

Transportation Technology Careers: 2005

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Abstract

This paper's purpose is to assist in developing a deeper understanding of the future educational and training needs of the transportation industry. This paper explores the significant transportation industry career opportunities and new job descriptions for the 21st century and focuses on emerging careers in five areas of transportation: highway, rail, transit, air and maritime. The needs and opportunities for well-trained transportation engineers, technologist, specialists and managers are examined.

The paper investigates the new career **opportunities** that will emerge for transportation technologists by the year 2005 and that these new career opportunities will require higher levels of education and offer significant new challenges for college graduates. Convergence in technology and information changes in the business environment and markets, new government regulations and spending levels are explored as they affect transportation industry careers.

The paper explores the significant career opportunities that will appear, in which a broad **range** of new technologies are successfully introduced that span all transportation areas and provide enhanced connectivity; and that new jobs will emerge as: new information systems and networks are implemented, new **intermodal** services are **provided**, public transit grows, greater attention is given to system management, and many traditional jobs are replaced by new ones that require advanced technical skills and business practices.

Background

Transportation is a vital component of the life-support system of industrial and post-industrial societies and is an essential element for the development of nations. It is a major factor in assuring a favorable quality of life, health, **social** and economic well-being and national security. The transportation system is also the key to mobility and for the **efficient** movement of people, goods, services, resources and information. Every sector of the economy depends upon efficient transportation. Transportation consistently ranks as a top factor in **determining** site location for economic development and is the life line for economic survival in a mobile-based world.

A successful transportation system is dependent upon people with the knowledge and skill to direct the movement of people, goods, services, resources and information. It is an industry that requires dedicated, technically trained specialists with keen administrative and managerial skills. Persons with such training and experience will be in constant demand and this need will continue to grow indefinitely.

Introduction

This paper is intended to assist in developing a deeper understanding of the future educational and training needs of the transportation industry. Education is a building block of our society. The need for well-trained transportation specialists and managers has never been greater. New opportunities are arising. Cooperative efforts between the United **States**, Canada, and Mexico (**NAFTA**) will boost transportation activities in the **future**.

The Federal Aviation Administration forecasts airline traffic to grow from 501 million revenue passenger enplanements in 1992 to 900 million in the year 2005. The Boeing Aircraft Company estimates that \$234 billion in new aircraft will be needed by 2005.



After years of neglect, rail transportation is growing. Passenger growth on Amtrak is expected to grow about four percent annually through 1997, after expanding seven percent in 1992 when it provided six billion miles of travel for 40 million passengers. (This estimate might be affected by proposed Amtrak downsizing.)

Freight transportation is enormous in size. The U.S. trucking industry generates some \$218 billion in revenues, railroad -freight accounts for almost \$32 billion, water transportation accounts for about \$10 billion, and the airline cargo industry generates \$7 billion. Trucking, the largest service employer in the transportation industry, is expected to exhibit significant growth through the year 2005.

More people are employed in the transportation industry than in legal services, educational services, nursing, amusement, or data-processing. By the year 2005, approximately one in ten employees will be working in the broadly defined transportation industry. (This figure does not include those working in media and telecommunications.)

Convergence in technology and information, changes in the business environment and markets, and new government regulations and spending levels will affect transportation careers in highway, rail, transit, air and maritime sectors of the transportation industry. Increasingly, transportation careers will be **intermodal**. Many new jobs, such as: information specialists, network engineers, and management analysts will be needed across the traditional modes of transportation.

A survey was conducted among industries, educational institutions and government agencies related to transportation. This included senior level people who are responsible for the management and policy direction of their respective organizations.

This paper focuses on the key modal sectors: highway, rail, **transit**, air and maritime. These were selected because the size and growth of these sectors are covered by statistical reporting agencies such as the U.S. Department of Labor, Department of Commerce and public and private units. Related components of the transportation industry, excluded in this presentation include automotive, recreational vehicles and activities. These markets are expected to grow and represent additional career opportunities not covered in this paper.

Key Assumptions

The following assumptions were used in the preparation of forecasts and finding for this study:

1. Decline in low-skill jobs
2. Managing diversity
3. Growth in women in the work force
4. College graduate salary advantages
5. Economic outlook
6. Oil pricing

Decline in Low-skilled Jobs

Low-skill jobs are declining in importance and new jobs will require higher level skills. (This conclusion is based on an analysis of skill ratings in which low ranged from 0 to 2.5, high rating from 3.0 to 7. Engineers were rated at 5.1, management -4.4, technicians -4.1, marketing and sales - 3.4; and transport workers -2.2, according to the Work Force 2000 study conducted by the Hudson Institute.) New jobs in growing industries will demand much higher skills levels than do the jobs of today. Most of the new jobs in transportation will require increased capability to read, write, follow directions, use mathematics, and utilize a systemic decision-making process.

Managing Diversity

Managers and technical specialists will have to deal with a greater diversity in the workplace and cultural differences while still producing expected results in the marketplace. The population and the overall work force will grow more slowly than at any time since the 1930s. However, the number of minorities and their skill levels are expanding. The Work Force 2000 study also concluded that careers in the future will require more education.



About one in ten of the labor force in 2005 will be an Hispanic worker. The Hispanic labor force is likely to ~~increase its numbers~~ -to 17 million by the year 2005, growing at an average of 3.5 percent ~~annually~~ y. The number . of Asians will be an estimated 3.8 percent of the 2005 work force; the number of blacks will rise to almost 13 percent. Transportation markets reflect the trend toward greater diversity. For example, the number of minorities who ~~are~~ truck drivers increased from 16.4 percent in 1980 to over 25 percent in 1990.

In the future, the overall population growth rate will slow but its diversity will rise. A key success factor for transportation specialists and managers will be their ability to understand and coach their diverse work force effectively.

Women in the Work Force

In 1970, 42 percent of college enrollments were women. By 1990, the number rose to 55 percent. Of the estimated 13.7 million students, 7.5 million are women, and 6.2 million are men. Projections by the U. S. Department of Education are that over 8 million women will be enrolled in U.S. colleges by 1995. By the year 2005, women may constitute over 60 percent of college enrollments. By the year 2005, an expected 71.4 million women will be in the labor force, reaching an all-time high participation rate of 63 percent. More women will be working, and their share of the **total** labor force will rise from 45.3 percent in 1990 to 47.7 percent in 2005. The participation rate, or the number of women who are available and are working in the labor pool, is expected to rise to 63 percent by 2005.

The number of women who **will** be seeking college degrees and employment in transportation sector will increase. This increase will put pressures on employers to provide college-educated women higher pay and more challenging assignments. Women are likely to seek careers across the full spectrum of occupations in transportation: management analysts, software application engineers, pilots, budget analysts, and marketing and management positions.

College Graduates

The starting salaries of college graduates with technical degrees tend to **outpace** those graduates with other specialties, but the college degree, especially backed with work experience, is likely to bring initial compensation much higher than will a high school **diploma**. It is estimated that over a 20 year career, an occupation with a high school education will earn \$360,000 while an occupation with a 4 year degree will earn \$620,000 (using median annual earnings data of 1987).

Economy

The U.S. economy is expected to recover from the current recessionary cycle. However, the pace will not be as rapid as that of the 1975-1990 period. Modest recovery is already visible in several transportation markets. Air cargo, passenger, and trucking sectors are already **outpacing** the economy.

Oil Prices

The transportation industry is highly dependent upon the cost and availability of energy. **Oil** prices are expected to be relatively stable during the next decade. In the base case scenario, oil prices will be about the same level in the year 2005 as in 1990, in constant dollars. There is a small chance, with about 10 percent probability at present, that oil prices might rise significantly within the next two to three years. If this rise were to occur, market growth and career advances would be reduced in the short run, depending upon the severity and duration of the oil price increase and its impact on the **global** economy. However, it is quite unlikely, even in this pessimistic scenario, that oil prices would remain high during the entire decade.

The unexpected sharp increase in oil prices during the 1970s resulted in major increases in energy efficiency and in dramatic increases in the discovery and recovery of **large** oil resources. Higher oil prices, at the time, created a huge incentive for the energy suppliers and energy users to adapt. As a result of market forces, oil prices in constant dollars fell during the 1980s and again in the early 1990s . . .to about the same level as in 1993.

Technological Advances And Careers

New technologies that will appear in the key transportation sectors of the future will create the need for careers that will be important within and across key modal sectors. Some of the new technologies include:



1. Advanced tracking and tracing systems
2. Global navigation satellites/positioning
3. Advanced train-control systems
4. Magnetic levitation
5. Aeronautic telecommunications network
6. Fly-by wire aircraft
7. Terminal air-traffic-control automation
8. Terminal Doppler weather radar
9. Hub and spoke systems

Evolving technologies in vehicular transportation include:

1. Intelligent transportation systems
2. Advanced electric automobiles
3. Vehicle propulsion systems

Transportation careers will include information related jobs such as transportation-information specialists, systems-simulation engineers, smart-systems engineers, transportation systems planners, logistics-systems engineers and planners, transportation training specialists, and environmental and ecological specialists.

Investment in information technology in transportation already exceeds that, on a per employee basis, in banking, savings and loans, insurance, and retailing industries. Transportation firms spent an estimated \$3,200 per employee in 1992. Information technology, affecting virtually all transportation sectors includes:

- 1. - Teleconferencing voice and video
2. Optical fibers, packet switching, digital systems
3. Local area networks, personal wireless systems
4. Satellite communications
5. ISDN and SONET switches

High-growth careers requiring high school education or extensive company training, include:

- | | |
|---------------------------------|--------------------|
| Fire-fighting personnel | Reservation agents |
| Aircraft mechanics | Travel agents |
| Transportation records analysts | Flight attendants |

Low-to moderate-growth careers requiring high school or less education and training, include:

- | | |
|-----------------------|-------------------|
| Ship pilots | Data-entry clerks |
| Administrative clerks | |

High-growth careers requiring bachelor's degree or more education, include:

- | | |
|------------------------------------|----------------------|
| Operations research analysts | Aircraft Pilots |
| Systems analysts | Accountants |
| Civil, traffic engineers, planners | Electrical engineers |
| Management analysts | |

Moderate-growth careers requiring bachelor's degree or more education, include:

- | | |
|---------------------------|-------------------------------------|
| Transportation executives | Transportation marketing managers |
| Financial managers | Transportation mechanical engineers |
| Transportation educators | |

Changes In The Economy And Transportation Markets

Structural changes in the economy are transforming the transportation markets of the future. The several driving forces are

1. New opportunities are emerging because of the globalization of markets, resources, and communications and because of the opening of financial markets, increased use of automation and networks overseas, and rising imports to the U.S.



2. Rivalry will increase in the U.S. domestic transportation markets as foreign firms look to the U.S. market for growth and opportunity.
3. U.S. firms will face increased competition overseas as governments **privatize** large transportation firms.
4. New alliances and joint ventures are becoming more common in U.S. markets involving customers, suppliers, and rivals. Moreover, the **NAFTA** alliance will create new market opportunities for transportation firms.
5. The U.S. economy is downsizing and flattening its labor force so that a larger number of part-time employees, independent contractors, and **outsourced** workers will be prevalent.

These five **changes** in the business environment will strongly affect the transportation labor force of the future. Key careers that will be high growth and require at least a college degree include:

Operations analysts	Systems analysts
Traffic engineers	Transportation planners
Management analysts	

Us Federal Agency Spending

Federal government regulatory spending for transportation markets totaled \$1,997 million in 1993, according to an analysis by the Center for the Study of American Business at Washington University in St. **Louis**. Overall spending in 1970 was \$279 million. Spending by the National Transportation Safety Board in 1993 amounted to \$36 million, bringing the grand total to over **\$2** billion annually. Government spending has risen faster than the economy since 1970. Regulatory spending on **all** transport modes rose 5.1 percent, with expenditures for the Federal Highway Administration the highest at 18.5 percent annually, and expenditures for the U.S. Coast Guard were 6 percent per annum in 1993. In real terms, less the **effects** of inflation, government spending has declined for the Federal Railroad Administration and the National Highway Traffic Safety **Administration** in 1993. However, spending by other agencies have a significant effect on transportation.

The U.S. Environmental Protection Agency has an estimated 1993 budget of \$4.5 billion, and the Department of Energy has an overall budget of \$573 million. Specific governmental regulatory units also have **budgets**: the Interstate Commerce Commission (scheduled to be sunset with functions transferred to other agencies) with an estimated \$52 million **budget**, and the Federal Maritime Commission has a budget of \$19 million while the International Trade Administration of the **Department** of Commerce has a budget of \$26 million. Key **transportation** laws, regulations policies, **and/or** agreements will have a long-term impact on the five transportation sectors. They include the **Intermodal** Surface Transportation Efficiency Act, Staggers Act, Airport **and** Airway Trust Fund, North American Free Trade Agreement, Air Quality Act and the National Highway Act.

Transportation Career Sectors

Trucking and Air-Transport Service Careers

Trucking service jobs increased from 1.1 million in 1975 to 1.6 million by 1990. Because of the transportation shift from water to road, the increasing amount of imported goods, and the effects of deregulation, trucking employment is expected to expand to 1.9 million by the year 2005. **Air-transportation** jobs have also increased since 1975, when 362,000 workers were employed. By 1990, employees numbered 789,000. Although airline services were negatively affected by the recent recession, employment by the year 2005 is expected to reach 920,000 air-transport-service jobs.

Rail Service Careers

The railroad-service industry is likely to expand, but overall employment will decline. Rail revenues are likely to reach \$30 billion by 1994, with operating profits of almost \$5 billion. Since 1982, rail employment has been reduced by 48 percent because of mergers, longer trains, centralized dispatching, use of computers to replace many administrative tasks, and the elimination of superfluous positions such as the **brakeman**. **Intermodal** traffic is the fastest-growing segment of rail. It combines highway trailers and marine containers via rail flatcars. Since the 1982 deregulation of **intermodal** transportation, rail **intermodal** transportation has expanded on average 6.8 percent each year.



Transportation Services Careers

The shift to a service economy, and advances in transportation technology, and **rising** productivity in key **service** sectors are increasing the number of career opportunities in transportation services. An estimated 3.7 million jobs will be in transportation service sectors by the year 2005, 1.04 million jobs will be in equipment sectors of air, **rail**, water, and trucking in the same **timeframe**.

Transportation services were cited as one of the nine largest service industries in Work Force 2000 by the Hudson Institute. Service industries are dominant in the industrial market economies. **Over** 62 percent of total production is in the service economy in industrialized nations, 29 to 45 percent is in low-to **middle-income** economies, **according** to the study. Transportation-service productivity is increasing. For example, railroad productivity has expanded at an annual 9.8 percent since 1982. Air transport productivity is also increasing, in part because of the purchase of over \$106 billion of new aircraft delivered to airlines between 1990 and 1992.

Moreover, trucking services may benefit from the Intelligent Transportation System (ITS) program as well as from a much larger federal transportation initiative. President Clinton has recommended spending millions on intelligent transportation system program in 1994-5. SRI International's Washington, DC, Policy Analysis group expects the U.S. Congress to authorize nearly **all** of Clinton's budget **request**.

The **Intermodal** Surface Transportation Efficiency Act (ISTEA) of 1991 is designed to be a six-year \$151 billion effort funded by the federal government through 1997. A National Highway System Act was enacted in 1995, with a "son of ISTEA" being planned for 1996. ITS is being expanded into a more comprehensive transportation systems approach.

Transport services **in** trucking, air and new services will provide diverse career opportunities and **transportation-**equipment jobs are expected to realize some recovery by 2000. Trucking **services** will expand its major role in providing employment through the year 2005. The partial decline of jobs in **rail** and maritime will be offset by job growth in air transportation, public **transit**, and new transportation services.

By 2005, trucking employment will constitute about 42 **percent**, air 35 percent, water 7 percent, and rail 6 percent of total transportation sectors. New transportation **services** are expected to provide 11 percent of transportation jobs within a decade.

The recent global recession, defense downsizing, corporate restructuring and lower overall private capital spending have been key factors in the decline of jobs in key **transport-equipment** sectors, especially the aerospace market. Some of this is being moderated by increasing growth in the international market, including the Asian/Pacific region. As airline profitability improves and the need to replace older aircraft becomes important, commercial aircraft builders will increase production and the need for high-skill jobs will increase **after** 2000.

By the year 2005, aerospace jobs will constitute 70 percent, rail equipment manufacturing 17 percent. shipbuilding 3 percent and truck and trailer about 10 percent of total transportation equipment employment.

Professional and Administrative Careers

Professional, managerial, and marketing and sales careers are among the high growth opportunities in transportation today. Job openings are expected to grow at 27 percent between 1990 and the year 2005 for professionals and executives and at 24 percent for marketing and sales managers. Generally, these occupations require at least a bachelor's degree for entry and career success. Other, more numerous functions, such as administrative jobs, will show about half the growth rate and usually require only a high school diploma.

Career success in the professional and managerial occupations of the future will be a blend of good quantitative and qualitative skills. Increasingly, managers will have to deal with a diverse and slower growing labor force, calling for more dependence on "soft" skills such as leadership and ethics. Transportation professionals as well as managers will have to be computer literate. Information technology has pervaded virtually every part of highway, rail, transit, air and maritime sectors of transportation.



Air-Transport Careers

Air-transport **markets** are expected to expand by 4 to 5 percent annually through the forecast period. As a result, . four airline service careers will increase:

Pilots	Systems analysts
Management analysts	Information analysts

In most air-transport careers, employees will be expected to be able to have or manage one or more of the following skills and capabilities:

Macroeconomics analyses	Systems analyses
Environmental analyses	Airport design and planning
Transport systems design	Telecommunications network design
Aviation security systems design	Advanced weather systems design
Navigation and satellite systems design and implementation	

Government careers in aviation are also expected to grow. The 1992 Federal Aviation Administration (FAA) work force in **fiscal** 1992 had a budget of \$4.3 billion for aviation operations, \$1.9 billion for airport improvement programs, and \$2.7 billion for engineering projects. The FAA had a full-time complement of 52,320 employees in 1992 in the following areas:

1. Air **traffic** (25,299)
2. Electronics (**6,582**)
3. Engineering (3,054)
4. Aviation-safety inspection (3,068)
5. Technical, administrative (14,317)

This staff supervises and monitors a wide spectrum of aviation, including 420 air-traffic control towers, 5,551 public-use and 12,030 private-use airports, and approximately 690,000 active pilots.

Passenger Arrangement Careers

An increasing number of career opportunities will arise from the growth of passenger-service arrangement and shipment facilitation. Air cargo represents a significant growth area.

An expanding number of foreign visitors to the United States as well as residents traveling overseas will require the assistance of new service providers that go beyond traditional travel agents. Many of these providers will prepare special packages that involve education, health, sightseeing and cultural activities. Passenger travel arrangements will serve a more sophisticated and demanding customer. Key skills will include knowledge of specialized activities and travel accommodations, ability to converse in a foreign language and understanding of cultural preferences.

Express packages now account for nearly half the air-cargo ton-miles shipped by companies. **Career** opportunities are expanding in the express package and air and ground-delivery courier businesses, which are expected to grow faster than air transportation through the year 2005. Moreover, rising imports and exports will create the need for jobs in customs clearance tracking and monitoring of shipments and packages. Internal corporate **intermodal** monitoring will grow as client demand increases.

Logistics Careers

Logistics business opportunities are also expected to expand. Career opportunities are rising **in** the delivery of just-in-time inventories, same-day delivery, hazardous shipment controls, specialized warehousing and shipment systems (such as Federal Express's Parts Bank), and a number of expanding logistics processes. Logistics is recognized as a major function in the business world and career paths are often very challenging. This is not surprising, since logistics employs the **second** largest number of people in the United States. For a career in logistics, you must be able to learn and contribute quickly.

Logistics accounts for 11 percent of the United States Gross National Product (**GNP**). U.S. industry in 1990 **spent** an estimated \$352 **billion** on freight transportation, more than \$221 billion on warehousing, storage and



inventory and more than \$27 billion to administer, communicate and manage the logistics process. Profitable companies of the future will be the ones who recognize the crucial role that logistics play in improving profits, introducing new products, opening new markets in a global economy, and providing better service to its customers. Three logistics segments will provide job opportunities within the next decade in companies, in transport carriers, and outside contractors.

In-House Logistics

1. A company-integrated shipping system
2. Each division of a corporation with its own logistics system
3. A company using multiple freight forwarders, carriers, trucking firms, marine-shipping and air-express firms

Logistics Alliances

1. Company develops a common "partners" program with key transportation firms
2. Company develops individual alliances with air-freight forwarder and trucking, rail, maritime transportation, and express firms
3. Company joins a consortium of shippers who use a group of transportation specialists
4. Company acquires a freight forwarder
5. Company relies on outside contractors
6. Company outsources logistics to third-party providers entirely

Express Transportation Careers

As of 1990, express transportation revenues are estimated at \$10 billion on a global basis and growing at a rate of 15 to 20 percent annually. The industry entered into its fourth phase of development in 1988. The first or traditional phase ranged from 1948 to 1967, the transitional phase from 1968 to 1981, the competitive phase from 1982 to 1988, and the current global phase from 1988 to 2005. Although industry growth rates have declined from the 60 to 80 percent levels experienced in early phases, career opportunities continue in this sector that is intermodal by its basic nature. Express transportation combines trucking, air delivery, and a blend of sophisticated information services to provide new services to consumers, government, and business.

Hazardous Materials Careers

An estimated 1.5 billion tons of hazardous materials were shipped some 784 billion ton-miles by all modes of transportation in 1982. Although trucking accounted for the largest tonnage, waterborne transport shipped the largest ton-miles. In the past ten years, hazardous material shipments have increased significantly. An expanding economy, rising imports, and growth in transportation markets will likely require shipments in larger volumes through the year 2005, under tighter regulatory controls and environmental monitoring.

About 70 percent of the hazardous tonnage shipped by truck is hazardous chemicals and the remaining 30 percent is hazardous petroleum products. Large volume hazardous chemicals include some 147 products such as sulfuric acid, propane, nitrogen, oxygen, ammonia, and calcium oxide. Ten states originate or receive large amounts of hazardous shipments: Louisiana, Texas, Alabama, Illinois, Ohio, Missouri, Mississippi, Indiana, Georgia and Tennessee.

Career opportunities in transportation of hazardous materials are expected to be numerous in the public and private sectors. For example, federal, state, and local inspectors are working with or for the Federal Aviation Administration, the Federal Highway Administration, the Federal Railway Administration, the U.S. Coast Guard, and the Research and Special Programs Administration. In 1984, almost 1,000 inspectors were employed at the federal level alone.

An expanding effort exists to develop and automate a number of databases on transportation of hazardous materials, including tracking, monitoring, reporting accidents, and developing new ways to improve safety and cost-effectiveness. In the future, a large number of specialists will be needed to help train shippers and carrier personnel in the transportation of hazardous materials and in designing and implementing emergency response programs. An Office of Technology Assessment study concluded that only 25 percent of the 2 million emergency response staff in the U.S. were adequately trained.



Aerospace Manufacturing Careers

U.S. transportation manufacturing, especially aerospace equipment suppliers, have experienced declines in sales and employment. Aerospace downsizing is due in part to the **econom**y, reduced defense spending, competition from **Airbus** (a European consortium) and significant airline financial losses that amounted to over \$10 billion in the past four years. Total aerospace employment reached a peak of 946,000 in 1990. As of the end of 1992, there were 792,000 aerospace workers and managers. However, this sector has a backlog of \$96.7 billion in civilian and military aircraft, which is scheduled to be delivered over the next five years. The aircraft sector, which amounted to \$34.8 billion for military and \$37.9 billion for civilian planes in 1992, is expected to grow during the next decade. Missiles and space, which together accounted for \$39 billion in sales in 1992, will be under budget pressure during the same period. The international component, particularly in the Asia sector, will grow at a substantial rate with U.S. aircraft well positioned to receive a major market share.

Although the defense sector will continue to shrink in terms of sales and employment **through** 2000, other opportunities, including: defense conversion, civilian transport production, and spin-offs from large **firms** will revive this sector in the 2000-to-2005 period. U. S. transportation manufacturing are stronger than many observers realize. U.S. manufacturing continues to lead that of other nations in industrial productivity. Many aerospace-related industries are now positioning themselves overseas with various sized operations.

A 1993 study by McKinsey illustrates that, as of 1990, Japanese workers were only 83 percent as productive as U.S. employees in manufacturing, and German workers were 79 percent as productive. A key finding of the McKinsey study is that competition played a key role in the U.S. lead. If Germany and Japan open their markets to competition in the future, as is expected, sales and employment will grow to meet export market needs.

Trucking Industry Careers

U.S. trucking is one of the largest employers in the nation. Expenditures for truck freight in 1992 was \$293 billion. The trucking industry's percentage share of the national total freight bill increased **from** 73 percent in 1980 to over 78 percent in 1992. Preliminary data for 1993 shows truck revenues raising their share of the total market to 80 percent.

The fastest-growing component of trucking is less-than-truckload (**LTL**). Growth in this sector **outpaced** overall trucking in the past decade. LTL shipments grew 1.2 percent in 1991 and 3.8 percent in 1992 and is expected to grow 5.5 percent in 1993. LTL is defined as truck cargoes of less than 10,000 pounds. It has benefited from the expansion of just-in-time inventory systems that require companies to ship small lots more frequently.

For the LTL sector revenues have nearly doubled since 1980 rising **from** \$10.6 billion in 1980 to \$21 billion in 1992. Career opportunities in LTL, short haul (less than 700 miles) and **intermodal** transportation (with air, rail, and maritime), are likely to be **favorable** within the next decade.

Information technology is increasingly being used in the trucking-service industry, ranging from developing new software applications to vehicle maintenance and inventory systems to automated tracking systems to providing special terminals and networks for customers who are frequent shippers.

Passenger Transit Careers

Passenger transit is also expanding. Jobs in this sector have risen from 270,000 in 1975 to over 358,000 in 1992. Strong growth is expected during the final decade of this century. Passenger transit in the United States is expected to expand to new locations and upgrade existing routes and facilities. Examples of major efforts include Portland, Oregon, with a new **rail** system that **received** \$238 million in federal support; new systems in Atlanta with \$329 million in federal-aid, and major new rapid transit programs in Chicago, St. Louis, Baltimore, New York and New Jersey. Most major metropolitan cities have new transit systems under development or in expansion programs.

Much of the new growth will include advanced technologies. Consumer friendly services of the future will include improved customer information, ticket access, better safety features and advanced signaling systems. Careers for specialists in engineering, advanced design, software **programming, and management and budget**



analysis will be in demand. Transit systems will see many changes in the next decade. There is likely to be **changes in government** assistance, state and **local** government initiatives, and a rise in private offerings of transit systems.

The **federal** government has approved an increase to \$4.6 billion in capital and operating expenses for transit for the fiscal year 1994. It represents a 21 percent increase over 1993. This is somewhat less than the \$5.3 billion specified in the **intermodal** Surface Transportation Efficient Act authorization. The Act also expands national transit programs such as the Federal **Transit** Administration. A total of \$31 billion has been approved over a 6-year period, with almost 60 percent to come from the Mass Transit Access Account of the Highway Trust Fund.

Conclusions

Nearly 12.1 million Americans are employed in the transportation industry as **broadly** defined. High-growth transportation career opportunities will require high levels of education and offer a significant challenge for graduates. Few other industries offer the growth as well as the opportunity to travel and meet with people from virtually every discipline and interest. Trucking, air transportation, transit, and new transportation services are the fastest-growing sectors of the transportation industry. Dealing with and managing diversity/complexity will be critical challenges for graduates in the 1990s. **Intermodal** and other modal groups such as public transit and new technologies (i.e. intelligent transportation systems) in the vehicular sector offer promising career opportunities.

Employment in the transportation industry will continue to rise. Significant **career** opportunities will appear, in which a broad range of new technologies are successfully introduced that span these modes of transportation and provide enhanced connectivity. New jobs will emerge as new technologies are introduced, new information **systems** and networks are implemented, new **intermodal** services are provided, public transit grows, and many traditional jobs are replaced by new ones that require advanced technical skills and business practices.

Transportation-related career opportunities, including new job descriptions, will potentially exceed 650,000 by 2005.

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