I. Freight, the Economy, and Transportation Planning

During the 1990s, Oregon has been one of the fastest growing states in the U.S. Oregon's renowned livability has been a major contributing factor to the population and employment turnaround from the early 1980s when much of the state underwent a severe economic recession. Further contributing to the turnaround was a conscious effort to develop a more balanced economy that would be less adversely affected by national and international swings in prosperity and decline.

Because Oregon is a relatively small state in terms of population and employment, it depends on bringing in money from other states and nations for a considerable part of its economic livelihood. This includes incomes derived from the exports of agricultural, forest, high technology, and other products as well as incomes from tourism and a wide variety of businesses that sell their services to customers outside the state.

Access to markets is critical to Oregon's export-based economy. Historically, this has included access to the nation's largest domestic market--California--and to a lesser extent other nearby states as well as states further east. More recently, Oregon's economy has benefited from growth in and access to Pacific Rim nations, especially those in the Far East. Recent trade agreements such as the 1993 North American Free Trade Agreement are expected to further open markets in Canada and Mexico and possibly elsewhere if NAFTA is expanded to include other countries.

Convenient and reliable transportation is a key variable underlying the success of Oregon's economy. Maintaining a balanced transportation system for moving raw materials to manufacturers and finished products to consumers helps Oregon companies compete favorably with companies elsewhere. Over time, failure to maintain and improve the transportation system for moving freight likely will result in Oregon's economy becoming less competitive with those in other states and nations.

Purpose

The purposes of this report are to show how freight moves the Oregon economy and to identify some of the concerns and needs about maintaining and enhancing current and future freight mobility. This is accomplished in part through a review of various aspects of Oregon's transportation system for moving materials and finished products to manufacturers, distributors, and final consumers in Oregon, other states, and internationally. For simplicity, materials and finished products are referenced as "goods" and as "freight" when they are transported from origin to destination. Highways, rail lines, waterways,

airways, and pipelines for moving materials and products are the freight transportation system. Freight modes primarily are trucks, trains, ships, barges, and airplanes.

The report pulls together information about freight from numerous federal, state, regional, local, and other sources. It is intended to be a compendium of these various sources of information rather than a document that explores new territory or develops new data. As such the report provides an overview of the

- importance of freight to the national and Oregon economy,
- freight transportation planning and programming,
- Oregon's freight transportation system,
- freight performance, concerns, and needs, and
- possible future directions for additional work on freight.

Background

The background section of this chapter includes an overview of recent trends and the role of freight in the nation's and Oregon's economies. This is followed by a summary of various characteristics of freight movements along with a review of various freight considerations in transportation planning and programming, focusing on recent and current efforts underway at the national level and in Oregon. Freight planning and programming frequently addresses freight mobility, accessibility, and other issues that are reviewed at the end of the background discussion.

Freight's Importance in the National and State Economy

According to a recent U.S. Department of Transportation publication, the "reason U.S. consumers are the envy of the world is that our nation essentially is an economy in motion" (see the list of references in Appendix 1: USDOT, *U.S. Freight: Economy in Motion*). The motion consists of moving raw materials to markets or production sites, semi-finished goods to and from production sites, and finished goods to distribution centers and retail stores. The movements can occur internationally, locally, or between interstate and intrastate origins and destinations.

Transportation thus helps add value to the economy via the activities of companies that move the materials and products, make the vehicles that carry freight, provide transportation services such as wholesaling and distribution, and otherwise engage in business enterprises that directly or indirectly support the movement of freight. The sum of these activities represents freight's contribution to national and regional economic well-being.

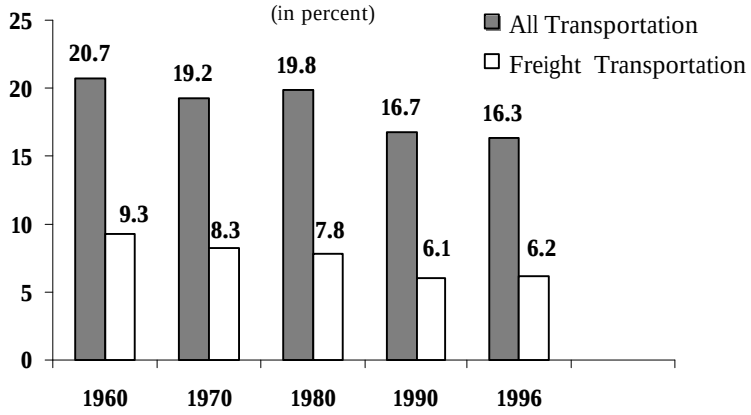
The following discussion reviews the economic contribution of transportation in general and freight in particular. Freight's importance is summarized first for the nation and secondly for Oregon. The discussion for Oregon includes more detailed information than the discussion for the nation as a whole. Where data are available, freight's economic importance is highlighted by mode.

Freight's Contribution Nationally: Recent Trends

The importance of economic activities is often expressed in terms of dollars or employees. In terms of dollars, the most commonly used measures pertain to total economic output (for example, gross national product or gross domestic product— see Appendix 2 for definitions) or various measures of income. In terms of employees, the measures pertain to the number of employees in various transportation-related economic sectors. Tonnage and ton-miles are among other measures discussed below.

GNP and Expenditures. The Eno Transportation Foundation reports that personal and freight transportation industries accounted for about 16 percent of the gross national product in 1997, down from a peak of 21 percent in 1960 (Figure I-1). Freight contributed 6.2 percent of the nation's GNP in 1997, about the same as in 1990 but down from 9.3 percent in 1960, 8.3 percent in 1970, and 7.8 percent in 1980. Deregulation of transportation sectors and greater competition are believed to have been major contributing factors to declines in transportation's share of GNP.

Figure I-1
Transportation's Contribution to
U.S. Gross National Product, 1960-1997

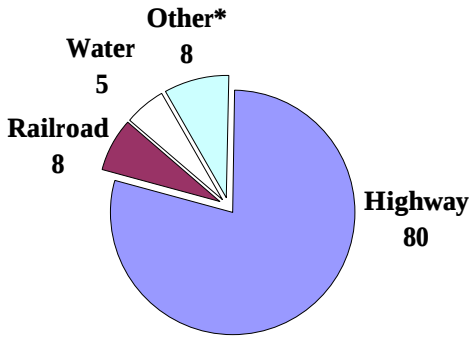


Source: Wilson, *Transportation in America*, 1998, p. 38

The U.S. Department of Transportation (see the list of references in Appendix 1: *Transportation Statistics Annual Report 1998*) presents a slightly lower figure (11 percent) for the contribution of transportation-related final demand to Gross Domestic Product in 1996. This figure included the value generated by in-house as well as for-hire transportation services.

In 1997, about $504 billion was spent for freight transportation nationally. Expenditures for truck freight were 80 percent of the total (Figure I-2), up from 73 percent in 1980. Air freight expenditures more than doubled from 1.9 percent of the total in 1980 to 4.5 percent in 1997. The share of the other freight modes declined as follows: rail from 13 to 7.0 percent, water from 7.3 to 5.0 percent, and pipelines (oil) from 3.5 to 1.7 percent.

Figure I-2
Expenditures for Freight Transportation Nationally, 1997
(in percent)



*Includes Air (4.5%), Oil Pipeline (1.7%), and Miscellaneous (2.1%).
Source: Wilson, *Transportation in America*, 1998, p. 9.

Employees. About 14.7 million employees nationally worked in a variety of transportation and related industries in 1997 (Table I-1). This represented 11.1 percent of the labor force, down from 13.5 percent in 1960 and a slight increase from 10.5 percent in 1990. While information on freight's share of total employment is not readily available, the data nonetheless show that freight-related sectors were among the major employers. These included the two largest sectors--truck driver and delivery companies, and trucking and truck terminals--which together accounted for 34 percent of total transportation-related employment in 1997.

Table I-1

National Employment in Transportation and Related Industries, 1960 and 1997
(in thousands)

	1960	1997	% Change, 1960-97
Transportation Service			
Air Transport	191	860	350
Railroads	885	300	-66
Oil pipeline	23	16	-30
Trucking and truck terminals	770	2,414	214
Water	222	185	-17
Other	273	323	18
Transportation Equipment Manufacturing			
Aircraft and parts	646	444	-31
Motor vehicles, equipment, tires	829	1,295	56
Railroad Equipment	43	36	-16
Ship and boat building and repair	141	179	27
Other	33	75	127
Transportation Related Industries			
Automotive/accessory retail dealers	807	1,345	67
Automotive wholesalers	215	494	130
Automotive service and garages	251	1,249	398
Gasoline service stations	461	649	41
Truck drivers and delivery persons	1,477	2,490	69
Freight handlers	365	539	48
Other	605	730	21
Government Transportation Employees			
U.S. DOT	38	63	66
State and local	499	525	5
U.S. Postal Service	83	125	51
Other	18	11	-39
Total	8,875	14,347	62
Transportation as a Percent of Total Employment	13.5%	11.1%	

Source: Wilson, *Transportation in America*, 1998, p. 61.

Of the transportation-related sectors shown in Table I-1, the fastest growing from 1960 to 1997 were automotive services and garages followed by air transport services, which

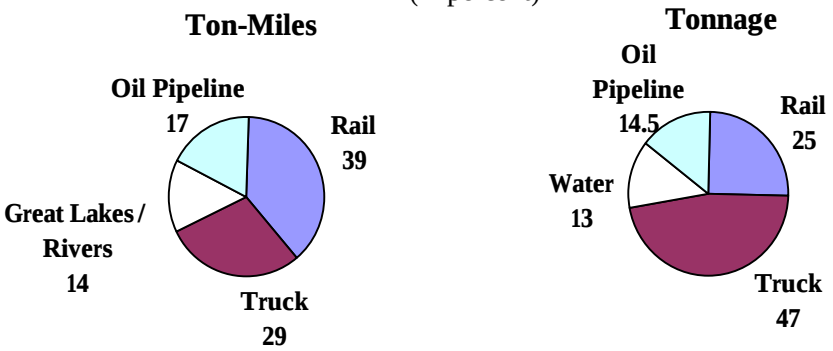
increased by 398 percent and 350 percent respectively. By contrast, several freight-related sectors declined in employment, with railroad transportation services experiencing the greatest decrease.

Tonnage and Ton-Miles. Tracking trends in tonnage and ton-miles is another way to measure the importance of freight. (A ton-mile represents the movement of one ton of freight over a distance of one mile.) The amount of domestic intercity tonnage moved nationally since 1997 increased by 23 percent from 1990, and the number of ton-miles moved increased by 25 percent.

By comparison, GNP in 1997 was 13 percent higher than in 1990. According to the Eno Transportation Foundation (*Transportation in America 1998*), higher rates of growth for ton-milage and tonnage than for GNP suggest increasing freight efficiencies brought about by heavier loads, lighter materials and packaging, fewer empty and unprofitable trips, and smaller inventories through the usage of just-in-time deliveries.

Modal shares of total tonnage and ton-miles are similar for oil pipeline and water but not for truck and rail (Figure I-3). Trucks account for considerably more tonnage than rail; the reverse is true for share by ton-miles. This is because rail freight often is shipped longer distances than truck freight. Additionally, since 1986, truck's share of tonnage and ton-miles increased while shares decreased for water and pipeline. Rail's share of tonnage decreased while its share of ton-miles increased, suggesting that compared to other modes, the average distance of rail shipments is getting longer.

Figure I-3
Ton-Miles and Tonnage Nationally by Mode, 1997
(in percent)



Air transport was 0.2 percent of tonnage and 0.4 percent of ton-miles.
Ton-mile data do not include coastwise shipping.
Figures are preliminary 1997.
Source: Wilson, *Transportation in America*, 1998, pp. 11 and 12

In summary, national data show that transportation accounts for about 16 percent of the nation's economy, with about six percent attributable to freight transportation. Although freight's share of the GNP increased between 1990 and 1997, it has decreased by about one-

third since 1960. On the other hand, the amount of freight moved nationally has grown faster than GNP. The relatively faster growth in tonnage and ton-miles than in GNP is attributable in part to a variety of efficiency improvements in the freight transportation industry.

Freight's Contribution Nationally: Forecasts

Forecasts from Standard & Poors DRI show that freight volumes and revenues are expected to grow slightly more or slightly less than the nation's Gross Domestic Product. From 1996 to 2006, GDP is forecast to grow at 24 percent, while freight tonnages and revenues are forecast to grow at 21.5 percent and 30 percent respectively. Air freight is forecast to grow the fastest, followed by rail intermodal (Table I-2). The transportation of freight by water and by pipeline is expected to grow the slowest.

Table I-2

Revenues and Tonnage of Domestic Freight Shipments, 1996 – 2006*
(in percent change annually)

	Revenues	Tonnage
Air	8.2	8.2
Pipeline	1.0	1.0
Rail	1.7	1.6
Rail Intermodal	4.6	4.5
Truck	2.6	2.3
Water	0.8	0.9

*Forecasts are for primary shipments from origins to destinations. Due to lack of data, the forecasts do not include secondary shipments.
Source: Standard & Poor's DRI, *US Freight Transportation Forecast... to 2006*, 1997 pp. 6 and 7.

Freight's Importance to Oregon's Economy

As noted earlier in this chapter, Oregon's economic livelihood is largely dependent on generating income from outside the state. This occurs in a variety of ways, including the sale and transportation of commodities to consumers in other states and nations. The transportation of commodities also involves moving materials from points of origin in-state and from other states and nations to producers in Oregon. The importance of moving materials and products to and from a variety of origins and destinations suggests that freight's contribution to Oregon's economy is similar to freight's contribution nationally.

Earnings and Employment Statewide. Data from the U.S. Bureau of Economic Analysis (BEA) show that transportation services accounted for 3.7 percent of Oregon's non-farm earnings in 1996. Data from the Oregon Employment Department show that transportation services accounted for 3.5 percent of Oregon's non-farm employment in 1996 and 3.4 percent in 1997. Because these data are reported by type of business rather than by occupation of the worker, they do not include an unknown amount of transportation services provided in-house rather than purchased from outside vendors. Thus the

contribution of transportation services to Oregon's economy is greater than the approximately 3.5 percent shown above.

Transportation contributes 10 to 13 percent of Oregon's non-farm earnings and employment.

Moreover, neither BEA nor Employment Department data show income or employment figures for other relevant categories such as transportation-related construction, consulting services, or government. The data are, however, broken down for transportation equipment manufacturing and wholesale trade. If these figures are added to those for transportation services, the contribution of transportation increases to 12.5 percent of Oregon's nonfarm earnings in 1996 and 10.6 percent of Oregon's nonfarm employment in 1996 and 1997.

Leading Businesses. A variety of small and large companies contribute directly or indirectly to Oregon's freight-related transportation employment. The *1992 Census of Transportation*, for example, identifies the following numbers of establishments in various freight transportation sectors statewide: trucking--1,680, warehousing--56, water transportation--123, air transportation--118, freight shipping services--190. Data from *County Business Patterns* show that 87 percent of freight transportation establishments employed fewer than 20 persons in 1996, while just over 2 percent employed more than 100 persons. Similarly, data from ODOT's Motor Carrier Transportation Division show that most motor carriers with an active plate are small in size, with 78 percent operating one to five vehicles and only one percent operating more than 100 vehicles.

The largest transportation-related company operating in Oregon is Freightliner Corporation, North America's leading manufacturer of heavy trucks. Depending on economic conditions such as market demand, about 4,800 employees work at Freightliner's Portland facilities. Other leading manufacturers of freight-related transportation equipment include Greenbrier and Boeing. Greenbrier, through its Gunderson subsidiary, employs about 1,200 persons making rail cars, oceangoing barges, and auto/truck stack equipment in Portland and Springfield. Boeing's aircraft parts plant in east Portland employs between 1,000 and 2,000 persons depending on overall business conditions.

Leading freight related employers are Freightliner, Gunderson, United Parcel Service, Consolidated Freightways, Union Pacific Railroad, and USF Reddaway.

Among transportation services companies, United Parcel Service is the largest, with over 3,000 employees in Oregon. The largest trucking companies are Consolidated Freightways, which employs over 2,000, and USF Reddaway, which employs over 1,000. Among other larger trucking companies are Cummings Transfer Company in Albany and May Trucking Company in Salem, both of which are included in *Oregon Business* magazine's list of 150 largest Oregon-owned companies. The Union Pacific Railroad is the state's leading rail carrier with just over 2,000 employees in Oregon.

Several air transportation companies employ a substantial number of workers in Oregon. Horizon Air and Delta Air Lines hire the most, with each employing over 1,000 workers moving freight and people through Oregon's airports. Evergreen International Aviation,

which is headquartered in McMinnville and handles air freight among its various business activities, is ranked 14th among the 150 largest Oregon-owned companies.

Distribution and wholesale trade is one of the most important transportation-related activities in Oregon, especially in Portland and elsewhere along I-5. Data from the U.S. Bureau of Economic Analysis Regional Economic Information System show that Oregon ranked first among western states in wholesale trade's contribution to non-farm earnings and employment and in the top 10 nationally. According to the Port of Portland, the Portland area is the second largest wholesale distribution center on the West Coast.

Oregon ranks

- first in the western U.S. and
- in the top 10 nationally

in wholesale trade's contribution to non-farm earnings and employment.

The importance of distribution activities results in part because of the advantages of being served by major east-west and north-south interstate highways and railroads, as well as having marine transportation and air transportation services. Good transportation connections, perceived quality of life, differences in tax structures between Oregon and neighboring states, and favorable access to major trading partners in East Asia and other Pacific Rim nations contribute to Oregon's advantageous location for distributors serving retail stores in Oregon and other parts of the Northwest and the nation.

Many of these companies serve Oregon's timber products and food industries. An example of the former is North Pacific Lumber Company, the nation's largest independent forest products wholesaler and distributor. Food products companies with distribution facilities in Oregon include Albertson's, Americold, Safeway, United Grocers, Waremart, and Western Family Foods. Other companies with distribution facilities in Oregon serve a wide variety of consumer markets. Nike, Target Stores, Columbia Sportswear, Rite Aid, Les Schwab Tires, Tyco Toys, and Wal-Mart are some of the larger companies serving regional and national markets from facilities in Oregon.

Mail order companies account for another type of transportation-related freight activity. Horticultural and food products are among the types of mail order companies located in Oregon. One of the nation's largest mail order companies, Bear Creek Operations, ships a variety of food and other products from the Medford area.

Several natural gas pipeline companies are headquartered in Oregon. NW Natural, which distributes gas to over 450,000 customers in western Oregon and Washington, is the largest gas company headquartered in Oregon. Northwest Pipeline Corporation, headquartered in Portland, operates transmission pipelines serving NW Natural and other customers. PG&E Gas Transmission-Northwest, also headquartered in Portland, is the largest U.S. transporter of Canadian natural gas via a 612-mile pipeline between western Canada and California.

Foreign Trade. As noted elsewhere in this chapter, transportation is a key contributor to Oregon's ability to compete in international markets. According to National Trade Data Bank figures compiled by the Massachusetts Institute of Social and Economic Research (MISER), Oregon companies exported nearly $10.1 billion of products to foreign nations in 1997. This represented an increase of nearly 100% from $5.1 billion in 1990. Among the 50 states, Oregon ranks 10th nationally and 4th (after Washington, California, and Arizona) in the western U.S. in value of exports per capita.

Oregon ranks

- 4th in the western U.S. and
- 10th nationally

in value of exports per capita.

MISER data show that marine transportation accounts for over half of the value of exports from Oregon. Air transportation, though accounting for a small proportion of Oregon's exports by weight, contributes a much greater proportion by value--33 percent in 1995. By value, high technology equipment accounted for about 46 percent of Oregon's exports in 1995, up from 30 percent in 1990. Crops and food products contributed another 25 percent in 1995, down from 28 percent in 1990. Another 15 percent in 1995 was attributable to forestry and paper products, down from 26 percent in 1990. Transportation equipment accounted for just under 4 percent in both 1990 and 1995.

MISER data further show that Japan (18%), Canada (14%), South Korea (11%), and Taiwan (6%) accounted for about 50 percent of the value of Oregon's exports in 1997. According to the Oregon Office of Economic Analysis, about 57 percent of Oregon's exports go to East Asia compared to 29 percent nationally. Oregon is the nation's sixth largest exporter to Asia; 64 percent of Oregon's merchandise exports are destined for Asia, the highest percentage nationally.

Oregon's leading trade partners

- Japan
- Canada
- South Korea
- Taiwan

account for about 50% of Oregon's exports.

Passage of the North American Free Trade Act is expected to contribute to increased trade between the U.S., Canada, and Mexico. According to Bureau of Transportation Statistics data collected at ports of entry between the U.S. and Canada and the U.S. and Mexico, about $3.5 billion moved by truck and rail between Oregon and Canada and Mexico in 1997. About 94 percent of this trade was with Canada, with trucks accounting for 81 percent of the trade with our neighbor to the north. Trucks accounted for nearly all (96%) of Oregon's trade with Mexico. Oregon had a surface trade deficit with Canada and Mexico in 1997: imports represented 63 percent and exports 37 percent of Oregon's trade by land with the nation's two NAFTA partners.

Recent economic problems in Asia combined with Oregon's high dependence on Asia for trade have contributed to a downturn in Oregon's exports. MISER data show that from 1997 to 1998, the value of Oregon's exports declined by 2.3 percent compared with a 3.0 percent increase from 1996 to 1997. Recent publications from both the Office of Economic Analysis and the U.S. Bank (*U.S. Territory 1999: Western Region*) expect problems in Asia to result in a slower growth rate in Oregon's economy in 1999.

Over the longer term, Oregon's economy is expected to grow faster than the nation as a whole, similar to the state's experience through much of the 1990s. Foreign trade is expected to be an important contributor to Oregon's future growth, suggesting that transportation will continue to be an important element in moving the state's economy.

Economic Impacts. Oregon's transportation and freight-related activities contribute jobs and incomes directly and indirectly to the state's economy. The magnitude of the direct impacts depends in part on the extent to which the transportation activity brings in money from outside the state. The greater the amount of revenues brought in from outside the state, the greater the direct economic impacts are likely to be.

Much of the business for companies that manufacture transportation equipment comes from outside the state in part because of the relatively small size of the Oregon market. Thus companies like Freightliner, Greenbrier, Boeing, and others contribute substantially to Oregon's economy in terms of the jobs created directly. They also contribute indirectly through the purchases of supplies and other inputs, which further increases the size of their economic impact. The greater the amount of inputs purchased from within the state, the greater the direct and indirect impacts are likely to be.

Economists and other analysts sometimes measure the magnitude of direct and indirect impacts by calculating multipliers. An employment multiplier of 2.0, for example, means that for every job directly created, another job is indirectly created in other sectors of the economy through purchases of supplies and inputs. Additional impacts occur due to increased spending by employees of companies experiencing direct and indirect impacts; impacts resulting from increased spending are called induced impacts (see Appendix 2 for the definition of direct, indirect, and induced impacts).

As part of an analysis of economic impacts from highway construction expenditures, the consulting firm E.D. Hovee and Company in 1996 estimated direct, indirect, and induced impacts for various types of economic sectors in Oregon. Employment multipliers for several transportation-related sectors were as follows:

	Employment Multipliers	
Transportation-Related Sector	Direct and Indirect	Direct, Indirect, and Induced
Manufacturing	1.39	2.38
Transportation, Communication, and Public Utilities	1.46	2.54
Wholesale Trade	1.06	1.85

While analysis of broad industry sectors does not show specific contributions of transportation or freight related activities, it nonetheless provides an idea of the additional jobs generated by these activities. The analysis suggests that from 85 to 154 additional jobs are generated for each 100 jobs directly generated in the three transportation-related sectors shown above.

85 to 154 additional jobs are generated for each 100 jobs in Oregon's transportation-dependent industries.

Estimates of the economic impacts of marine ports and airports provide further information about the economic importance of transportation-related activities. Studies for ports and airports typically estimate impacts for all activities, not just those involving freight. The discussion below summarizes some of these impacts.

The Airport Technology and Planning Group, Inc., (AirTech) in 1996 estimated economic impacts for Oregon's commercial service and general aviation airports. Economic impacts were estimated for on-airport tenants, visitors traveling via commercial service airlines, and visitors traveling via general aviation aircraft. Freight-related impacts would be among the impacts for on-airport tenants. Less directly related impacts would include those associated with freight-related businesspersons traveling through airports. The study did not identify impacts from on-site freight-related businesses or freight-related business travelers.

Most air freight passes through commercial service airports (see Chapter II in this report for more information on commercial service airports). At the time of the study, commercial service airports were located in Eugene, Klamath Falls, Medford, North Bend, Pendleton, Portland, and Redmond. Together, the seven commercial airports were estimated to generate 9,900 jobs directly and another 10,600 through multiplier effects.

	Direct Jobs	Indirect and Induced Jobs
Eastern Oregon Regional Airport (Pendleton)	117	139
Eugene Airport	263	301
Klamath Falls International Airport	311	326
North Bend Municipal Airport	198	210
Portland International Airport	8,402	8,874
Roberts Field-Redmond Airport	285	349
Rogue Valley International-Medford Airport	343	397

The employment multiplier for on-site business at these seven airports was 2.07, suggesting that for every 100 jobs directly generated, another 107 jobs were generated through indirect and induced impacts. By comparison, the 20,500 jobs generated by on-site businesses were exceeded substantially by the additional 133,300 jobs generated as a result of visitors traveling through the seven commercial service airports; most of these visitors were traveling through Portland International Airport.

Although the study's authors did not estimate freight's economic contribution to the combined 150,000-plus jobs generated at commercial service airports, they did attempt to identify benefits qualitatively by conducting a survey of 1,000 Oregon businesses regarding their dependence on aviation. Among the findings were the following.

- 70 percent of respondents use air cargo/package express on a regular basis,
- Without commercial air service, business activity/employment would be 11 percent less, and
- 76 percent of respondents indicated that a commercial service airport was "essential" or "important" to their locational decision.

The study went on to discuss impacts and benefits for each airport. Benefits associated with air cargo carriers were among the "other benefits" summarized briefly for each airport.

In 1997, the Oregon Coastal Zone Management Association, under contract to the Oregon Economic Development Department, produced a report summarizing economic contributions of Oregon's ports. The report estimated employment, income, and taxes-generated contributions associated with various activities for 22 of Oregon's 23 port districts (the Port of Portland conducted a separate analysis). Economic contributions were estimated in categories referenced as dependent, associated, and related (see Appendix 2 for further information on the definition of dependent, associated, and related contributions). For each category, the report's authors calculated direct, indirect, and induced impacts similar to those discussed above for airports.

The total employment contribution for the 22 port districts except the Port of Portland was estimated as follows: dependent— 13,900, associated— 39,900, and related— 8,500. Freight-related impacts were summarized within the category of dependent-transportation contributions. Along with waterborne commerce shipments of forest and agricultural products, petroleum, minerals, and aggregates, the transportation category included activities such as ship building and repair, fishing, recreational boating, and other activities such as airports, toll bridges, railroads, and tour boats.

For the 22 port districts except the Port of Portland, the study estimated the transportation contribution to be 4,153 jobs. Just over 60 percent of the jobs were associated with businesses in the port district for the Oregon International Port of Coos Bay. Businesses in the port district for the Port of Astoria accounted for another 11 percent of the transportation-related jobs. The report did not itemize the number of jobs specifically related to moving freight.

In 1996, Martin McConnell Associates, a Portland consulting company, developed estimates for similar but not identical impact categories for the Port of Portland. Updated numbers for employment and other impacts are reported on the Port's Internet Web page at the "Fast Facts" site as follows: aviation-related jobs— 106,000, marine-related jobs— 60,000. According to the web site, the 166,000 jobs influenced by the port represent 20 percent of all jobs in the Portland region.

Freight Transportation Service Requirements and Characteristics

The need for transportation services varies according to the type of commodity being shipped. Input-output analyses at the national level provide an indication of transportation's importance through interindustry tables showing the amount of transportation services purchased by a variety of industrial sectors. According to a recent study by the consulting firm Louis Berger International, Inc., the following economic sectors spend the largest share of their total output and value added on transportation services: manufacturing of nondurable goods; agriculture, forestry, and fisheries; utilities; manufacturing of durable goods; and business services.

Transportation service requirements also vary by industrial sector and commodity type (Table I-3). In general, low cost, low speed, and low damage characterize shipments for sectors producing raw materials or other bulky, low-value products. Conversely, sectors producing high-value products and/or relying on just-in-time deliveries place high emphasis on frequent, reliable, and fast service.

Table I-3

Transportation Services Requirements by Major Sector and Selected Commodities

Sector	Commodity	Transportation Services Requirements
Agriculture, Forestry, Fisheries	Grain	Low cost, low speed, low damage
	Fruits and Vegetables	Frequent and reliable service
	Livestock	Low cost, low speed, low damage
	Forestry Products	Low cost, low speed, low damage
	Fish Products	Frequent and reliable service
Mining	Crude Petroleum	Low cost, low speed, low damage
	Natural Gas	Regular movements
	Sand and Gravel	Low cost, low speed, low damage
Construction	Construction Material	Low cost, low speed, low damage
Manufacturing	Food Products	Frequent, reliable, fast service
	Frozen Foods	Frequent, reliable, fast service
	Wood Products	Frequent, reliable, fast service
	Paper Products	Frequent, reliable, fast service
	Printing and Publishing	Frequent, fast service
	Chemicals and Allied Products	Frequent, reliable, fast service
	Rubber and Plastics	Frequent, reliable, fast service
	Industrial Machinery and Equipment	Frequent, reliable, fast, and innovative service
	Electronic and Electrical Equipment	Frequent, reliable, fast, and innovative service
	Motor Vehicles	Frequent, reliable service
	Professional and Scientific Instruments	Frequent, reliable, fast, and innovative service
Wholesale	Motor Vehicles	Frequent, reliable service
	Chemicals and Allied Products	Frequent, reliable service
	Groceries and Food	Frequent, reliable, fast and innovative service
	Paper Products	Frequent, reliable, fast and innovative service
	Lumber and Construction Material	Frequent, reliable, fast and innovative service
Retail		Frequent, reliable, fast and innovative service
Services		Frequent, reliable, fast and innovative service

Source: Based on Louis Berger International, Inc., *Economic Trends and Multimodal Transportation Requirements*, 1999.

Transportation service characteristics also vary by mode. Table I-4 shows selected characteristics of freight transportation modes according to value of shipments, typical volumes of cargo hauled, service qualities, and distance traveled for each of the major components of the freight transportation system, including movements through intermodal facilities. Although not shown in the table, intercity buses and intercity passenger trains (e.g., Amtrak) also move a small amount of freight. In general, their characteristics are similar to some of those for air and truck (e.g., small packages of moderate to high value).

Table I-4

Selected Characteristics of Freight Transportation Modes

	Cargo Value	Cargo Volume	Service	Distance Traveled
Truck	Moderate to high	Loads of less than 50,000 pounds per vehicle. Higher weights with state permits.	Single driver can go 500 miles/day. Team or relay driving can go further. On-time performance for most carriers is 90 percent or better.	Varies by carrier type. Two-thirds of tonnage moves less than 100 miles. Interstate carriers average more than 400 miles.
Rail	Moderate to low	Multiple carloads. No weight restrictions.	Dedicated service can move goods cross-country by third morning. More normal times: 4-7 days. Short-line hauls often require less time. On-time performance varies from 60 percent to 85 percent or better.	Average length of haul is 670-800 miles. Short-line carriers have shorter average length of haul.
Air	High	Small. Most are less than 100 pounds.	Service normally is overnight or second day.	Average distance is more than 1,300 miles.
Ship	Moderate to low	Bulk, container, and general freight shipments.	Bulk service is slower than container (which averages 7-10 days trans-Pacific and trans-Atlantic.	Average distance is more than 2,300 miles for international shipments and shorter for shipments within the U.S.
Barge	Moderate to low	Bulk and container shipments.	Varies according to system segment. Competitive with rail on large dimension and bulk shipments.	Average distances vary by system segment.
Pipeline	Low	Bulk shipments.	Flow rates vary with consumer demand.	Average distance is 825 miles for crude oil and 375 miles for finished products.
Intermodal	Moderate to high	Containers by truck, rail, air, or water. Trailers by truck and rail. Also other types of connections such as air/truck, water/rail, water/truck water/pipeline, pipeline/truck.	Matches top end of rail—third morning for cross-country. On-time performance equal to or better than rail but not as good as truck.	Distances normally range from 700 to 1,500 miles or more.

Source: Based on U.S. Department of Transportation, *U.S. Freight: Economy in Motion*, 1998.

Truck tractor-trailer combinations are the most common type of freight carrier and move the greatest variety of goods and commodities, ranging from low-value bulk commodities to high-value, time-sensitive commodities. Trucks, along with intercity buses, have the greatest locational mobility among freight modes in that they can go, subject to size and weight

limitations, wherever roads go. Most truck trips are for short distances although interstate carriers compete with rail carriers for long trips.

Some types of truck trailers also can move by other modes, primarily rail via trailers on flat car (TOFC) or via a variety of other piggyback technologies. Trucks also move freight on trailers carrying containers, which are big rectangular boxes often measured according to TEUs (twenty-foot equivalent units) and are equivalent in size to 8 feet by 8 feet by 20 feet.

Trains also move a variety of different types of freight, but tend to focus on bulk commodities such as grains, minerals, timber products, chemicals, and others. Commodities typically are hauled "medium" distances rather than short or long distances. Rail mergers or acquisitions are contributing to longer distance trips for some railroads. Short line railroads focus primarily on short distance trips. Because trains run on track in fixed locations, they have less locational mobility than trucks. Moreover, many rail branch lines have been abandoned during the 20th century, further reducing the number of locations that can be served by rail.

In addition to hauling truck trailers on flat cars as noted above, trains move containers on flat cars (COFCs). Commodities moving by TOFC and COFC tend to be higher in value than other types of products moved by rail cars. Inadequate landside access (for example, congested roads) sometimes adversely affects movements by trucks carrying commodities to and from intermodal rail yards.

Ships and barges carry many of the same commodities as rail does, with a relatively greater emphasis on low-value bulk commodities but also some higher valued commodities such as motor vehicles. Ships move commodities primarily on ocean routes and large inland bodies of water. Barges move primarily on rivers and intercoastal waterways and compete with rail and to a lesser extent, with trucks and pipelines, for long distance shipments. Barges and ships also move containers, and some carriers focus exclusively on containers. Movements by ships and barges are locationally constrained by depth of waterways and harbors and by other barriers such as inadequate landside access to marine terminals.

Airplanes specialize in the long-distance movement of high-value, time-sensitive commodities such as mail, food and horticultural products, and high-technology equipment. Timely shipment by air often depends on timely shipment by truck between areas of production and air freight terminals. Airplanes have considerable flexibility in moving products through the air but are constrained by the largely fixed location of airports and air freight terminals. Like intermodal rail yards and marine terminals, air freight terminals sometimes are adversely affected by inadequate landside access.

Pipelines carry primarily oil and natural gas and occasionally other products in combination with a transport medium (for example, coal in a water-based slurry). Oil pipelines compete primarily with barges and trains and in some areas, with trucks. Oil-producing areas are well served by pipelines; remote and sparsely populated locations away from production areas are less well served.

Natural gas is difficult to carry by other modes; thus natural gas pipelines generally do not compete with other modes. The exceptions include natural gas moving in liquefied form by ship or as propane by rail car or truck. Where natural gas is not available, other process and heating fuels must be used. This sometimes reduces economic competitiveness of unserved areas relative to nearby areas with natural gas.

The movement of freight often occurs intermodally. This means that freight is exchanged between modes somewhere between the beginning and end of the commodity shipment. The exchange occurs at some type of intermodal facility such as a marine or air freight terminal, reload facility, or intermodal yard. As noted above, inadequate landside access sometimes adversely affects movements through intermodal facilities. This is most likely to be a problem in densely populated urban areas.

Freight Considerations in Transportation Planning and Programming

Passage of the federal Intermodal Surface Transportation Efficiency Act (ISTEA) in 1991 resulted in a higher visibility for freight at the federal, state, and regional levels. Interest in freight has been further stimulated by various state and regional transportation plans as well as by the passage in 1998 of the federal Transportation Equity Act for the 21st Century (TEA 21). The discussion below summarizes how freight is being considered in transportation planning and programming at the federal, state, regional, and local levels.

Federal

ISTEA was the first federal transportation legislation to explicitly recognize the importance of freight or goods movement, especially through intermodal facilities (see Appendix 2 for a definition of intermodal facilities). The importance of intermodal freight transportation is highlighted in ISTEA's Declaration of Policy:

> *"It is the policy of the United States to develop a National Intermodal Transportation System that is economically efficient and environmentally sound, provides the foundation for the Nation to compete in the global economy, and will move people and* ***goods*** (emphasis added) *in an energy efficient manner."*

To support freight movements, ISTEA included a variety of funding, planning, and other provisions. On the funding side, ISTEA created a programmatic category providing resources for a newly established National Highway System which includes many of the most important highways for freight moving by truck. ISTEA also created a Congestion Mitigation and Air Quality (CMAQ) Program which could be used to fund projects that would have air quality benefits, for example, rail freight projects that would result in reduced harmful emissions in air quality non-attainment areas.

On the planning side, ISTEA required Metropolitan Planning Organizations to conduct transportation planning activities, including the development of plans that address the efficient movement of freight along with access to ports, airports, and intermodal

transportation facilities. Similarly states were required to develop multimodal transportation plans that considered efficient freight movements and access to intermodal facilities.

Another important provision was that projects and programs identified for funding in MPO transportation improvement programs (TIPs) were required to be included without modification in the State Transportation Improvement Program. Such improvement programs, however, were required to be financially constrained to include only those projects and other activities for which funds had been identified.

States also were required to develop six information management systems, including an Intermodal Management System for freight and passenger movements through intermodal facilities. Other freight-related provisions in ISTEA included the establishment of a Bureau of Transportation Statistics to provide better data on freight and people movements, creation of a National Commission on Intermodal Transportation to develop a detailed investigation of intermodal transportation issues, and funding of various types of Intelligent Transportation System programs including those for commercial vehicle operations.

Other federal freight-related activities include the passage of legislation to implement provisions in ISTEA as well as the development of a national freight transportation policy. Passage of the National Highway Designation System Act of 1995, for example, identified the routes to be included on the National Highway System, including routes to major intermodal freight facilities. The NHS legislation also removed the ISTEA requirement for states to develop five of the six management systems, although many states continued to develop one or more of the systems voluntarily.

In early 1997, the U.S. Department of Transportation issued a National Freight Transportation Policy Statement of guiding principles for the nation's freight transportation system. The purpose of establishing the principles was to develop a U.S. DOT policy framework to help shape decisions affecting freight transportation across the various modes. In general, the principles address funding and planning, cost-effective investments, economic growth, safety, environmental protection, energy conservation, technological advances, defense and emergency requirements, international trade, and freight and passenger service on joint facilities. Appendix 3 of this report lists the eight principles.

With the signing into law of TEA 21 in May 1998, federal transportation funding provisions were reauthorized until the year 2004. TEA 21 retains many of the same or similar provisions initially established in ISTEA, including the requirement for state and metropolitan transportation planning. While reducing the complexity of requirements for multimodal transportation planning, TEA 21 retains provisions requiring states and MPOs to address freight mobility, access, and connectivity.

TEA 21 Freight Planning Considerations

- Increase the accessibility and mobility options available to people and for freight
- Enhance the integration and connectivity of the transportation system, across and between modes, for people and freight.

TEA 21 also adds a new requirement that freight shippers and other stakeholders be given opportunities to comment on transportation plans and TIPs.

State

Prior to and consistent with ISTEA planning requirements, the Oregon Department of Transportation began explicitly incorporating freight considerations into its transportation planning activities. This occurred in part due to the recognition that freight mobility is a key component of Oregon's economic livelihood. Freight considerations to date have been less explicitly considered in transportation programming activities such as the Statewide Transportation Improvement Program. Completion of various planning efforts underway as well as this freight study is expected to help move ODOT forward in more explicitly considering freight in transportation programming.

The *Oregon Transportation Plan*, adopted by the Oregon Transportation Commission in 1992, is ODOT's first multimodal transportation plan. The OTP recognizes the importance of freight to the state's economy through a number of policies and actions under an overall economic development goal (see Appendix 4). In general, the policies support accessibility, connectivity/linkages, safety, mobility, balance, and capacity as part of a multimodal and intermodal transportation system.

OTP Freight Policy Categories

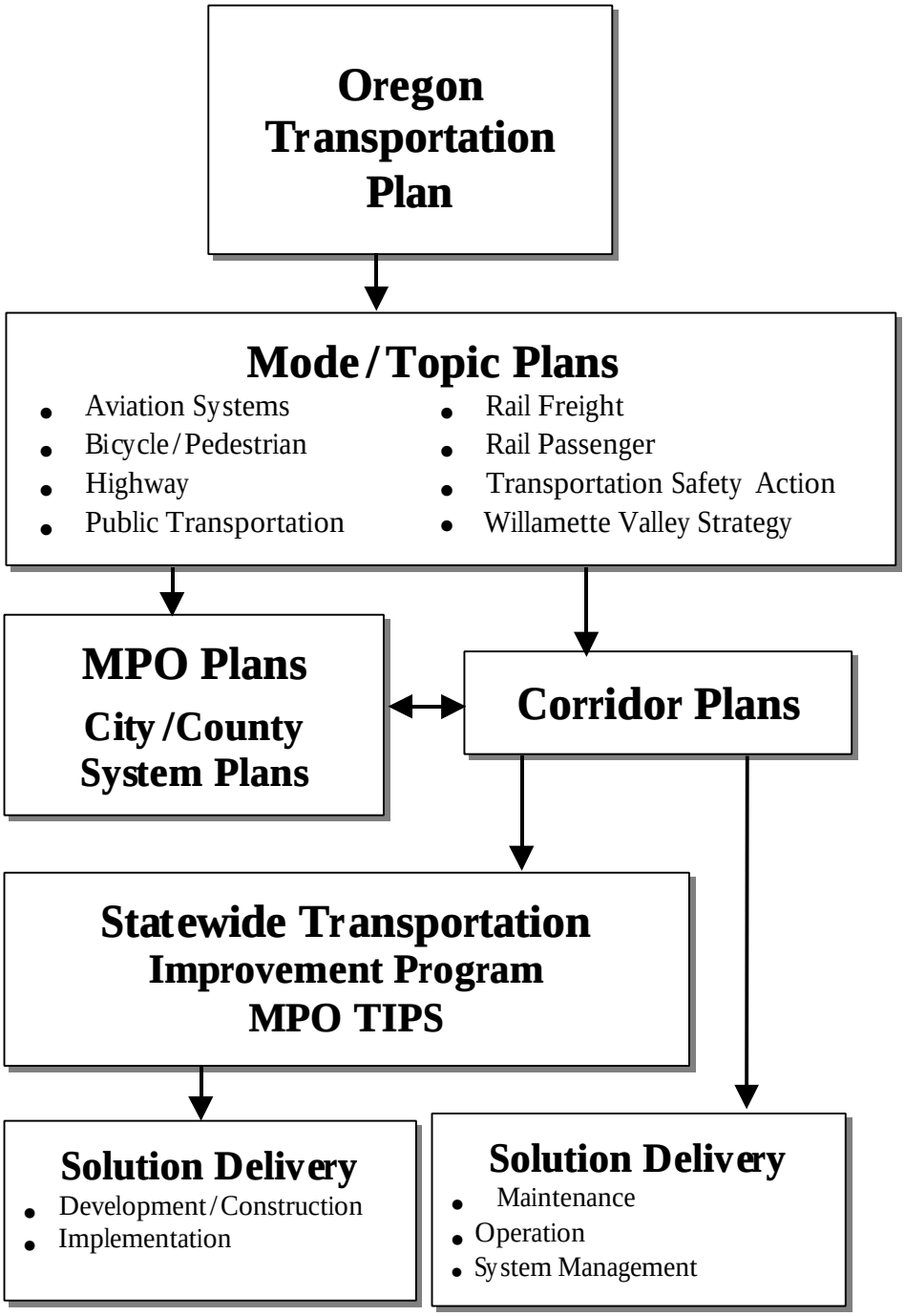
- Accessibility
- Connectivity among places
- Connectivity among modes and carriers
- Safety
- Rural mobility
- Balanced and efficient freight system
- Linkages to markets
- Expanding system capacity
- Intermodal hubs
- Management practices

For each policy in the OTP, there are one or more implementing actions. These refer to activities that ODOT can undertake over a 20-year time period in cooperation and coordination with other state and federal agencies, local jurisdictions, and the private sector. Progress toward implementing these actions is monitored regularly through an annual or biennial report, the most recent of which is for 1997.

A number of other planning and related efforts complement and support the OTP in addressing freight mobility (Figure I-4). Modal and related plans and studies address freight by updating and expanding freight provisions in the OTP. Like the OTP, modal plans cover a 20-year time period and are revised and updated every five to seven years depending on resources available and other considerations.

Among the modal and related plans and studies, the *Oregon Rail Freight Plan* is the most explicit in its focus on freight. Oregon's first rail plan was completed in 1978 and has been updated four times, most recently in 1994. Earlier versions of the rail plan were prepared mostly to meet Federal Railroad Administration requirements for receiving funding through the Local Rail Freight Assistance program.

Figure I-4
Oregon Transportation Planning and Programming



The 1994 Rail Freight Plan expanded earlier rail plans and the OTP by including specific policies and actions pertaining to economic competitiveness of the rail system, retention of local rail service, protection of abandoned rights-of-way, and integration of rail freight considerations into land use planning efforts (see Appendix 5). The plan also makes a number of funding recommendations to support rail freight needs, primarily for rail infrastructure and equipment (see Chapter III of this report for more information about rail freight needs).

Rail Freight Plan
Policy Categories
- Economic competitiveness
- Protection of abandoned rights-of-way
- Retention of rail service
- Integration into local land use planning

The *Oregon Highway Plan* is the other major modal plan addressing freight. In March 1999, the Oregon Transportation Commission adopted the most recent version of this plan. Among the provisions of the 1999 *Oregon Highway Plan* is the designation of a State Highway Freight System (see Chapter II of the *Freight Moves* report for a map showing highways in the freight system). The Plan also identifies several freight-related performance measures (see Chapter III) as well as a number of policies and actions relating to the freight system and efficiency of freight movements (see Appendix 6). Included as one of the plan's actions (1C.2) is the preparation of a statewide freight study; completion of *Freight Moves the Oregon Economy* will implement this action.

Highway Plan
Freight Policy Categories
- State highway freight system
- Efficiency of freight movements

Other freight-related provisions in the Highway Plan include policies and actions relating to access from highways to adjacent properties. The Highway Plan's discussion of access management is intended to balance access to developed properties while ensuring the safe and efficient movement of through traffic and local traffic. The plan identifies a range of policies, actions, and standards pertaining to interchange development, driveway and roadway spacing and design, traffic signal location, median design and spacing of openings, and other factors associated with managing access along various types of urban and rural highways. Managing access includes providing for through truck movements as well as for the pick up and delivery of goods and materials to and from adjacent commercial properties such as those in urban business areas. Additionally, one of the plan's actions (1C.3) provides for State Freight System Routes to be designated as Expressways where minimal or no access would be provided directly from the freight route to adjacent properties.

The *Oregon Transportation Safety Action Plan* and the *Willamette Valley Strategy*, both adopted by the OTC in 1995, are another plan and study that address freight but in less detail than the rail freight and highway plans. The Safety Plan includes several policies addressing truck, rail, and marine safety, while the *Willamette Valley Strategy* includes a number of recommended strategies to improve freight connections, safety, and mobility on Willamette Valley intermodal facilities and highways, rail lines, and waterways.

Currently under development is the Oregon Aviation Plan, which is expected to be adopted by the OTC in 1999. The Aviation Plan follows several earlier Aviation System Plans which

primarily addressed airport infrastructure conditions and needs. While the 1999 Oregon Aviation Plan will focus primarily on airport infrastructure including terminals, it also will include a variety of policies and actions similar to those in the other modal plans discussed above. Draft materials for the plan suggest it will include several policies and actions supporting efforts to enhance air freight access to national and international markets as well as to better integrate freight surface transportation modes with Oregon's airports.

Oregon Aviation Plan
Freight Policy Categories

- Access to markets
- Integration with surface transportation modes

ODOT also is working with a variety of public and private sector interests to develop multimodal plans for 31 transportation corridors statewide (Figure I-5). Corridor planning includes the development of corridor strategies and corridor plans listing projects and programs planned over a 20-year time period in the future. Projects and programs for corridor strategies and plans include those to enhance freight mobility and connectivity.

Regional and Local

Oregon's four metropolitan areas (Eugene-Springfield, Medford, Portland, and Salem) are required by federal and state law to prepare regional transportation plans. Metropolitan Planning Organizations (MPOs) have been designated to coordinate transportation planning in each of Oregon's metropolitan areas. In the last couple years, each MPO has completed a draft or final regional transportation system plan in which freight concerns and needs are addressed (see Chapter III for more information on MPO transportation plans).

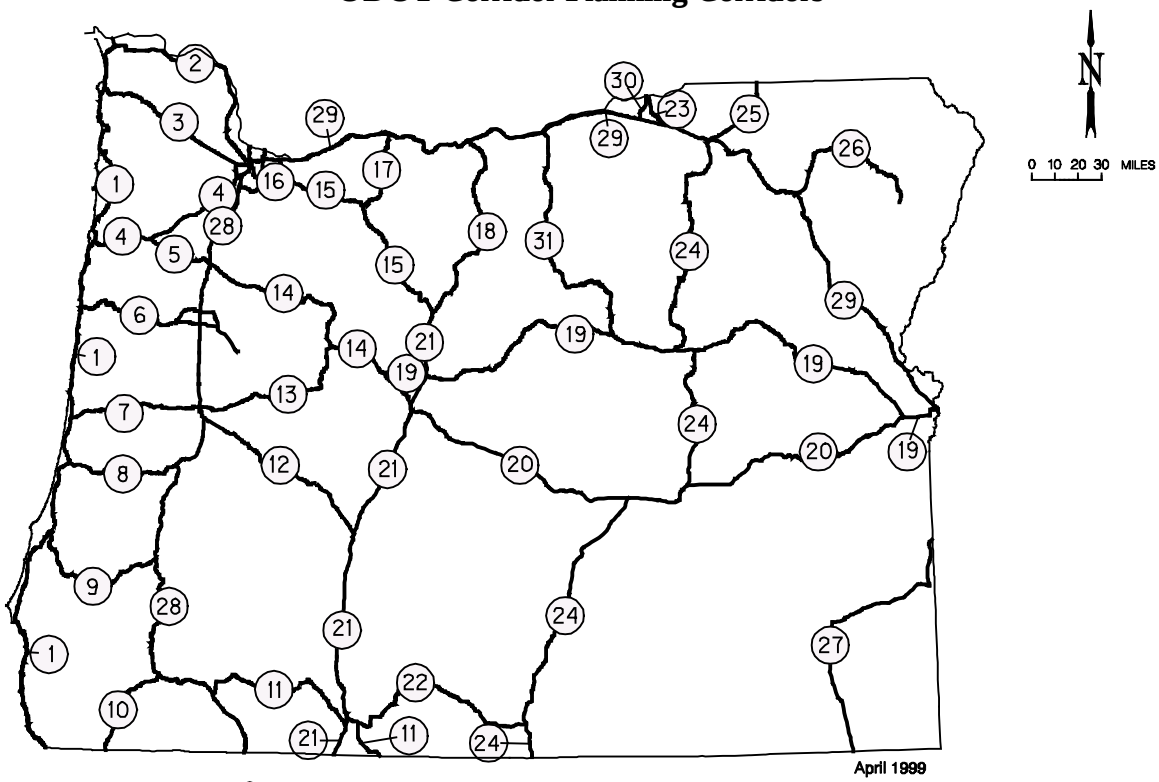
The Oregon Transportation Planning Rule (Oregon Administrative Rule 660-012) requires cities and counties to prepare Transportation System Plans (TSPs) to help implement Oregon's statewide planning goal for transportation (Goal 12). Among the various components of TSPs are lists of projects and programs to meet anticipated local transportation needs over a 20-year period into the future. Although the Planning Rule requires local jurisdictions to develop plans incorporating elements for various freight-moving modes, it does not require them to specifically identify projects and programs to enhance freight mobility.

Planning and Programming

Project implementation is the final part of the planning and programming process. Local and statewide transportation improvement programs (TIPs) identify specific projects and programs for funding over a four-year period into the future. TIPs are updated every two years to reflect changes in planning, funding, and other considerations. Federal law requires projects included in MPO plans to also be included in the Statewide TIP, the most recent of which is for the years 1998-2001. ODOT and other jurisdictions are currently in varying phases of developing TIPs for the years 2000-2003.

Figure I-5

ODOT Corridor Planning Corridors



(#) Numbers correspond to corridors below.

LEGEND

1. Oregon Coast Highway (US 101)
2. Portland - Astoria (US 30)
3. Cannon Beach - Portland (US 26)
4. Lincoln City - Portland (OR 18/99W)
5. Willamina - Salem (OR 22)
6. Newport - Sweet Home (US 20/OR 34)
7. Florence - Eugene (OR 126/I-105)
8. Reedsport - I-5 (OR 38/OR99)
9. Coos Bay - Roseburg (OR 42)
10. Grants Pass - California (US 199)
11. Medford - California (OR 62/140/39)
12. Eugene - US 97 (OR 58)
13. Eugene - Santiam Jct (OR 126)
14. Salem - Bend (OR 22/US 20)
15. Gresham - Madras (US 26)
16. Sunrise Corridor (OR 212)
17. Hood River - Mt. Hood (OR 35)
18. Madras - Biggs Jct. (US 97)
19. Sisters - Ontario (OR 126/US 26)
20. Bend - Vale (US 20)
21. Madras - California (US 97)
22. Klamath Falls - Lakeview (OR 140)
23. Umatilla - Pendleton (US 395/I-84)
24. Pendleton - California (US 395)
25. Washington - Pendleton (OR 11)
26. LaGrande - Wallowa Lake (OR 82)
27. Idaho - Nevada (US 95)
28. Washington - California (I-5)
29. I-5 - Idaho (I-84)
30. Washington - I-84 (I-82)
31. Arlington - US 26 (OR 19)

When they are completed, TSPs and corridor plans are intended to be the source of projects and programs included in TIPs. Because few TSPs and corridor plans have been completed and adopted by governing bodies to date, they have not been the primary sources of projects and programs included in TIPs. A variety of other procedures thus have been used, including identification based on modeling procedures, analysis of technical data, and public input through a series of public involvement meetings held across the state.

Other projects may be developed independently of the STIP process. For example, port districts and other local jurisdictions may develop projects with their own sources of financing. These projects may or may not be identified in the state or local TIP. Moreover, small or routine projects may not be of sufficient size or perceived importance to be identified in TIPs.

Freight Issues

Many issues affect freight movements. Chapter III of this report addresses several of these issues in more detail for road, rail, waterway, air, and pipeline components of Oregon's freight transportation system. By way of introduction, the discussion below briefly summarizes some of the issues, focusing on accessibility, capacity, connectivity, environmental sensitivity, land use compatibility, reliability, and safety. Other issues not discussed below include cost and profitability, the effects of which are difficult to measure and assess due to the sensitivity of the private sector to disclose proprietary data.

Freight Issue Categories
- Accessibility
- Capacity
- Connectivity
- Environmental sensitivity
- Land use compatibility
- Reliability
- Safety

In general, ***accessibility*** measures how well various parts of a region are served by freight providers. An area with low accessibility has few providers serving freight generators. Improved accessibility would occur as more providers better serve existing freight generating areas within a region. Improvements to accessibility often are market-based beyond the purview of the public sector. The public sector, however, might help increase accessibility indirectly by improving or extending a transportation facility to an underserved area, thereby potentially reducing travel time or vehicle wear and tear.

Capacity measures how well a transportation facility handles the amount of traffic using the facility. Low capacity means the current or expected usage of the facility exceeds the ability of the facility to accommodate the usage. Capacity measures frequently are used to analyze the ability of transportation facilities to handle current and anticipated traffic volumes, including for modes that move freight. As volumes approach capacity, traffic speeds slow to unacceptable levels, congestion increases, and mobility declines. Capacity can be improved in a variety of ways, including construction of additional transportation features such as more lanes, a new road or bridge, additional rail lines, deeper waterways, or a bigger pipeline. To more efficiently use existing capacity, better transportation system management, including Intelligent Transportation System measures, is playing a greater role in moving traffic including freight. Larger freight-hauling equipment (e.g., longer trucks, longer and/or

higher rail cars, deeper draft ships) strain existing transportation facilities and often result in the need to build new capacity or better manage existing capacity.

Connectivity refers to how well individual freight generators link with the transportation system. Low connectivity means travel distances are longer than they would be if connections were more direct. Longer travel distances also mean greater travel time. Connectivity can be improved by constructing "missing links" in the transportation system, thereby reducing out-of-direction travel. Analysis of connectivity throughout an economic region contributes to the understanding of accessibility as discussed above. Connectivity also may refer to links between modes. The absence of good linkages with other places or between modes may mean the freight transportation system is not operating as efficiently as it could.

Environmental sensitivity includes a variety of issues including impacts of existing and new facilities on the natural environment. Concerns include emissions from freight vehicles into the air and water, spills of hazardous materials, and impacts of new construction projects on the natural environment. Impacts are of special concern in pristine or near-pristine areas as well as in areas where environmental quality already is low due to existing conditions. Among the issues of special concern in the Pacific Northwest are impacts of existing transportation facilities and new projects on areas with threatened, endangered, or otherwise sensitive plant or animal species.

Land use compatibility is similar to environmental sensitivity due to real or perceived concerns about incompatible land uses located near one another. This may include noisy, smelly, or otherwise potentially offensive characteristics associated with freight facilities in proximity to residential, natural, or other potentially incompatible land uses. Land use compatibility has become an increasingly important issue in areas under transition from one type of land use to another. In some areas, successfully addressing land use compatibility issues is critical to maintaining an acceptable quality of life.

Reliability is a function of the predictability of the transportation system. Low reliability means shippers and carriers often experience unexpected problems in getting products from origin to destination. This may result in missing deadlines and not meeting customer expectations for delivery. Improving reliability may mean changing delivery routes and scheduling. It also could mean improving the transportation system to reduce problems such as recurring and non-recurring (unpredictable) congestion. Reliability is an especially important factor for shippers, carriers, and customers involved with just-in-time deliveries.

Safety pertains to safety of drivers, passengers, and the motoring public in general. Poor safety generally means a high number or rate of crashes resulting in fatalities, injuries, and/or property damage. Improving safety may involve a blend of private-public programs and investments including safety education programs, improved vehicles, greater enforcement and vehicle inspection, and improvements to roads, rail lines, waterways, airports, and pipelines.

Concerns about the above issues vary over time and location. Over time, previously unimportant issues become more important due to such factors as population and economic

change, passage of new laws, improved technology, and greater or reduced funding levels. Issues that are important in one area may be relatively unimportant in another area with different social and economic characteristics. Successfully adjusting to changing circumstances over time and locationally is critical to efficiently moving freight.

Summary and Organization of the Remainder of the Report

Summary

Freight's Importance to the Economy

Freight plays a major role in moving the Oregon economy. Most freight moves by truck, rail, waterway, air, and pipeline, with trucks accounting for the greatest volume of freight moved nationally and in Oregon. Various estimates show that freight transportation accounts for between five and 15 percent of the national and state economy depending on the type of measure used. National-level forecasts show that shipments of freight by air and by rail intermodal will increase fastest in the future, while shipments by water and by pipeline will grow the slowest.

Among Oregon's leading freight-related businesses in terms of employment are Freightliner, Greenbrier (Gunderson), United Parcel Service, Consolidated Freightways, USF Reddaway, and the Union Pacific Railroad. Several airlines employ substantial numbers of people in Oregon, some of whom are involved with air freight shipments. Oregon is relatively more dependent than any other western state on wholesale trade and distribution activities. A number of large distribution facilities are located in Portland and elsewhere in the state, primarily in the I-5 corridor. NW Natural is Oregon's largest pipeline company in terms of employment, and is among the state's leading employers overall.

Oregon ranked 10th nationally and 4th in the western U.S. in value of exports per person in 1997. Air transportation accounted for a very small amount of Oregon's freight tonnage moved in international markets but for about one-third of the value of foreign trade. High technology equipment accounted for about half of Oregon's foreign trade by value in 1995, up from 30 percent in 1990. Crops and food products accounted for another 25 percent by value in 1995, down from about 28 percent in 1990, and 15 percent in 1995 was attributable to forestry and paper products, down from 26 percent in 1990.

Japan, Canada, South Korea, and Taiwan are Oregon's major trading partners, accounting for about 50 percent of the value of exports in 1997. Economic problems in Asia contributed to a slowing of Oregon's foreign trade in 1998. Continued slowing is expected in 1999, with longer-run expectations being more positive.

In part due to the North American Free Trade Agreement, Oregon's trade with Canada and Mexico is growing. Canada accounts for over 90 percent of Oregon's trade with the two

NAFTA partners. Trucks move the vast majority of Oregon's freight to and from Canada and Mexico.

For each 100 jobs in freight-related transportation sectors of Oregon's economy, approximately 85 to 150 additional jobs are generated through multiplier effects. The multiplier effect is less for the wholesale trade sector than for the manufacturing and transportation, communications, and public utilities sectors. According to Port of Portland information, about 20 percent of all jobs in the Portland region are influenced by the port's marine and aviation activities. About 106,000 jobs are related to aviation activities and another 60,000 are related to marine activities. For port districts other than the Port of Portland, about 4,150 jobs are dependent on transportation. Over 60 percent of these jobs are associated with businesses in the port district for the Oregon International Port of Coos Bay.

Federal Freight Policy

The federal Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 was the first federal transportation legislation to explicitly recognize the importance of freight mobility. ISTEA included a variety of funding, planning, and other provisions and requirements to support state and regional governments in freight transportation planning activities. Subsequent to ISTEA, federal lawmakers passed other legislation addressing freight transportation in a variety of ways. The legislation included the National Highway System Designation Act of 1995 and in 1998, the Transportation Equity Act for the 21st Century. Further encouraging freight considerations in planning and programming activities was the U.S. Department of Transportation's creation of a National Freight Transportation Policy Statement and guiding principles in 1997.

Oregon Freight Planning

In Oregon, the *Oregon Transportation Plan* and associated modal and topic plans address freight transportation through a number of policies and actions. In general, the policies and actions support accessibility, connectivity/linkages, safety, mobility, balance, and capacity of the freight transportation system. The *Oregon Transportation Plan*, *Oregon Rail Freight Plan*, and *Oregon Highway Plan* are the three plans providing the most direction regarding statewide freight transportation policies and actions.

Transportation corridor plans, local transportation system plans, and regional transportation plans for metropolitan areas identify objectives, actions, projects, and programs to address freight mobility and other related issues. When completed, corridor plans and transportation system plans are intended to be the sources of projects and programs included in the Statewide Transportation Improvement Program. Port districts and other local jurisdictions may identify local freight transportation projects independently of the STIP process.

Freight Issues

Concerns about accessibility, capacity, connectivity, environmental sensitivity, land use compatibility, reliability, and safety and other freight-related issues vary over time and

location. Population and economic change, new legislation, improved technology, and different funding levels are among the factors influencing change in freight mobility and similar issues. Successfully adjusting to changing circumstances is critical to efficiently moving freight.

Remainder of the Report

The remainder of this report further discusses various aspects, issues, and concerns pertaining to Oregon's freight transportation system. Chapter II provides more detailed information on the locational characteristics of roads, rail, waterway, air, pipeline facilities, intermodal freight facilities, and non-intermodal freight generators such as distribution facilities and industrial areas. Where available, existing and future commodity flow information is shown for various freight-moving modes.

Chapter III provides further detail on freight issues, concerns, and needs. These are addressed within the context of selected performance measures, primarily those related to congestion, physical condition of facilities, and safety. The bulk of Chapter III focuses on concerns and needs about moving Oregon's freight by road, rail, waterway, air, and pipeline. Identification of concerns and needs is based on a blend of modeling, technical data and estimates, review of plans and other documents, personal observation, and public input.

Chapter IV presents a number of possible "next steps" to further extend the discussion of freight mobility in Oregon. This includes steps that would help fill missing gaps in information as identified in this report. It also includes the identification of possible refinements or extensions to improve freight-related planning and programming activities, including policies and actions in existing plans.

The appendices provide

- citations to sources of data and definitions of terms and acronyms used in this report,
- U.S. Department of Transportation principles for freight transportation policy,
- a summary of freight-related policies and actions in the *Oregon Transportation Plan*, *Oregon Rail Freight Plan*, and *Oregon Highway Plan*,
- information about intermodal connectors on the National Highway System,
- a list of freight needs/solutions identified in work completed for Oregon's Intermodal Management System,
- a Legislative Finding on ODOT's role in port-related transportation planning and development, and
- comments from reviewers on the January 20, 1999 draft of this report.