p.21.
138 ibid., pp. 23–24.


140 ibid., pp. 1–2.


144 Sampson, p. 49.


146 See Davidson's article, "Toward the 21st Century Ltd.," (footnote 142), pages 70 and 71, for a list of the railroads which will probably follow the lead of the Penn Central and merge in the near future.

147 Davidson, "Toward the 21st Century Ltd.," *Time* (January 26, 1968), p. 71B.


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