

*Multi-Modal
Freight Analysis Framework*

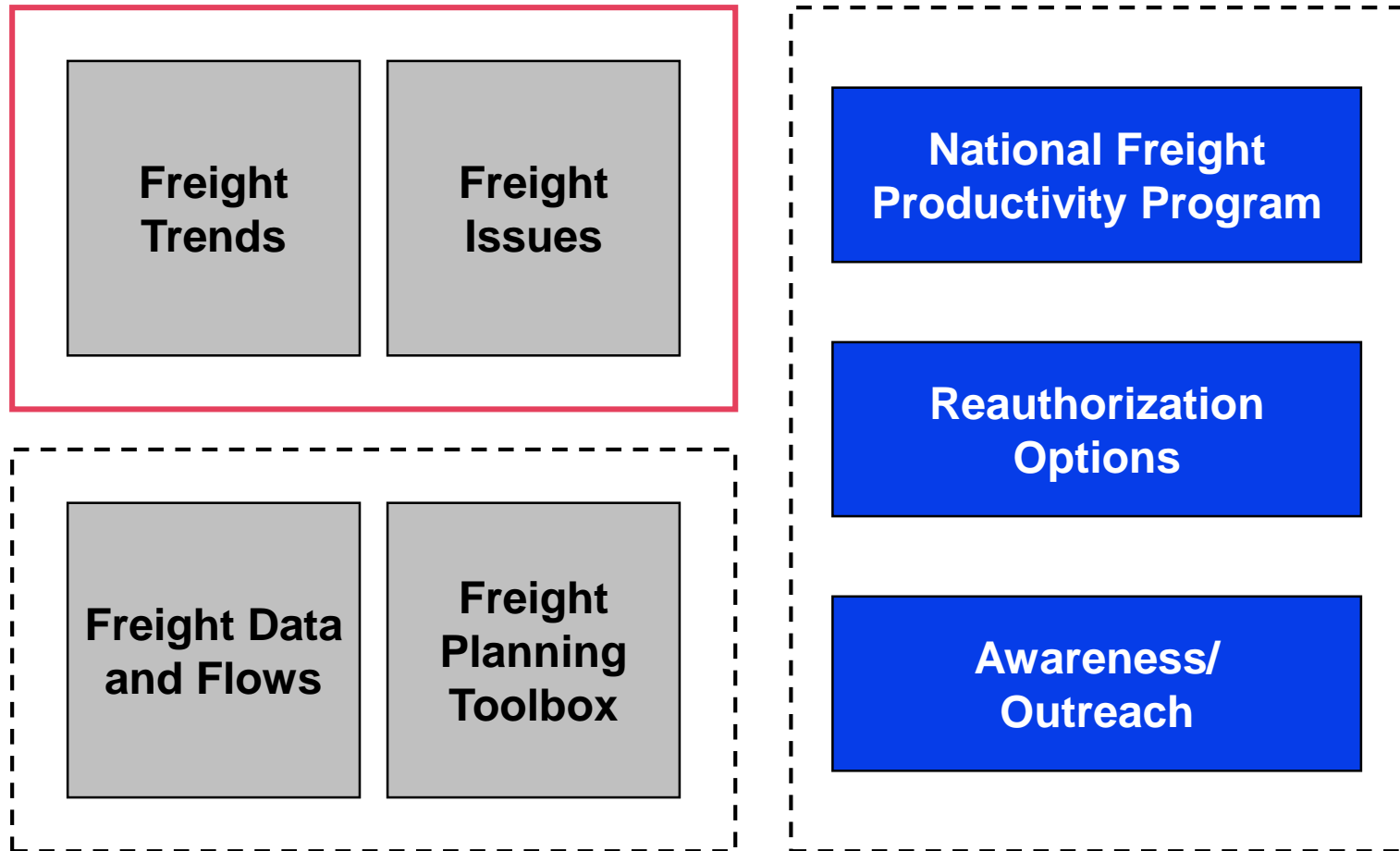
Freight Trends and Issues: Themes

June 21, 2000

Project Objective

- Develop a national freight productivity program
 - Obtain authorization and funding for the program in the next reauthorization of the surface transportation legislation
- Project elements
 - Analysis of freight trends, issues, opportunities, and potential Federal roles
 - Analysis and forecasts of North American freight/commodity flows
 - Discussions with industry, government, and the public

Project Elements



Freight Trends and Issues

Initial work is to define trends, implications, and issues

- Trends
- Implications
- Issues
- *Solutions*
- *Federal roles (where warranted)*

Freight Trends and Issues: Themes

Presentation of trends and issues is organized around three sets of themes

- Markets/Logistics (*demand*)
 - From national markets to global markets
 - From a manufacturing to a service economy
 - From push to pull logistics systems

- Carriers/Transportation Systems (*supply*)
 - From modal fragmentation to cross-modal coordination
 - From system construction to system optimization

Themes *(continued)*

- Public Policy
 - From economic deregulation to safety regulation
 - From modal to multi-modal surface transportation policy
 - From low visibility to environmental accountability
 - From DoD stovepipes to “Focused Logistics”

Workshop Objectives

- Review themes
 - Missing or incorrect trends, implications, or issues?
 - Better data to illustrate trends and issues?
- Identify opportunities
 - Potential solutions?
 - Potential federal roles?

Theme: From National to Global Markets

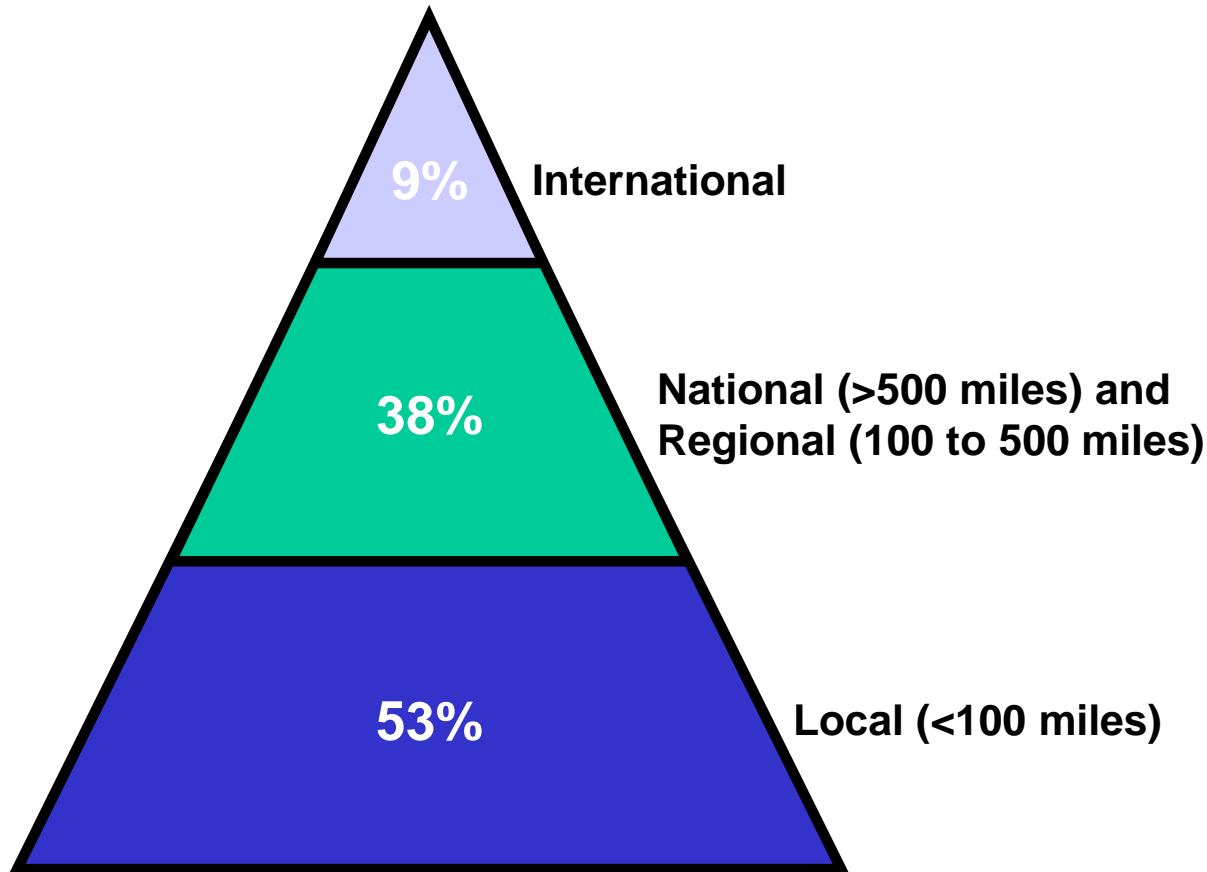
- Trends
 - Increasing domestic, NAFTA, and global trade
 - Outsourcing for comparative economic advantage in production
 - Emergence of global trade blocs and city-state trade areas
- Implications for freight transportation
 - Far-flung intermodal supply chains
 - Increasing freight traffic and congestion along trade corridors and at ports, airports, and border crossings

Theme: From National to Global Markets (continued)

- Implications ...
 - Changes in the location of high-volume lanes and economies of scale for freight carriers
 - Demand for global trade infra- and info-structure
 - Harmonization of trade and regulatory policies
- Issues
 - Infrastructure capacity
 - Financing gateway and trade corridor freight infrastructure
 - Trade policy volatility

Freight Movement by Geographic Area

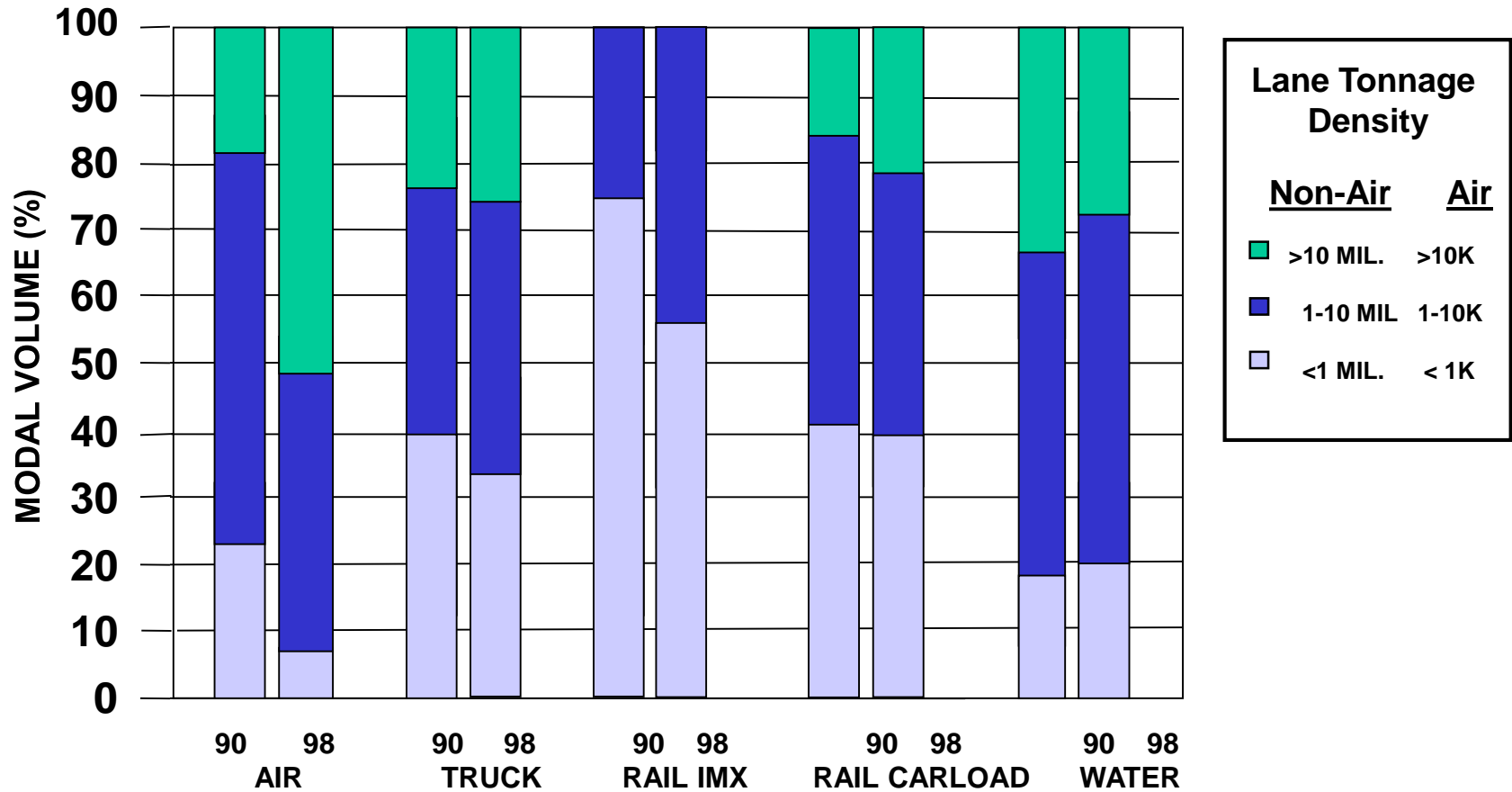
In 1998, 9% of the freight tonnage moved by all modes was international; 91%, domestic



Source: Reebie Associates. The domestic portions of international freight movements are included in "International" to minimize double counting.

Lane Density of Domestic Freight Traffic

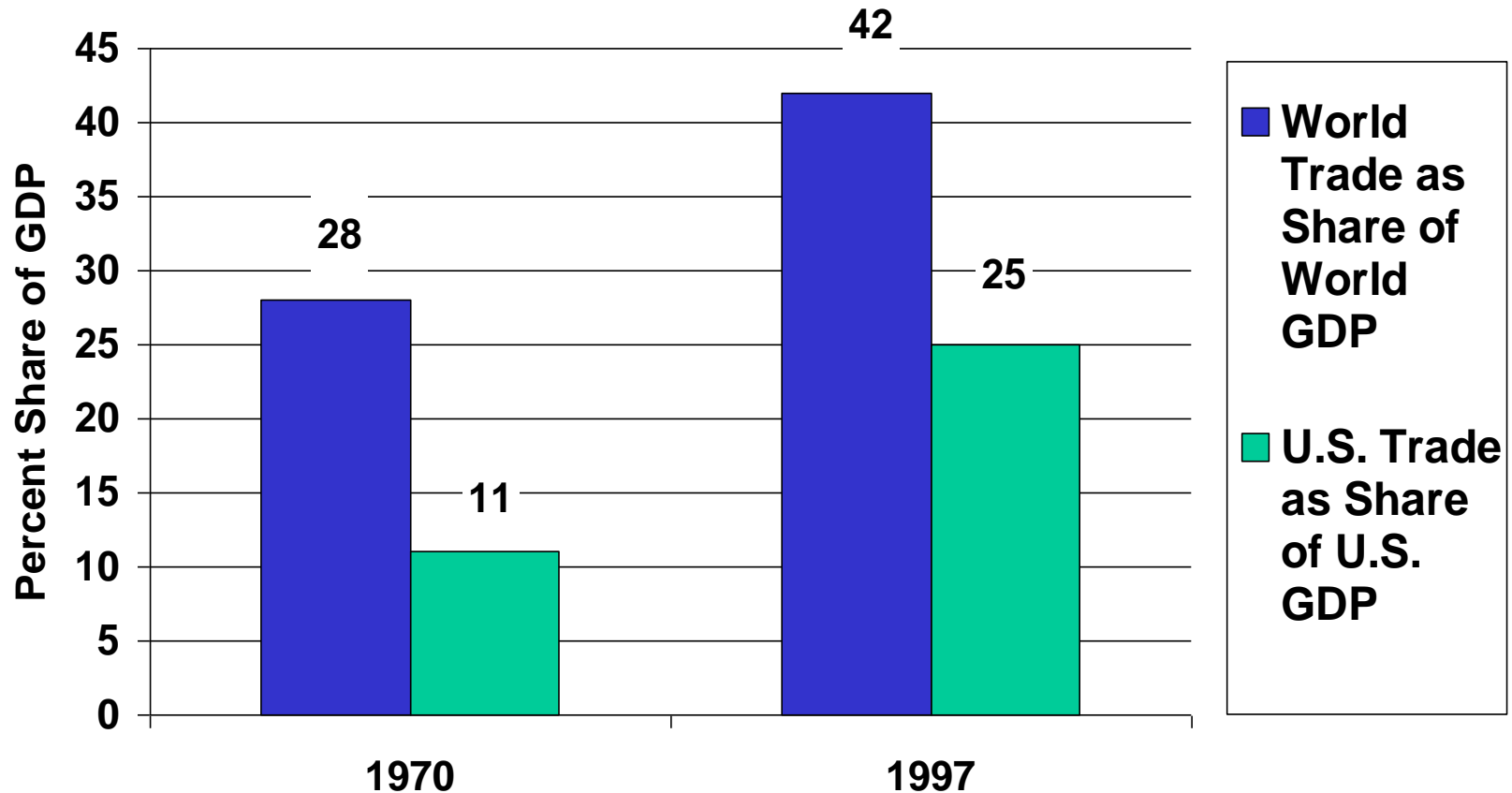
The density of freight traffic moving between major metropolitan areas has increased



Source: Reebie Associates, TRANSEARCH. Growth in lane tonnage density between major Bureau of Economic Analysis areas by mode.

World and U.S. Merchandise Trade

Trade is growing and now accounts for 25% of U.S. GDP, up from 11% in 1970



Source: World Bank, World Development Indicators 1999

Theme: From a Manufacturing to a Service Economy

- Trends

- Continuing evolution of the U.S. economy as a service and information economy
 - ⇒ Service-producing sectors accounted for 80% of jobs and 61% of the output in non-farm wage and salary industries in 1988
- Decline in manufacturing employment, but increase in manufacturing output
 - ⇒ Goods-producing sectors accounted for 20% of jobs and 39% of the output in non-farm wage and salary industries in 1998

Theme: From a Manufacturing to a Service Economy

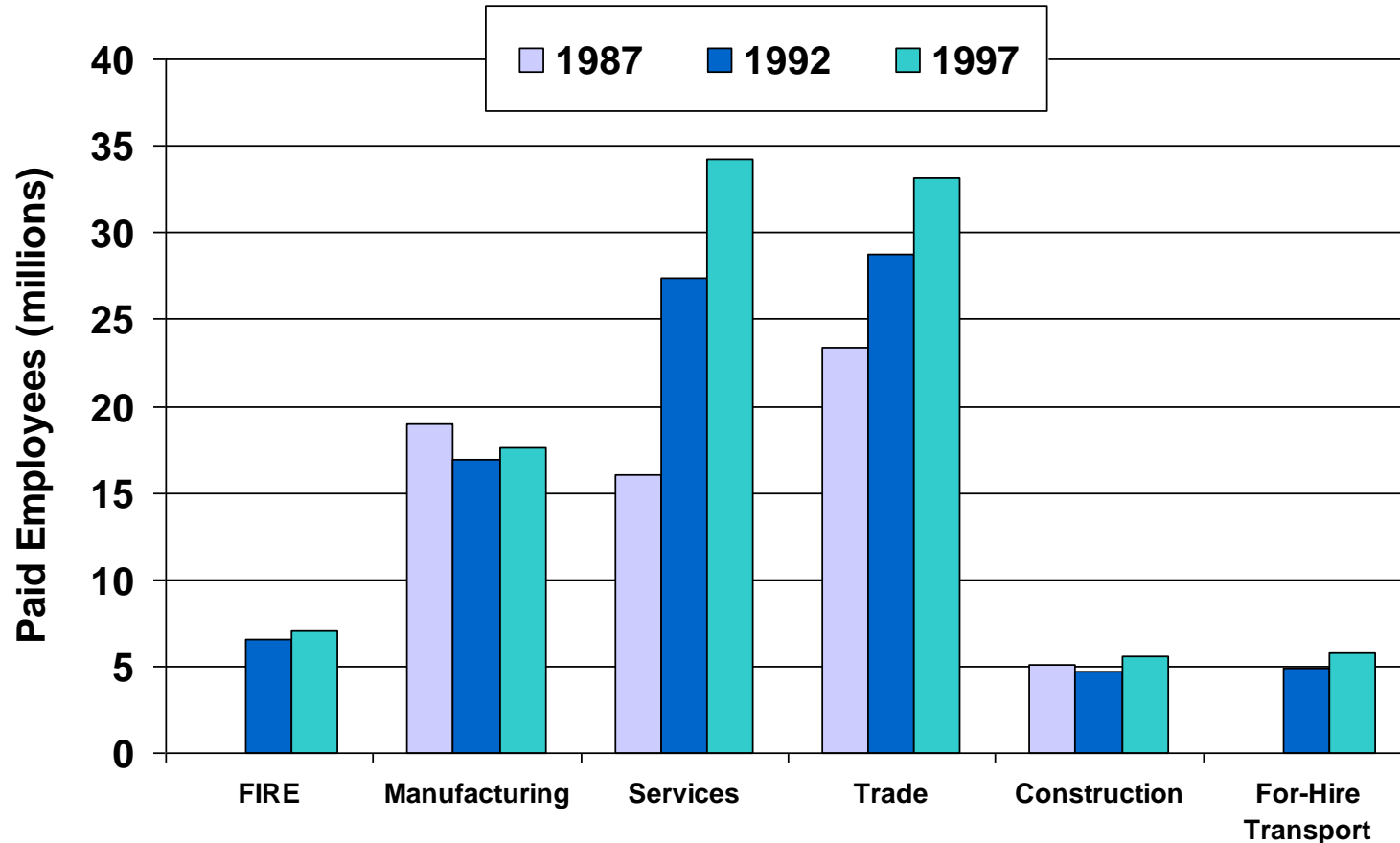
- Trends ...
 - Customer-driven shift to customized, mass-market products and services
 - Emergence of e-commerce and e-business
- Implications for freight transportation
 - Both service and goods-producing sectors generating more small shipments of light, high-value freight moving longer distances (both business-to-business and business-to-consumer shipments)

Theme: From a Manufacturing to a Service Economy (continued)

- Implications ...
 - Reliability and speed increasingly important
 - Increasing demand for package and air freight services
 - Carrier consolidation to drive down the cost of operation of high-value transport services
- Issues
 - Reliability and predictability of transportation services
 - Economic development more dependent on high quality, multi-modal transportation services

Employment Growth by Sector

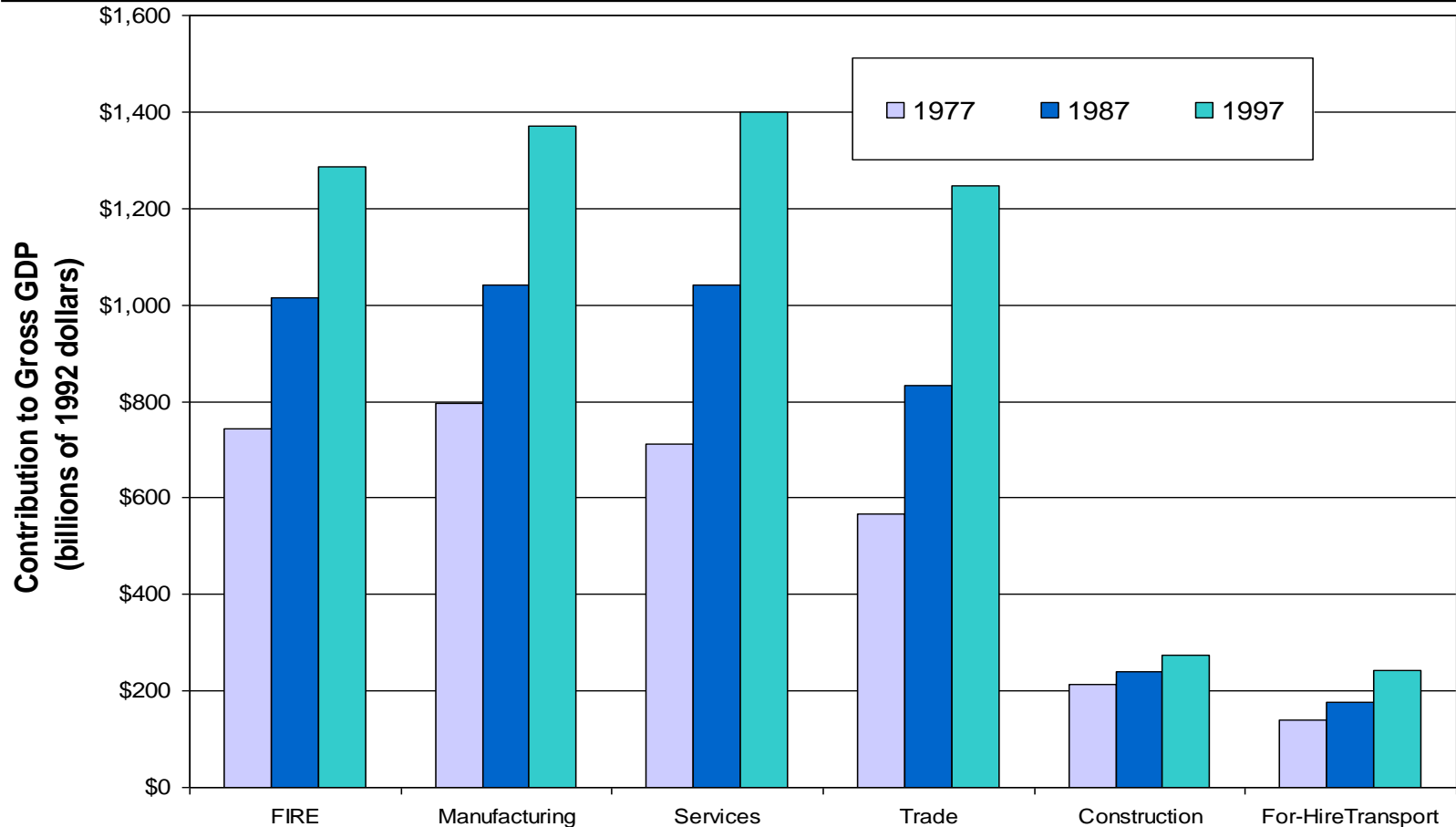
Rapid growth in service employment, little in manufacturing



Source: US Census Bureau, 1997 Economic Census (No 1987 Census of FIRE and Transportation sectors)

Economic Value Added by Sector

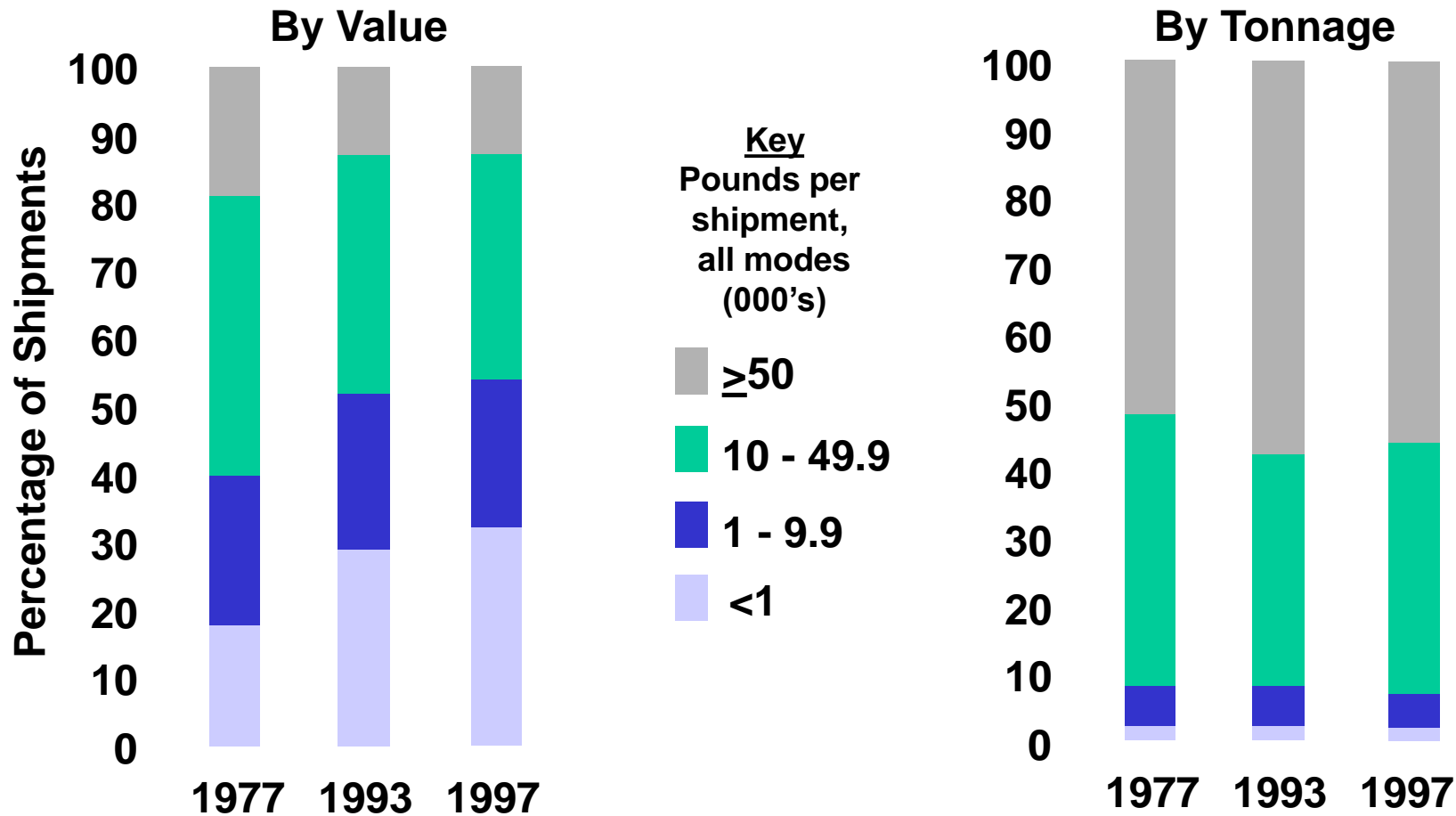
Increased production in manufacturing as well as services



Source: U.S. Bureau of Economic Analysis, *Survey of Current Business*, various years. Note: 1977 values are based on 1972 SIC codes (as opposed to 1987 SIC codes) and therefore, the industry definitions are slightly different.

Freight Shipments

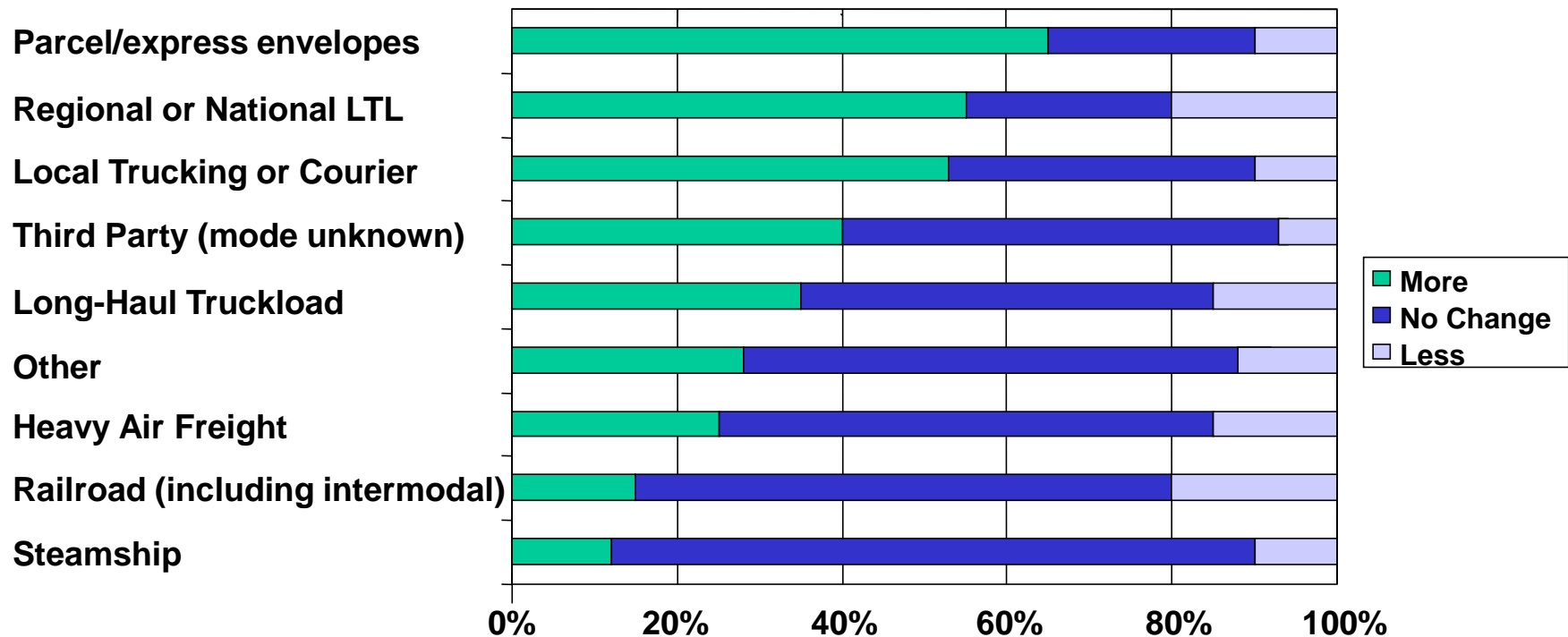
Shipments under 1000 pounds are increasing as a percentage of shipment value



Sources: 1997 CFS, 1993 CFS, 1977 COT (1977 data limited to primary shipments of manufactured goods)

E-Commerce and Freight Movement

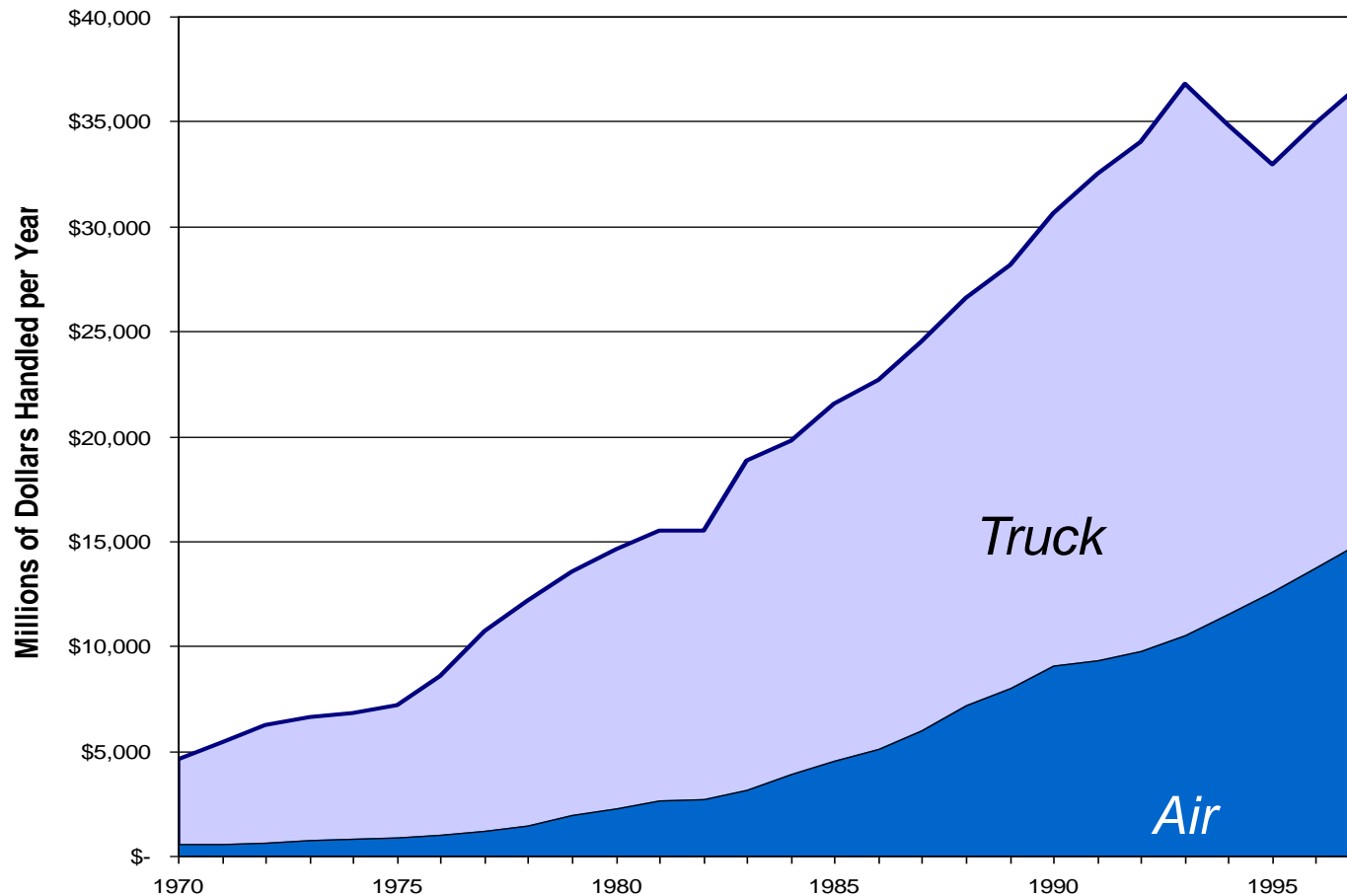
Shippers expect to use more parcel/express, LTL, local trucking, and /courier services



Source: Morgan Stanley Dean Witter Equity Research, April 2000

Small Package Freight by Mode

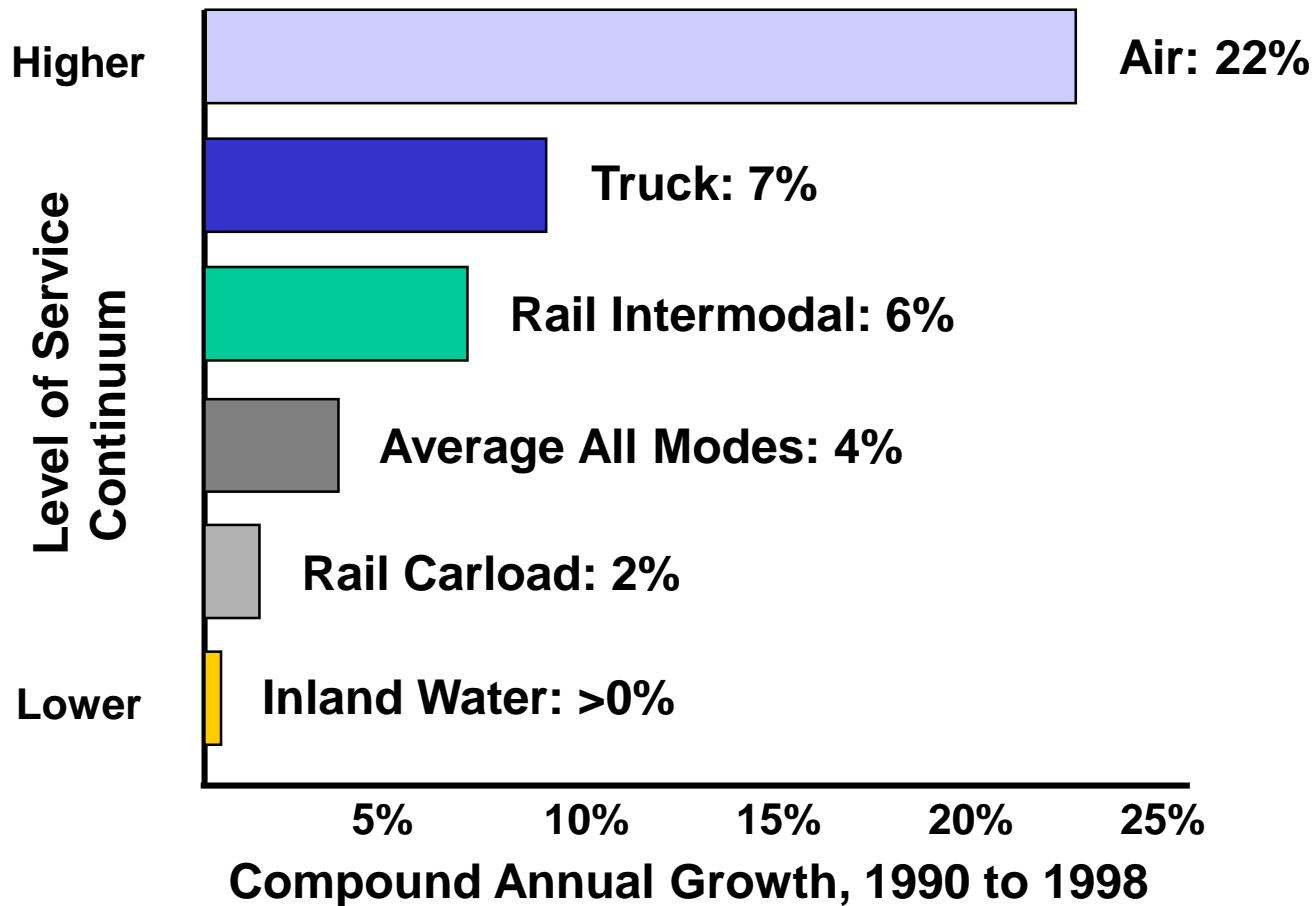
Trucks account for 70 percent by value, air for 30 percent



Source: USDOT, Bureau of Transportation Statistics, National Transportation Statistics 1999

Modal Growth in Tonnage

Demand for reliable, high-speed service is growing



Source: Reebie Associates, Transearch ("Truck" comprises primary shipments.)

Theme: From Push to Pull Logistics Systems

- Trends
 - Manufacture-to-order and time-definite-delivery
 - Pull logistics systems (“neuro-logistics” systems)
- Implications for freight transportation
 - Lower inventory levels and less slack production capacity, creating greater dependence on transportation service
 - Increasing demand for reliable, flexible, cost-effective, timely, and visible door-to-door freight services
 - Closer integration of shippers’ and carriers’ operations

Theme: From Push to Pull Logistics Systems (continued)

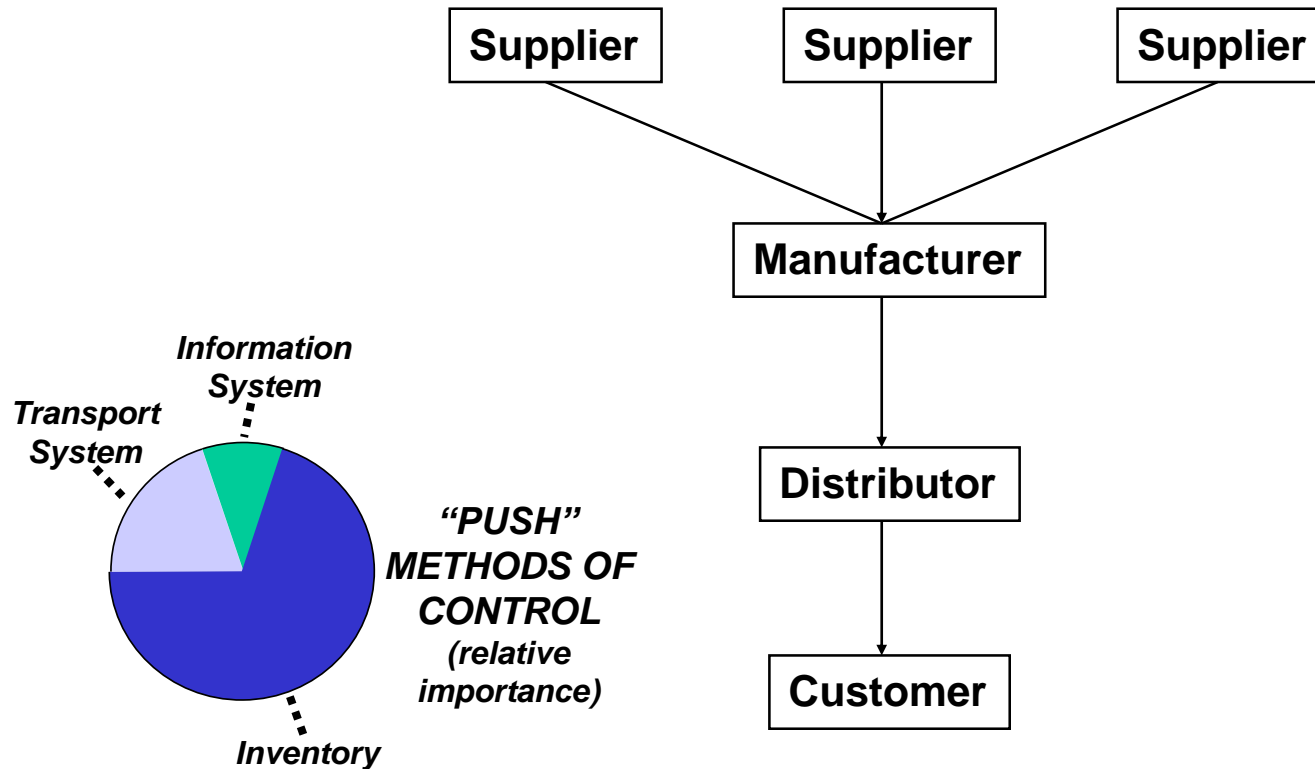
- Implications ...
 - Growth of 3PLs, 4PLs, and virtual transportation companies
 - Concentration of supply-chain control through consortiums and alliances
- Issues
 - Simultaneous increase in robustness and fragility of logistics and transportation systems

Theme: From Push to Pull Logistics Systems (continued)

- Issues ...
 - Risk management of potential service disruptions
 - ⊖ e.g., unanticipated spikes in supply or demand
 - ⊖ e.g., system failures (weather, labor disputes, terrorism, ...)
 - E-commerce impacts on local pick-up-and-delivery truck-miles-of-travel, congestion, and emissions
 - Cargo security (theft, pilferage, and smuggling)

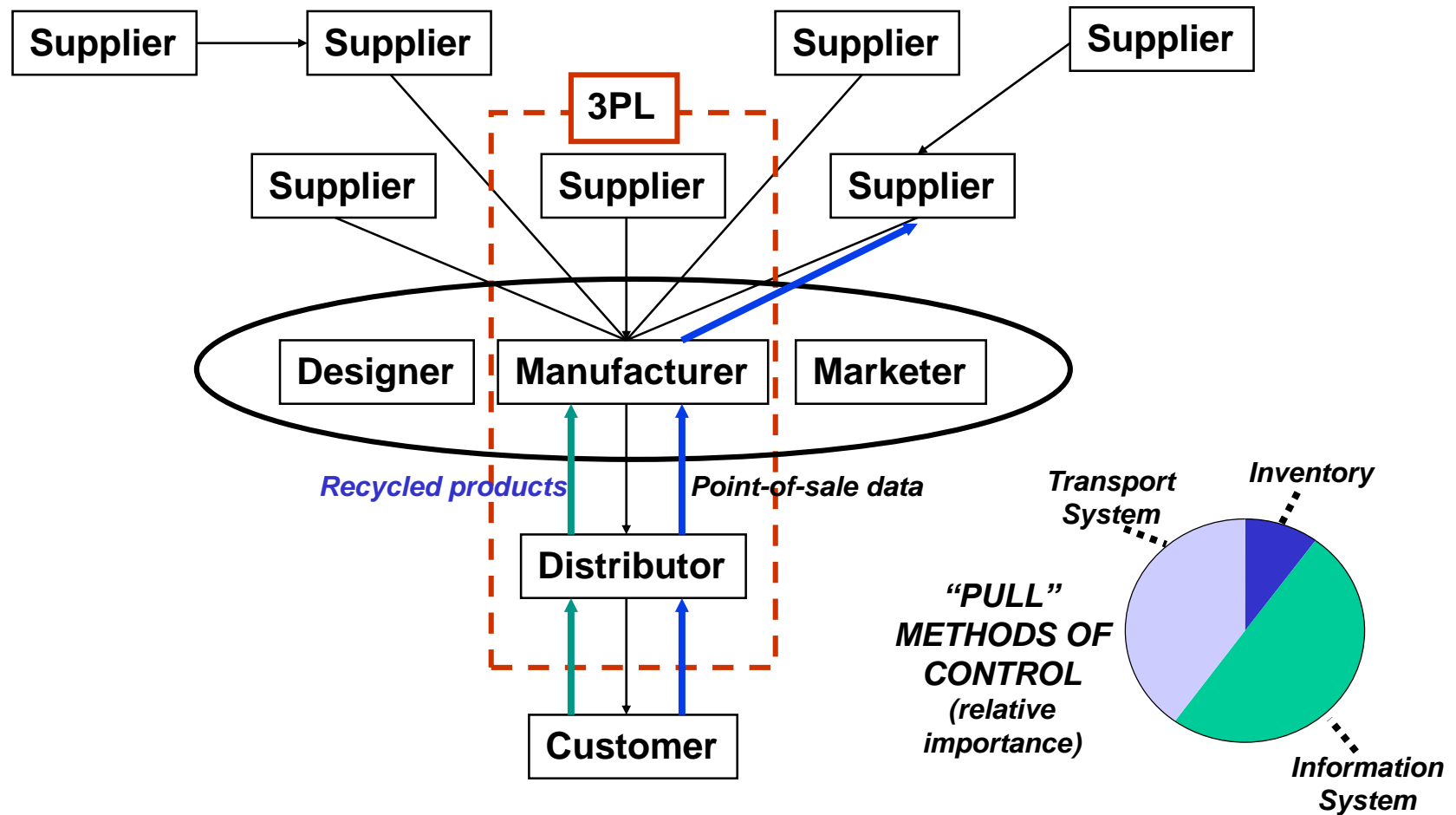
From Push to Pull Logistics Systems

The Push System



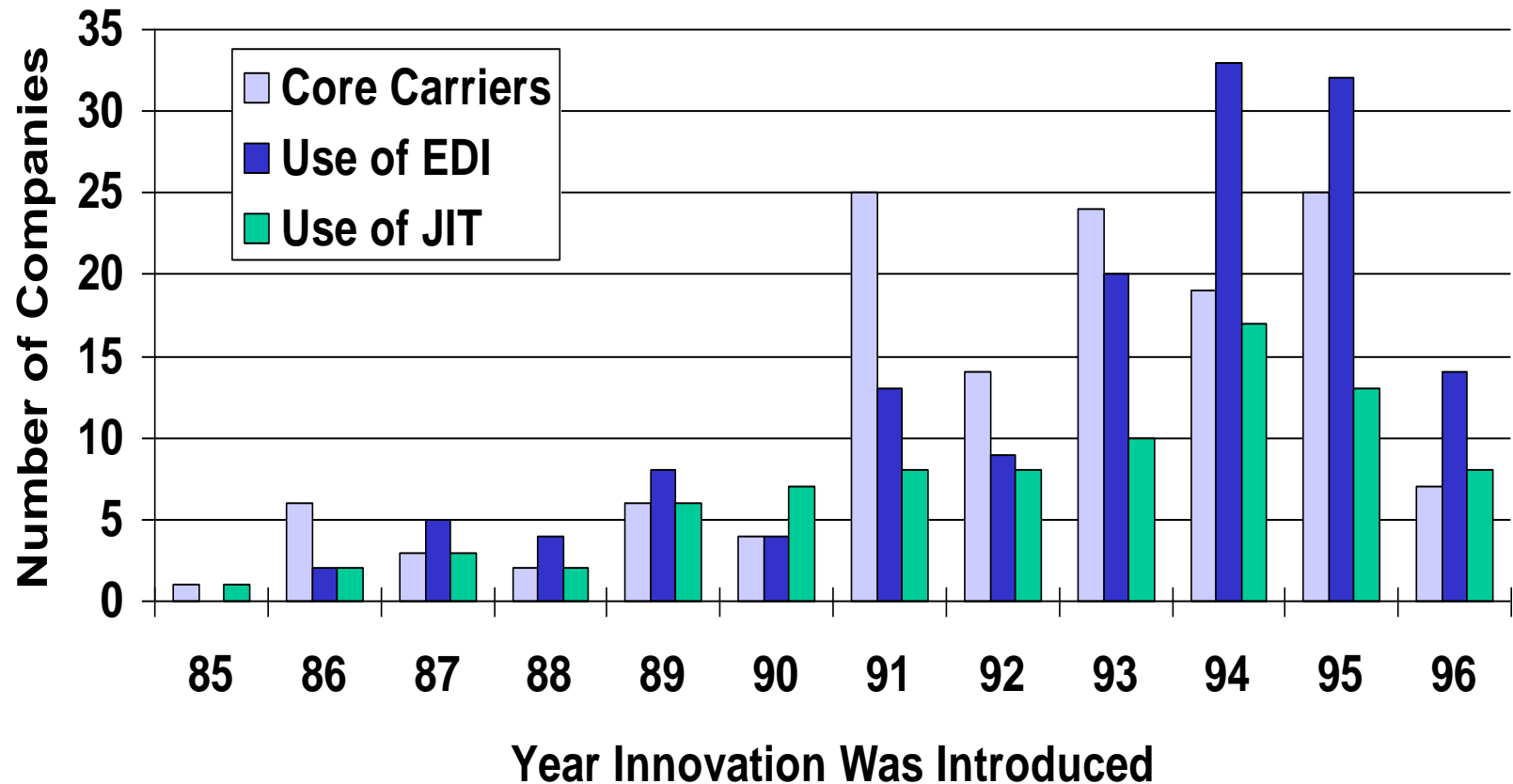
From Push to Pull Logistics Systems

The Pull System



Adoption of Logistics Innovations

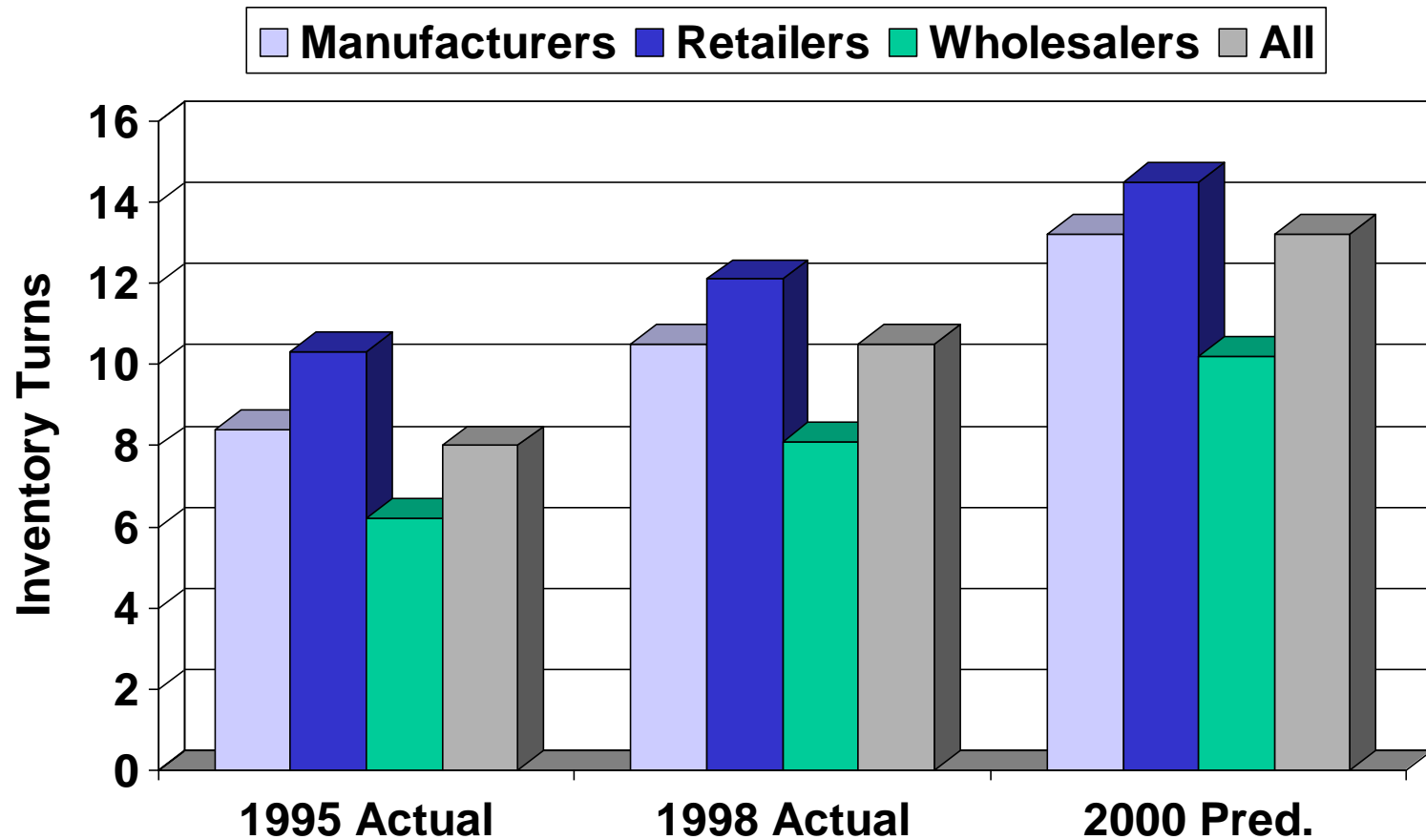
Companies are taking advantage on new logistics management tools



Source: Survey of 410 Members of Canadian Association of Logistics Mgt, P. D. Larson, Transportation Journal, 1998

Inventory Turnover

Companies expect to increase the rate of inventory turnover



Source: Warehouse Education Research Center

Theme: From Modal Fragmentation to Cross-Modal Coordination

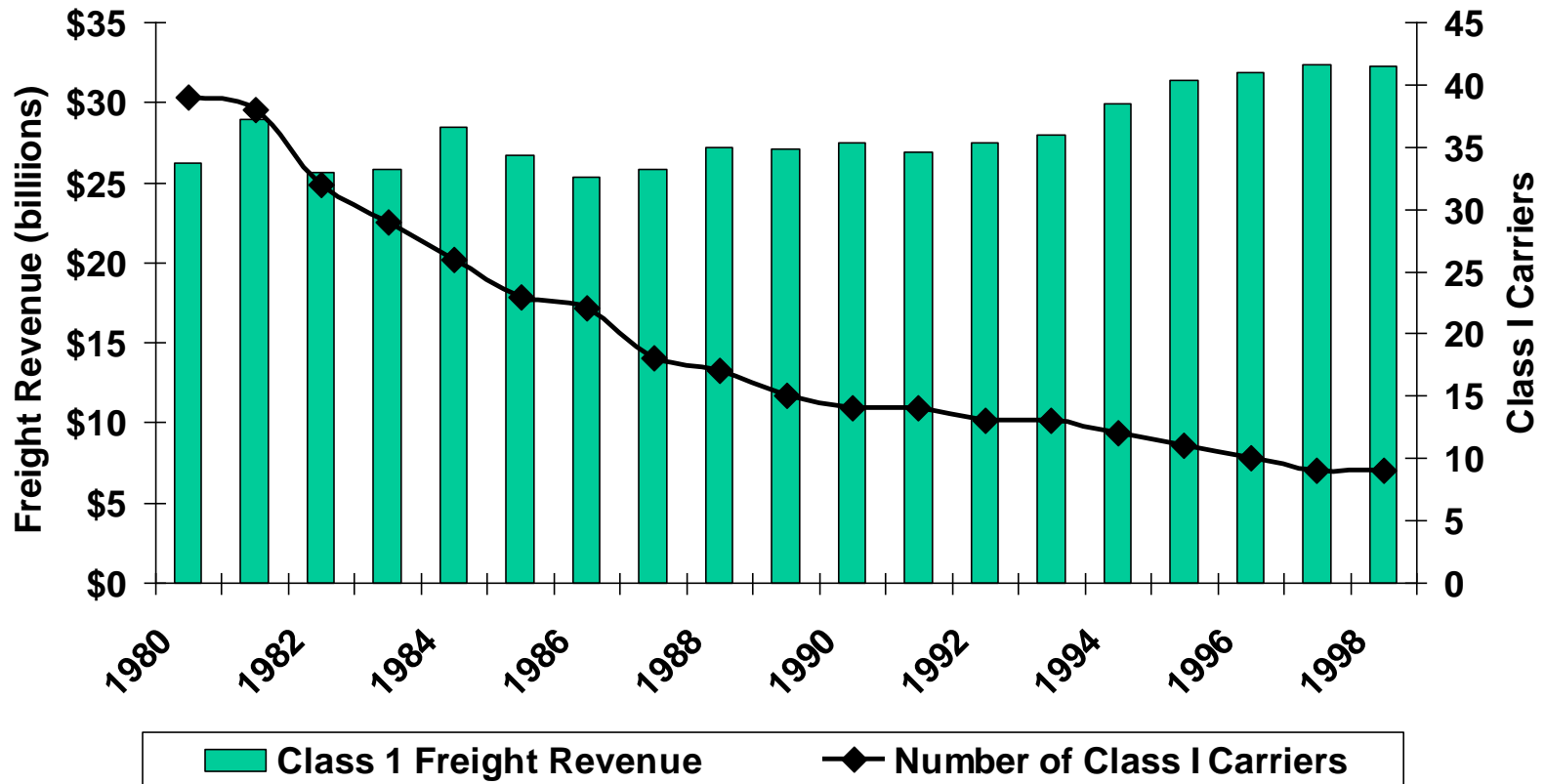
- Trends
 - Increasing cross-modal coordination for door-to-door service
- Implications for freight transportation
 - Potential for better freight services
 - Rapid development and adoption of technologies for tracing shipments and managing vehicles and fleets
 - Greater complexity

Theme: From Modal Fragmentation to Cross-Modal Coordination (continued)

- Implications ...
 - Increasing carrier concentration and consolidation among
 - ↻ High-service, low-cost transport providers
 - ↻ Value-added logistics and information managers
- Issues
 - Barriers (economies of scale) to market entry and competition
 - Harmonization of business practices, standards, information technology, and government regulation across modal and national boundaries

Railroad Industry since Deregulation

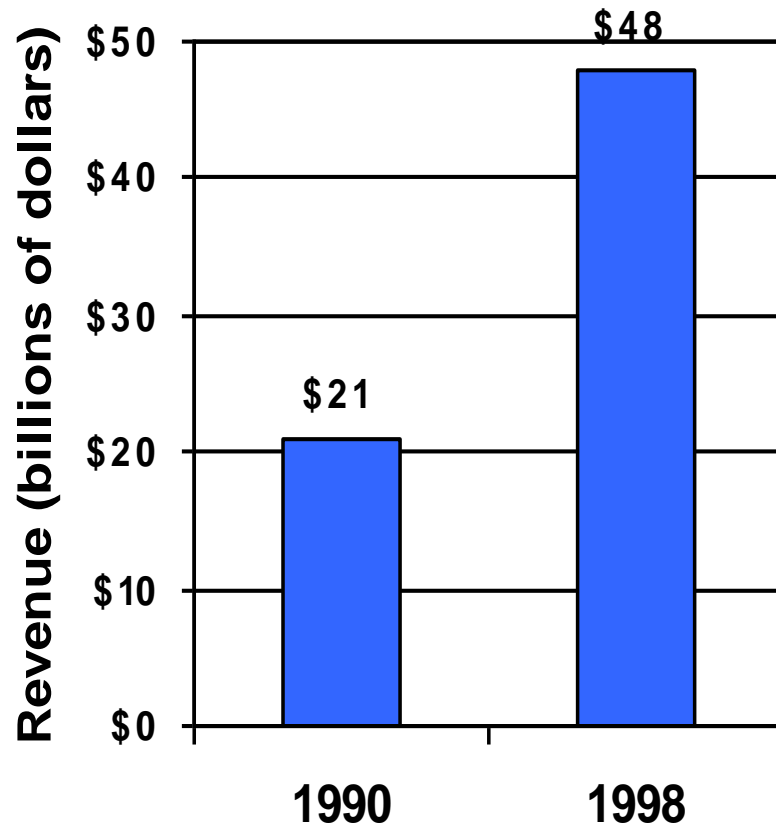
Class I railroads have experienced extensive consolidation, but relatively flat revenues



Source: *Railroad Facts and Railroad Ten Year Trends*, Association of American Railroads

Revenue Concentration among Trucking Companies

Large, consolidated companies control more business



Source: ATA "Transport Topics"

- 90 carriers broke \$100M in revenue in 1998, up from 70 in 1990
- Revenue in this group was almost 2 ½ times larger than 8 years before
- Group does not include household-goods carriers, UPS, or FedEx

Theme: From System Construction to System Optimization

- Trends

- Spot capacity increases from new infrastructure projects
- Limited capacity increases from larger trucks and trains
- Moderate capacity increases from faster, larger ships and wide-body planes
- Significant increases in operational capacity expected from IT- and ITS-enabled freight transportation systems

Theme: From System Construction to System Optimization (continued)

- Implications for freight transportation
 - High expectations and investment in IT and ITS for scheduling, routing, dispatching, highway and traffic management, shipment tracing, and stowage and terminal management
 - Investment in automation and terminal handling systems
 - Investment in operations research techniques

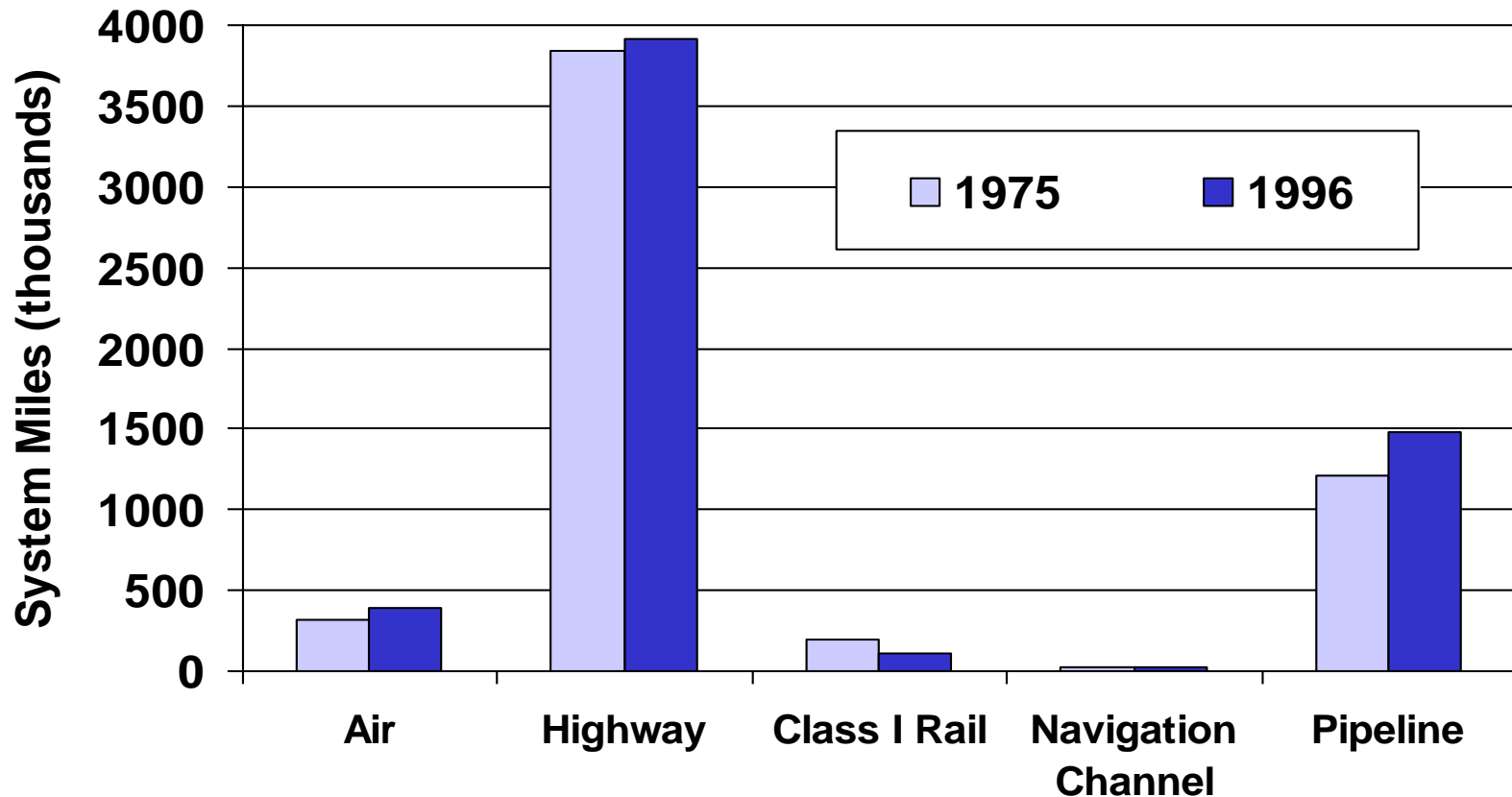
Theme: From System Construction to System Optimization (continued)

- Issues

- Highway congestion, especially landside access to ports and terminals
- Insufficient rail and intermodal terminal capacity
- Public and private financing of system maintenance and new capacity
- Public-public and public-private integration of ITS and IT systems
- Immature national and international ITS and automated identification standards; limited interoperability
- Shortages of labor and skills

System Mileage within the U.S.

Highway and air increased modestly; Class I rail lost mileage



Source: USDOT, Bureau of Transportation Statistics, National Transportation Statistics 1999

More Traffic on the Highways

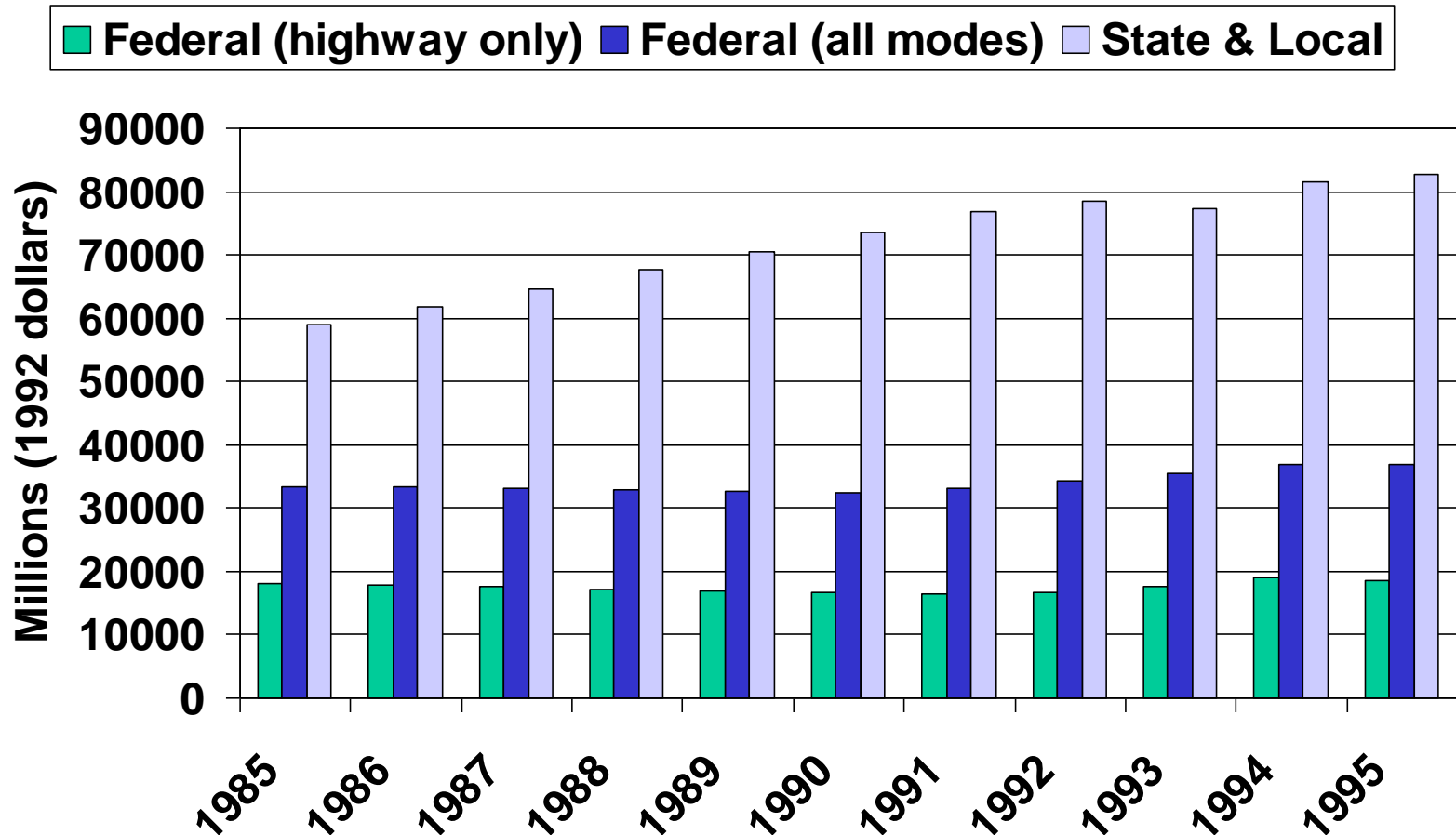
Daily Vehicle Miles of Travel per Lane-Mile, 1987-1997

	1987	1997	Annual Rate of Change
<i>Rural</i>			
Interstate	3,530	4,952	3.40%
Other Principal Arterials	2,090	2,522	1.90%
<i>Urban</i>			
Interstate	11,230	13,696	2.00%
Other Freeway	9,240	10,620	1.40%
Other Principal Arterials	5,010	5,768	1.40%

1999 Status of the Nation's Highways, Bridges and Transit: Conditions and Performance
Federal Highway Administration

Federal, State, and Local Spending

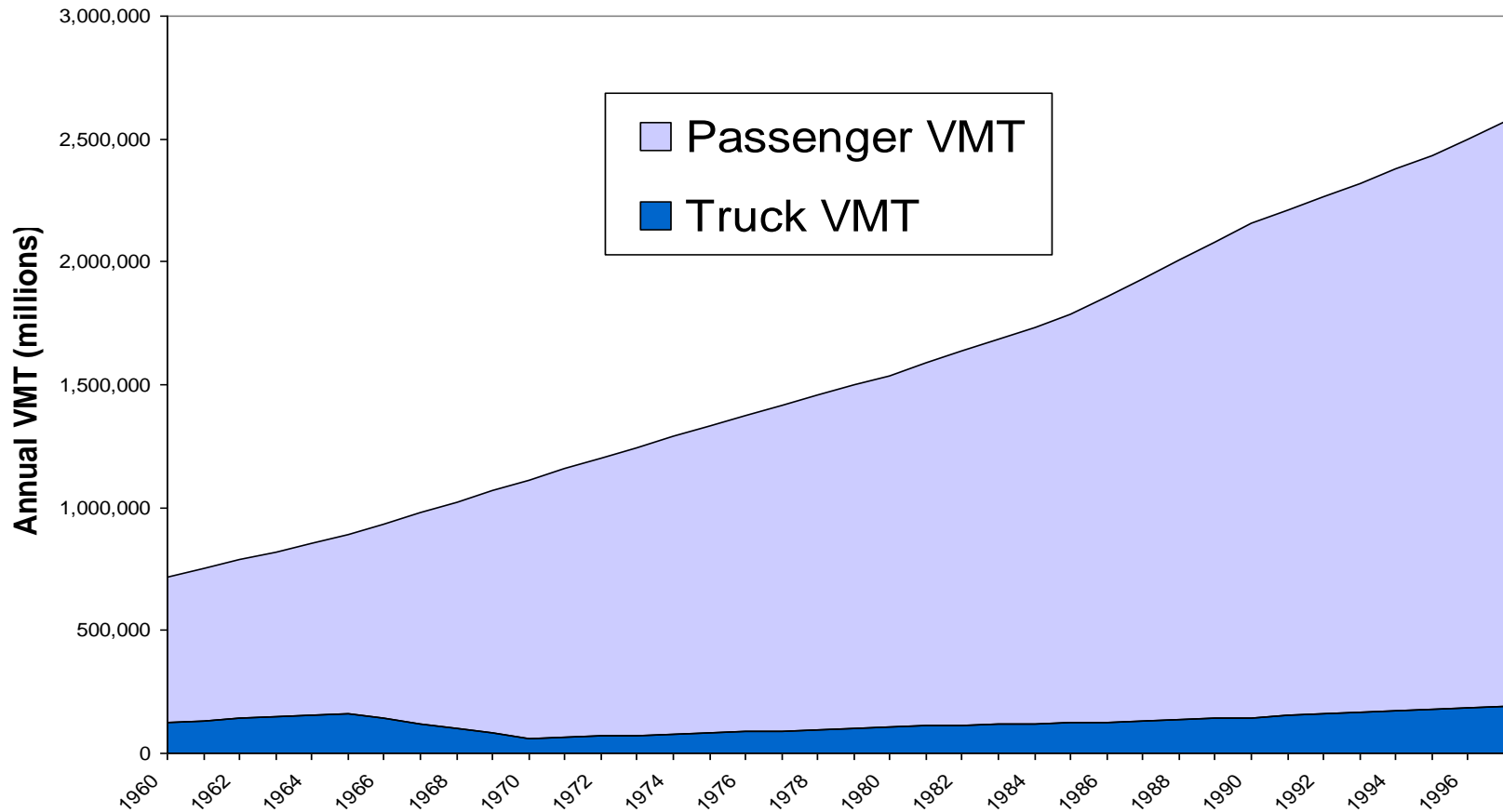
Total public sector transportation spending has increased 29.5%; state and local, 40%; all Federal 10%; and Federal highway 2%



Source: USDOT, Bureau of Transportation Statistics, National Transportation Statistics 1999

Annual Vehicle Miles of Travel

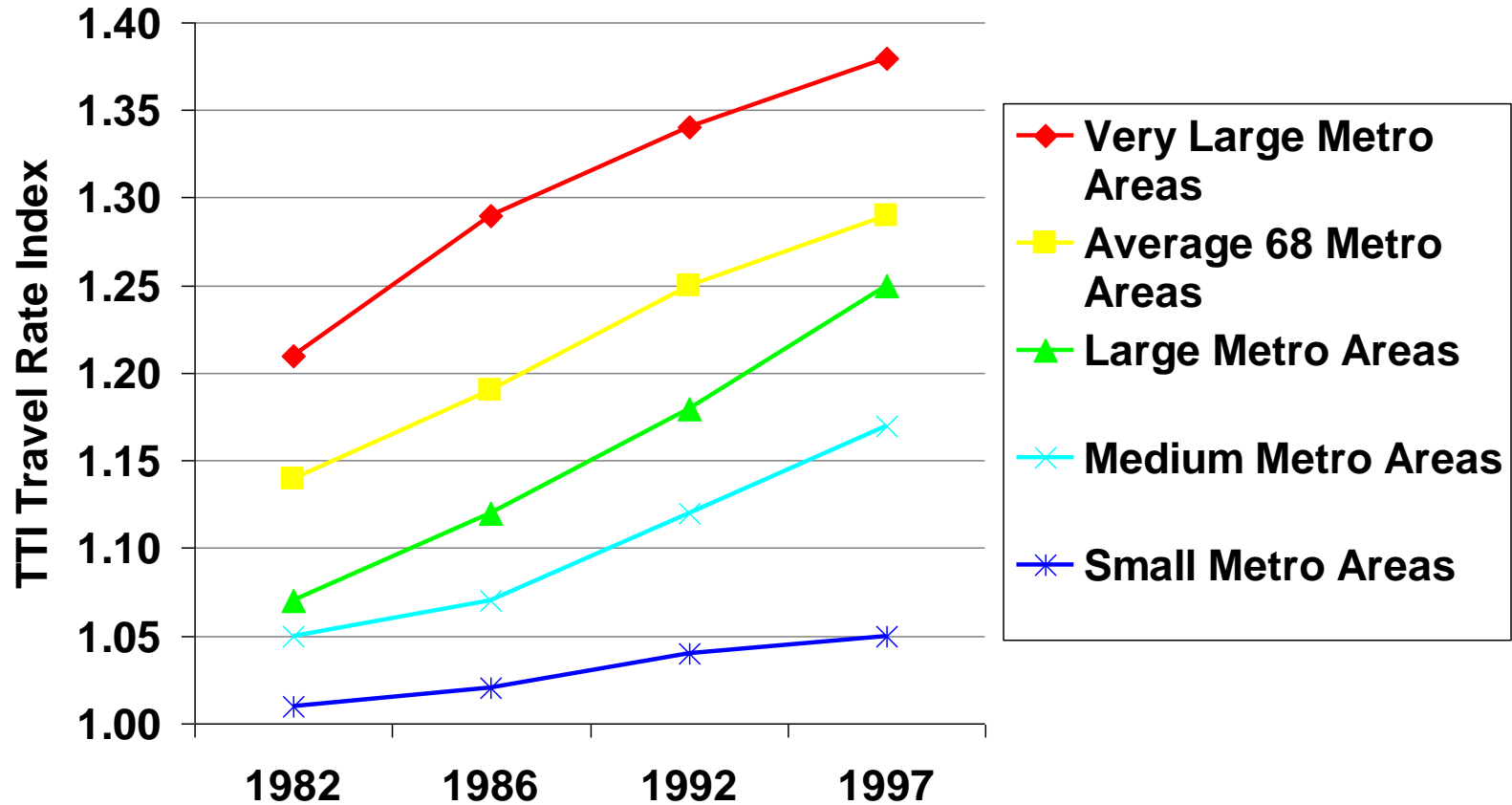
Passenger VMT has increased 302%; truck VMT, 50%



Source: USDOT, Bureau of Transportation Statistics, National Transportation Statistics 1999. Decrease in truck VMT in late 1960s reflects changing definition of truck to exclude pickup trucks used for personal travel.

Travel Rate Congestion Index

The average percentage growth in peak-period-travel-time compared to off-peak-travel-time in 68 large metro areas was 81%



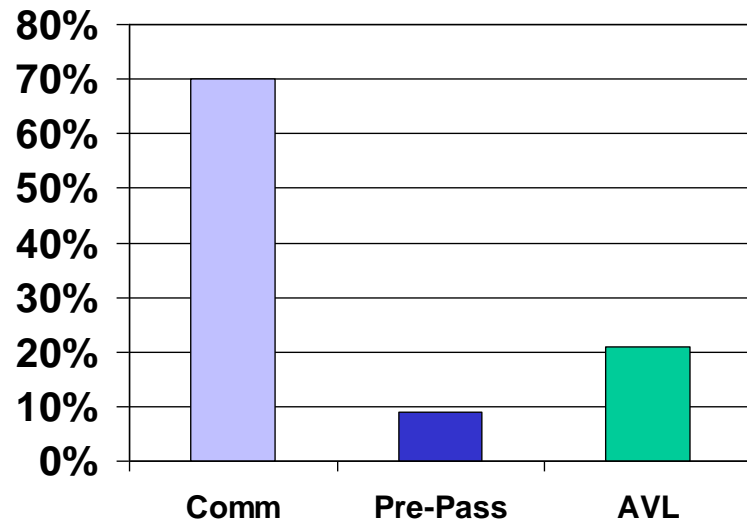
Source: Texas Transportation Institute

California Motor Carriers' Perception of Congestion and Response

Carriers are investing in technology to counter increasing congestion

- 82% see congestion as serious or critical
 - Costs of slower speed
 - Scheduling problems
 - Driver morale
 - Accidents & insurance
 - Higher fuel & maintenance
- 85% see congestion worsening over next five years

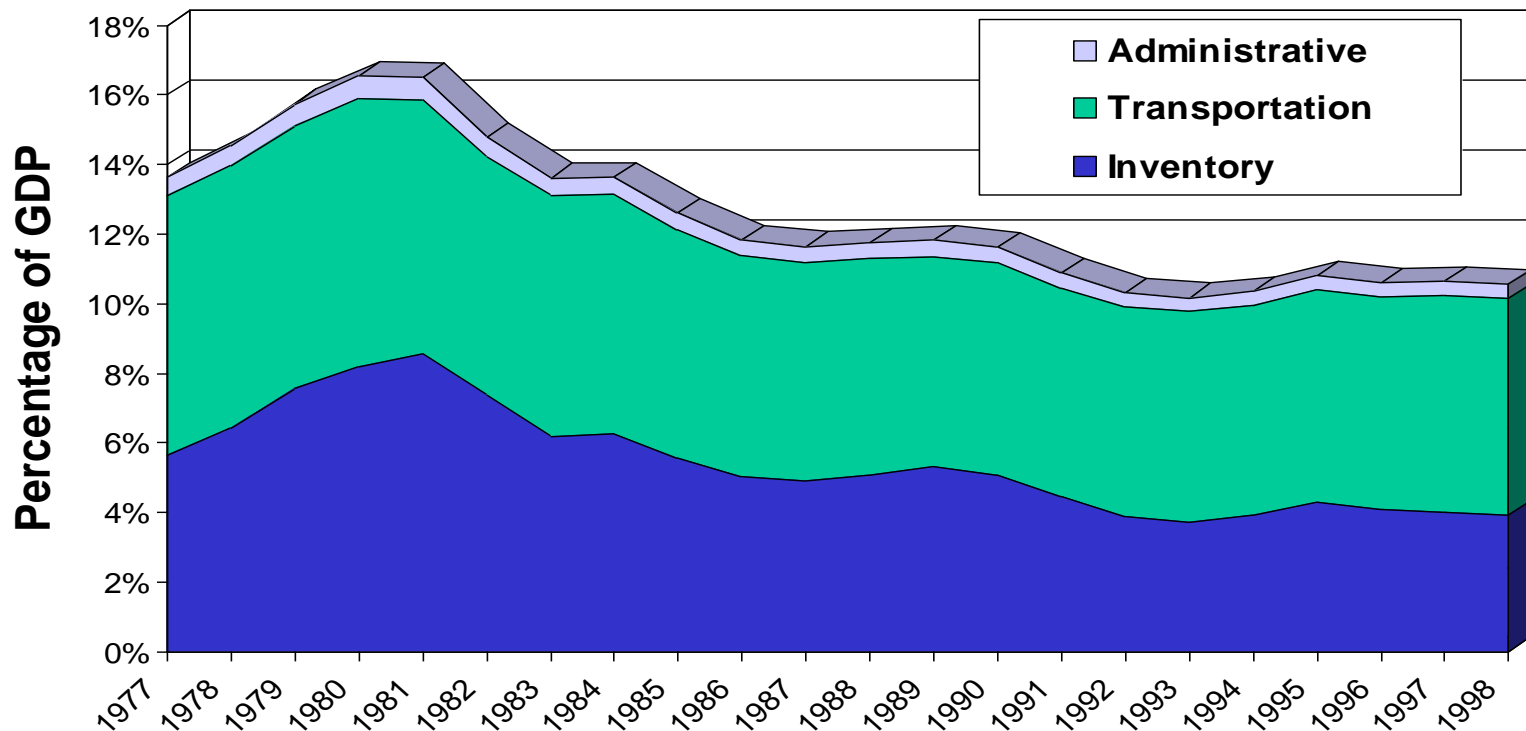
Carrier Use of Mobile Communications, Pre-Pass Transponders, and Automatic Vehicle Location Systems



Source: Regan & Golob, Transportation Journal, Sep. 99

Logistics Expenditures and GDP

After a long improvement, expenditures have stalled at about 10%



Source: Cass/ProLogis 10th Annual State of Logistics Report, 1998

Railroad Productivity

Improvements since 1965 reduced 1995 costs by \$25 billion

- Shift to unit trains allowed more tons to be hauled with fewer resources (\$7.5 billion annual savings in 1996)
- Improved track and network rationalization resulted in lower track costs (\$ 7 billion)
- Computers and communications reduced clerical and mid-management forces (\$4.7 billion)
- Reduced crew consists saved \$4.2 billion
- Improved fuel efficiency saved \$1.3 billion

Source, Martland, Journal of the Trans. Res. Forum, v. 38, #1, 1999

Railroad Productivity (continued)

Prospects for continued productivity improvement are modest

- Heavy-haul railroads: 315,000 pound car would provide only a 10% increase in loading density
 - Compared to 45% increase achieved since 1965
- Network rationalization: more, not less, capacity will be needed
- Effects of IT: clerical savings have largely been realized
- Crew consist: average consist is already half what it was in 1960s
- Fuel: some continued improvements, but modest

Source, Martland, Journal of the Trans. Res. Forum, v. 38, #1, 1999

Motor Carrier Productivity

Major productivity improvements have largely been achieved

- Interstate and other highways
 - 50% reduction in trip times
 - Significant increases in size and weight
- Truck technology
 - Better fuel economy
 - Introduction of specialized equipment
- Communications and control
 - Reduction in empty mileage

Source, Martland, Journal of the Trans. Res. Forum, v. 38, #1, 1999

Motor Carrier Productivity (continued)

Other areas of cost savings showing diminishing returns

- Labor costs
 - Average wages for truck drivers are rising after 20 years of decline (in real dollars)
- Fuel costs
 - Prices are rising after 20 years of decline
- Excess capacity
 - Bottlenecks and congestion are growing concerns for rail and motor carriers

Source, Martland, Journal of the Trans. Res. Forum, v. 38, #1, 1999

Theme: From Economic Deregulation to Safety Regulation

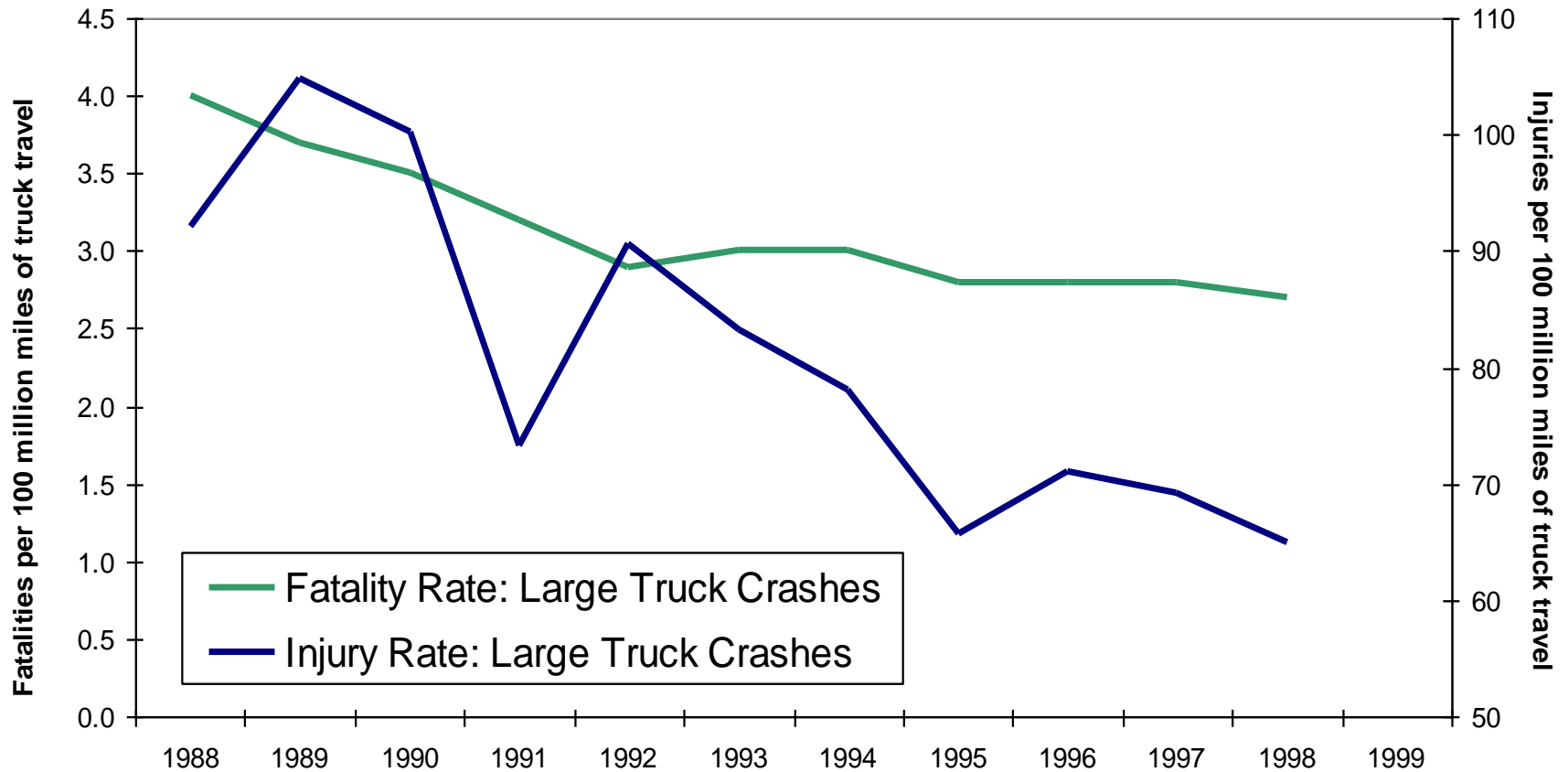
- Trends
 - Less focus on economic deregulation
 - More focus on safety regulation
- Implications for freight
 - Diminishing productivity returns from deregulation
 - Pressure for reduced accidents and fatalities
- Issues
 - Re-regulation to preserve competition
 - Changes in operating regulations (e.g., hours of service)
 - Cost and human-factors impact of safety technology

Federal Transportation Deregulation

- Aviation Deregulation of 1978
- Motor Carrier Act of 1980
- Staggers Rail Act of 1980
- Ocean Shipping Act of 1984
- Ocean Shipping Reform Act of 1998

Truck-Involved Fatalities and Injuries

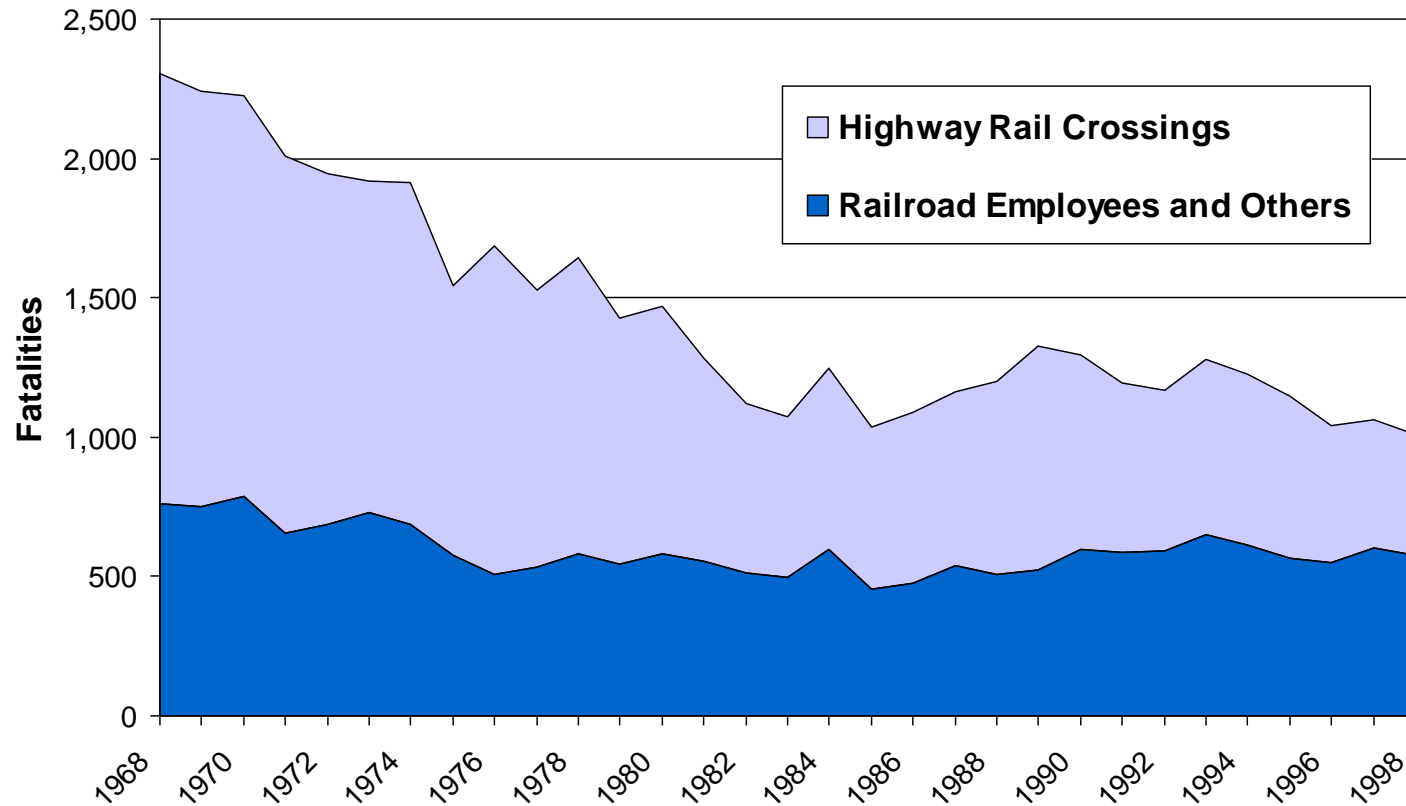
5,374 fatalities and 127,000 injuries in 1998; 5,203 fatalities in 1999; fatality rate declining slowly



Source: Federal Motor Carrier Safety Administration, Safety Action Plan, 1999; and Monthly Progress Report, April 2000

Railroad Fatalities

Highway grade crossing fatalities have declined 72%; railroad fatalities, 29%



Source: National Transportation Statistics Annual Report, September 1993, (Bureau of Transportation Statistics) and Railroad Safety Statistics 1998 Annual Report (Federal Railroad Administration Office of Safety Analysis)

Theme: From Modal to Multi-Modal Surface Transportation Policy

- Trends

- Evolving public sector awareness of the need for multi-modal policy, planning, and investment (ISTEA and TEA-21)
- Increasing state and local control of transportation investment
- Increasing use of highway trust funds for system preservation
- Growing demand to re-link transportation investment and economic development

Theme: From Modal to Multi-Modal Surface Transportation Policy (continued)

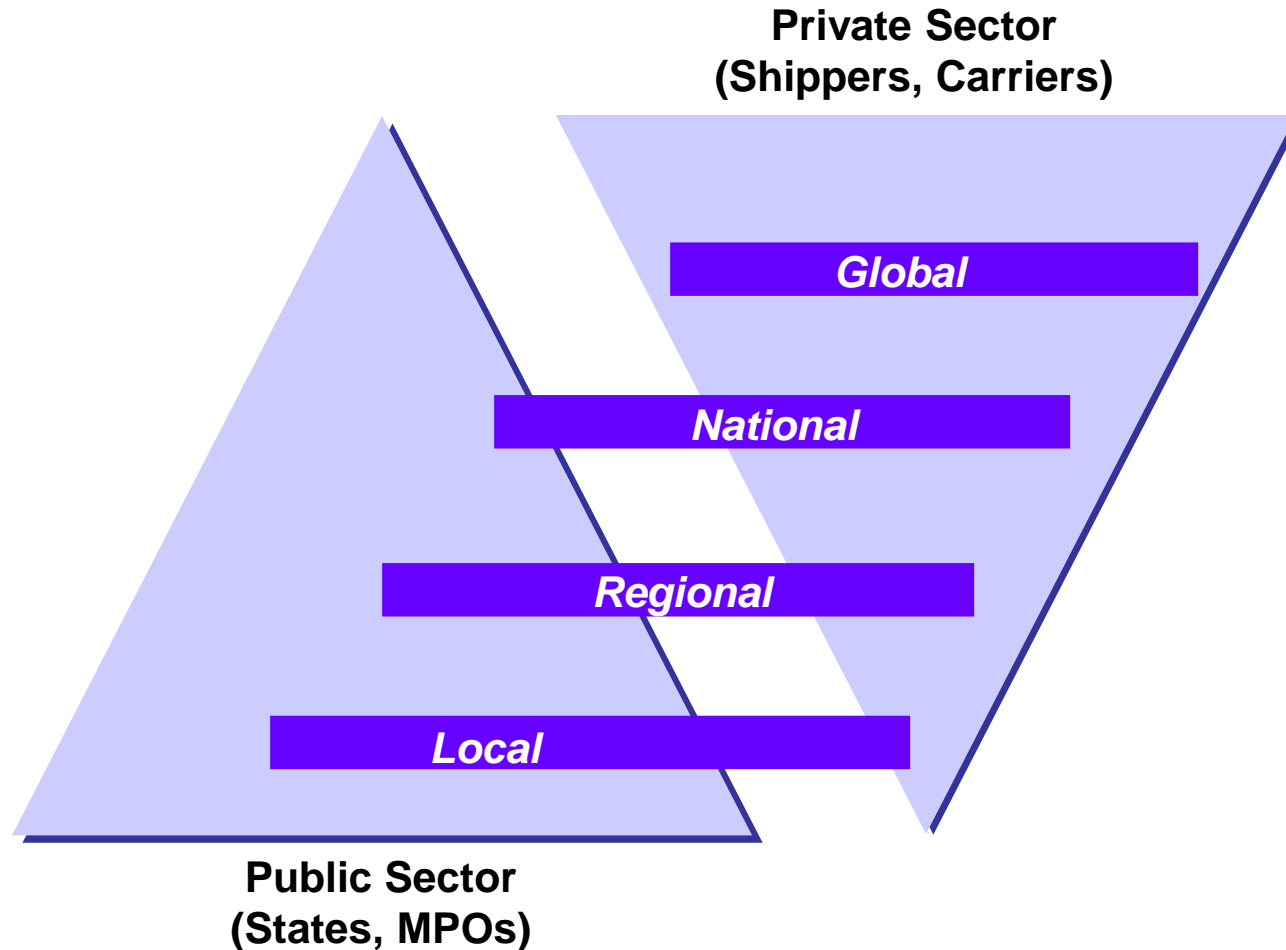
- Implications for freight
 - More complex planning and investment environment
 - Mismatch between scale of transport operations (increasingly regional and global) and public sector jurisdictions (local and state)
- Issues
 - Role of multistate freight and trade corridor programs
 - Identifying and financing freight projects of national significance
 - Use of highway trust funds for non-highway freight projects

Theme: From Modal to Multi-Modal Surface Transportation Policy (continued)

- Issues ...
 - Slow, inflexible public planning and project delivery compared to private sector
 - Disjointed modal planning
 - Difficult to engage private sector freight interests in state and MPO planning processes; limited freight representation
 - Inadequate freight planning data and analysis tools

Freight Transportation Perspectives

State and MPO focus is regional and local; private sector focus is increasingly national and global



Theme: From Low Visibility to Environmental Accountability

- Trends
 - Global warming; continued concern about ambient air quality
 - Sustainability (balancing transportation, economic development, environmental, social, and land use goals)
 - Environmental justice (disproportionate adverse effects on minority and low income populations)
- Implications for freight transportation
 - Greater demands for fuel efficiency; and engine emissions, especially NO_x and particulates

Theme: From Low Visibility to Environmental Accountability (continued)

- Implications ...

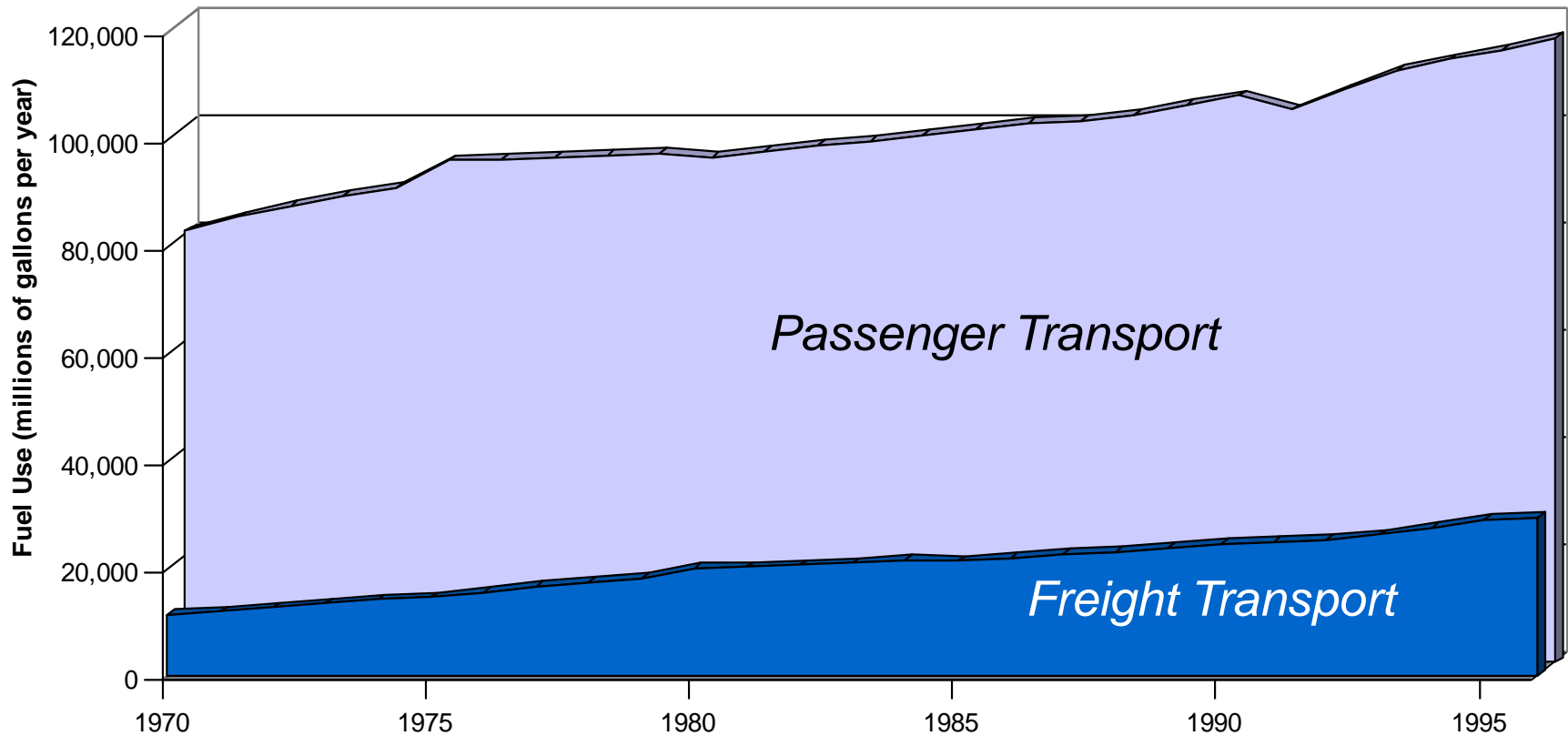
- Increased environmental scrutiny of port and terminal development
- Land use development pressure; NIMBY-ism

- Issues

- Cost of new fuel and engine technology and controls
- Dredging and brownfield reuse
- Greener transportation planning process
- New institutional and regulatory arrangements
- Balancing environmental justice with economic development

Transportation Fuel Consumption

Passenger vehicles transport account for 80%, freight for 20%



Source: USDOT, Bureau of Transportation Statistics, National Transportation Statistics 1999

Theme: From DoD Stovepipes to “Focused Logistics”

- Trends

- Faster deployment of significant forces from a few continental U.S. bases to global theatres
- Decreasing relative importance of DoD business to US transportation carriers
- Shift to commercial business practices and systems
- Continuing sensitivity to hazardous materials safety and terrorism

Theme: From DoD Stovepipes to “Focused Logistics” (continued)

- Implications for freight transportation
 - Pressure on DoD for acquisition of timely, cost-effective transportation, especially marine transportation, for surges
 - Greater integration of U.S. military systems and global commercial freight transportation systems
 - More shipments moving directly from vendors to military units in the field, bypassing military depots
 - Increasing micro-management of munitions movements
 - Susceptibility to primary and secondary effects of terrorism

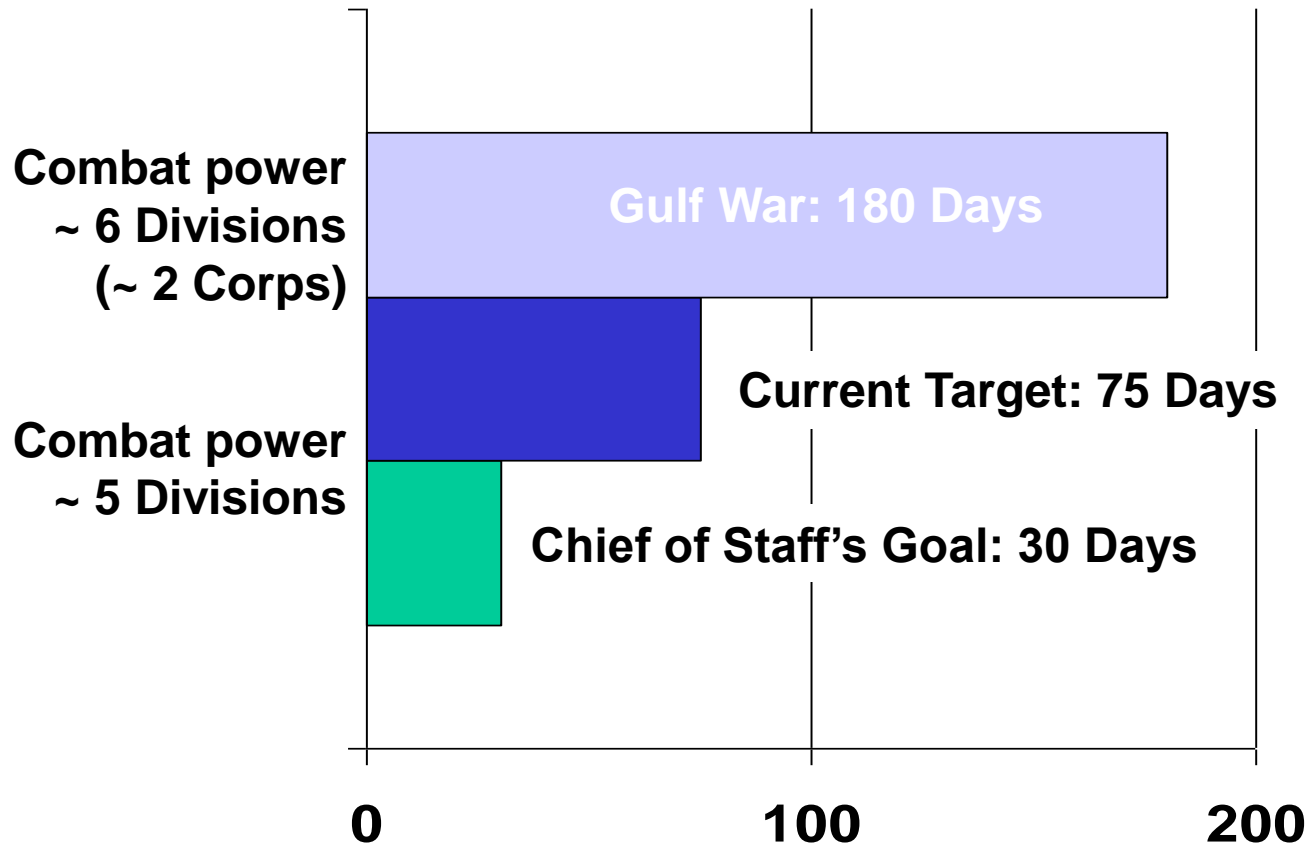
Theme: From DoD Stovepipes to “Focused Logistics” (continued)

- Issues

- Potential for disruption of civil commerce and defense industry production because of military surges
- Harmonization of DoD needs with civil systems
- Assurance of system safety and security

Army Strategic Mobility Requirements

The military's goal is to reduce deployment time by 80%



Source: Adapted from briefing by William Lucas, MTMC, to TRB Annual Meeting, Jan. '00

Preliminary Conclusions

- Markets/Logistics (*demand*)
 - Yesterday – mass manufacturing economy; push logistics; moderate transportation performance requirements; declining total logistics costs
 - Tomorrow – service economy; pull logistics; longer supply chains; higher transportation performance requirements; increasing total logistics costs

Preliminary Conclusions (continued)

- Carriers/Transportation Systems (*supply*)
 - Yesterday – adequate networks; productivity from interstate highway construction; larger trucks, doublestack trains, and containerships
 - Tomorrow – congested networks; fewer opportunities for “hard” technology productivity; increasing demand for “soft” technology productivity (e.g., information technology and operational productivity)

Preliminary Conclusions (continued)

- Public Policy

- Yesterday – major freight productivity gains from deregulation; devolution; limited environmental accountability
- Tomorrow – greater environmental accountability; more complex decision and investment environment; demand to re-link economic development and transportation investment

Preliminary Conclusions (continued)

- General

- System improvements from previous investments and initiatives have been largely realized. Since 1980, logistics expenditures have steadily declined to 9.9% of GDP.
- New sources of freight transportation productivity are needed to meet new, complex demands on the freight transportation system