American Railroads Delivering Lower Prices and Higher-Quality Service

Edwin L. Harper

Railroads are the United States of America's most important transportation resource, accounting for 38% of all intercity revenue ton-miles — more than any other mode.

Indeed, railroads are the arteries of commerce for a vast nation whose raw materials, supplies and products often travel 2,000 miles or more to reach generating plants, mills, factories and ports.

All four US coastlines — Atlantic, Great Lakes, Pacific, and Gulf — host a thriving international trade dependent on railroads for efficient inland movement of bulk and containerized cargoes.

Two of the United States' top three trading partners are our north and south neighbors — Canada and Mexico — and the three rail networks closely coordinate operations, management systems and research activities. In fact, research into new and more-efficient rail plant, equipment, components and operating practices are a priority of the railroad industry, which has made a substantial investment in the world's leading facility for railroad research and technology — the Transportation Technology Center near Pueblo, Colorado. I shall say more about this facility shortly.

Privately-Owned USA Railroad Network

The US rail network reaches tens of thousands of towns and cities using 1.2 million freight cars pulled by more than 18,000 locomotives moving freight trains over 170,000 miles of rails at speeds often reaching 70 miles per hour or more.

About 213,000 workers are employed on US railroads. Most are unionized and their average compensation — $69,000 annually, composed of $54,000 in wages and $15,000 in benefits — places them in the top 2% of all US workers in terms of average compensation.

Annual maintenance requirements on this rail system are $6.5 billion for equipment and $4.4 billion for roadbed, track and signals. Additionally, $7 billion is being spent annually now for plant and equipment renewal. The combination of maintenance and investment requirements exceed $17 billion each year — all of which must come from internally-generated funds and borrowing.

The history of railroads in the United States is one of private ownership where cost accounting, productivity of employees and capital assets, pricing activities, and quality of service play a crucial role in determining survival in an unyieldingly competitive environment.

Freight railroads are not only privately owned, they receive no public subsidy — and desire none — pay property taxes on rights-of-way, are the least polluting and most fuel-efficient way to move freight over land, and are the safest transport mode for moving hazardous materials.

More than 500 Railroads

The major freight railroads — known as Class 1 — number just 12 systems, but account for 73% of the nation's rail mileage, 89% of the freight railroad employees, and 91% of freight railroad revenue.

Actually, there are more than 500 railroads in the United States, most being short line and regional carriers. Class 1 and smaller railroads interconnect and produce annual freight revenue of $31 billion.

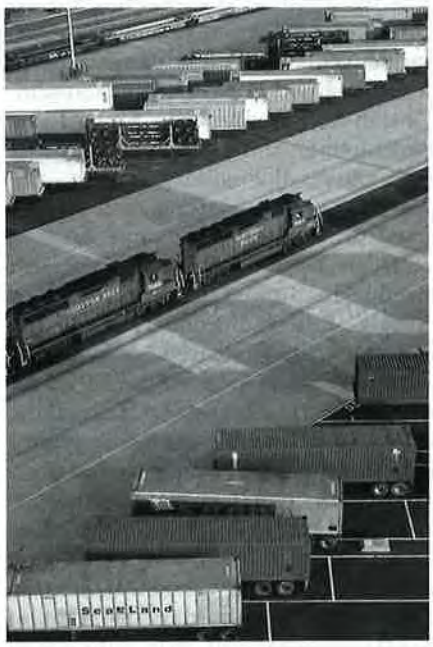
Railroads Make Comeback

Railroads in the United States have made a comeback from the 1960s and 1970s when the condition of plant and quality of service fell to unacceptable levels. The reasons were overly-restrictive economic regulation, subsidies to railroad competitors and a bloated workforce.

Recognizing that a healthy, private-sector freight railroad system was essential to the worldwide competitiveness of American industry, federal lawmakers passed two crucial laws.

The first law, passed in 1970, permitted freight railroads to exit the money-losing passenger business by creating a quasi-public corporation — the National Railroad Passenger Corporation, known as Amtrak. Amtrak carries 100% of US intercity passengers and uses freight railroad tracks for most of its routes. Amtrak has become one of the world's most efficient passenger railroads, recovering some 80% of its operating costs from fares.

The second law substantially reduced economic regulation affecting railroads. It is called the Staggers Rail Act of 1980 and was named in



■ LA International Container Terminal
(Southern Pacific Lines)

honor of a retiring congressman active in railroad issues. The Staggers Act permitted freight railroads to eliminate unprofitable routes, enter into contracts with customers, establish service levels and rates based on market forces, and limit the regulatory challenge of rates to instances where it could be proven that railroads hold and abuse market power.

Meanwhile, recognizing the need to pare costs in order to compete with truck and barge operators (many of which are non-union) using government subsidized rights of way, railroads negotiated with their labor unions to trim the workforce and, in the process, provide a package of severance and retraining benefits whose costs exceeded $7 billion. As a result, the rail workforce was reduced from about 500,000 in 1980 to 213,000 today.

Spectacular Efficiency Gains

The railroads' efficiency gains in recent years have been nothing less than spectacular. Since passage of the Staggers Act, railroads have been improving their profitability and are closing in on a long-elusive target, a return on investment equivalent to their cost of capital.

The improvement in profitability has not come at the expense of customers. In fact, railroad rates, as measured in revenue per ton-mile, have declined in both current and inflation-adjusted terms. Since 1984, revenue per ton-mile has declined by 40% when adjusted for inflation.

How has this been possible? Railroad productivity has soared, with railroads becoming one of the six most productive industries in the United States. Railroad productivity for the most recently measured 5-year period is up 7% versus an average of 1.1% for 178 industry categories. Meanwhile, since 1980, freight-car productivity has risen by 86%, locomotive productivity is up 76%, track productivity is up by 61%, and fuel efficiency has risen by 52%.

More specifically, asset utilization has soared. Consider our fleet of multi-level freight cars that carry new automobiles and trucks — a line of business that represents 7% of annual railroad revenue. The number of annual trips and loadings of this equipment have soared by 125% and 130%, respectively, since 1980. No wonder automakers choose railroads for almost 70% of their new-vehicle transportation needs.

With improved cash-flow, productivity gains and $17 billion in annual spending on plant and equipment renewal and investment, the rail industry's operating ratio has improved by 8 percentage points to its current 85%.

Impressive Safety Gains

Railroads are among the safest industries in the United States. Train accidents and derailments have been reduced by 50% since 1981; railroads are three times safer than other means of land transportation. One major trucking company reported that when it began shifting its long-haul trailers from highways to rails, accidents declined by 36%.

Meanwhile, 99.9% of tank-car shipments arrive incident free, with tank cars involved in fewer than one accident or derailment per billion ton-miles, In terms of hazardous materials transportation, the railroad accident rate per billion ton-miles is one-fifth that of the trucking industry.

Growing Business

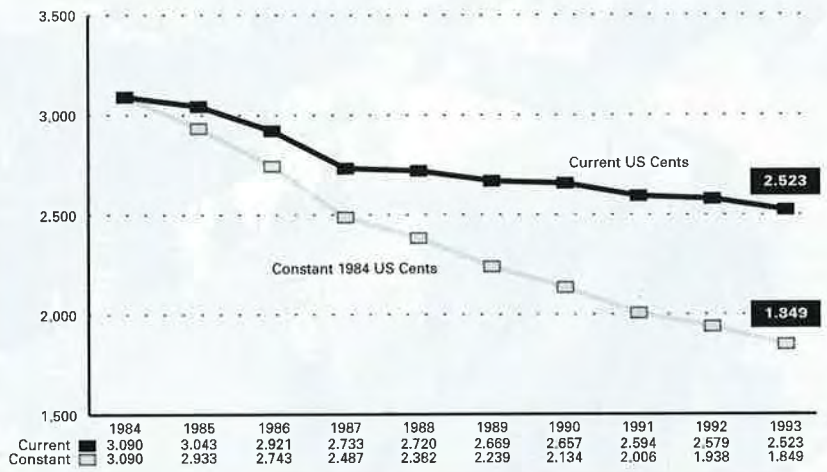
Railroads have embraced their market freedoms aggressively and set out to design new logistics systems based solely on the needs of the customer.

Freed of the government straitjacket requiring a one-size-fits-all marketing approach, railroads began designing their transportation offerings to meet specific shipper de-

Table 1 Today's Freight Railroad Industry

Freight-market share:	38% (No. 1)
Employees:	213,000
Privately-owned freight railroads:	509
Class 1 (revenue at least $254 million/y):	12
Rail employees' average compensation:	Top 2% workforce
Physical Parameters	
Miles of road operated:	170,000
Number of freight cars:	1.2 million
Number of locomotives (all diesel-electric):	18,161
Annual ton miles:	1.2 trillion
Trailers and containers carried:	8.2 million
Carloads:	17.9 million
Financial Parameters	
Annual revenue:	$31.0 billion
Investment and maintenance requirements:	$15.1 billion
Track maintenance expense:	$4.4 billion
Equipment maintenance expense:	$6.5 billion
New investment in track and facilities:	$2.8 billion
New investment in equipment:	$1.4 billion
Current tax liability:	$3.3 billion
Net investment:	$51.0 billion
Cost of capital:	11.4%
Return on net investment:	7.1%
Profit gap:	4.3%

Figure 1 Freight Revenue Per Ton-Mile in Current and Constant 1984 US Cents



	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Current	3.090	3.043	2.921	2.733	2.720	2.669	2.657	2.594	2.579	2.523
Constant	3.090	2.933	2.743	2.487	2.362	2.239	2.134	2.006	1.938	1.849

mands, with rates based on the competitive value of those various services to the shipper. Speed of delivery is not the top priority for every shipper, but it may be for some. But regardless of door-to-door agreed-upon transit times, virtually all customers expect delivery within a narrow time frame.

By designing creative service packages — indeed, sometimes by taking responsibility for non-transportation logistics functions such as warehousing — railroads are winning back customers and finding new ones. For the first time in generations, railroading has become a growth business in the United States.

Auto manufacturers are so confident of the railroads' ability to deliver as promised that auto plants around the nation now look to railroads as integral partners in just-in-time assembly line production.

Partnership also have been formed with steamship lines and once arch-rival truckers, causing intermodal shipments of trailers and containers to grow by almost 7% annually over the past decade to reach 8.2 million units in 1994.

In fact, rail transport of almost all commodities has been growing, with carloads, intermodal volume and revenue ton-miles reaching record levels in 1994.

Two of the most important commodities to US railroads — coal and grain — are available at many locations around the globe. US railroad efficiency and competitive pricing helps keep American farmers and miners competitive in markets thousands of miles from home.

The intermodal movement of trailers and containers has become the railroads' fastest growing line of business. Interestingly, while railroads directly market virtually all of their carload and logistics services, intermodal business is increasingly marketed by others. In fact, 39% of intermodal business is marketed by steamship lines, 37% by third-party consolidators, and 16% by trucking companies.

Technology Leads

Technology, born of costly and painstaking research, is at the heart of railroad productivity and traffic gains. Much of this research is carried out by the Association of American Railroads where one-third of the budget is dedicated to research.

Consider some of the railroad industry's research advances that have been translated into products we use today.

US railroads have purchased more than 1,000 AC locomotives, most with 4,000 horsepower engines permitting three AC units to accomplish the job of five DC models. The maintenance costs of these high-adhesion AC units also are lower. Some railroads intend to order the more-efficient AC-traction locomotives with 6,000-horsepower engines.

Cabooses, whose maintenance and transportation costs unnecessarily drove up rail rates, are a rarity today, having been replaced by electronic end-of-train devices that advise the locomotive engineer of essential brake, speed and direction data. Trackside scanners search more efficiently for overheated wheels and axles and dragging equipment.

Development of a simulation model permits new freight car and freight-car component designs to be tested for operating environment defects without suppliers first having to build costly prototypes.

The Association of American Railroads developed a track-loading vehicle that is able to apply varying "loads" or forces to rails for testing safety and integrity under different load conditions.

Track life has been increased threefold through improved steels and lubrication practices. Increased track strength and improved monitoring and maintenance practices have caused a dramatic reduction in track-related derailments. New car technologies such as double-stack, Roadrailer and aluminum coal hoppers have helped customers become more competitive in their own markets. And heavy-axle research has led to new truck (bogie) designs permitting heavier payloads, reduced operating costs and improved operational safety.

Seamless Transportation

Railroad technology is not limited to hardware. Where railroads physically connect with each other (intramodal) or connect with trucks or container ships (intermodal), there must be an exchange of information and a joint-rate relationship beyond the interchange of containers or freight cars. Duplicating the efficiency of single-carrier handling is the goal of what is being called seamless service.

Seamless service is a promise to the customer of advance trip planning — an assurance that appropriate and clean empty rail equipment will be available as promised; that trains will depart and arrive on a known and predictable schedule; that interchanges to connecting carriers will be made on-time and at correct junction points; that exceptions will be few; and that those exceptions and corrective action — with a revised trip schedule and estimated time of arrival — will be reported to the customer on a timely and accurate basis.

The Association of American Railroads is coordinating the delivery of seamless service through the Interline Service Management project.

It begins with new automatic equipment identification (AEI) tags attached to freight cars and locomotives. These tags contain, on an internal computer chip, vital information on the equipment. Track scanners interrogate these computer chips and transmit the desired data to central computers where rail managers are alerted to exceptions instantaneously so they can immediately begin corrective action. Customers, meanwhile, soon will be able to use personal computers to learn the current status of their empty car orders or loaded shipments, any exceptions, and the corrective action being taken.

There is more. The Interline Service Management project is also working to computerize freight-rate information so that customers can determine price more accurately and quickly. Of course, confidentiality is essential, and this is another objective.

Interline Service Management is also designed to create and produce accurate billing information, and to determine, report and disburse appropriate interline revenue sharing among participating carriers — all in a paper-less environment.

■ Double-Double-Header Container Train *(SPL)*

■ Double Stack Container Train in The Rocky Mountains *(SPL)*

Research in Pipeline

The benefits of research by the Research and Test Department of the Association of American Railroads have been abundant. The industry's research efforts have attached to them an enviable benefit-cost ratio: benefits have exceeded costs 10-fold!

With many of the "easy" productivity gains having been made, the role of technology in keeping railroads competitive will become even more important. As competitive as transportation has become in our global economy, even the fastest runners get bitten, but those just a few steps slower are often swallowed.

US railroads have numerous research projects underway — each chosen based on rigorous benefit-cost analysis to ensure not only a high probable payback, but a high likelihood of success.

With 286,000-pound payloads becoming commonplace on US railroads, research is underway to determine whether a 315,000-pound maximum is feasible with new truck (bogie) and suspension designs. Other efforts are aimed at improving the method of applying grease for rail lubrication, optimization of wheel and rail profiles, design of lower maintenance and longer-lasting turnouts and crossing diamonds, and methodologies to reduce bridge-maintenance costs.

With increased customer demand for rail service, a welcome problem of occasional track congestion has developed. With some track segments supporting more than 200 million gross tons per mile annually, maintenance requirements are growing. But increased maintenance imposes unacceptable traffic delays.

The solution is to reduce track-maintenance time through improvements in track-maintenance processes and equipment, which is another focus of our research efforts. Another element of reducing track congestion is automated train-inspection stations and on-board equipment diagnostics, which also improve over-the-road reliability.

Electro-Pneumatic Brakes

One successful research project nearing implementation is the development of electro-pneumatic train braking to replace air brakes. Successful tests have been concluded on a unit coal train consisting of sixty-five, 50-foot, 100-ton capacity, open-top hopper cars made of steel. Electro-pneumatic brakes deliver braking commands at the speed of light rather than the speed of sound, ensuring

more even and reliable train braking.

Additional benefits of electro-pneumatic brakes include reduced maintenance costs, increased fuel savings by elimination of power braking, reduction and elimination of time-consuming undesired emergency applications, reduced buff/draft forces that contribute to cargo damage, and higher train-operating speeds that increase track capacity.

Environment-Friendly Railroads

The environmental benefits of rail are well known with recent US, Canadian and German studies showing substantial environmental benefits of trains over other motorized forms of transportation. In the United States, improved air quality has become a national imperative, and railroads are committed to reducing locomotive emissions even further.

In a recent agreement with the Environmental Protection Agency, which has been assigned the task of implementing a Federal emissions reduction plan in the smog-bound Los Angeles area, railroads are committed to reducing locomotive NOx emissions by another 55% by the year 2010.

This will be achieved by advancements in diesel locomotive technology — retrofitting existing units and applying the technology to new constructions. Use of natural-gas powered locomotives is also being tested.

Further research includes a joint project with Argonne National Laboratories and is aimed at developing mechanical energy storage systems — better known as flywheels — that will signal a momentous breakthrough in cleaner engine design. Oxygen enrichment of locomotive intake air is also being studied to determine the reduction effect on emissions.

Transportation Technology Center

The core of US railroad research efforts is at the 52-square mile Transportation Technology Center (TTC) near Pueblo, Colorado. TTC is a world-class intermodal transportation research and test center owned by the Department of Transportation, but operated and maintained by the Association of American Railroads.

TTC has 48 miles of railroad track devoted to testing all types of rolling stock, track components, and signal and safety devices. The test tracks include the High Tonnage Loop for track component and wear and fatigue research; the Railroad Test Track and Transit Test Track for high-speed vehicle testing; the Precision Test Track for vehicle testing on perturbed track; and the Wheel/Rail Mechanism Loop for steady-state and dynamic curve tests.

TTC also has unique laboratory test facilities for evaluating vehicle dynamics, structural integrity and reliability.

Many of the now-celebrated rail research advances resulted from cooperative projects between the Association of American Railroads' Research and Test Department, individual railroads and railroad suppliers. Improved steel for rails was born of testing at TTC, as were rail lubrication and AC locomotives. The Transportation Technology Center is available for proprietary testing by private-sector firms as well as government bodies — both foreign and domestic. Roy Allen, AAR's vice president for research and test at our Washington, DC, headquarters is the individual to contact for more information.

The Association of American Railroads

The Association of American Railroads (AAR) is the world's leading railroad policy, research and technology organization, focusing on increasing the safety and productivity of rail carriers. AAR's mission is accomplished through three activities:

- Advocating the interests of railroads in the public policy arena.
- Enhancing the productivity and safety of the railroad industry through research and development and other support programs.
- Facilitating a seamless intermodal interchange by exchanging electronic information among railroads, their customers, and suppliers.

Most of AAR's 650 or so employees and $100-million budget are focused on operations, maintenance, safety, theoretical and applied research, economics, finance, accounting, communications, electronic data interchange, and public affairs, and representation of members before Congress, regulatory agencies and the courts.

With its headquarters in Washington, DC, AAR also operates the Transportation Technology Center near Pueblo, Colorado.

Railroads — A New Age

Railroading in the United States has become an exciting industry, wrapped in growth and especially attractive to investors and the media. Restructuring, new technology, unprecedented gains in productivity, deregulation and a new emphasis on quality all have acted as a growth hormone, transforming a once lethargic industry into a vital, vibrant and vigorous transportation network.

With research programs playing a catalytic role, the foundation is being laid for even more productivity gains that will translate into more growth. The best is yet to come. ■

Edwin L. Harper

Dr Harper received his Ph. D. from the University of Virginia. He has held a number of senior positions under Presidents Nixon, Ford and Reagan. He served as a top executive in several major US corporations before joining AAR as President and CEO in 1992.